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SCHOOL-BASED ORAL HEALTH PROGRAMMES IN THE TSHWANE DISTRICT OF GAUTENG: SCOPE, IMPLEMENTATION AND OUTCOMES

MPHO PRIMROSE MOLETE

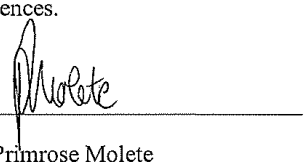
A thesis completed by published work submitted to the Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, in fulfilment of the requirements for the degree of

Doctor of Philosophy

2021

Declaration

I, Mpho Primrose Molete declare that this Thesis is my own work. It is being submitted for the Degree of Doctor of Philosophy at the University of the Witwatersrand, School of Public Health, Johannesburg. It has not been submitted before for any degree or examination at any other University. I confirm that the work I am submitting for assessment is my own original work excluding where I have explicitly indicated otherwise in the form of acknowledgements or references.



Mpho Primrose Molete

19 day of April 2021 In Parktown.

1. DEDICATION

To my mother: Josephine Matlakale

For all your sacrifices in prioritising my education and believing in me even when I didn't believe in myself. Kea leboga, Mama!!

To my husband: Lebohang Molete

Thank you for being the "wind beneath my wings" and creating an environment where I can flourish.

To my children: Sechaba & Lesedi Molete

You two are my inspiration. Thank you for bringing abundant joy in my life.

To the Almighty God.

Thank you for never leaving me.

"Your praise shall continually be in my mouth" Psalm 34:1

2. PUBLICATIONS ARISING FROM THIS RESEARCH PROJECT

1. **Molete,** M.M, Igumbor, J, Stewart, A. and Yengopal, V, 2019. **Dental status of children receiving school oral health services in Tshwane**. South African Dental Journal, 74(4), pp.171-177.

2. **Molete, M,** Stewart, A, Bosire, E. and Igumbor, J., 2020. **The policy implementation gap of school oral health programmes in Tshwane, South Africa: a qualitative case study**. BMC Health Services Research, 20, pp.1-11.

3. **Molete M,** Stewart A, Igumbor J. **Implementation fidelity of School Oral Health Programs at a District in South Africa**. Plos One, 15(11) e0241988, pp.1-11.

4. **Molete, M,** Stewart, A, Moolla, A. and Igumbor, J.O, 2021. **Perceptions of provincial and district level managers' on the policy implementation of school oral health in South Africa.** BMC Health Services Research, 21(1), pp.1-10.

3. ABSTRACT

Background: School settings are an essential platform for promoting oral health at the early stages of a child's life; hence implementation of such programmes needs to be well executed in order to obtain long term favourable oral health outcomes among children and adolescents.

Objectives: My study sought to assess the scope, implementation and outcomes of school oral health programmes in the Tshwane district of Gauteng South Africa. The key objectives were as follows;

- To describe provincial and district level managers' perceptions and translation of school oral health policy,
- To describe the implementation processes and gaps of school oral health programmes in the Tshwane health district.
- To determine the dental health status of the learners and factors associated with the dental status.
- To determine implementation fidelity and its effects on the dental status of school learners receiving the school oral health programmes.

Methods:

My study utilised a convergent parallel mixed method approach where oral hygienists and leaners at participating schools were assessed. The first objective in chapter 4 described the scope of school-based oral health services. The second objective in chapter 5 elaborated on the actual programme implementation. The third and fourth objectives in chapters 6 and 7 determined the effect of the programme on expected outcomes and identified the direct and indirect factors affecting the quality of the programme.

The first and second objectives of my study were undertaken using qualitative study designs. The first objective explored perspectives of oral health managers by using an exploratory qualitative study where eight oral health managers from the Gauteng provincial and district offices were interviewed. In addition to the interviews, policy documents were reviewed.

The second objective described the implementation approaches from the perspectives of 10 oral hygienists who were implementing the programme. A qualitative explanatory case study was undertaken using a combination of data from direct observations, policy documents and interviews. The measuring tools included process maps and an interview guide.

The third and fourth objectives were undertaken using quantitative cross sectional study designs. A multistage sampling technique was employed to randomly select 10 primary schools from the oral hygienists' list of schools; two grades in each school were selected and all learners in the selected grades were included in an oral health examination. Ten oral hygienists were observed and interviewed as they carried out the activities of the programme and records were reviewed. Data collection tools included an oral health examination form, and an implementation fidelity checklist.

Results: The results of the first objective indicated that in as much as national policy covered the principles of strategic vision, responsiveness to health needs, equity and inclusivity with clarity in the strategic document; the principles were not translated consistently by the managers at a local level. In the second objective, the results revealed that policy implementation was affected by poor prior planning, inadequate resources, poor school infrastructure and a lack of support from key stakeholders. In the third objective, upon assessing 736 learners with ages raging between 6-16 years, the prevalence of dental caries in the permanent dentition was found to be 25.9%; in the primary dentition it was, 30.2% and the unmet treatment need (UTN) was 89.6%. The last objective revealed that the level of fidelity obtained was 39.6% and that it was shown to be inversely correlated with levels of decay. In addition, to attain the ideal of zero levels of decay, an 80% of fidelity was required. The fidelity elements that were found to directly predict the outcome of decay included duration (IRR, 0.49; p=0.02) coverage (IRR, 0.54; p=008), content (IRR, 1.36; p=0.03) and age (IRR, 2.14; p=0.00). Moderating factors of fidelity which indirectly influenced the outcome of decay included facilitation strategy, duration and age. These were predicted to reduce the risk of decay by 92%, 83% and 48% respectively.

Conclusions: There was poor policy awareness and hence there were policy and practice misalignment and variations in the processes of implementation across the 10 schools.
Although the prevalence of dental caries was relatively low in comparison to similar studies in South Africa, there were high levels of unmet treatment need. The school oral health programmes exhibited high levels of pupil coverage, however, the content (28%) of the programmes and fidelity offered was low (39.6%). Much of the gaps in policy translation were attributed to inadequate human resources and poor communication processes by the national leadership to support district level implementation. Therefore optimizing multi-

sectoral participation and identifying shared, novel and practical solutions to policy translation impediments is necessary.

Key words: Implementation; Fidelity; Oral health; School health; Health policy; Programmes

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8. LIST OF ABBREVIATIONS

AIDS	Acquired Immunodeficiency Syndrome
ART	Atraumatic Restorative Technique
BMI	Body Mass Index
Coef.	Coefficient
CRFA	Common Risk Factor Approach
DMFT/dmft	Decayed Missing Filled Teeth (Permanent/primary teeth)
DOH&BE	Department of Health & Basic Education
EBSCO	Elton Bryson Stephens Company
GDE	Gauteng Department of Education
GDOH	Gauteng Department of Health
HIV	Human Immunodeficiency Virus
HPS	Health Promoting Schools
IRR	Incidence Rate Ratio
ISHP	Integrated School Health Programme
NCD	Non Communicable Diseases
NDOH	National Department of Health
NIRN	National Implementation Research Network
PHC	Primary Health Care
PUFA/pufa	Pulpal Ulcerative Fistula Abscess (Permanent/primary teeth)
SD	Standard Deviation
SE	Standard Error
SiC	Significant Caries Index
UTN	Unmet Treatment Need

1. CHAPTER ONE - INTRODUCTION

1.1. Introduction and Background

Dental caries is the most prevalent oral disease affecting children in the world (Fraihat et al., 2019). Globally children who suffer from poor oral health are more likely to have restricted activity of daily living as a result of pain caused by the dental infection (Shenoy and Sequeira, 2010). Furthermore, over 50 million school hours are lost annually because of oral health problems which affect children's performance in school (Weichselbaum and Buttriss, 2011). The disease disproportionally affects families that are impoverished and who have poor access to healthcare, nutrition and limited oral health awareness (Bourgeois and Llodra, 2014). Children in developing countries also greatly suffer the burden of disease thus the condition has been shown to be a marker of socioeconomic disadvantage (Macnab et al., 2014, Peres et al., 2019). In addition, the dental caries experience in childhood is predicted to increase the experience of dental disease in adulthood (Jordan et al., 2019). The condition is therefore a public health problem affecting 3.5 billion people around the world (Kassebaum et al., 2017, Peres et al., 2019).

Oral health promotion programmes have been demonstrated to be effective at reducing dental caries among children and lowering future dental costs (Fraihat et al., 2019). The programmes often occur within a school environment with the intention of addressing conditions affecting school children with broad comprehensive approaches (Jürgensen and Petersen, 2013). The process of planning and implementing these programmes has evolved over years and emphasizes the need for greater cooperation between health and education sectors of government. In addition, there are calls to also increase the role of communities and inter-disciplinary collaborations in addressing oral health inequalities (Gargano et al., 2019, Peres et al., 2019).

In South Africa, oral health disparities are wide due to a lack of oral health awareness and limited access to oral health services among disadvantaged and vulnerable communities (Kolisa, 2016, Govender et al, 2013). This pattern is exacerbated by insufficient oral health-care facilities, workforce, and inequitable distribution of dental services in the country (Thema and Singh, 2013a, Smit and Osman, 2017). Given the limitations, there is a need for

affordable and effective oral health promotion programmes that will widen the reach of many children in order to address existing inequities (Macnab et al., 2014, Singh, 2011).

According to the last South African Children's National Oral Health survey conducted between 1999 and 2002; 60% of 6 year old children in the country suffered from dental caries and 80% of the cases were untreated for the disease (van Wyk and van Wyk, 2004). A survey conducted in parts of Gauteng Province, South Africa, reported the prevalence of caries among 6-8 year olds to be 46%, with 90% of the children having untreated caries (Thekiso et al., 2012). In Kwa-Zulu Natal Province, among 6-7 year old children, a caries prevalence of 73% was found, and 94% of pupils required treatment (Reddy and Singh, 2015a). Of concern is that the number of caries- free children seems to have declined in Kwa-Zulu from 35% to 27% in 2002 and 2015 respectively (Reddy and Singh, 2015a, Wyk and Wyk, 2004). This demonstrates that the burden of disease persists in the country and hence there is need to assess the lack of improvement

There are policy documents in South Africa that address the need and processes of improving child oral health in school settings. The key documents include the Integrated School Health Policy, the National Oral Health Strategy and the Gauteng Oral Health Strategy (DoH, 2011, DoHBE, 2012, National Department of Health, 2010, National Department of Health South Africa, 2018). The Integrated School Health Policy is jointly formulated by the Departments of Basic Education and Health. The Oral Health Strategies are developed by the National & Provincial Oral Health Directorates. These documents outline the macro intentions and activities of the government in addressing children's oral health needs in schools. They provide the vision, goals and principles that seek to guide activities, as well as establish accountability and responsibilities for the proposed activities (Buse et al., 2005, Lehmann, 2016). In addition to these official documents, there are internal community oral health guideline documents that have been developed to translate and disseminate the central level decisions to officials responsible for the implementation of oral health services at the coalface; and also for recommending procedures in carrying out the broad policy objectives (Buse et al., 2005).

Variations of school oral health programmes have been ongoing for over 20 years in South Africa (Reddy and Singh, 2015a, Lalloo and Solanki, 1994). The majority of the programmes are vertical and hence the country has put in efforts to integrate all school health services in

line with the World Health Organisation's (WHO) goals through the Integrated School Health Programme (ISHP) (Health Basic Education, 2012). The joint initiative between departments of health and education seeks to provide public health services and create an enabling environment for the integration of learning, wellbeing and support (Health Basic Education, 2012). Therefore oral health is included within the broader school health services in the country, and the Tshwane health district in Gauteng Province is one of the sites piloting this government initiative and other health reforms (National Department of Health, 2015). Although oral health was officially integrated into the ISHP in 2011, little has been reported on the implementation of oral health services within the broader school health programmes.

Although most literature on school oral health programmes report on the improvements of oral health outcomes; the studies reviewed lacked information on the quality and consistencies of the interventions being reported (Jürgensen and Petersen, 2013). Furthermore, available literature on school oral health programmes have largely focused on clinical outcomes with very few studies exploring implementation process evaluation as a critical precursor of clinical outcomes (Jürgensen and Petersen, 2013, Carroll et al., 2007b). Additionally, few programmes displayed a range of activities as suggested by the WHO, instead, most narrowly focused on oral health education rather than oral health promotion which is broader and aims to address the wider social determinants of oral health (Conrado et al., 2004a, Cooper et al., 2013, Lalloo and Solanki, 1994, Macnab et al., 2008b). Yet evidence has shown that health education on its own is not sufficient to achieve behavioural change or the desired health outcome (Stillman-Lowe, 2008, Freeman and Ismail, 2009).

1.2. Rationale

As indicated in the literature, variations of school based oral health programmes have existed in South Africa (Reddy and Singh, 2015a). These variations are in spite of the existence of standard policy documents and the internal guidelines that attempt to translate policy into procedures and guide the whole system in working together towards achieving common objectives (Lehmann, 2016). Inconsistent policy implementation and fragmented service delivery has therefore been widely reported and requires careful exploration to inform appropriate remedial actions (Singh et al., 2010, Reddy and Singh, 2015b). This is essential in identifying the policy implementation inconsistencies that weaken the effectiveness of services and hinders the attainment of favourable outputs through concerted efforts, particularly in resource constrained settings (Carroll et al., 2007a, Moore et al., 2015a).

In addition, successful policy implementation is dependent on the quality of its governance, active participation of actors and the organization as a whole (Campos and Reich, 2019). To understand the capacity and competence of success factors within the school environment; my study begins by assessing the relevant policies and oral health managers' interpretation of the policies in line with their role in driving policy implementation at schools. This exploration was guided by the governance assessment framework of Siddiqi et al. (2009) as it encompasses key governance principles from national policy formulation to policy implementation.

The role of inequality in health access, utilization and wellbeing is well documented (Macnab et al., 2014). This is reflected in the South African context that is linked with a history of political and social inequalities, which have subsequently resulted in health and socio-economic inequities (Omotoso and Koch, 2018). None of the South African oral health programmes reviewed sought to redress oral health inequalities with a broad perspective. Furthermore, peer reviewed process evaluations of existing programmes is scarce, thus there is not much information that can be used to assess gaps or opportunities for effective integration of school health activities (Jürgensen and Petersen, 2013, Carroll et al., 2007b). In this regards, programme implementation needed to be systematically mapped out in order to understand the processes, content, context and central role of actors in carrying out existing programmes (Walt and Gilson, 1994). This exercise assisted in identifying emerging implementation gaps and opportunities.

The last South African National Children's survey was undertaken between 1999-2002 (van Wyk and van Wyk, 2004). It is outdated and most concerning is that the epidemiological information from the survey has contributed to the development of the South African National Oral Health Strategy. New epidemiological data are therefore essential and can be used as a baseline to periodically track changes when evaluating clinical outcomes as a measure of policy and programme effectiveness and in identifying gaps and emerging needs. There has also been no epidemiological data from the school learners receiving the programmes in the Tshwane district. Therefore, my study assessed the dental epidemiology of the learners in order to derive the oral health needs of the children and obtain information for appropriate planning.

Despite the existence of ongoing school oral health services for over 20 years in South Africa, to date no significant oral health improvement has been noted among school learners in the country (Reddy and Singh, 2015a, Reddy and Singh, 2015b, Thekiso et al., 2012). Literature suggests that programmes should be monitored through stages of design and implementation in order for accurate interpretations of how elements of the interventions contribute to the desired outcomes that can be achieved (Damschroder et al., 2009). Carrol further argues that the closer a programme is aligned to its original design, it is more likely to produce favourable outcomes; this is referred to as fidelity (Carroll et al., 2007a). My study therefore sought to determine the implementation fidelity of school oral health programme and factors influencing its fidelity. Furthermore it revealed the extent of policy alignment and highlighted the factors contributing to desired clinical outcomes (Carroll et al., 2007a, Proctor et al., 2011).

1.3. Aim

The aim of my study was to describe the scope, implementation approaches and outcomes of school oral health programmes in Tshwane, Gauteng.

Specific Objectives

The specific objectives of my study were to:

1. To describe provincial and district level managers' perceptions and translation of school oral health policy,
2. To describe the implementation processes and gaps of school oral health programmes in the Tshwane health district.
3. To determine the dental health status of the learners and factors associated with the dental status.
4. To determine implementation fidelity and its effects on the dental status of school learners receiving the school oral health programmes.

1.4. Structure of the Thesis

This thesis is presented in a divided block format. The following constitute a divided block thesis format, as prescribed by the Faculty of Health Sciences, University of the Witwatersrand:

- The background and study rationale
- A literature review chapter
- A generic methodology chapter
- Results section that will be presented in separate, discrete chapters
- Discussion, recommendation and conclusion chapters, which will synthesize the whole thesis findings and make conclusion and recommendation.

The chapters' specific to this thesis therefore include the following:

Chapter 1: Provides information on the context of dental caries affecting schoolchildren. The development of school oral health policies and programmes in addressing the condition are discussed. The chapter then culminates with the study rationale, aim and objectives.

Chapter 2: Provides the outline and critique of the literature concerning school based oral health programmes. It details the existing state of the field, highlights the gaps in the literature and provides details of the conceptual framework and justification of the study.

Chapter 3: Describes the overarching methodology and justification of the methodological approaches used.

Chapter 4 – 7: Outlines the results of the study and the chapters are linked with sections that provide bridges from one chapter to the next. The chapters will be as follows:

> **Chapter 4:** Managers' perceptions and translation of the school oral health policy in a South African district.
>
> **Chapter 5:** The policy implementation gap of school oral health programmes in Tshwane, South Africa: A qualitative case study.
>
> **Chapter 6:** Dental status of children receiving school oral health services in Tshwane.
>
> **Chapter 7:** Implementation fidelity of School Oral Health Programs at a District in South Africa.

Chapter 8: Provides a discussion of the thesis by synthesizing key findings with exiting literature and proposing key recommendations.

Chapter 9: Provides the final concluding summary remarks of the entire thesis.

2. CHAPTER 2 - LITERATURE REVIEW

2.1. Introduction

The literature review provides the background on the development of school oral health programmes and outlines gaps in existing programmes across the world. It outlines arguments on the usage of the Common Risk Factor Approach (CRFA) in addressing school health and deliberates on school oral health policy in South Africa. Policy implementation, along with its stages, drivers and barriers of the process are additionally discussed. The chapter is then culminated by exploring implementation theories and how they have been incorporated into the study conceptual framework.

The literature was searched using the following databases; Pubmed Advance Search Builder, Cochrane Library, EBSCO host and Google scholar. Both key words and title and abstract builder were used for the search. The following words were used: school health services, dental care for children, child, education, oral health and implementation. These were combined and relevant papers were retrieved. Some papers were traced from journal articles.

2.2. Developments of school oral health programmes

The World Health Organization (WHO) has played a role in shaping the development of school health programmes dating back to the 1950`s with the aim of facilitating collaboration of the educational and health sectors in working towards improving education and health outcomes in this specific setting (St Leger et al., 1992). Traditionally the school programmes, referred to as Health Promoting Schools (HPS) mostly focused on health education; however, the WHO advocated for a holistic comprehensive approach, which is shaped by the Ottawa Charter principles of health promotion. (Kwan and Petersen, 2003, Kwan et al., 2005a, World Health Organization, 1986a). The guiding key elements re-iterated by the World Health Organisation (WHO) include; school health policies; healthy physical environments; school social environment; community relationships; personal health skills and school health services (Kwan and Petersen, 2003, Jürgensen and Petersen, 2013).

The objectives of the HPS are to promote the adoption of lifestyles that promote good health, provide an environment that supports healthy lifestyles and enable students and staff to take

action for a healthier community (Langford et al., 2015a). HPS are hoped to influence health on three different levels, which include the individual, the school environment & wider community (Langford et al., 2015a). At an individual level, health education can be attained through the school curriculum; it is assumed that when children acquire knowledge they will be able to make the right choices. The various activities at the schools are then expected to provide the children with the necessary skills to be able to act on what they have learnt (Macnab, 2015). Subsequently improvements in knowledge, attitudes and skills establish new norms and re-inforce behaviour change. All this is expected to be supported by an enabling school environment, such as the promotion of healthy nutrition, no smoking, anti-bullying protocols and hygienic sanitation facilities. Families and wider communities are expected to be integrated into the school initiatives as they impact on children's health. Schools should therefore be in consultation with the families and surrounding communities so that they can obtain their support and participation in health promoting activities (Macnab, 2015, Langford et al., 2015b).

The most prevalent oral diseases across the globe include dental caries, periodontal disease and cancers of the lips and oral cavity (Peres et al, 2019). However, dental caries is most common among children and adolescents; furthermore, it poses the greatest unmet healthcare need (Fraihat et al, 2019). Dental caries is caused by localised destruction of enamel and dentine by acids released from fermentable carbohydrates, which have been metabolised by bacteria found in the oral cavity. The process occurs over years, and progressive demineralization accompanied by loss of minerals from tooth substances subsequently result in cavitation of a tooth (Peres et al, 2019). Dental caries can be prevented by a reduction of a high sugar diet and adopting frequent tooth brushing habits in order to effectively eliminate the bacterial plaque found in the oral cavity (Haque et al, 2016).

The caries condition can be tracked from childhood, adolescent, adulthood and later life thus indicating that the disease potentially has consequential effects in an individual's life course (Peres et al., 2019). The global prevalence of untreated caries is 34% and found commonly among adolescent aged 15-19 years (Kassebaum et al., 2017). Furthermore, the prevalence of dental pain among children ranges between 5-33% and increases with age, severity & decreased socioeconomic status (Ratnayake and Ekanayake, 2005, Goettems et al., 2012). The condition affects the quality of life of children in terms of compromised ability to eat, loss of sleep due to pain, loss of school days and loss of concentration at school (Paula and Mialhe, 2013, Jackson et al., 2011). The literature also indicates that children in developing

countries suffer the greatest burden of disease as often the treatment costs outweigh available resources (Macnab et al., 2014, Lawal and Taiwo, 2018, Peres et al., 2019).

A cross sectional prospective study to investigate the association between dental caries and Body Mass Index (BMI) among 12 year olds in the Philippines (Benzian et al., 2011b). included 68 public schools, and in each school, 30 grade 6 children aged 11-13 were sampled. The results of the 1951 children indicated a caries prevalence of 82.3%, a PUFA of 55,7% and children with PUFA scores were more likely to have low levels of BMI (OR:1.47; CI:1.19-1.80; $p<0.001$) than those with no PUFA. This implies that children with severe dental caries were significantly more affected than those without severe caries. The authors suggest that the results of the low BMI may be attributed to the effects of pain, restricted food intake, reduced concentration, reduced sleep and subsequently reduced growth (Benzian et al., 2011b).

Significant associations have also been reported between oral health and school performance among children (Blumenshine et al., 2008b, Jackson et al., 2011). In an epidemiological survey undertaken among 600 primary school children in India, the authors found that children with below average grades had significantly higher df-t (decayed, filled teeth) scores (4.47; SD:27) than children with excellent results (1.56; SD:2.5), $p<0.001$ (Garg et al., 2012). Similar results were reported from a systematic review of papers retrieved between 1990-2013, however no explanation of direct linkages have been established thus far (Paula and Mialhe, 2013).

It is therefore apparent that poor oral health among children negatively impacts on learning, nutrition and well-being. Hence oral health can be incorporated as a starting point into almost all key school health promotion elements as it involves issues that affect children broadly including behavioural factors such as nutrition, personal hygiene and socio-economic determinants (Peres et al., 2019, Van den Branden et al., 2015). It has also been argued that oral health incorporation into health promoting schools can easily be done as it is not associated with stigma, cultural or religious undertones (Macnab, 2015). Furthermore, positive oral health outcomes have often been reported in Oral Health Promoting Schools across the world (Semer et al., 2005, Nascimento et al., 2013, Monse et al., 2013b).

2.3. Status of existing school oral health programmes

The most recent global survey on school oral health programmes was conducted by the WHO in 2012, with the aim of reviewing approaches to school oral health and describing the various interventions used (Jürgensen and Petersen, 2013). Sixty-one countries responded to the questionnaires and in all, 108 projects were evaluated. Findings revealed that school oral health approaches varied across countries because of the differences in health systems, financing of health, educational sectors, socio-economics, health policies and burden of diseases. Some approaches focused narrowly on oral health and others extended to other health activities. However, the full range of activities as prescribed by the Ottawa Charter and school health programme guidelines was rarely applied (Jürgensen and Petersen, 2013). There was a lack of consistency in implementation approaches, which had a bearing on how success of school oral health could be measured.

The majority of the programmes reviewed reported positive oral health outcomes particularly in relation to improvements in knowledge, attitude and practices of children exposed to school oral health programmes. The reason may be that the programmes reported were largely education based (Gambhir et al., 2013, Haque et al., 2016, Khoshnevisana et al., 2017). Programmes that showed favourable clinical outcomes were those conducted or followed up over a long time frame of a minimum of three years (Fraihat et al., 2019). In most studies, the reporting on the processes of implementation was generally poor (Cooper et al., 2013, Nascimento et al., 2013, Macnab and Kasangaki, 2012, Monse and Benzian, 2010, Yusof and Jaafar, 2013, Reddy and Singh, 2015a).

Other studies reviewed indicated how integrated platforms were utilized to bring about improvements in school oral health. Studies conducted in Tanzania, reported that due to a shortage of oral health personnel, health and oral health education were integrated into the Tanzanian primary school curriculum. This has been ongoing for years and has contributed to low levels of dental caries amongst primary school children (Mbawalla et al., 2013, Nyandindi et al., 1996). This demonstrates a great opportunity in utilizing other non-oral health professionals such as teachers or nurses or health promoters in carrying out oral health education or activities for the promotion of health (Thema and Singh, 2013a, Mbawalla et al., 2013, Kolisa, 2016).

The implementation of school-based oral health programmes is also shown to come with a variety of contextual challenges. A programme implemented at five primary schools in a deprived area in London, was evaluated and it was found that although the programme was well received, it experienced challenges in terms of communication links between the health and educational teams; how the activities impacted on school staff time; some schools experienced space challenges and poor organization of logistics (Yusuf et al., 2015). In Nigeria, when school oral health educational programmes were reviewed over 5 years, challenges reported were attributed to the lack of basic resources such as audio-visual aids; erratic power supply; inadequate health promotional materials and financial constraints in supplying toothbrushes (Lawal and Taiwo, 2014). This is no different from the problems experienced in the programmes observed in other developing countries (Reddy and Singh, 2015b).

A systematic review and meta-analysis undertaken in 2014 sought to assess the effectiveness of general health promoting schools in improving the health and well -being of students and their academic achievement; 67 eligible trials were found in studies on HPS reviewed between 2011-2013 with only one of the trials being on oral health. Thus oral health could not be included in the meta-analysis and therefore conclusions on effectiveness could not be made (Langford et al., 2015b). This highlights a gap in reporting of school oral health programmes which was echoed by Jürgensen and Petersen (2013); that although many school based programmes exist around the world, few have been scientifically documented and systematically evaluated.

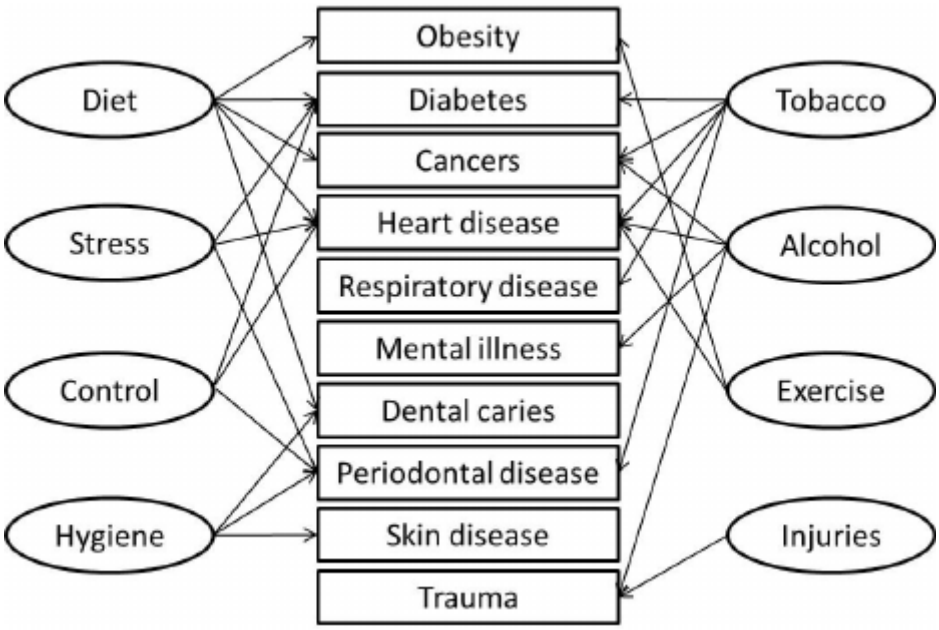
2.4. Common Risk Factor Approach in oral health promotion

It is evident that conventional dentistry has demonstrated some limitations with regards to addressing the burden of dental caries. It is more curative orientated than preventive and this has shown over the years to be unsustainable (Sheiham and Williams, 2015). The reason being that high levels of untreated decay among children across the world continue. In addition there is inadequate manpower to treat all oral diseases, particularly in low – middle income countries (Marcenes et al., 2013a, Thema and Singh, 2013a). Furthermore, in South Africa, oral health had the highest level of need for care amongst 66% of school learners (National Department of Health, 2015).

The cost of dental treatment is also expensive. It has been estimated that restoring teeth of children in low income nations could cost between £1,024 to £2,200 per 1000 children between the ages of 6-18 years (Sheiham and Williams, 2015). This is worrying as populations in low-middle income countries are projected to increase and therefore more dental manpower would be needed which would not be feasible in many developing countries (Sheiham and Watt 2000, Heilmann et al., 2015). This justifies the call for strengthening preventative care by incorporating oral health promotion programmes into the prevention and treatment of non-communicable diseases (NCD's) by utilizing a Common Risk Factor Approach (CRFA) (World Health Organization, 2013a).

A common risk factor approach (CRF) is a practice that promotes general health by controlling a small number of risk factors that impact on major NCDs such as cardiovascular disease, obesity, diabetes, mental illnesses, cancers, injuries and respiratory diseases. Oral health conditions have risk factors in common with diabetes, obesity, cardiovascular diseases, cancers and injuries (Heilmann et al., 2015). The common risk factors include poor diet, hygiene, stress, tobacco and alcohol use (Heilmann et al., 2016, Sheiham and Watt, 2000). See **Figure 2.1**. In turn, predisposing factors of major oral diseases such as dental caries; periodontal diseases, oral mucosal lesions and dental trauma include diet, smoking, alcohol, stress and injuries. (Sheiham and Watt 2000). See **Figure 2.1.**

Figure 2.1: Illustration of the Common Risk Approach to Oral Health (Adopted from (Sheiham and Watt, 2000).



The fundaments of the Common Risk Factor Approach (CRF) are underpinned by the recognition that oral diseases share risks with some non-communicable diseases and hence the approach proposes that once the common risks are altered, a reduction of a few conditions can occur rather than only tackling one condition (Watt and Sheiham, 2012). This demonstrates that there is a need for health promotion interventions to be broad in their approach in order to target complex factors affecting general health and oral health. The WHO has advocated for the implementation of a CRF approach as opposed to a vertical lifestyle approach, in the belief that the benefit of CRF would improve health conditions of not only the wider population but of high risk groups as well (Petersen et al., 2015a, Watt and Sheiham, 2012).

The global strategy is that oral health promotion be integrated with chronic disease prevention and general promotion as the risks to health are linked (Petersen and Kwan, 2010). Schools have therefore been suggested to be potentially effective for implementation of integrative approaches such as the CRFA as they have access to large diverse child populations and can modify risk factors in childhood that address common areas such as knowledge, attitude and behaviour (Petersen et al., 2015b, Watt and Sheiham, 2012).

Among school-children, shared risk factors encountered may include playground injuries which can cause trauma to bones and teeth; poor diet which may result in dental caries, diabetes and obesity. In addition poor physical hygiene which may cause increases in dental plaque, periodontal diseases and diarrheal conditions (Sheiham and Watt 2000, Blumenshine et al., 2008b). The shared risk factors have no ranking order as the principle of the CRFA is to highlight linkages that are shared in order that conditions may be managed in a multi-disciplinary manner (Macnab and Kasangaki, 2012).

Considering that South Africa has high levels of unmet oral health needs, dire shortage of oral health personnel in the public sector, limited financial resources and access to care in some remote communities (Thema and Singh, 2013a), it would seem fitting to implement a multidisciplinary approach in an integrated school health programme. However evidence in the country has demonstrated that the process of oral health integration into general health programmes is challenging as a result of contextual factors such as low staff morale, lack of technical support to guide the integration process, poor oral health knowledge amongst general health practitioners and the mismatch experienced between policy development and the implementation process (Singh et al., 2010, Molete et al., 2013).

2.5. School oral health policy in South Africa

In South Africa, there is no official policy document that only focuses on school oral health promotion, as the oral health activities are largely guided by the South African National Oral Health Strategy policy document. According to the strategy document, one of the key broad recommendations of improving oral health is by integrating strategic activities into programmes and policies that have an impact on community health like child, adolescent health, nutrition and non-communicable diseases (National Department of Health, 2004). The document is one of the main policy documents guiding oral health promotion & services in South Africa; however, it does not discuss school oral health promotion in detail. Its main emphasis is on highlighting strategic goals that are to be achieved at a national, provincial and district level. The goals set are informed by findings of the National Oral Health Survey of 1999-2002, and little is mentioned on how the goals should be achieved.

The Gauteng Oral Health Strategy is a provincial document informed by the national strategy with the aims of addressing and monitoring provincial and district implementation in order to

achieve the overall national oral health goals by 2030. (Gauteng Department of Health, 2010b). The plan describes its aim to have over 40% of six-year-old caries free and to reduce the DMFT of 12 and 6 year olds by 2030. It aims to create an enabling environment for oral health promotion, disease prevention at all levels and matching oral diseases with the best intervention strategies and available resources. There are additionally three unofficial documents that attempt to provide the details on how school oral health is to be carried out in order to achieve the national goals; these include the Oral Health Services & Oral Health Centres-Service Transformation Plan (Rashid, 2014-unpublished); Community Oral Health Services Manual (undated) and the Gauteng Oral Health Promotion Strategy Document (undated). The documents are however fragmented and lack consistency on clear operational guidelines.

Singh et al conducted an oral health promotion policy analysis and the report revealed that although the policy intentions are often well outlined in South Africa, the level of consultation on oral health policy issues is very poor. Moreover what is of concern is that considering that the last National Children's Oral Health Survey was undertaken in 2002, which implies that all planning and decision making has occurred with outdated epidemiological information, hence the oral health plan is not based on a reliable current needs analysis (Singh et al., 2010).

In an attempt to incorporate the general health of children in school settings and strengthen primary health care, the Integrated School Health policy was introduced in 2012. The goal of the policy is to improve environmental conditions in schools and address health barriers to learning in order to improve educational outcomes such as access, retention and school achievement (Department of Health & Basic Education, 2012). The Integrated School Health Policy seeks to provide a complement of school services such as oral health, hearing, vision impairment, nutrition, psychiatric disorders and risky behaviours in one environment (Mohamed S, 2013). It can therefore be argued that oral health promotion has been given some attention in general public health policies. However it is unfortunate that the outcomes of efforts placed have not been reflected in the oral health status of primary school children (Reddy and Singh, 2015a, Thekiso et al., 2012). Furthermore, there has been little scientific documentation on how implementation of the various policies has progressed over the years.

To date, in South Africa, a few scientifically documented school-based oral health programmes have been conducted in 1994, 1995 & 1996 & most recently in 2015. The studies in the 90's had strong methodological designs, one being a randomized clinical trial and two being three year cohort studies. In addition, all of them reported on the caries reduction effects of the intervention. However, they lacked information on how processes of implementation were organized and the quality of the programmes (Lalloo and Solanki, 1994, Chikte et al., 1996, Louw et al., 1995). The study conducted in 2015, assessed the viability of delivering oral health promotion activities at Health Promoting Schools in Kwa-Zulu Natal and found that of the 23 health promoting schools participating in the study, there were inconsistencies in the oral health activities offered and oral health was not integrated into the school curriculum. The managers of the Department of Basic Education did not prioritize oral health promotion; furthermore the educational staff and school health nurses lacked knowledge on oral health promotion (Reddy and Singh, 2015b). Similar to the other studies in the country there was an information gap in the various activities the schools were offering. The lack of intervention detail from the mentioned studies takes away the ability to fully determine how the interventions influence outcomes during stages of implementation (Chamberlain et al., 2011, St Leger, 1999).

2.6. Policy implementation

Policy implementation refers to a set of activities carried out for attaining specific policy objectives (Burke and Stephens, 2017). Policy implementation sits within a policy cycle of policy design, policy delivery and policy review which is often complex and evolving (Burke and Stephens, 2017). There are three generational scholarly perspectives on policy implementation (Brynard, 2005). These include; the classical generation which assumes that implementation can happen automatically once policy has been accepted; generation two thinking acknowledges that implementation is a complex and not a linear process (Brynard, 2005). Finally, generation three thinking aims to understand how implementation works and how it can be improved by using frameworks and predictive theories, which is the thinking behind the practice of implementation science (Fixsen et al., 2005).

Implementation is meant to bridge the gap between theory and practice, therefore it is a process that takes time and occurs in incremental stages (Burke and Stephens, 2017). There are therefore four essential steps to implementation which include; exploration, installation, initial implementation and full implementation, see Figure 2 (Fixsen et al., 2005). These steps

are recommended not to be skipped and require about 2-4 years to be finalized (Fixsen et al., 2005, Chamberlain et al., 2011).

2.6.1. Stage 1 – Exploration

The stage involves exploring and planning by assessing areas requiring implementation, the fit and feasibility of the innovation and whether the organization is ready to receive the innovation (Burke and Stephens, 2017, Scaccia et al., 2015). It is also essential that buy-in from key stakeholders such as leaders, front line staff and civil society is secured. This stage can happen during policy development.

2.6.2. Stage 2 – Installation

This involves planning and resourcing. There needs to be a clear plan for carrying out the innovation and an implementation team responsible for guiding the process (Burke and Stephens, 2017). The plan should include a model outlining the inputs, outputs and outcomes. In addition, there needs to be secure funding for all resources needed including the employing and training of staff (Bempah and Kanmiki, 2017).

2.6.3. Stage 3 – Initial Implementation

The innovation can be put into effect or piloted at this stage. During these activities there needs to be ongoing technical assistance for staff, monitoring of ongoing implementation, continued communication and feedback mechanisms to inform future actions (Burke and Stephens, 2017). The implementation plan should be regularly reviewed and updated (Chamberlain et al., 2011).

2.6.4. Stage 4 – Full Implementation

At this stage the innovation is fully adopted. It is culturally embedded and the outcomes are ready to be evaluated (Burke and Stephens, 2017). The core components of the innovation are in place and time and resources are well invested (Bempah and Kanmiki, 2017). Implementation teams also have an opportunity to learn from their experiences in order to inform future organizational and policy issues (Powell and Rey, 2015).

2.7. Enablers and Barriers to implementation

The literature suggests a few key enablers or drivers that facilitate implementation. They have been classified by the National Implementation Research Network into three groups. These include competency drivers; organizational drivers and leadership drivers (National Implementation Research Network, 2020). Competency drivers include; selection of

implementation teams, staff capacity, coaching and training. Organizational drivers refer to organizational support, implementation plans, administration and communication. Leadership drivers, involve stakeholder consultation buy in, resources, technical assistance and monitoring and evaluation (Burke and Stephens, 2017).

Barriers to implementation need also to be identified early on in order that actions can be taken through one of the enablers (Burke and Stephens, 2017). These include the external environment, resistance to change and vested interest. The external environment refers to existing structures or processes that are not aligned to the intervention. For instance, short policy cycles which disturb the momentum when the implementation requires a longer time to be implemented (Burke and Stephens, 2017). Resistance to change from the implementers could also stem from policy leaders imposing change prematurely before the stakeholders and organization are ready (Shea et al., 2014). Additionally, vested interests of staff, managers, lobby groups and professional bodies could affect implementation negatively or positively. For instance, politicians may want to influence the intervention in favour of their own political agenda, which could have negative repercussions (Burke and Stephens, 2017). The complexities of implementation are therefore evident and hence there are various theories suggested for successful implementation.

2.8. Implementation research theories

Carroll et al. (2007a) developed a conceptual framework for implementation fidelity in order to be used as a tool to assist in attributing outcomes to an intervention. Fidelity refers to the extent to which an intervention is delivered according to the intended protocol or policy and evidence has shown that high levels of fidelity are significantly related to positive change of a programme, see Figure 2.2 (Dusenbury et al., 2003, Durlak and DuPre, 2008a). The framework historically consists of five elements namely adherence, exposure, quality of delivery, participants responsiveness and programme differentiation (Hulscher et al., 2003). Adherence is concerned with whether an intervention is delivered as was designed. Exposure or dosage refers to the level of an intervention received by participants, which includes coverage, frequency and duration (Carroll et al., 2007b). Quality of delivery refers to the manner in which the programme is delivered and it can be benchmarked against some standard (Dusenbury et al., 2003). Participant responsiveness measures the extent to which participants respond or are engaged with the intervention. Programme differentiation or

component analysis is concerned with determining elements that are essential for the success of the intervention (Dusenbury et al., 2003).

The authors of the framework further suggest that the extent to which fidelity is achieved is moderated by not only quality of delivery and participants' responsiveness. Two more elements are added namely; intervention complexity and facilitation strategies (Carroll et al., 2007b). The reason being that in terms of intervention complexity, it is argued that the more complex the intervention the more challenging the implementation would be. Therefore simple interventions are arguably more likely to achieve high fidelity (Atun et al., 2009, Dusenbury et al., 2003). Facilitation strategies refer to the support systems of an intervention such as training, provision of guidelines and adequate financial and human resources. These factors are considered to strengthen implementation delivery and intervention outcomes (Dusenbury et al., 2003).

Figure 2.2: Framework on implementation fidelity

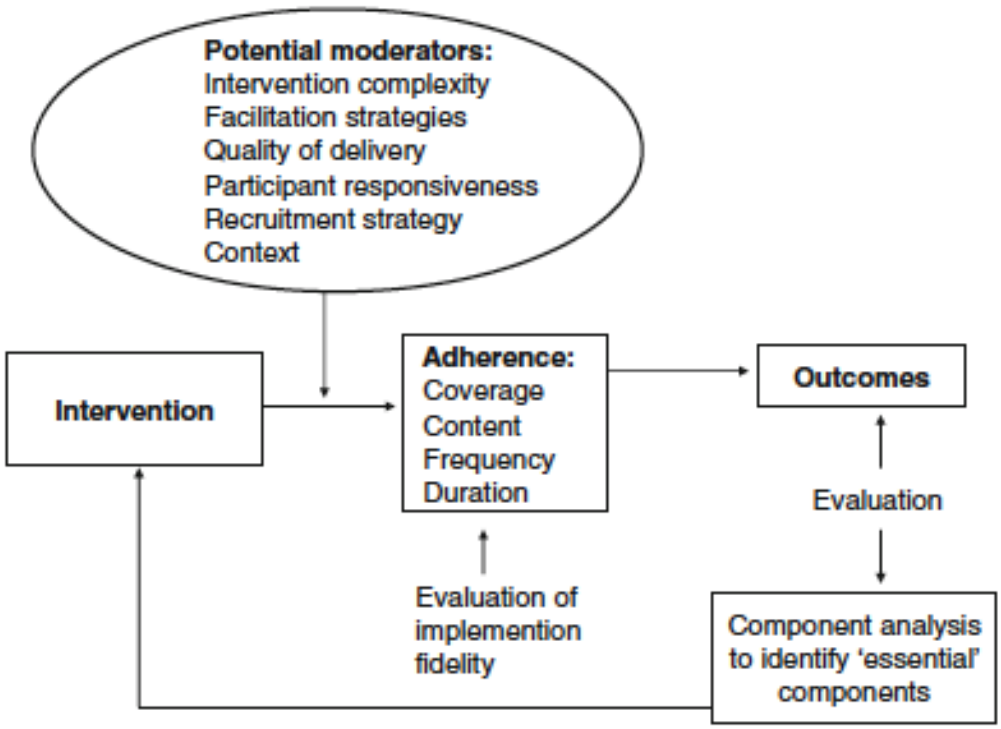


Fig. 1 The modified conceptual framework for implementation fidelity (Hasson, 2010)

Evaluating comprehensive interventions such as school health programmes has often been found to be a challenge as the interventions are complex and effectiveness of outcomes may not necessarily result from the programme but from other underlying determinants (Rabie and Cloete, 2013, Moore et al., 2015b).Therefore an assessment of implementation processes is key as it has a bearing on the effectiveness of the programme. Additionally, it is essential in providing an understanding of how the intervention is organized, how participants and activities interact. This assists in determining whether poor outcomes are due to a poorly designed intervention or whether the actual implementation is a challenge (Mũkoma and Flisher, 2004, Speller et al., 1997, Moore et al., 2015b). Hence, there exist a few other perspectives that can be used to add detail to Carrol's theory so that determinations can be made on where the implementation gaps may lie.

These include; the Siddiqi governance assessment framework and the Walt & Gilson Policy triangle (Siddiqi et al., 2009, Walt and Gilson, 1994). The Siddiqi governance assessment framework makes recommendation on conditions needed for successful implementation and assesses questions that encompass governance principles from national policy formulation to policy implementation (Siddiqi et al., 2009). It includes 10 key principles ranging from strategic vision to the ethics of policy implementation and the details are illustrated in **Table 2.1.**

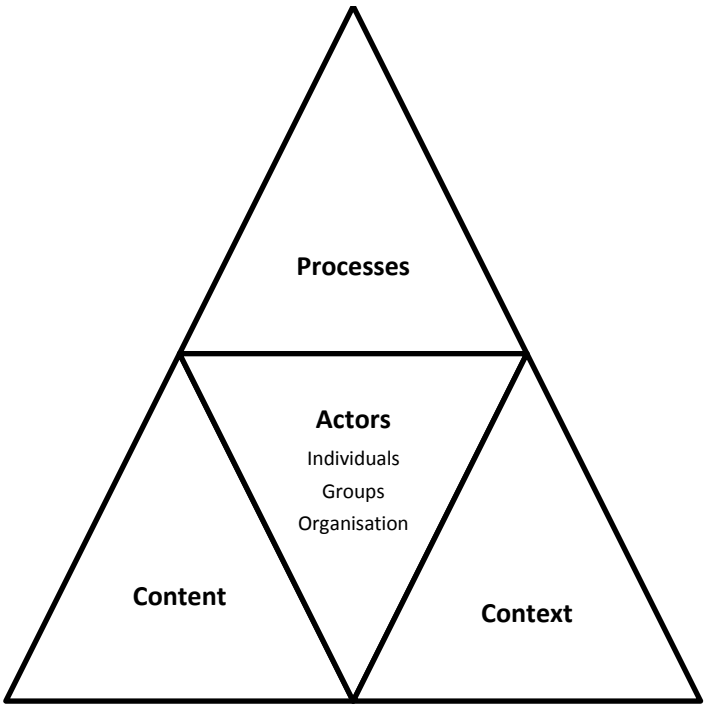
Table 2.1: Governance Framework Principles

Health Systems Governance Principles	Description
Strategic vision	There needs to be clear understanding of policy objectives and long term vision
Participation and consensus orientation	Participation is necessary among all stakeholders and there should be clarity on how decisions are finalized.
Equity & inclusiveness	The allocation of public sector resources needs to be equitable and address financial barriers of the poor.
Rule of law	Policies need to be translated to laws or rules, which need to be enforced.
Transparency	There needs to be transparency in decision-making and allocation of resources.
Responsiveness to patient health needs	Policies need to be responsive to the needs of the population.
Effectiveness and efficiency	The human resource systems and communication processes from leadership need to be effective.
Accountability	Mechanisms for overseeing adherence to financial, administrative rules need to be in place.
Intelligence and information	There needs to be adequate health systems information and it should be accessible and reliable so that it can be used for decision-making.
Ethics	Importance needs to be attached to ethics in research and services.

Source: Adopted from Siddiqi et al. (2009)

The Walt & Gilson Policy triangle has been used to assess the key elements at play within the policy implementation process. It highlights how the elements of policy content, processes and context influence the extent of policy implementation and the central role of actors in implementation, see Figure 2.3.

Figure 2.3: Illustration of the Walt & Gilson triangle

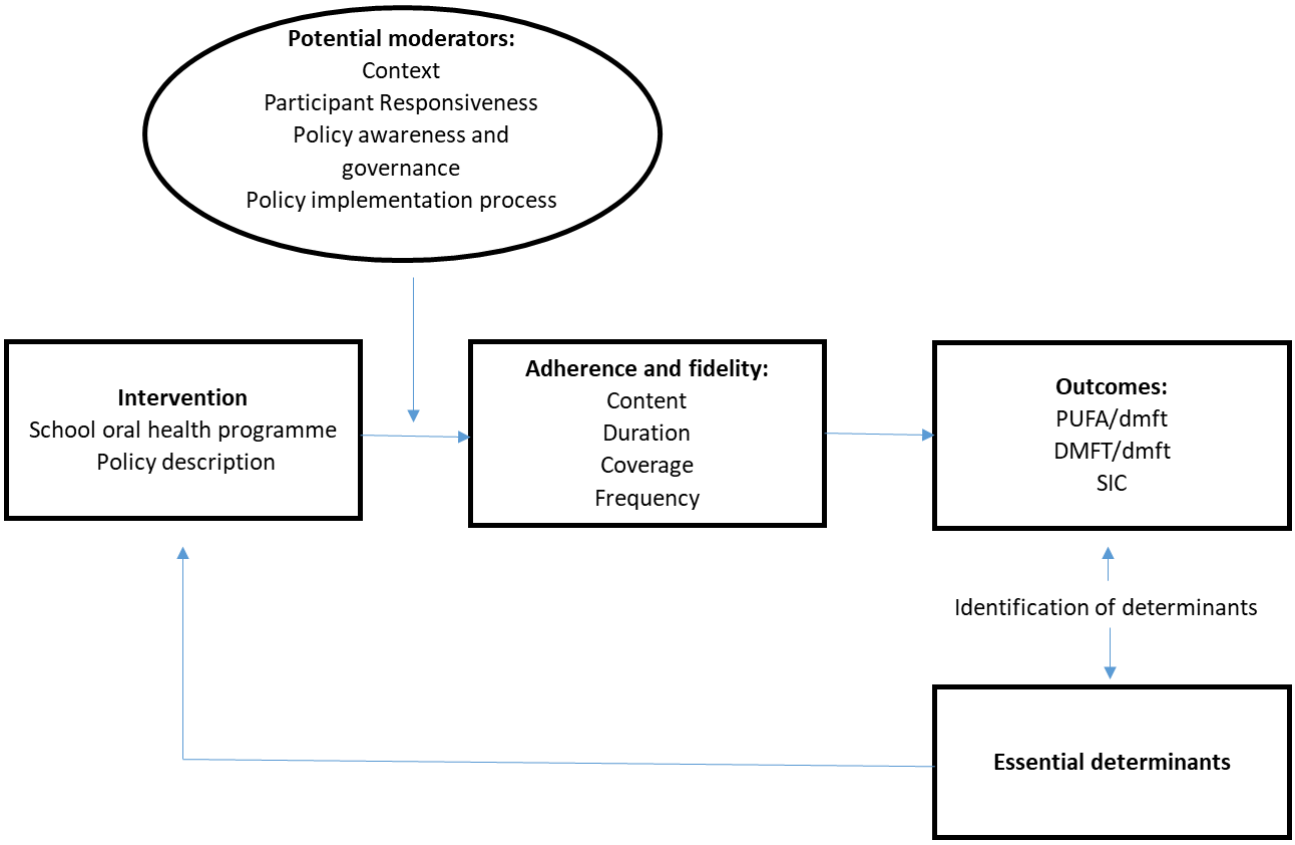


2.9. Conceptual Framework

The overarching framework for my study is adapted from Carroll's Implementation Fidelity Framework as the study is premised on the intention to assess the actual implementation of the school oral health programme policy and in turn establish the extent to which implementation at an operational level is aligned to policy; this is referred to as fidelity (Carroll et al., 2007b). Theoretical perspectives of the Siddiqi's governance framework and the Walt and Gilson model have been integrated into the framework in order to elaborate on Carroll's elements for the study. In the adapted framework, the governance principles of Siddiqi have been integrated as potential moderators, as they are likely to influence the relationship between the intervention and level of adherence and fidelity. The processes,

content, context, actors from the policy triangle are integrated in Carroll's elements of the intervention, potential moderators and fidelity. Essential determinants have been added in the framework in order to derive the key elements of success in the programme that can be used to address gaps in clinical outcomes and refine the intervention. See Figure 2.4.

Figure 2.4: Conceptual framework



3. CHAPTER THREE - METHODOLOGY

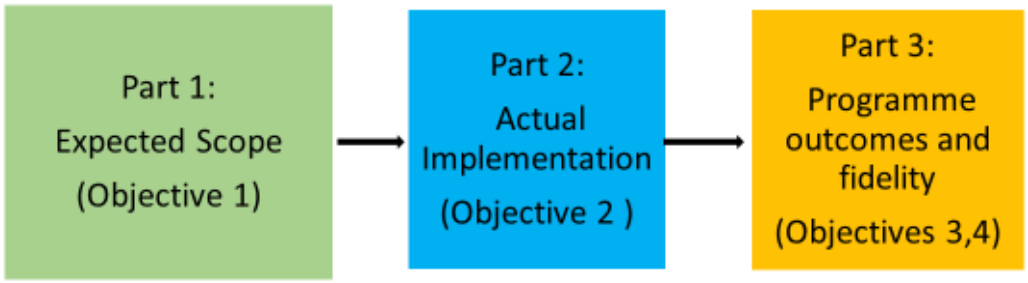
3.1. Introduction

My study utilised a convergent parallel mixed method approach. This involved a separate collection of qualitative and quantitative data which were merged during the interpretation phase (Creswell and Clark, 2007). Combining the two research approaches in this way provided depth and breadth of understanding of the topic and simultaneously contributed to the validity of the study as the information from the two methods was confirmed. (Creswell and Clark, 2007, Stern et al., 2012, Katzenellenbogen and Joubert, 2007). The qualitative data were mostly used to provide meaning to the quantitative data and further enhanced the depth of the study results (Schoonenboom and Johnson, 2017). The quantitative and qualitative data outcomes were integrated throughout the research process (Schoonenboom and Johnson, 2017).

The study was undertaken in three parts, the first part described the scope of school-based oral health services from the perspectives of policy and the oral health managers. The second part elaborated on the actual programme implementation. The third part determined the effect of the programme on expected outcomes and identified the direct and indirect factors affecting the quality of the programme. The three parts are illustrated in Figure 3.1.

Section 3.2 of this chapter covers the crosscutting methodological features of the thesis while section 3.3 provides summaries of the specific study methods and designs of the different manuscripts that constitute the thesis. Additional information on the specific study methods and designs are presented in the respective chapters of the thesis. This chapter ends with a description of the ethical considerations.

Figure 3.1: Diagrammatic outline of methodology



3.2. Crosscutting methodological features

3.2.1. Study setting and population

The Tshwane health district is a large metropolitan municipality situated in the northern part of the Gauteng Province. It has a population of 2.9 million people and is demarcated by seven regions with a mix of both urban and peri-urban areas because of its incorporation of former homelands (Ganief and Thorpe, 2018). The Tshwane district is also one of the national priority pilot districts for the National Health Insurance. The National Health Insurance is a financing mechanism that South Africa is planning to adopt in order to ensure universal health coverage for all citizens. Primary health care reforms will be key to the health systems transformation process as they are central to facilitating health promotion, prevention of illness and a first point of entry into the healthcare sector (Mashoto et al., 2010). School Health Programmes are among the primary health care interventions being piloted across 11 health districts in South Africa (Health Basic Education, 2012).

My PhD study population consisted of provincial and district oral health managers from the Gauteng Oral Health Directorate, oral hygiene clinicians' co-ordinating oral health activities at the schools in Tshwane and school learners aged between 6 to 7 and 12 to 13. The study also targeted schools in quintile 1 and 2 as school oral health programmes were prioritised for those particular quintiles as the areas were economically disadvantaged. In South Africa, schools are categorized according to the national poverty ranking of public schools referred to as quintiles (Health Basic Education, 2012). Quintile 1 schools are located in disadvantaged regions and quintile 5 schools are located in economically affluent areas (Health Basic Education, 2012).

The participating schools in the study were located as follows; two were in central Tshwane, two in the south of Tshwane, three in the west of Tshwane and three in the east of Tshwane as illustrated on the map (Figure 3.2). Four of the schools were quintile 1 schools and six of the schools were quintile two schools. All the schools were non-fee-paying schools and were on government subsidized school meals.

Figure 3.2: Map of Tshwane depicting the distribution of participating schools

- The blue dots ( ) on the map represent the location of the participating schools.

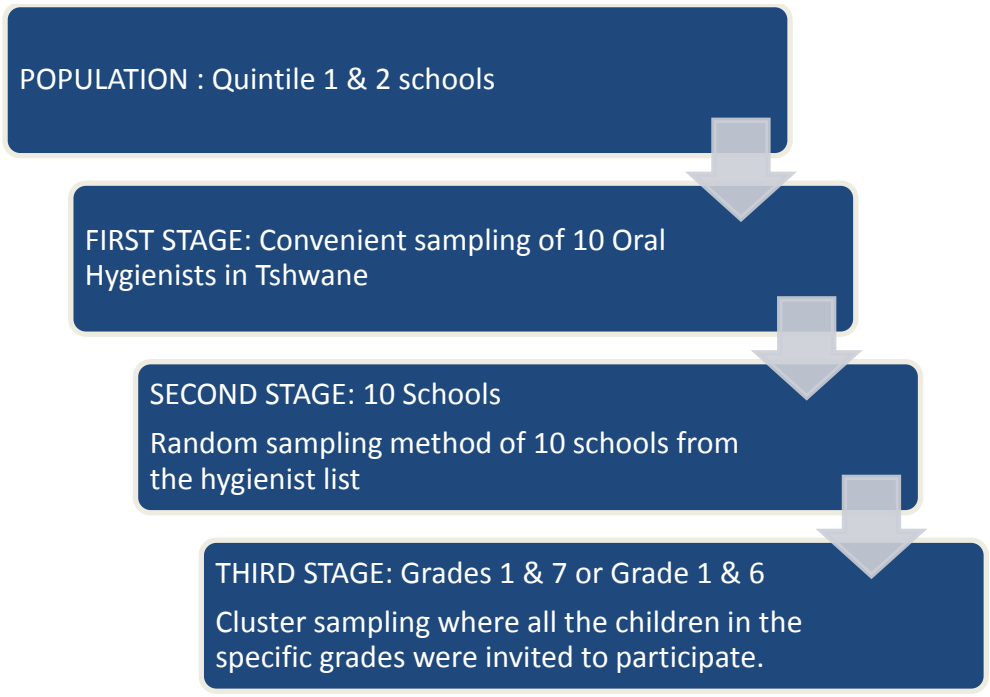


3.2.2. Study Sampling

As Tshwane District only has10 oral hygienists, all 10 were invited to participate in the study. A multistage sampling technique was undertaken for the selection of schools and learners aged 6/7 and 12/13 as recommended for dental surveys (World Health Organisation, 2013b). All 10 oral hygienists had a list of schools that they were co-ordinating. The first stage of sampling involved a random selection of one school from each of the hygienist list according to the inclusion criteria. The second stage involved cluster sampling of grades 1 and 7 in each school where all children in each selected grade cluster were invited for participation. Some schools accommodated children until grade 6 and some until grade 7, therefore the two selected grades per school were either grade 1 and 6 or grade 1 and 7 depending on the school. A sample of approximately 700 learners was required to enable the estimation mean DMFT with a precision of ± 0.3, assuming a standard deviation of 2.0 with a design effect of

2. The sample size calculation also accounted for the clustering effect of pupils within schools (Statcalc,version 14). **Figure 3.3** illustrates the sampling method.

Figure 3.3: Illustration of the multistage sampling method



3.2.2. Data collection instruments

Multiple data collection tools were utilised. These included the process mapping templates, fidelity checklists, oral health assessment forms, a semi-structured interview guide and policy documents (Appendix A-D). The process maps represented a visual illustration of school oral health service delivery components and were used as an analytical tool to delineate and document the sequence of activities and events followed by the hygienist at each school (Wilgis and McConnell, 2008). An implementation fidelity checklist covering essential programme components was used to measure the key components recommended by the World Health Organisation (WHO) and local policy.

At the schools, the process mapping template was utilised to observe the programme activities of the oral hygienists and their interactions with the school community. The fidelity checklist was then used to gather information from the oral hygienists and from policies. The fidelity checklist was pre-tested on one of the school oral health programmes not involved in the study in order to ensure precision and repeatability (Katzenellenbogen and Joubert, 2007).

Upon observing the oral hygienists and interviewing them, clinical oral health examinations of the learners were undertaken according to WHO guidelines (World Health Organization, 2013b). The data collection was undertaken by the principal researcher and an assistant researcher who were trained and standardised to ensure inter and intra examiner agreement. Each of the results chapters (Chapters 4-7) provide further details on how the various data collection instruments were utilised.

3.3. Specific Methodological approach by study objectives

This section provides summaries and justification of the methodological approaches used for each objective. A snapshot of this information is shown in Table 3.1.

Table 3.1: Summary of study design and methodology by objective

Study Objectives	1.Describe provincial & district managers perceptions & translation of School Oral Health Policy	2.Describe the implementation process & gaps of School Oral Health Programmes	3.Determine the dental health status of learners & factors associated with the oral health status	4.Determine implementation fidelity & its effects on the dental status of learners
Study Population	Provincial & district oral health managers involved in school oral health	Tshwane District oral hygienists	Primary school children in the Tshwane District	Primary school children in the Tshwane District
Sampling & Size	Purposive (n=8)	Purposive (n=10)	Multistage sampling of pupils (n=736)	Multistage sampling of pupils (n=736)
Design	Qualitative Exploratory	Qualitative Case Study	Cross-sectional	Cross-sectional
Key variables measured	Perceptions of school oral health policy by the managers.	Processes of implementing the policy at schools.	Socio-demographic variables DMFT/dmft PUFA/pufa Significant CariesIndex (Sig)	Socio-demographic variables Dental caries Fidelity Fidelity moderators and determinants
Data collection method	Policy documents review In-depth interview	Process mapping Interview guides	Clinical examination (DMFT/dmft; PUFA/pufa)	Clinical examination (DMFT/dmft; PUFA/pufa) Fidelity Checklist
Data analysis	Thematic Framework Analysis	Thematic Framework Analysis	Descriptive statistics Multilevel modelling Multiple linear regression analysis	Descriptive statistics Multilevel Poisson's regression analysis

3.3.1. Part 1 – Scope

Objective 1: To explore policy and manager's roles and perceptions in implementing school oral health programmes in Gauteng Province.

This section summarises the methods used for Objective 1, further details are presented in Chapter 4 of this thesis.

Study design

An exploratory qualitative study design was used to address this objective. This design was appropriate as there is little existing knowledge in South Africa in the area of operational managers' perspectives on oral health programmes and how they engage with policy. Hence the method provided an opportunity to explore the topic in-depth and understand the context and the meaning behind the perspectives and experiences of the managers in driving the policy implementation process (Spencer et al., 2003). It also brought about an understanding of the context in which the participants engaged with policy. The reasons behind certain participant's responses were illuminated; and deeper thoughts and behaviours governing responses and interactions among policy makers and implementers were also revealed.

Study population & sampling

According to the Gauteng Oral Health Directorate organogram (Appendix E), there are 12 oral health managers in the province. A sample of eight oral health managers from the provincial and district offices were purposively sampled, as they were key stakeholders responsible for managing school oral health.

Data collection and tools

Data were collected through in-depth interviews and policy document review. The semi-structured interview guide was adapted from the WHO (2003) school oral health guidelines (Appendix D). The policy documents reviewed included the National Oral Health Strategy and the Gauteng Oral Health Strategy (National Department of Health, 2010, National Department of Health South Africa, 2018).

Data management & analysis

A thematic framework analysis was utilised which included the steps of; familiarisation, identifying a thematic framework, indexing, charting and finally, mapping and interpretation (Ritchie et al., 2013). The findings of the policy analysis were also charted in alignment with the conceptual framework and were used to support the statements made by the participants. The four criteria of trustworthiness which include credibility, dependability, transferability and confirmability were ensured in the analysis (Lincoln and Guba, 2002).

3.3.2. Part 2 – Implementation

Objectives 2: To describe the implementation processes of school oral health programmes in the Tshwane health district.

This section summarises methods used for Objective 2; further details are presented in Chapter 5 of this thesis.

Study design:

An explanatory case study design was utilised to answer this objective as I sought to answer a question that explained the presumed links of why events were unfolding in a particular way in an uncontrolled complex intervention (Baxter and Jack, 2008). A single case was selected where the unit of analysis or case was the ***programme*****.** The research question was; ***What were the processes of implementing the school oral health programmes?*** and the boundaries of the case were on time and place (Creswell and Creswell, 2017); which was, ***implementation of the school oral health programmes in 2017 at Tshwane***.

A single case study was preferred over the one with embedded units and multiple case approaches for the following reasons: The contextual environments that the oral hygienists were working under were very similar and hence sufficient understanding was derived from assessing the entire programme as a single case (Baxter and Jack, 2008). Secondly although there were two isolated school settings that presented stark contrasts, the data were not sufficient to analyse embedded units or create multiple cases (Baxter and Jack, 2008).

Study population & sampling

As there were only 10 oral hygienists providing oral health services at various schools in Tshwane, all of the oral hygienists were invited to participate in the study. One school from each of the oral hygienist's list of schools that had been on an oral health programme for more than one year was randomly selected to participate.

Data collection & tools

Multiple data sources were used which included process maps, fidelity checklists, and policy documents (Baxter and Jack, 2008, Creswell and Clark, 2017). The data collection tools namely the process maps and interview guides were developed by using the prescripts of the national oral health policy documents and the WHO school oral health guidelines (World Health Organisation, 2003). The observations were carried out as each of the oral hygienists was performing their activities at the various schools and interviews were carried out after they had carried out their work. (Appendix A & Appendix B).

Data management & analysis

A thematic framework analyses similar to Objective 1 was utilised (Ritchie et al., 2013). The initial codes were derived from the Walt & Gilson triangle in order to guide the development of a thematic framework that was used for identifying the rest of the codes inductively. Trustworthiness was ensured as in objective 1.

3.3.3. Part 3: Programme Outcome and Fidelity

This section summarises the methods used for Objectives 3 and 4; further details are presented in Chapters 6 and 7 of this thesis. This part of the thesis has two subsections, the first section deals with Objective 3 to determine the dental health status of the learners in order to assess effects of the programme; and the second describes the processes to fulfil Objective 4 which sought to analyse implementation fidelity and its effects on the dental status of school learners receiving school oral health programmes in the Tshwane health district.

Study design:

Objectives 3 and 4 were measured using cross-sectional study designs. The design enabled the assessment of quantitative data at one point in time where two or more variables were examined to describe the extent of the burden of disease and detect patterns of associations (Bryman, 2001).

Study population & sampling

The study population included children aged 6/7 and 12/13 as they are ages recommended for dental surveys (World Health Organization, 2013b). Children of these ages were in grades 1, 6 and 7 classes. Cluster sampling of the children was conducted according to grades and the final sample size of the study population was 736. The 10 oral hygienists facilitating the school activities were also observed and interviewed.

Data collection & tools

The data collection tools included the Decayed Missing Filled Teeth Index (DMFT/dmft) and the Pulpal Ulceration Fistula Abscess (PUFA/pufa index). These were used according to the WHO survey guidelines (2013); (Appendix C). The fidelity checklist was used to observe and interview the oral hygienists. Records were also reviewed to verify some information and the data collection was guided by the implementation fidelity checklist (Appendix B). All the tools were pre-tested on one of the school oral health programmes not involved in the study in order to ensure precision and repeatability (Katzenellenbogen and Joubert, 2007).

Data management & analysis

Study inferences were drawn from statistical predictive models and the modelling was multilevel as the analysis was required at both school and individual child levels (Peugh, 2010). The statistical tests used included multiple linear regression for objective three (Chapter 6) and Poisons regression analysis for objective four (Chapter 7). The justifications of the various strategies are explained below.

***Multilevel modelling*:** Assumptions of traditional regression analysis are that, individual measures being considered in a study are independent. However in my study that was not the case as the variable dental scores of children in the same school were correlated because the children shared the same environment; this is referred to as a clustering effect (Merlo et al., 2005). This effect would violate the assumption of the independence of the measures had the

analysis been undertaken on one level only (Harttgen and Misselhorn, 2006). Hence, there was a need to analyse measures of effect at two levels in order to accommodate for the clustering effect of the children's dental scores at the schools.

Multiple linear regression analysis: Instead of having one explanatory variable as in a linear regression analysis, the explanatory variables of my study included age, gender, services and location. Hence the use of a multiple linear regression technique. This type of analysis also assisted in demonstrating the relationships and size effects between the independent and dependant variables (Uyanık and Güler, 2013). Chapter 6 provides more specific detail on how the analysis was conducted.

Poisson's regression analysis: This analysis was used in my study for forecasting counts of events, exposure or observations (Hayat and Higgins, 2014). It is used only on numerical continuous data and its restriction is that the dependant variable should have a count or poissons distribution (Hayat and Higgins, 2014). It was appropriate for use in objective 4 (Chapter 7) as both the independent (Fidelity) and dependant (Decay) variables of the study were count based. Chapter 7 provides more specific detail on how the analysis was conducted.

3.4. Ethical Considerations

The study was underpinned by fundamental principles that protect participants from harm and respect of individual integrity (Slowther et al., 2006). Research ethics approval was obtained from the Wits Human Research Ethics Committee (M170115); (Appendix F). Permission to access the schools was obtained from the Gauteng Department of Basic Education, see (Appendix G).

I approached potential participants for the in-depth interviews via an invitational letter which included the participant information sheet and consent form (Appendix H&M). Those who provided written consent were given an interview appointment which was held at their places of work. Participants were assured of their details remaining anonymous.

The school principal had to agree for entry into the school premises upon being satisfied with the permission letter from the Department of Basic Education. The, oral hygienists, parents or legal guardians of learners were provided information sheets which outlined the details of

the study before it was carried out. This provided an assurance of the negligent risk resulting from the study and that their confidentiality was ensured (Slowther et al., 2006).

The parents were requested to sign consent in order to give permission for the children to participate in the study and the learners were also required to assent whether they agreed to participate or not (Appendix N&O). This ensured that the rights and dignity of the child were upheld at all times. No learner was examined clinically without evidence of parental consent and assent. When oral health needs were identified from any of the children screened, the oral hygienists were notified and the children were treated or referred to the nearest primary health care facility.

It is an ethical obligation to ensure that my research findings are disseminated and well understood by research participants, as they are key stakeholders in the delivery of school oral health services. In order to ensure broad dissemination of study results, I will organize community workshops for teachers, parents and the general school community. In addition, written and orally presented policy briefing platforms would provide me with an opportunity of engaging managers and policy makers from oral health, general health, and education on informing policy direction. This would not only benefit the progress of school oral health programmes, but would promote trust in the research process (Turcotte-Tremblay.,2018).

4. CHAPTER FOUR - PERCEPTIONS OF PROVINCIAL AND DISTRICT LEVEL MANAGERS' ON THE POLICY IMPLEMENTATION OF SCHOOL ORAL HEALTH IN SOUTH AFRICA.

Molete M, Stewart A., Moolla A. and Igumbor JO, 2021. Perceptions of provincial and district level managers on the policy implementation of school oral health in South Africa. *BMC Health Services Research*, *21*(1), pp.1-10.

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4.1. Background

In South Africa, even though school oral health programmes have been ongoing for over 20 years, the services provided at the schools are reported to be inconsistent and fragmented (Molete et al., 2020, Reddy and Singh, 2015b, Singh et al., 2010). This is in spite of the widely referenced national and provincial evidence based recommendations contained in the oral health strategic policy documents (Kwan et al., 2005b, Reddy and Singh, 2015b). South African studies report that some schools are offered once-off activities and others are serviced only once a year (Molete et al., 2020, Reddy and Singh, 2015b, Singh et al., 2010). Upon assessing the gaps between policy and practice from the perspectives of frontline oral hygienists implementing the school oral health programmes, Molete et al. (2020) observed the behavior of frontline oral hygienists as they traded policy direction with poor quality interventions in response to the structural challenges of policy implementation.

The main policy document guiding oral health in South Africa is the National Oral Health Strategy (National Department of Health, 2010). The national strategy provides an oral health framework for provincial and district governments who are then tasked with translating it into operational plans for frontline implementation, thus all the operational documents are informed by the national oral health strategy. One of these is the Gauteng Provincial Oral Health Strategy (Gauteng Department of Health, 2010a). The provincial strategic document recognizes the national goal of reducing the burden of oral diseases by 2030 in its strategic approach to prioritize child oral healthcare access through school based programmes; increase the percentage of 6 year olds who are caries free to 60%; and to reduce 12 year olds

Decayed Missing Filled Score (DMFT) score to an average of 1.0 (Gauteng Department of Health, 2010a).

Gauteng Province of South Africa has an oral health head office, which is responsible for leading provincial and district oral health services. The provincial oral health services are offered through three university based dental health facilities, which are responsible for primary, secondary and tertiary services. The districts' facilities offer primary health services, some limited secondary services and are located across five health districts within the Province of Gauteng (Gauteng Department of Health, 2010a). Each district has a dental manager that oversees all the districts' operational needs. In addition to a dental manager each district also has an oral hygiene manager who is responsible for the oral hygiene work which includes preventative care and community oral health services (National Department of Health, 2010, Gauteng Department of Health, 2010a).

The dental and oral hygiene district managers are responsible for coordinating the attainment of national and provincial strategic objectives at a local level (Bergen and While, 2005). Consequently, the district managers are responsible for how policy is experienced by oral healthcare users and have the discretionary power to decide what actions are appropriate and what problems should be prioritized for action in the context of resource limitation and the local disease burden (Lehmann, 2016, Lipsky, 2010). Therefore, they have a key role to play in how policy implementation unfolds at a local level. Their judgements are affected by their values and beliefs, such as personal experiences, education and training, organizational norms and cultural norms (Bergen and While, 2005). Their values and beliefs are translated to core policy positions that influence their response to policy proposals and how they decide to engage with a particular policy (Lehmann, 2016). Hence, it is necessary to get an understanding of how they operate and how their actions influence policy implementation.

Policy implementation processes are commonly categorized as top-down or bottom-up (Lehmann, 2016, Cloete et al., 2018). A top-down approach is often formulated at a national level and then translated to operational instructions that are used by implementing officials at a local community level. The process is rigid and tends to undermine the involvement of local implementers who are expected to carry out the work (Lehmann, 2016). The bottom-up approach is iterative as incremental steps of change and revisions are made between local implementers and national leaders (Lehmann, 2016). This approach also emphasizes the role

of local implementers in the implementation process in terms of the discretionary authority they have in carrying out the policy within a local context (Lipsky, 2010).

The two approaches both have their limitations however they complement each other in navigating through the complexities of policy implementation (Cloete et al., 2018). Hence, the development of hybrid approaches that combine top-down mechanisms to promote good practice together with bottom-up persuasive orientated mechanisms (McDermott et al., 2015). Central to the hybrid integrated approaches are the relationships between and within organizations for managing deliverables, risks and promoting collaborations (Szirom et al., 2002). For good governance all key stakeholders need to be represented to ensure transparency, enhance understanding of decisions made, as well as share the strategic and operational processes (Delaney, 2015). Poor governance processes and lack of engagements often lead to systems with dysfunctional cultures and lack of effective leadership (Delaney, 2015).

A major component of policy implementation is about governing actors and organizations working together towards attaining policy objectives (Campos and Reich, 2019). Hence governance is key for overall health systems development and understanding governance is important in improving health systems performance (Siddiqi et al., 2009, Upadhaya et al., 2017). The Siddiqi governance assessment framework will therefore be used in this study as it is broad and integrates questions that encompass governance principles from national policy formulation to policy implementation (Siddiqi et al., 2009). The use of this framework is aimed at analyzing the policy response of oral health managers at provincial and district levels in driving the implementation of school oral health services. This framework additionally assists in outlining the policy gaps and conditions needed for successful implementation. Please see Table 4.1 for a description of the 10 key principles ranging from strategic vision to the ethics of policy implementation.

Table 4.1. Governance Framework Principles

Health Systems Governance Principles	Description
Strategic vision	There needs to be clear understanding of policy objectives and long term vision
Participation and consensus orientation	Participation is necessary among all stakeholders and there should be clarity on how decisions are finalized.
Equity & inclusiveness	The allocation of public sector resources needs to be equitable and address financial barriers of the poor.
Rule of law	Policies need to be translated to laws or rules, which need to be enforced.
Transparency	There needs to be transparency in decision-making and allocation of resources.
Responsiveness to patient health needs	Policies need to be responsive to the needs of the population.
Effectiveness and efficiency	The human resource systems and communication processes from leadership need to be effective.
Accountability	Mechanisms for overseeing adherence to financial, administrative rules need to be in place.
Intelligence and information	There needs to be adequate health systems information and it should be accessible and reliable so that it can be used for decision-making.
Ethics	Importance needs to be attached to ethics in research and services.

Source: Adopted from Siddiqi et al (2009)

4.2.Methods

This is an exploratory qualitative study as there is little pre-existing knowledge on managers' perspectives on policy implementation of oral health programmes (Singh, 2011). This method provides an opportunity to explore the topic in depth in order to understand the context and the meaning behind the provincial-district managers' perspectives in terms of policy implementation (Ritchie et al., 2013).

The study population consisted of oral health managers from the Gauteng districts and provincial offices. There are a total of 12 oral health managers in the Gauteng province, and a purposive sample of eight managers responsible for school oral health were selected from the following districts Tshwane, Central Johannesburg, West Rand, Erkhululeni, Sedibeng and West Rand and two from the Gauteng provincial head office. Of the eight participants, two were dentists, one a dental therapist and five were oral hygienists. These key-informants were the most appropriate in providing access to the information that was needed as they are responsible for operational planning and supervision of the oral hygienists who were implementing school oral health services (Creswell et al., 2007).

Data were collected through in-depth interviews and policy document review. The semi-structured interview guide consisted of questions concerning: policy, programme objectives, school health services and education, school and community relationships and nutritional services (World Health Organisation, 2003). The policy documents reviewed included the National Oral Health Strategy and the Gauteng Oral Health Strategy (Gauteng Department of Health, 2010a, National Department of Health, 2010). In addition, internal operational plans that included the Community Oral Health Service Manual and Gauteng Oral Health Promotion Strategy were also reviewed. The interview guide was used in managing the questioning and allowed the interviewer the flexibility of probing according to the participants' responses (Gorman et al., 2018). The first author conducted the interviews at the offices of the participants; the interviews were approximately an hour long, and were audio recorded and transcribed verbatim (Ritchie et al., 2013). Field notes were additionally compiled after each interview to gather information on the context of the setting.

4.3.Data analysis

A framework analysis was utilised following the steps outlined by Ritchie et al. (2013). The framework analysis included familiarisation, identifying a thematic framework, indexing, charting and finally, mapping and interpretation (Ritchie et al., 2013). The analysis was iterative and the first and fourth authors reviewed the transcripts and policy documents multiple times for familiarisation. Identifying a thematic framework involved a generation of initial codes deductively and aligned it to the conceptual framework; this was done by the first author. The first and fourth authors further identified other emerging codes inductively to build the thematic framework. This was done until the data were saturated. Indexing involved aligning the selected codes to the constructs of the conceptual framework. Specific themes were arranged according to charts on a matrix to ensure that they reflected the descriptions of the participant and were aligned to the conceptual framework constructs. The findings of the policy analysis were also charted in alignment with the conceptual framework and were used to support the statements made by the participants. All the authors reviewed the charts to check for potential biases. This then further guided the mapping and interpretation of the data as the themes were reviewed and refined (Gorman et al., 2005).

The four criteria of trustworthiness which include credibility, dependability, transferability and confirmability were addressed (Miles and Huberman, 1994). In terms of credibility, all authors reviewed the data and addressed biases in order to ensure that the phenomenon was accurately described. The third author then re-coded the data; cross checked the entire process and resolved discrepancies in order to improve dependability. In addressing transferability, the context of the fieldwork was well described so an assessment could be made on whether a similar method can be applied to another setting. Finally, confirmability was ensured by utilizing field notes for making analytical sense of the data and additionally, data were shared with some of the participants in order to confirm that the data were truly represented (Miles and Huberman, 1994).

4.4.Results

As outlined in Table 4.2, the results discussed reflect the findings of both the policy document review and the perspectives of the provincial-district managers.

Strategic Vision

Although the national strategy does not have a vision statement, its key goals are clear and designed to improve oral health services for all citizens. The goals are to be attained as follows; 60% of 6-7 year olds to have fissure sealants placed on first permanent molars; 40% of 11-12 year olds to have fissure sealants placed on second molars and 50% of primary school children in the country to be exposed to a tooth-brushing programme. Furthermore, 20% of primary schools in each province to be on an oral health programme each year. However, it appears that activity targets on how to achieve the main goals are poorly understood by the oral health managers and there is no clarity on how each district aims to achieve their targets. This point is illustrated by these excerpts from the managers interviewed:

"Well, we have a target from national, the target from national is about 50 schools for Gauteng, but they try by all means to reach as many as possible, because I remember the other year they were sitting at 520 schools (For toothbrushing programmes)." ***P1***

"*We're focusing on Grade R, 1, 2 and 3. Uhhh, it is crazy, you know inside those schools there are 600 children in the Grade 1, 2 and 3. Then maybe they would go to another school and also accommodate the Grades R, 1 and 2 there, it all depends, it depends on Oral hygienists, Oral hygienists by now they know their areas…they know the schools".* ***P3***

Participation and consensus orientation

The national and provincial strategies briefly outline the need for communication links and regular annual meetings between national and provincial offices; there is no mention of participation from district leaders, interdisciplinary departments and the community. Integration of oral health into other health programmes, and co-ordination of stakeholder collaboration has also been documented in the policy. However, none of the documents mention how the collaborations and integrated decision making could be established. There is an integrated school health policy developed by the National Department of Basic Education

and Health, however there appears to be no written co-operative guideline between local departments of health and education in carrying out the school health policy. In this regard, one of the participating managers remarked that:

"I mean the years that I've been working here and then when you go to the meetings, it's always said that there's an agreement between department of health and department of education, but when you go down to the level of the schools, nobody knows about this agreement ". P6

Inter-organisation collaboration is perceived negatively and one of the managers suggested that it may possibly be effective at top management as it has not translated adequately at an operational level. This is attributed to the challenges of large classes and inadequate resources that the managers experience.

*"They (referring to executive management) think, it's a good thing, because if your manager is sitting in an office, obviously, yes...you know, for them it's an excellent concept, but if you're operational, it is completely different".**P5***

Equity and inclusiveness

The national strategy is founded on the human rights articulated by the constitution of South Africa in terms of access to health care irrespective of gender, age, ethnicity, culture, religion or geographic location. A comprehensive primary healthcare service package in oral health is therefore available for all individuals irrespective of financial standing. Thus all district primary health care services are free, including school oral health services. This addresses equity and inclusiveness. However according to the oral hygienists, the human resource limitations faced by school oral health hinder the delivery of screening and services to the wider school population. Another participant added that:

*"They are not expected to screen everybody at the schools because like I indicated, in terms of the human resource, we're short, understaffed, in terms of Oral Hygienists". **P1***

Rule of law

The strategic and operational documents reviewed do not have mechanisms or incentives alongside their recommendations to regulate the behaviour of local officials in order to facilitate effective implementation. Districts are expected by the national office to customise

their interventions according to the specific needs of a community and the available resources. However, the managers do not work according to a systematic plan for customising their interventions. Instead, they allow the implementing hygienist to use their discretion in customizing activities; this then subsequently translates to coping mechanisms, such as selecting smaller schools or classes that were cooperative, with the plan of making working life easier and reaching performance targets successfully. The participant's views are expressed in the quotes:

"No, we're not prescriptive. Each district has their own way of working" ***P1***

"We, we've sort of formulated a criteria in terms of fissure sealants and to choose the smaller schools because in the future we find it doesn't help for us to go to a big school . We're only 2, so, it's better to choose smaller schools so that you start the programme and then you cover all the children" ***P6.***

Transparency

The provincial strategy and local operational policies lack transparent information with regards to how school oral health services should be resourced in terms of staff and equipment. Oral health finances are integrated within the district budgets and there is no ring-fenced budget for specific oral health activities, thus oral health programmes are expected to request resources from the province and district at their point of need. The system appears to constrain the local managers in acquiring adequate resources and lack clarity on the level of resources available for their programmes. They therefore perceive resources for school oral health to be inadequately allocated as shown by the remarks:

*"They have posts for dentists but the posts for oral hygienists and dental therapists are limited, that's the group, that we should be targeting because we want to prevent."****P5***

This limitation impacts on widening the reach of school children and on what the oral hygienists are able to do at the schools.

*"I can't really say it's according to the need because everybody needs, all the school's needs but I only have 5 oral hygienists. So, they are concentrating on certain schools or whatever they have time for."****P3***

Responsiveness to patient health needs

The national and provincial strategies expect the districts to assess the oral health condition of the community, prioritise needs, identify resources available and select appropriate activities. The participants however added that there is a lack of consistency in response to the question on how to plan for their activities as they get to the different schools:

"*Oh, ok, remember they have to screen the children first. So from the screening they will be able to determine what type of treatment, will be ."* ***P1***

"Ok, they first must try to offer the brushing programme ok? it's policy and obviously they are linked to targets". ***P4***

"*With, with us in Gauteng, we've got a community manual that advises us on what we do and when".* ***P2***

It is also apparent that some of them follow guidance from internal procedural documents that have been compiled over the years by the hygiene managers. This observation is demonstrated in quotation:

"The oral hygienists also refer to a community oral health manual; therefore there are few other internal working documents they are referring to. You know, we have a really nice manual. We have a Community Services, Community Oral Health Services manual.

The internal documents mentioned include the Community Oral Health Service Manual and the Gauteng Oral Health Promotion Strategy document. The Community Oral Health Services manual, summarizes the goals of the national and provincial strategies, and includes logistical operational procedures for school activities. It provides information on how the oral hygienists should assess the school community; examine the oral health needs of the children, the equipment they should take and the administrative documents they should complete. The Oral Health Promotion Strategy is very similar to the Community Oral Health Service manual; the only difference is that it does not include the operational procedures. The two internal documents are however not official, they are not dated and thus there is no indication on when they were drafted or disseminated.

Effectiveness and Efficiency

The national strategy does have a monitoring and evaluation plan and has included tools that the managers can utilise for assessing their communities and reporting appropriately. However, it does not mention any plans for training or capacity development of provincial or district implementers in using the tools. Hence, at an operational level where the districts are expected to formulate direction in achieving the goals, there is no evidence that the monitoring and evaluation tools are being utilised and consensus is lacking. The view is illustrated by the quote from one of the participants:

"In the district, we've been trying to find innovative ways to do...to carry out these programmes but it's we're at a standstill. We don't know, we don't know." ***P6***

The managers have therefore attempted to set targets that are aimed at not only achieving the broad national goals but are also used for monitoring work performance. These targets however differ per district and there are inconsistencies on how they are set and interpreted. This has caused some discontent among implementing oral hygienists.

"So, that's (referring to targets) also a confusing thing for our hygienists. The one says this, the other one says that...and you know what, that the districts all seem to be doing, what they want. You know what, if you are in your province, Gauteng province, you need to stick to the same thing" ***P4***

Accountability

The national strategy outlines how all the district and provincial services should be accountable to the national office at meeting the strategic goals. The National Department is responsible for leading the processes of formulating, implementation and reviewing the oral health strategy. In addition, it is to establish norms and standards for oral health service delivery as aligned to existing policy. The National Director for oral health collaborates with the academic oral health leads from universities that have dental schools in matters concerning policies for oral health services in the country. The provincial departments are expected to guide the district services in customising the interventions and setting operational targets; the structure follows a hierarchical top down approach where policy is centrally controlled. Although the oral health managers have indicated that they are given the opportunity of proposing policy direction changes, they have to follow the system of

command and can only approach the National Office when they have evidence based information from the academic sector.

"Management decision can change how things are done, particularly when programme is not working, they could change direction, provided the National Office agrees and the universities provide evidence". ***P1***

The managers reported that it is not always easy to get academic support when they want to change policy direction; responsiveness from some of the academics is not as forthcoming as they would like it to be.

*"It's a sore point. For me personally, I sometimes or most of the times feel that academic world is very far removed from the real world ok, I get very upset when I look at the number of academics doing researches, extensive research and I look at what is happening practically, it's like we're worlds apart."****P5***

Intelligence and Information

This refers to the availability of adequate health systems information for making appropriate oral health decisions. This was not reflected in the national and provincial strategy documents as the oral health epidemiological information is that of 2002 and thus not useful for making current decisions and ongoing appropriate oral health planning. Although there are pockets of recently published regional epidemiological information, none of them are reported in the strategic documents and furthermore they do not adequately reflect the oral health needs of the wider population. This results in the managers' lack of confidence in making concrete decisions as expressed in remarks of the interviewees:

"Because we know it's good to brush teeth and we know it's good to protect and to put fissure sealant, but we don't know out there in the community, we actually don't have the proof, you know the evidence base that shows its working in the schools". ***P6***

They indicate that they would like university academics to share their expertise in evidence based practice so that they could make better decisions.

"Well, in terms of reporting, we will see data that they are doing according to the goals and their job descriptions, but I still feel if we can get an engagement and support from the universities in terms of research, to find out, are we really making an impact because, one

can come and say, I'm doing so many restorations, so many fissures but, was it a quality treatment, is it indeed helping, are we winning?" ***P1***

Ethics

The national strategy does not include the importance of aligning ethical principles in research and oral health services. However, at an operational level the oral hygienists follow the appropriate ethical procedures for accessing schools and children at the schools.

"So, as department of health, the role that we play, we engage with the department of education so that we can be given permission to access the children in the schools, and so that were able to screen them and identify the, problems that they may have in terms of oral health and then, start to plan on how to go about treating the children" **P1**

Table 0.1: Assessment of Governance Principles

Governance Principles	Policy Document	Managers' perceptions
1. Strategic vision	Strategic goals are clear in policy.	Poor understanding on how the goals should be carried out.
2. Participation and consensus orientation	Policy does aspire for intersectoral participation of stakeholders but does not outline how integration could be established.	Participants don't know how to establish collaborations and objectives among the various stakeholders are not commonly understood.
3. Equity & inclusiveness	Primary health care and school health should be made available to all at no cost.	At implementation level, the human resource constraints do not allow wider access of schools
4. Rule of law	Policies do not have mechanisms to regulate the behaviour of local officials for facilitation of implementation.	Implementers are left to enforce the policies at their own discretion.
5. Transparency	There lacked transparent information with regards to how school oral health services should be resourced.	The implementers are of the view that school oral health programmes have been poorly budgeted for.
6. Responsiveness to patient health needs	Policy expects implementers to assess their communities and be responsive to their needs.	Planning of local activities is not responsive to direct community needs. It is based on staff capacity and contextual circumstances
7. Effectiveness and efficiency	There is no mention of communication processes or training to support implementation.	There is a lack of consensus on driving the implementation of the program. This lowers effectiveness and efficiency.
8. Accountability	District and Oral Health universities are expected to be accountable to the national office for meeting strategic goals.	Implementers are accountable to the provincial office however they lack adequate support to strengthen implementation.
9. Intelligence and information	There is lack of adequate health systems information to make appropriate oral health decisions.	Participants report on the need for relevant evidence to make confident programme decisions
10. Ethics	The policy does not have information the ethical considerations of providing school oral health services.	The implementers follow procedures on obtaining permission of accessing the schools and the children.

Key

Optimum: Moderate: Weak:

4.5. Discussion

Our study shows that although the policy goals appears to be clear on paper, there is a lack of clarity at an operational level on what the key policy objectives are and how to achieve them. The policy aspirations of inter-sectoral collaboration were not realised as there was no clear framework at a national level. There was no policy direction on law enforcement and transparency with resource allocation. The principles of responsiveness and equity were not fully translated to policy action due to poor interpretation of how they were meant to be carried out. Much of the policy gaps were attributed to poor communication processes by the national leadership to support local implementation. Further, the policy lacked information on accountability, reliable information systems and ethical guidelines. This left the implementers to utilise their discretion in devising their own strategies, which were uncoordinated.

The national oral health policy in South Africa is largely derived from a top-down approach as it was developed by the leadership at a national level. Although the managers attempted to operationalise the policy by developing their own operational guidelines in line with their interpretation, there was still a lack of uniformity (Campos and Reich, 2019). This may indicate that the oral managers were grappling with the processes of policy implementation (Lehmann, 2016). There was lack of common understanding on how to achieve the strategic vision as the five districts had different targets and the managers did not have consistent responses on what the expected targets were. This is of concern given that the variation of the targets was not all based on community needs, but rather on what was practically possible. This phenomenon was confirmed by findings from a study assessing implementation activities of oral hygienists at school sites (Molete et al., 2020).

Although integrated participation and consensus orientation was a policy aspiration, it was not realised at an operational level, as there were no mechanisms put in place to establish and facilitate those relationships at a national and provincial level. Furthermore the district managers lacked the agency of building relationships with stakeholders at a local level (Damschroder et al., 2009, Conrado et al., 2004b). The policy was vague on the rule of law and transparency in terms of budgeting and resource allocation. This resulted in variations in implementation, and coping mechanisms in response to the contextual and resource constraints the oral hygienists were facing. They opted for activities which made their work logistically practical, and districts were allowed to use their discretion in terms of selecting targets and activities without having clear accountability measures (Campos and Reich, 2019,

Lipsky, 2010). The shortage of personnel highlighted by the hygienists has been supported by the literature (Govender et al., 2013). Oral health promotion is reported not to have a dedicated budget, oral hygienists make up only 15% of the oral healthcare workforce in the country and their vacancy rate in the public sector is 52% (Bhayat and Chikte, 2019, Govender et al., 2013). These limitations affect the hygienist's responsiveness to local community needs and their ability to widen their reach of schools for addressing oral health inequities. This is reflected by them not being able to visit their designated programmes on a regular basis (Molete et al., 2020).

There was no mention of quality assurance or directive to address ways of enhancing effectiveness and efficiency (Delaney, 2015). Furthermore the variations in carrying out the policy resulted in the development of duplicate internal operational guidelines that were hoped to bring about co-ordinated ways of working (Lipsky, 2010, Jürgensen and Petersen, 2013). As much as the effort was a noteworthy initiative, there was no evidence from the participants that the internal guidelines were widely adopted. Accountability mechanisms of the policy did not apply to all the levels of the system, and it was command driven in order to ensure that the lower authorities comply with the policy (Mascini, 2013, Stillman-Lowe, 2008).

The aim of the monitoring and evaluation plan was to regularly assess the oral health profile and service delivery data, however there was no evidence that the monitoring and evaluation tools included by policy were utilised. The internal guideline documents were also not aligned to the national oral health strategy monitoring and evaluation plan. Hence the reliance on the involvement of academics, which was perceived not to be forthcoming. This hampered the ability of the managers in making informed decisions (Siddiqi et al., 2009). It can therefore be suggested that the managers be capacitated in utilising the monitoring and evaluation tools for their local decision making (Bempah and Kanmiki, 2017).

Considering the gaps identified and the expressed perceptions of the participants, various independent studies offer practical solutions to some of these challenges. For instance; Delaney (2015), suggest that policy makers at a national level need to ensure that there is a clear understanding of the strategic vision and how that needs to be achieved. They added that this can be achieved by involving participation of all key stakeholders in policy development, establishing initiatives for joint action or through appropriate capacity building and ongoing support (Delaney, 2015). This will ensure shared and joint enforcement of the

rule of law, transparency and accountability (Delaney, 2015, Siddiqi et al., 2009). Furthermore, it would improve the overall responsiveness, equity and inclusiveness. In addition, adequate resources to facilitate effective implementation, strengthening of routine information systems and surveillance are paramount to tracking and achieving programme targets (Bempah and Kanmiki, 2017). The operational managers should optimise their power to improve programme planning, communication and to harmonise service adaptations in response to perennial challenges, using evidence informed solutions (Hill, 2003).

A limitation of the study was that the sample size was small but included all the key stakeholders responsible for school oral health policy decisions in the province. In addition, there may have been a response bias from the participants which may have distorted their view on the policy. Hence, the policy documents were assessed in order to strengthen our study data and verify the information provided by the participants. We cannot claim that the findings are nationally representative as we only interviewed the oral health managers in our target province; however, the results provide baseline information and methodological approach for further research.

4.6. Conclusions

The governance principles adopted from Siddiqi et al. (2009) assisted in highlighting the policy implementation challenges experienced by the oral health managers in Gauteng. The policy articulated the governance principles of strategic vision, responsiveness to health needs, equity and inclusivity well, however there were gaps concerning the rest of the governance principles. The principles that were clearly laid out by the policy were not fully and consistently understood or translated by the managers at a local level. As much as management attempted to develop local procedural guidelines to ease policy execution, their attempts lacked technical leadership support from the national office and academia in the province.

It is therefore recommended that robust repeated training on policy content is required across all government levels and officials. Furthermore, the training should be tailored to a variety of audiences in order to strengthen a shared understanding of policy and its goals. There is a need for formal structures, such as planning committees or civil society forum that offers policy implementation support, oversight and monitoring at local level.

5. CHAPTER FIVE: THE POLICY IMPLEMENTATION GAP OF SCHOOL ORAL HEALTH PROGRAMMES IN TSHWANE, SOUTH AFRICA: A QUALITATIVE CASE STUDY

Molete M, Stewart A, Bosire E. and Igumbor J, 2020. The policy implementation gap of school oral health programmes in Tshwane, South Africa: a qualitative case study. *BMC health services research*, *20*, pp.1-11.

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5.1. Background

Most oral health conditions are preventable and their early onset is reversible (Bourgeois and Llodra, 2014, Kwan et al., 2005b). Yet, school going children across the world continue to experience high levels of untreated dental diseases (Kassebaum et al., 2017, Sohn et al., 2006). South African Oral Health policy presents measures to address the oral health needs of children in school settings (National Department of Health South Africa, 2018). Additionally, schools provide an ideal opportunity to reach children with oral health education, skills and other differentiated services (Kwan et al., 2005b, Jürgensen and Petersen, 2013). The South African public school system is also an opportune vehicle to address oral health needs of children with its over 88% enrolment of children aged five years and older (Statistics South Africa, 2013, UNESCO, 2011). In addition, the inextricable link between oral health of children and schools is demonstrated in the association between poor oral health status and poor school performance (Blumenshine et al., 2008a, Garg et al., 2012).

School oral health programmes have existed for many years in South Africa but the burden of oral health disease persisted between 2002 and 2015 with the prevalence of dental caries among 6 year olds ranging between 46% -73% (van Wyk and van Wyk, 2004, Thekiso et al., 2012, Reddy and Singh, 2015a). South Africa's school oral health policies seek to respond to local oral health needs while learning from global best practices (Kwan et al., 2005b). Hence, there are existing policies such as the South African National Oral Health Strategy (2010), the Integrated School Health Policy document (2012); and the School Health Policy and Implementation Guidelines (2011).

These policies recommend that school oral health programme deployment processes should include appropriate community and resource assessments before school selection and entry. Other key steps include the mass mobilization of school staff, caregivers and pupils in order to obtain acceptance and co-operation for programme delivery. Oral health needs of pupils are to be identified and targeted services offered to specific age groups. The targeted services should include oral health screening, fissure sealant placement on permanent molar teeth, fluoride varnish applications and provision of Atraumatic Restorative Technique (ART). In addition to the services mentioned, the oral hygienists are expected to introduce and sustain preventive activities such as the tooth-brushing programme.

The proposed processes of implementation are emphasized differently in each of the main South African documents with essential information concerning the implementation of the services being disjointed across the three policy documents. In addition, there are no clear guidelines of how to carry out the specific recommended tasks (Kwan et al., 2005b, DoHBE, 2012, DoH, 2011). It therefore becomes apparent that policy inconsistencies may potentially conflate oral health service delivery efforts (Singh et al., 2010).

Primary health care (PHC) revitalization is central to ongoing health reforms in South Africa as this is a platform for service delivery, health promotion facilitation, prevention of illness and a first point of entry into the healthcare sector (Matsoso and Fryatt, 2013). It comprises of three complementary streams which are currently been piloted at 11 provincial sites across the country. Since 2011, the District of Tshwane located in the Gauteng province of South Africa has been one of the pilot sites for school health services. The schools in the district are categorized into quintiles based on their socio-economic status. Quintile 1 schools are located in the poorest areas while quintile 5 schools are in higher socio-economic areas (Health, 2015). Oral health services are included in the quintile 1 and 2 school health services.

Our study therefore sought to assess the processes of implementation of school oral health programmes in Tshwane against policy recommendations. Given the complexities of policy implementation, the Walt & Gilson triangle was used to assess the key elements at play within the implementation process (Walt and Gilson, 1994). The triangle highlights how the elements of policy content, processes and context influence the extent of policy

implementation and emphasizes the central role of actors in the decision making processes and their influence on the three elements (Lehmann, 2016, Faraji et al., 2015). The Walt & Gilson triangle was therefore used to guide our analysis and to delineate key elements in the current school oral health programmes for clearer benchmarking against policy recommendations.

5.2. Methods

A qualitative explanatory case study was undertaken to clarify the implementation processes of school oral health programmes in Tshwane. The study was conducted between 2017-2018 using a combination of data from observations and interviews (Baxter and Jack, 2008). There were 10 oral hygienists providing oral health services at various schools in the district, each one being responsible for approximately four schools in a year, hence the 10 oral hygienists were purposively sampled to participate in our study as they managed the programmes at the schools. One school from each of the oral hygienist's list of schools that have been operational for more than one year was selected to participate in the study.

Data collection and tools

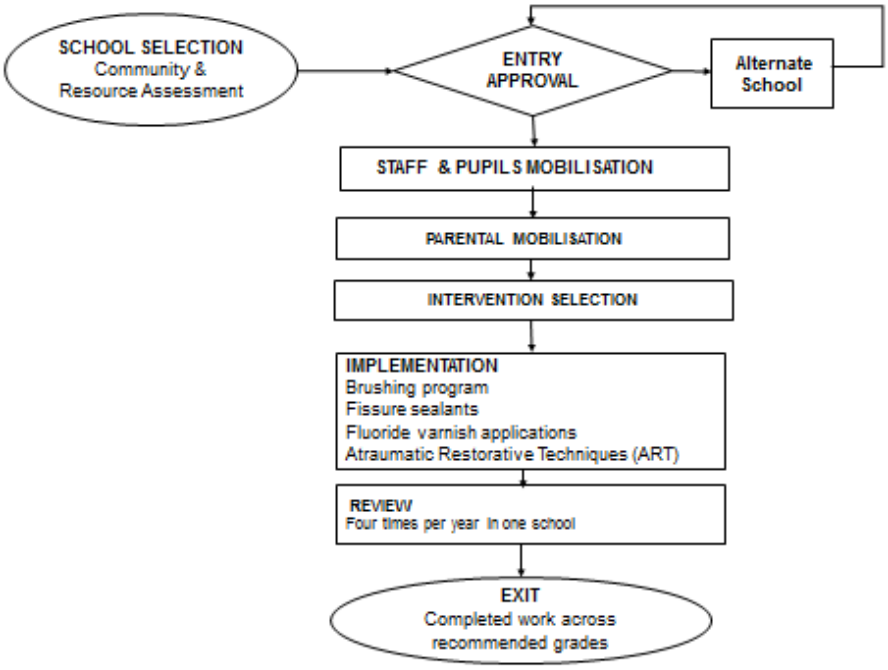
The data collection tools namely the process maps and interview guides were informed by using the prescripts and recommendations of provincial and national oral health policy documents and the WHO school oral health guidelines (Kwan et al., 2005b, National Department of Health South Africa, 2018), see A**dditional file 1(Appendix A & D)**. Process maps were used to guide the observations as the oral hygienists carried out their activities at the chosen schools. These maps represented a visual illustration of school oral health service delivery components and were used as an analytical tool to delineate and document the sequence of activities and events followed by the hygienist at each school (Wilgis and McConnell, 2008). Furthermore the mapping process assisted in understanding the interactive nature of the policy implementation process. Semi-structured face to face interviews were then conducted with the hygienists upon completion of the observations to explore the reasons for the steps followed and services offered.

The observations were carried out as each of the oral hygienists was performing their activities at the various schools. Observations took place during one of their morning sessions, lasting approximately four hours at a particular school. The stepwise process illustrated in **Figure 5.1** was used to benchmark actual observations at the schools for

compliance. Findings from the observations facilitated more probing and exploring of contextual barriers and drivers to the incorporation of oral health at the schools.

When the hygienists completed their procedures, individual interviews were conducted with the purpose of gaining an understanding of why implementation was undertaken in a particular way. The first author encouraged the oral hygienists to provide information on the actual processes that they followed during programme implementation, as opposed to stating the ideal process as outlined in the policy documents (Biggs et al., 2014). Interviews lasted between 30-45 minutes and were conducted in a private space within the school. Detailed field notes describing the school contexts, activities, and processes were also taken during data collection; these were examined by the other authors in order to ensure credibility of the data.

Figure 5.1: Map of proposed implementation



5.3. Data analysis

A thematic framework analyses was used for analysing the data, this involved the key processes of; Familiarisation; Identifying a thematic framework; Indexing; Charting; Mapping and Interpretation (Srivastava and Thomson, 2009). The transcripts were read repeatedly for familiarisation of the data by the first and third authors, this permitted for

identification of ideas, making observations, and getting insights and inferences. Upon familiarisation of the data, initial codes were derived from the Walt & Gilson triangle in order to guide the development of a thematic framework that was used for identifying the rest of the codes inductively. Coding was conducted until no further codes were identified and the data were considered to be saturated. Indexing and charting of the data involved merging of the codes into patterns of similarities and differences and aligning them to particular themes and sub-themes. The data were then integrated as we assessed the links among the data and brought about an understanding of events, processes and context. In addition, interpretation of the data was linked back to how our findings were aligned to the Walt & Gilson triangle. All findings were reviewed and refined prior to being measured against intended policy processes (Baxter and Jack, 2008).

To ensure trustworthiness, the data were shared with some of the participants for the purpose of giving them an opportunity of clarifying the data. In addition, the third author re-coded the data, cross checked the entire analysis process and discrepancies were resolved, this ensured dependability of the findings (Bryman, 2001). The use of these different data collection tools enabled triangulation of the study findings.

5.4. Results

The results illustrate the implementation of the programme using the broad themes of the policy analysis triangle (Walt and Gilson, 1994). Within the broad themes are sub-themes as displayed in **Table 5.1**. For content, the oral hygienist's interpretation of the content and its delivery at the schools is outlined. The context illuminated structural environmental factors at play in the school settings and the influence of actors in the implementation process is discussed. In addition, **Figure 5.2** is included to demonstrate the actual observed implementation, and two case observations in two contrasting schools are outlined**.** The final section then links in the Walt & Gilson summary triangle of the study findings.

Table 5.1: Summary table of themes and subthemes

Themes	Subthemes
Processes of actual implementation	School selection and entry Relational links Impacts of poor mobilization
Perceptions of policy content	Poor knowledge on policy content Uncertainty in delivering the content Dissatisfaction with programme content.
Contextual factors affecting implementation	Barriers to tooth brushing programme High service demands Inadequate infrastructure and equipment School food environment
Actors influencing the implementation process	Oral Hygienists Teachers Parents Dental assistants Snack vendors

Processes of actual implementation

The implementation of actual activities as measured against proposed policies demonstrated that there was poor alignment in the implementation process as in Figures **(1 &2).** First, the policy documents stipulate the need to carry out a community assessment before the selection of schools and initial entry. None of the oral hygienists used community assessments to inform school selection but rather relied on relational links.

" I have been coming to the school since 2006, I choose schools according to the cooperation of the school principal and staff" (Participant 1).

This subsequently led to easy entry into the schools as all participant's selections were based on historic working relationships.

"I came at the beginning of the year to negotiate, but they are used to me so I was given entry" (Participant 3).

Upon entry at a school, the oral hygienists were meant to mobilize school staff and learners in order to create oral health awareness and introduce the programme to the school community. Seven out of the ten study participants conducted this activity as exemplified below:

"At the beginning of the year, when I came to the school, I did education to everyone and demonstrated on the model" (Participant 1)

"I came to implement the brushing programme on January 17. First I trained the teachers and HOD (Head of Department) then went from class to class to educate the learners" (Participant 2)

The few that did not mass mobilize opted to provide individualized education while the learners were in the dental chair. However, they experienced significant challenges in obtaining support for the programmes. One participant cited:

"Tooth brushing programme was rejected at the school. There were many challenges and teachers have no time [for the implementation process]" (Participant 3).

Another participant concurred when she said:

"Teachers don't have time, I feel the programme should be implemented at grade R"(Participant 5).

Furthermore, the lack of mobilization resulted in poor parental cooperation in terms of parents responding to the consent forms or referral letters. Parental cooperation was poor due to limited understanding of the programme and fear of cost implications that could arise if their children needed more care.

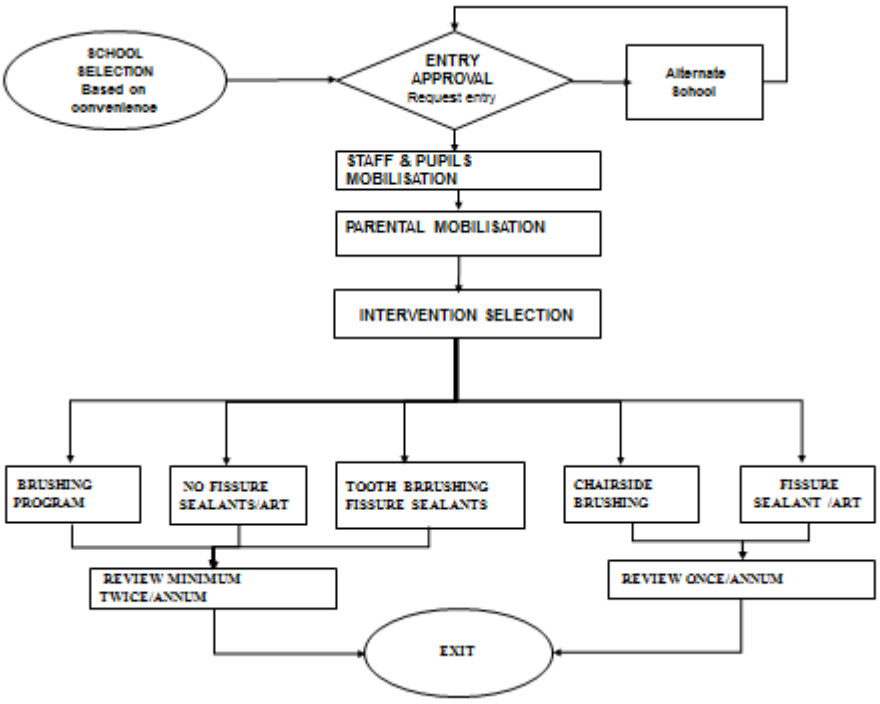
"Some parents don't sign consent for fear that they might need to pay for services." (Participant 3).

There were variations in terms of carrying out key activities as the oral hygienists focused on aspects of services that were feasible for them to carry out within their given circumstances (**Figure 2**). One participant expressed her frustrations when she said:

"You can't do all programmes at the school, time doesn't allow" (Participant 4).

The factors outlined were a hindrance to creating a platform favourable for implementing the key processes.

Figure 5.2: Map of actual implementation



Perceptions of policy content

There was acknowledgement that the oral health policy was widely disseminated, yet the majority of participants had not been officially trained on the policy. Hence there was general uncertainty on how programme activities were to be delivered and how emerging challenges were to be addressed. They also reported on erratic policy changes that affected delivery of activities. Participants said:

"You find that you start with old method then for next school you have to change" (Participant 1).

"Initially, we used to screen without consent, now the rules have changed. We are back to getting consent for the screening and then consent for treatment" (Participant 3)

Consequently, rapid changes and inconsistencies in interpreting policy content resulted in oral hygienists using their discretion in implementing services.

"Erratic policy changes have led to devising my own policy of screening only two grades in a year so as to finish in 2-3 weeks" (Participant 4).

Challenges relating to the content of oral health policy, together with a lack of preparedness and insufficient funds allocated for the programmes led to most oral hygienists feeling that the programmes were not beneficial. Participants said:

"I am not satisfied with the programme, the problem is with the department, money is tight, we sometimes have to rely on Colgate […] Sometimes Colgate delivers late or numbers are not adequate for all the children" (Participant 1)

"I have been in the programme for years but I do not know if there is progress on not." (Participant 6).

Most challenges relating to the content of the policy were attributed to high-level policy makers with poor knowledge of prevailing contextual challenges. One oral hygienists re-iterated:

*"**Policy makers don't pay attention to what is happening on the ground" (Participant 5).***

Content was therefore not well understood and appeared to have added no value to the implementation process.

<u>Contextual factors affecting implementation</u>

Prevailing contextual challenges influenced the decisions on whether or not to carry out a tooth brushing programme. Five oral hygienists were not able to carry out the programme as the infrastructure at the school was inadequate; there was poor access to water, sanitation and a lack of wash basins. In addition the schools had large class numbers; hence they abandoned the brushing programme and instead focused on providing fissure sealants and ART to a few pupils who had parental consent for treatment. This led to completing a particular school sooner and covering more schools in a year.

"Challenges include not enough basins, monitoring children was difficult, it would take two hours to do about 56 children in a class" (Participant 5).

"I try to cover as many schools in my area, so I am not likely to come back to the same school, same year" (Participant 7).

The oral hygienists believed that their set targets were unattainable and unrealistic amidst the logistical challenges they experienced.

"Policy is unreasonable, unrealistic and not feasible" (Participant 5).

Other challenges that were cited included the lack of dental assistance, as this affected the ability to perform services that were technically sensitive such as fissure sealants and ART. In addition, there was defective equipment such as poor suction pressure in portable equipment. The following excerpts illustrate these findings:

"Suction is not functioning, I have to improvise etch and children need to run to the tap to rinse" (Participant 7).

Participants also reported that theft of tooth brushes and paste was very common and this hindered them from demonstrating brushing techniques. As a result, teachers would occasionally ask learners to store their brushes at home;

"I was planning to continue with the brushing programme but the kids didn't come with brushes today. Brushes are being stolen" (Participant 1.

"Tooth brush are getting lost, when you do a follow-up, then you need to be giving them more brushes" (Participant 2).

Although most schools had government feeding initiatives, which were nutritionally based, the school food environment was compromised as high caloric foods and sugar sweetened beverages were easily accessible from tuck shops and snack vendors at the schools. Moreover, a large number of the vendors were parents or community residents whose relationship with the school could not be put at stake:

"There is a school nutrition programme which has two meals a day, morning and lunch breaks, yet tuck shops provides kotas and sweets, and many children also drink SSBs from the tuck shops" Participant 4.

"There are vendors selling sweets and chips on the ground, some of the vendors are school parents" Participant 1.

This situation made health promotion difficult, and hence, most oral hygienists were not happy with the environment in which they worked. One participant said:

"[I am] Not satisfied with the programme as I work in a compromised environment" (Participant 7).

Due to such competing challenges, some oral hygienist felt that the programme had little impact on the oral health of pupils. One participant re-iterated:

"I see no impact; I am just frustrated with the programme" (Participant 7).

The oral hygienists had to contend with prevailing contextual circumstances that they had no control over. These challenges deterred the implementation of recommended programme activities.

Actors influencing the implementation process

There were five groups of actors that directly or indirectly influenced the implementation of the programme in various ways; these included the oral hygienists, teachers, parents, dental assistants and snack vendors. Although the oral hygienists were well aware of the importance of the programme, there was general dissatisfaction with regards to how they were expected to carry it out. Hygienists were well aware that adequate support from the community at large was necessary for a successful programme. This was reflected by the statement:

***"The type of services I offer is determined by the level of cooperation or the accommodation I receive from the schools and also availability of facilities"* (Participant 3).**

Most of them resorted to improvising their techniques. For instance, the hygienists who were not able to offer coordinated brushing programmes resorted to getting each individual child to brush before being treated in the dental chair. This resulted in neglecting the children who were not scheduled to have treatment. The application of fissure sealants on teeth was also compromised as nearly all the saliva suctions were dysfunctional. Pupils were expected to rinse and spit at the nearest tap drain between treatments. This process prolonged the working time and compromised the retention of the placed fissure sealant.

Teachers played a key role in the supervision and motivation of learners in adhering to the oral hygienist programme. However, this support was missing as the teachers had busy schedules and oral health activities were not prioritized.

"Not all teachers adhere to the programme, they are non-cooperative" (Participant 5).

Lack of cooperation from teachers led to some schools rejecting some activities in their schools as reported by one participant:

"Tooth brushing programme was rejected at the school. There were many challenges and teachers have no time" (Participant 3).

The parents were key actors when it came to consenting for the learners, especially those needing referrals for further treatment. However, more than half of the oral hygienists reported that most parents were not co-operative at following up on their children's clinic referrals, welfare needs and signing consent forms for screening or referral.

"Parents are uncooperative and relegate a lot of responsibilities to schools" (Participant 2).

Dental assistants were important missing actors in the provision of oral health services at the schools. None of the oral hygienists were partnered with a dental assistant as there were staff shortages at the clinic facilities. This was a barrier to providing some of the technically sensitive procedures and hence some oral hygienists did not provide ART unless they had a dental assistant.

"I only do ART if I have some assistant, but I actually prefer to do it (ART) if I am in the clinic in case I experience some complications". Participant 10.

The snack vendors were informal traders residing in the community, some schools allowed them inside the school premises, and at other schools they were outside the school grounds. This type of trading was permitted as it was a way of growing the local economy and allowing unemployed parents residing in the area to generate some income. The presence of these vendors counteracted the healthy eating patterns the oral hygienists are working to cultivate.

The actors were found to have a strong central role in the interplay between the elements of processes, content and context. The parents, teachers and snack vendors derailed the processes of implementation by not having an understanding of the content and its benefits. This was reflected by the lack of compliance in the referral system, poor support of the tooth brushing programme and provision of unhealthy snacks at the school sites. The oral hygienists unfortunately found themselves constrained by the other actors.

Case Observations

The following case observations below provide an illustration on how elements of processes, content, context and actors are intrinsically linked and furthermore affect policy implementation on a typical working day. The cases were selected from two participating

schools that were experiencing distinct differences in terms of school environments and availability of resources.

Case Observation 1

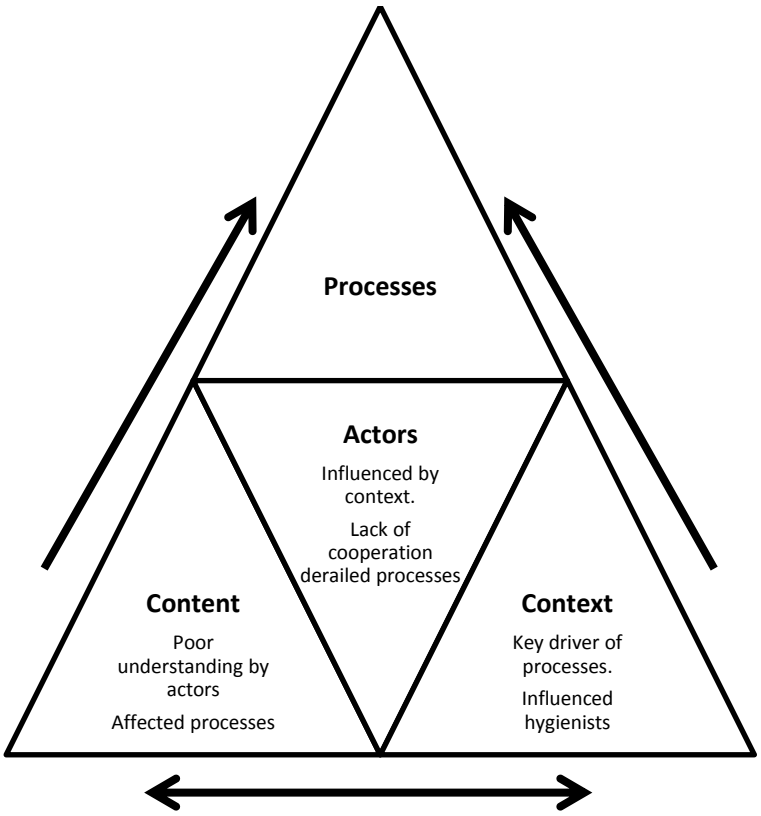
Participant 3 worked in a remote area, which were high crime and poverty rates. The infrastructure of the school was noticeably poorly maintained, with paint peeling off the walls, dysfunctional toilets, makeshift reception desk and broken metal desks stacked up behind classrooms. A third of the buildings were portable cabins that were not climate controlled, and she was working in one of the rooms. Her operator chair had no backrest; she had no adequate light in the room and had no working dental suction. She was offering fissure sealants on the day of the visit. She received the children in the room in pairs, she placed pumice on toothbrushes requested the children to brush their teeth and go and rinse at the nearest tap in the school yard. When they returned, she administered etchant on one of the children, and sent them off to go and rinse again before she could place the fissure sealants and apply fluoride gel. When the first child was complete, they had to go back to class to call the next pair and the process was repeated. She took 30 minutes to undertake a procedure that takes 15minutes, and hence she mentioned that she only gets to treat six children in the four hours at the school.

Case Observation 2

Participant 10 worked in an urban working class area. The school was evidently well managed and there were no apparent defects in school buildings that would affect learners' health. There were strict security procedures at the main entrance to maintain school safety. A short glimpse of classrooms indicated that classes had few children and were controlled relatively well. The oral hygienist was working in a room purposed as a sick bay or medical room. She had well-functioning portable dental equipment that took about an hour to set up. She appeared relaxed and comfortable in her setting; she took her time in engaging with the children and making them comfortable. The teacher brought her four children at a time, and each child sat on the operator chair for the fissure sealants until their treatment was complete. She reported that she managed to complete about 10 children over the four hours at the school per day.

Figure 3, provides a summary on how the central role of actors derailed the processes of implementation by their poor understanding of the content and lack of co-operation. In turn the context in this case appeared as a strong driver of the processes of implementation. Furthermore, the contextual circumstances informed the type of content the oral hygienists were able to implement.

Figure 5.3: Summary triangle of the Walt & Gilson model



5.5. Discussion

Our findings show that there was general misalignment between policy and practice, and that oral health programme delivery was not standard across the 10 schools. Policy processes were affected by poor prior planning, inadequate resources, poor school infrastructure and lack of support from key stakeholders. Furthermore, policy inconsistencies from management, coupled with the fact that the oral hygienists were not conversant with the policy hampered delivery of the policy content. The variations observed were often at the discretion of the oral hygienist in response to real contextual challenges which are common

among South Africa's frontline healthcare workers (Walker and Gilson, 2004). As a consequence, the oral hygienists traded policy directions with addressing practical challenges encountered.

It was clear that thorough assessment and planning did not occur before implementation as school selection and entry was not informed by the burden of need but rather on schools that were easily accessible. This was problematic as it disadvantaged the schools and children who may be in real need of services (Bourgeois and Llodra, 2014). The processes of mobilization of teachers and learners had not been done such that the oral hygienists struggled to garner adequate support of teachers and parents for implementation of the programmes. This stems from the fact that there was no initial involvement of teachers and the wider community in the preliminary planning and entry into schools (Jürgensen and Petersen, 2013, Casamassimo et al., 2009).

Chamberlain et al. (2011) suggest that lack of exploration of needs and fit before implementation affects ongoing implementation processes. This shortcoming was reflected by the insufficient consideration from the hygienists in terms of the level of resources and suitability of infrastructure available for them to carry out specific activities. Hence, there were improvisations that affected the quality of service delivery, for instance providing fissure sealants without a functioning suction system. Such unplanned improvisations often resulted from poor co-ordination which has been associated with inadequate training of oral health staff (Reddy and Singh, 2017). Had the hygienists or their managers undertaken coordinated initial assessments, alternate feasible activities could have been planned beforehand (Durlak and DuPre, 2008b).

The content of the policy was largely influenced by the oral hygienist's perception of the policy and the context of the environment within which they were working (Lehmann, 2016). Their understanding was vague and perceptions of policy implementation were not positive. They were uncertain of policy guidelines, and were frustrated with what was expected of them in the midst of challenges. Furthermore, policy changes were reported as erratic and resulted in hygienists being ill prepared to undertake the required tasks (Dusenbury et al., 2003, Shea et al., 2014). Regular guidance and technical assistance could benefit the hygienists in such instances (Darlington et al., 2018, Durlak and DuPre, 2008b).

Contextual challenges including limited resources and inadequate infrastructure informed decision making processes of how and what activities could be offered. This limited the number of children who could be covered for oral disease prevention. These complexities may be beyond the control of the hygienist as oral health budgetary allocations are generally inadequate in South Africa (Reddy and Singh, 2017, Reddy and Singh, 2015b). Periodic monitoring and adaptations of the services by the Departments of Health and Basic Education could assist by regularly assessing for a good fit between services required and available resources to perform the required services (Dusenbury et al., 2003).

There were high service demands in the midst of staff shortages and limited time to achieve set targets within the given school period. These challenges are echoed in similar health promoting school programmes across the African continent (Durlak and DuPre, 2008b, Macnab et al., 2008a, Lawal and Taiwo, 2014). The teachers are often not able to assist the hygienists in coordinating the programmes as they have high workloads and large classes with which to contend. In addition they lack knowledge and confidence in oral health promotion (Reddy and Singh, 2017). The consequences of this high service demand resulted in an inability to revisit and review schools four times a year as recommended by policy. This minimal reinforcement may have hindered the programme from being fully accepted and adopted at the schools (Banfield et al., 2015).

Although oral hygienists encouraged healthy eating, the schools had compromised healthy nutrition environments as snack vendors were allowed to become an integral part of the school. This has been a problem at South African public schools despite the National School Nutrition Programme being initiated in 2004 (Reddy and Singh, 2017, Faber et al., 2013). Moodley et al. (2015) attributes this challenge to the lack of mandatory regulation of food and beverages sold around school premises. The street vendors have been approached with suggestions to sell healthy snacks, however they claim that fruit is expensive, perishable and cannot be stored for long periods, hence it is more financially viable for them to sell processed snacks (Reddy and Singh, 2017, Moodley et al., 2015). Co-ordinated engagement processes between schools and community snack vendors are necessary to derive joint health promotion solutions that will benefit both pupils and vendors (Lewallen et al., 2015).

As actors, the oral hygienists were generally dissatisfied with the programme as they had to drive the processes of implementation in the midst of obstacles. However they attempted to

optimize their services despite their circumstances (Lehmann, 2016). The hidden actors such as the dental assistants and snack vendor had no direct involvement in the programme and yet influenced it significantly in terms of outcomes. The lack of dental assistants impacted on the hygienist's ability to carry out certain activities and inhibited quality of care (Potgieter and Naidoo, 2017). In turn, the presence of the snack vendors hindered the children from practicing healthy eating habits and protecting their oral health (Reddy and Singh, 2017). In this particular case it appeared that the actors are highly dependent on one another for successful implementation and therefore more effort should be placed on educating stakeholders on the content, value of the programme and collaborative support (Gill, 1994).

The above discussion has demonstrated how intrinsically linked the elements of processes, content, context and actors are in analyzing policy implementation (Walt et al, 1994). In our study the actors and context influenced the processes of implementation and the delivery of the policy content. In turn the limited understanding and interpretation of the policy content by the actors influenced the processes of implementation.

The implications of these findings are that the policy recommendations were not feasible given the presenting contextual obstacles. In this case, regular monitoring, evaluation and root cause analyses could be needed to identify contextually relevant modifications and address areas of concern in the programme. In addition, a multidisciplinary effort in the planning and execution of such complex programmes is necessary for tackling the factors affecting oral health delivery at schools.

5.6. Limitations

The school services were not observed over multiple visits and hence any change of patterns or trends in the services offered could not be reported on. However, multiple data sources including observations, interviews and policy documents were used to ensure that the phenomenon was explored from a variety of perspectives. In addition, during analysis, all the data were converged to ensure holistic understanding (Baxter and Jack, 2008, Hussein, 2009).

5.7. Conclusion

There was policy and practice misalignment and variations in the processes of implementation of oral health services across the 10 schools. This observation was partly the result of poor planning, inadequate understanding of policies, insufficient resources, poor

school infrastructure and a lack of support from key stakeholders. The delivery of the programme was largely driven by contextual circumstances and poor knowledge of the policy content. Furthermore the context informed the degree of the content that could be delivered. In all, the interplay between the elements of the policy triangle illuminated the factors that were responsible for the extent of implementation of school oral health policy and programme.

Linkage

Linking notes between chapters 4 and 5. This section contains information to clarify the link between Chapters 4 and 5. In depth discussions in findings of individual papers are in the discussion sections of each paper, while an overall discussion follows in Chapter 8.

The findings from chapters 4 and 5 show that there were inconsistencies in translation of the school oral health policy at both the provincial and district levels. The inconsistencies were largely derived from poor communication and interpretation of policy. The gaps in policy governance identified in chapter 4 such as rule of law, transparency, accountability and information and intelligence were reflected by the poor implementation of local school activities as shown in chapter 5. Poor planning and co-ordination beginning from policy dissemination and implementation were demonstrated in chapter 5. These shortcomings resulted in fragmentations where operating hygienists used their discretion in response to contextual challenges such as large class sizes, inadequate infrastructure and an unhealthy school food environment.

Chapters 4 and 5 utilised different qualitative methodological approaches to gather perspectives of school oral health implementation from the managerial and operational perspectives. Chapter 4 utilised an exploratory qualitative design in order to understand and describe the experience of the oral health managers. Chapter 5 then used an explanatory case study design in order not only to describe the implementation but also to explain the behaviour of the operating oral hygienists. The two chapters were both guided by frameworks in their explorations. Chapter 4 used the Siddiqi et al. (2009) governance framework and chapter 5 used the Walt and Gilson (1994) policy triangle. Hence, the analysis of the two chapters was guided by the thematic framework analysis.

6. CHAPTER SIX: DENTAL STATUS OF CHILDREN RECEIVING SCHOOL ORAL HEALTH PROGRAMS IN TSHWANE

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6.1. Introduction & background

Dental caries is a neglected public health problem globally and the incidence in developing countries is increasing at an alarming rate (Bagramian et al., 2009, Marcenes et al., 2013b, Reddy and Singh, 2015a). In South Africa, the high curative need of the condition is of concern, as over 90% of children in the country go untreated for dental caries (Thekiso et al., 2012, van Wyk and van Wyk, 2004). Though the disease is amenable to prevention and existing mechanisms of prevention are available, the disease has a multifactorial aetiology that is affected by the type of diet intake, socio-economic standing, environmental factors such as water fluoridation, availability of dental services and utilisation of care (Casamassimo et al., 2009, Fisher-Owens et al., 2007, Pinto-Sarmento et al., 2016). These factors influence the pattern of the disease and experiences across populations and within populations as a result of the varying risk profiles (Gussy et al., 2006), hence planning for oral health preventative programmes becomes a complex task.

School based settings around the world have been identified as platforms ideal for delivering oral health promotion and care to children as they are more likely to adopt healthy habits earlier and it is easier to equip them with personal skills such as maintaining personal hygiene, brushing teeth and adopting a healthy diet (Jürgensen and Petersen, 2013, Kwan et al., 2005b). These foundational skills when re-enforced over years subsequently contribute to better oral health experiences over the growing years (Haleem et al., 2015). The success of such programs in reducing the incidence of caries has been reported in some studies (Macnab and Kasangaki, 2012, Monse et al., 2013a), however implementation of the programs has been shown to come with a variety of contextual challenges (Lawal and Taiwo, 2014, Reddy and Singh, 2015b, Darlington et al., 2018).

South Africa is embarking on health reforms by introducing a National Health Insurance financing policy aimed at redressing health inequities and ensuring universal health coverage for all citizens (Department of Health, 2017). Primary health care revitalization will be key to the transformation process as it will be central to service delivery, facilitating health promotion, prevention of illness and a first point of entry into the healthcare sector (Matsoso and Fryatt, 2013). One of the revitalization streams include school health services which are currently being piloted across 11 provincial sites in the country (Matsoso and Fryatt, 2013, DoHBE, 2012). Oral health is included in the school health services and this provides a valuable platform for introducing early oral health care interventions in order to delay the onset and control the severity of dental caries (Thomson et al., 2004).

The City of Tshwane health district has been piloting the School Health Service Program since 2011 and Oral Health was incorporated since 2013.Tracking the success of these new reforms needs data at baseline and periodically (Moore et al., 2015a), however such information is lacking from school health programs where health reforms are being tested. The lack of baseline data makes it imperative to conduct a survey against which progress of the programs can be measured in the future.

This study is part of a larger study that is assessing the scope, implementation and outcomes of school oral health programs in Tshwane. The aim of this paper therefore sets out the scope by describing the dental status of school learners and assesses the influence of contextual factors on the dental status of the learner's at schools in Tshwane. Subsequent papers will focus on implementation processes and how the processes influence different outcomes.

6.2. Methods

This cross-sectional analytical study design was undertaken in the Tshwane Health District of Gauteng. Tshwane is a large metropolitan municipality situated in the northern part of the Gauteng Province in South Africa. It has a population of 2, 9 million with an unemployment rate of 24.2% (Ganief and Thorpe, 2018, Statistics South Africa, 2013). It is demarcated by seven regions with a mix of urban and peri-urban components and the economic situation of residents is mostly dependent on the area in which they are located. There are therefore socio-economic differences between the urban and peri-urban schools as more working parents are located in urban settings than those in peri-urban settings (Ganief and Thorpe, 2018, Statistics South Africa, 2013).

The oral health services in the area have 10 oral hygienists who manage school oral health programmes at various locations in the District and each oral hygienist is responsible for a number of school oral health programmes in a specific locality. The activities at the school include oral health education, supervised tooth brushing programs and fissure sealant programs. All the schools received some oral health education but due to a variety of factors, not all received a combination of a supervised toothbrush program and fissure sealants. Four schools received a combination of programs, four received fissure sealants and two schools received a supervised brushing program.

All 10 oral hygienists were recruited to participate in this study. Schools included had to have been receiving the services for more than a year. A multistage sampling technique was employed. In the first stage one school that met the inclusion requirements was randomly selected from each oral hygienist list. Upon selecting the 10 schools, grade 1 & 7 learners were selected from the schools, as the learners in these grades had ages ranging between, 6/7 and 12/13 which are ages recommended for dental surveys (World Health Organization, 2013b). The last stage included a random selection of one class of grade 1 & grade 7 learners at each participating school. A sample of approximately 700 learners was required to enable the estimation the mean DMFT with a precision of ± 0.3 (Joubert et al., 2007), assuming the standard deviation was 2.0 with a design effect of 2, which took into account the clustering effect of pupils within schools (Statcalc,version 14).

The oral health examinations were undertaken using the Decayed Missing Filled Teeth Index (DMFT/dmft) and the Pulpal Ulceration Fistula Abscess (PUFA/pufa index) (Shanbhog et al., 2013). All procedures in the survey were followed according to the WHO guidelines (WHO, 2013). Two examiners conducted the oral health examinations, they were trained and inter-rater reliability was established by conducting repeat examination of images up until the Cohen's Kappa score was > 0.80.

During the study, the participants were seated and their oral cavity was examined in a well-lit room using a light, mouth mirror and a community periodontal index probe (World Health Organization, 2013b). Information on the program activities was derived from the Oral Hygienists.

Descriptive summary statistics were used to calculate the dental health status and the results were initially categorised into four age groups (6-7); (8-10);(11-12);(13-16) in order to provide a broad overview of the dental scores across the ages. As the numbers were not well distributed across the four groups, the age groups had to be stratified into two groups (6-7) and (8-16) in order to obtain sufficient numbers and power for further analysis on assessing dental status according to gender, setting & services received, A multiple linear regression was then undertaken to determine the size of effect of the dependent variables (gender, setting, services) on the independent variables (DMFT, dmft, PUFA,pufa). For the 8-16 age stratums, analysis of the dmft and pufa were excluded out of the regression models as the scores were shown to be decreasing with age as was expected because exfoliation was still occurring during that age range. All the data was analysed using STATA software version 14.

The proportion of unmet treatment need index (UTN) was calculated by dividing the percentage of untreated caries over the caries prevalence (% UTN=% untreated caries/caries prevalence) (Jong, 1981). The significant caries index (SiC) was also calculated in order to determine the one third of the population carrying the highest caries score. Individual DMFT/dmft scores were sorted in a descending order, one third of the population with the highest scores were then selected and the mean DMFT/dmft for the subgroup was calculated in order to get the (SiC), the calculations were performed on an Excel software (Bratthall, 2000).

The study obtained ethical clearance from the University of the Witwatersrand Human Research Ethics Committee (M170115), and written approval was obtained from the Gauteng Department of Education. All learners participating had written consent from their parents and they assented to participation.

6.3. Results

Demographic characteristics

Out of the 10 selected schools, 736 learners participated in the study, 49.7% (n=366) of these were grade 1 primary school learners; with ages ranging between 6-12 years. The secondary school learners (50.1%; n=370) had ages ranging between 11-16 in grade 7. The participants consisted of 50.9% girls and 49.0% boys. Seven of the schools were located in an urban setting and three were located in a peri-urban setting.

Dental Status

The prevalence of dental caries in the permanent dentition was 25.9% and in the primary dentition, 30.2%.**Table 6.1** demonstrates that the largest age group (n=331) among the participants was made up of 6-7 year learners and the least (n=35) were the 8-10 year olds. The mean dmft was highest 2.5 [2.8] among the 6-7 year olds and mean DMFT was highest 1.8 [2.3] among the 11-12 year olds. Similarly pufa affected the 6-7 and 8-10 year group most, while the PUFA was high among the 11-12 year old learners.

Table 6.1: Dental status according to age (n=736)

Age Groups	**N (%)**	**dmft (sd)**	**DMFT (SD)**	**pufa (sd)**	**PUFA (SD)**
6-7	331 (44.9)	2.5 (2.8)	0.4 (0.9)	0.2 (0.6)	0.0
8-10	35 (4.7)	1.8 (2.3)	0.5 (1.1)	0.3 (0.9)	0.0
11-12	181 (24.5)	0.01 (0.1)	1.8 (2.3)	0.01 (0.1)	0.1 (0.4)
13-16	189 (25.6)	0.0	1.1 (1.7)	0.0	0.01 (0.1)
Total mean scores	736 (100)	1.1 (2.3)	0.9 (1.7)	0.1 (0.4)	0.03 (0.2)

The DMFT/ dmft results indicated that the "decayed" component contributed the most to the DMFT/dmft scores, as displayed in **Table 6.2.** The SiC index was significantly higher ($p<0.001$) than the mean DMFT/dmft in both the primary (3.7) and secondary dentitions (2.7).

Table 6.2: DMFT/dmft components (n=736)

Permanent Dentition				
Mean DMFT (SD)	Decayed	Missing	Filled	SiC
0.90 (1.7)	0.54 (1.2)	0.05 (0.3)	0.30 (1.2)	2.7 (1.9)
Primary Dentition				
Mean dmft (SD)	decayed	missing	filled	SiC
1.1 (2.3)	1.0 (2.1)	0.12 (0.7)	0.03 (0.3)	3.7 (2.7)

The PUFA/pufa components

The prevalence of PUFA/pufa mostly affected the primary dentition (pufa 5,2% vs PUFA 2.2%). **Figure 6.1** shows that fistula lesions (8%) contributed more in the permanent dentition and the pulpal lesions (4%) contributed more in the primary dentition.

Figure 6.1: Components contributing to the PUFA/pufa scores. Total (n =736)

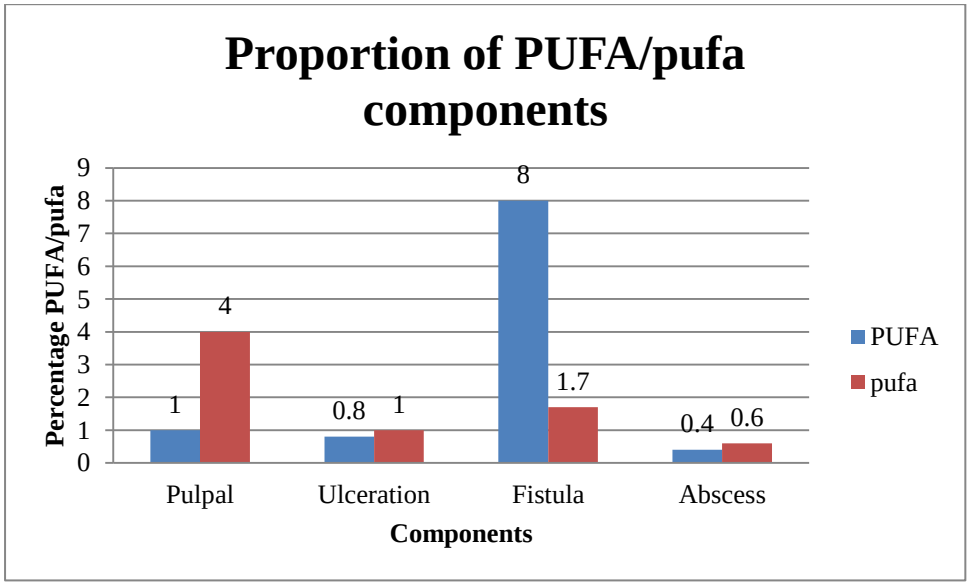


Table 6.3 describes the dental status according to age, gender, services received and setting. Among the 6-7 year old age stratum, there were no PUFA scores. In this group most of the learners were exposed to the fissure sealant services (n=121), and majority were from urban

areas (n=230). Among the 8-16 year old age stratum, the dmft and pufa scores with regards to age, gender, services and setting were less than the mean of 1. More of these learners were females, furthermore majority received fissure sealants (n=170) and were from urban areas (n=280).

Table 6.3: Summarizing the dental status according to two age stratums, gender, location and services received (n=736)

Variables	DMFT (SD)	dmft (sd)	PUFA (SD)	pufa (sd)
Age range				
6-7 (n=331)	0.37 (0.9)	2.5 (2.8)	0.0	0.2 (0.6)
Gender				
Female (n=161)	0.3 (0.8)	2.5 (3.0)	0.0	0.2 (0.5)
Male (n=170)	0.4 (1.0)	2.5 (2.7)	0.0	0.1 (0.6)
Services				
Fissure sealants (n=121)	0.3 (1.0)	3.2 (3.2)	0.0	0.3 (0.7)
Brushing prog. (n=93)	0.4 (0.8)	2.2 (2.4)	0.0	0.1 (0.5)
Both (n=117)	0.4 (0.9)	2.0 (2.6)	0.0	0.1 (0.3)
Location				
Peri-urban (n=101)	0.1(0.6)	3.3 (3.2)	0.0	0.2 (0.6)
Urban (n=230)	0.5 (1.0)	2.2 (2.6)	0.0	0.3 (0.6)
Age range				
8-16 (n=405)	1.3 (2.0)	0.2 (0.9)	0.05 (0.3)	0.02 (0.3)
Gender				
Female (n=214)	1.6 (2.3)	0.1 (0.6)	0.1 (0.4)	0.01 (0.1)
Male (n=191)	1.1 (1.6)	0.2 (1.1)	0.04 (0.2)	0.05 (0.4)
Services				
Fissure sealants (n=170)	1.9 (2.3)	0.2 (0.9)	0.1 (0.4)	0.03 (0.3)
Brushing prog. (n=137)	0.8 (1.7)	0.1 (0.5)	0.03 (0.2)	0.02 (0.2)
Both (n=98)	1.05 (1.6)	0.2 (1.1)	0.04 (0.2)	0.03 (0.2)
Location				
Peri-urban (n=125)	1.1 (1.6)	0.2 (0.9)	0.1 (0.4)	0.02 (0.2)
Urban (n=280)	1.4 (2.2)	0.1 (0.8)	0.04 (0.2)	0.03 (0.3)

Factors influencing the dental status

All the key exposure variables were inserted into the multiple linear regression model in order to determine the size of effect of the variables on the dental status. In terms of the DMFT **(Table 6.4);** the DMFT of the 6-7 year old learners from urban areas increased by a (Coef: 1.12; p=0.00) in comparison to learners from peri-urban areas. Furthermore learners who only received fissure sealants instead of both programs had increased levels of DMFT by (Coef:0.87; p=0.00). A similar increasing effect (Coef: 1.36; p=0.05) on the dmft scores of children that just received fissure sealants. The pufa scores were influenced by setting and services. Children who were located in urban areas and only received fissure sealants had increased pufa scores respectively (Coef:0.70;p=0.00); (Coef:0.82;p=0.00).

Table 6.5 outlines the regression results of the 8-16 age stratum and indicates that the DMFT of the male learners decreased (Coef:-0.46;p=0.01) in comparison to the female learners. In addition learners located in urban areas (Coef:3.02;p=0.00) and those who only received fissure sealants (Coef:3.10;p=0.00) had increasing levels of DMFT than those from peri-urban areas and those exposed to both fissure sealants and brushing programs. There were no significant influencing factors on PUFA.

Table 6.4: Table depicting multiple linear regression model results on effects of age, gender, services and setting on the dental status. Age stratum 6-7 years.

Variables	Coefficients	Std. Err.	p value	[95% Conf. Interval]	
DMFT	**Coefficients**	**Std. Err.**	**p value**	**[95% Conf. Interval]**	
Age	0.09	0.05	0.09	-0.12	0.21
Gender					
Female	0				
Male	-0.46	0.17	0.01*	-0.81	-0.11
Location					
Peri-urban	0				
Urban	3.02	0.31	0.00*	2.41	3.62
Services					
Both	0				
Fissure sealants	3.10	0.31	0.00*	2.48	3.73
Brushing prog.	-0.29	0.25	0.23	-0.77	0.19
PUFA	**Coefficients**	**Std. Err.**	**p value**	**[95% Conf. Interval]**	
Age	-0.01	0.01	0.36	-0.03	0.01
Gender					
Female	0				
Male	-0.03	0.03	0.38	-0.09	0.035
Location					
Peri-urban	0				
Urban	0.004	0.05	0.94	-0.11	0.11
Services					
Both	0				
Fissure sealants	0.05	0.57	0.38	-0.06	0.16
Brushing prog.	0.01	0.04	0.79	-0.07	0.09

**Significant results p≤0.05*

Table 6.5: Table depicting multiple linear regression model results on effects of age, gender, services and setting on the dental status. Age stratum 8-16 year range.

Variables	Coefficients	Std. Err.	p value	[95% Conf. Interval]	
DMFT	Coefficients	Std. Err.	p value	[95% Conf. Interval]	
Age	0.09	0.05	0.09	-0.12	0.21
Gender					
Female	0				
Male	-0.46	0.17	0.01*	-0.81	-0.11
Location					
Peri-urban	0				
Urban	3.02	0.31	0.00*	2.41	3.62
Services					
Both	0				
Fissure sealants	3.10	0.31	0.00*	2.48	3.73
Brushing prog.	-0.29	0.25	0.23	-0.77	0.19
PUFA	Coefficients	Std. Err.	p value	[95% Conf. Interval]	
Age	-0.01	0.01	0.36	-0.03	0.01
Gender					
Female	0				
Male	-0.03	0.03	0.38	-0.09	0.035
Location					
Peri-urban	0				
Urban	0.004	0.05	0.94	-0.11	0.11
Services					
Both	0				
Fissure sealants	0.05	0.57	0.38	-0.06	0.16
Brushing prog.	0.01	0.04	0.79	-0.07	0.09

**Significant results p≤0.05*

The Unmet Treatment Need (UTN) for the permanent dentition (DMFT) was 55.5% and for the primary dentition (dmft) 89.6%. This implied that close to 90% of the learners' affected required treatment for dental caries. The SiC Index was statistically significant for both the primary teeth (dmft) and permanent teeth (DMFT) indicating that the concentration of the disease was narrowly distributed among one third of the population in this cohort ($p<0.001$).

6.4. Discussion

The results of this study indicate that the prevalence of dental caries in this population was relatively low in comparison to results from similar studies in South African schools (Reddy and Singh, 2015a, Thekiso et al., 2012, van Wyk and van Wyk, 2004).

Reasons could either be attributed to exposure to fluoridated water by children accessing borehole water in the Tshwane rural locations. Or that learners were recipients of oral health programs and were able to access preventative care (Postma et al., 2008). Gender, location and services received emerged as key associated factors influencing the status and severity of dental caries in this population. The female learners, learners in urban schools and those with no exposure to a brushing program had higher levels of dental caries. The severity of dental caries affected the 6-7 year old the most and learners located in urban areas across the ages were worst affected.

The 8-16 year old males had less DMFT than females, the cause for the gender bias is uncertain; however, studies suggest that it may be due to gene-by sex interactions involved in the dental experience (Shaffer et al., 2015, Lukacs and Largaespada, 2006). Others report that it could be due to females experiencing early eruption times of teeth, thereby having longer exposure to cariogenic foods. In addition it has been observed that the fluctuating levels of estrogen in females during puberty and menstruation suppress the salivary flow rate, affect its composition and subsequently causes caries susceptibility (Lukacs and Largaespada, 2006).

The prevalence of dental caries on the permanent teeth of the urban learners was higher than those in rural areas and the primary teeth were similarly affected by the location. The change in nutrition as most families migrate from a peri-urban to urban settings for employment is contributory (Postma et al., 2008, Bourne et al., 2002). In addition, as the majority of children in urban schools have working parents, the children often had access to school snack money in addition to healthy government school lunches. In peri-urban schools, learners were more reliant on the government school meals and had less exposure to snacks. Other South African studies have demonstrated a similar phenomenon on oral health trends between urban and non-urban localities (Postma et al., 2008, Bourne et al., 2002, van Wyk and van Wyk, 2004). This has largely been attributed to the higher urban sugar expenditure [mean urban 8.06 (2.78) vs non-urban 7.35 (1.94)] and less access to borehole water which is higher in natural

fluoride than reticulated public water supply in cities (Bourne et al., 2002, van Wyk and van Wyk, 2004).

Learners, who were only exposed to a fissure sealant program versus both the supervised brushing and fissure sealants, had higher levels of caries across the age groups and higher severity of the condition among the 6-7 year olds. This implies that a more comprehensive program may be favorable in terms of controlling the condition at schools (Jürgensen and Petersen, 2013). Studies have also demonstrated that fissure sealant retention tends to be a challenge particularly when not placed in ideal clinical conditions (Potgieter and Naidoo, 2017). It must also be noted that fissure sealants are targeted to protect permanent molars and not primary teeth or the rest of the oral cavity, hence the negative result (Jürgensen and Petersen, 2013). The results are also dependent on the type of fissure sealants used, moisture tolerant glass ionomer fissure sealant materials may have resulted in better outcomes in field conditions as some studies have demonstrated (Yengopal et al., 2009).

The severe consequences of dental caries mostly affected the primary dentition as the pufa was high amongst the 6-7 & 8-10 year groups. This indicated that some form of dental neglect or poor access to treatment had been experienced, hence disease consequences such as pulpitis and fistulas resulted (Shanbhog et al., 2013). A review of parental influence on the development of caries reported that high levels of untreated caries often resulted from a combination of factors. These could include, geographic isolation leading to difficulty in travelling to services; parental attitudes, knowledge and beliefs. Attitude, knowledge and beliefs are implicated as this often determine the choices parents make for their children in terms of taste preferences in diet and dental hygiene and care (Hooley et al., 2012, Kolisa, 2016). Furthermore, there is poor perception of the importance of primary teeth and lack of knowledge and awareness on the significance of oral health, particularly among parents with poor education (Hooley et al., 2012, Kolisa, 2016).

Although the prevalence of caries was low in comparison to similar studies in South Africa and the WHO goal of mean DMFT of 3 among 12 year olds, the SiC index was high in both the primary and permanent teeth implying that the disease was unevenly distributed in this cohort and few children were carrying the major burden of the disease. This means that consideration may need to be given to the implementation of a high-risk prevention approach

on some services in order to address the needs of those highly affected. However, this has to be carefully executed in order to avoid neglecting the rest of the learners (Watt, 2005).

A high unmet need of over 89% was found. This is surprising given that the learners were recipients of oral health programs. The parents may possibly not be following up on the referrals generated from the oral health screening processes (Bajomo et al., 2004) or the healthcare professionals at the facilities may have been experiencing difficulties in attending to the restorative needs of the children for various reasons. Young children often exhibit anxiety and fear towards dental treatment, this then is expressed in disruptive behaviour while on the chair (O'Callaghan et al., 2006). Dental treatment is then hindered, particularly in public health facilities that are characterised by high patient loads and time limitations (Singh, 2011).

6.5. Limitations

The main purpose of the study was to highlight the oral health status of the learners receiving ongoing oral health programs and to ascertain the factors influencing the oral disease experience at the school settings. The study was observing existing participating schools in uncontrolled conditions, therefore settings and services received could not be controlled for equal distribution. Future studies will expand more on processes of program implementation and how it influences the oral health status of learners. In addition, as this was a cross sectional study no causal inferences could be made.

6.6. Conclusion

The prevalence and severity of dental caries was relatively low in this population, however the unmet treatment need and the SiC index were high. The consequences of the disease affected the primary teeth of the learners most and the factors associated with the disease were influenced by gender, location and the type of services offered by the programs. Female learners had higher levels of dental caries on the permanent teeth of 8-16 year olds, and across the ages learners from urban locations and those who only had access to a fissure sealant program and not a combination of services were worst affected.

7. CHAPTER SEVEN: IMPLEMENTATION FIDELITY OF SCHOOL ORAL HEALTH PROGRAMS AT A DISTRICT IN SOUTH AFRICA.

Molete M, Stewart A, Igumbor J (2020) Implementation fidelity of school oral health programs at a District in South Africa. PLoS ONE 15(11): e0241988.

The published version of the paper is available on the link or manually searching with the DOI: https://doi.org/10.1371/journal.pone.0241988

7.1. Background

School health programs date back to the 1950`s with the aim of facilitating collaboration between the educational and health sectors in working towards improving education and health outcomes of children in one setting (St Leger, 1999). The philosophy behind such programs has been further shaped by the Ottawa Charter on health promotion in terms of addressing conditions affecting school children by building healthy school policies; creating supportive environments; strengthening community actions; developing personal skills and re-orientation towards disease prevention and health promotion (Kwan et al., 2005b, World Health Organization, 1986b).

Oral health has often been one of the first activities to be adopted by schools as it can be incorporated into key elements of health promotion and provides an opportunity for addressing oral health within a general health promotion strategy (Kwan et al., 2005b). Oral health in South Africa is also included in the Integrated School Health Policy, which was legislated in 2012. The aim of the policy is to improve primary health care delivery, children's general health and education outcomes (DoHBE, 2012). One of the pilot sites for integrated school health is in the study district where oral health services offered include; oral health screening, education, brushing programs and fissure sealants. These programs have been officially offered since 2011 however they have not been assessed for implementation effectiveness (Matsoso and Fryatt, 2013, Singh, 2011).

School oral health programs in Tshwane are offered by the district oral hygienists who all have a diploma qualification in Oral Hygiene that include a module on the implementation of community programs. The oral hygienists are employed by the Department of Health in the Gauteng province; they are based in local district dental clinics and are responsible for

community and clinical preventative oral health care. In the school settings, the hygienists offer oral health education and co-ordinated tooth brushing programs to groups of children. In addition, they use portable dental equipment that is set up to provide, oral health screening, fissure sealants and simple restorations such as the Atraumatic Restorative Technique (ART).

The oral hygienists spend approximately three to four weeks of four hours per morning at a specific school delivering the program. They are expected to complete a school after attending to at least one primary grade class and one secondary grade class. At the schools, they offer mass oral health education to the teachers and all children, co-ordinated tooth brushing activities, screening, fissure sealants and ART to the children who require the treatment. The class teachers are involved in supervising the children on the tooth-brushing program after lunch times. Upon completing a specific school, the oral hygienists are expected to return to the school quarterly during the year to reinforce the education and the brushing activities.

Data from a global school oral health survey and a review of school health services, found that the full range of health promotion at schools was narrowly implemented and not applied broadly as recommended by the Ottawa Charter (Baltag et al., 2015, Jürgensen and Petersen, 2013). Furthermore studies have shown that although over 80% of the documented programs reported positive oral health outcomes as a result of interventions, there was general poor reporting of the extent of implementation (Cooper et al., 2014, Haque et al., 2016, Khoshnevisana et al., 2017, Macnab et al., 2008a, Reddy and Singh, 2015a).

It is recommended that interventions should be monitored through stages of design, development and implementation in order that accurate interpretations of how of elements of the interventions contribute to the desired outcomes can be made (Damschroder et al., 2009). Such deductions are made possible by the concept of fidelity, which refer to the application of an intervention as originally designed. In understanding how the intervention was designed and the operational processes leading to its success, evidence can then be documented on how to strengthen an entire intervention or to precisely target poor performing components of the intervention (Lynas and Hawkins, 2017). A program with high fidelity would therefore be considered to produce favorable outcomes (Durlak and DuPre, 2008b, Harn et al., 2013).

Implementation fidelity is not a linear construct as it is influenced by various contextual factors and its measurement is complex (Durlak and DuPre, 2008b). There are various frameworks of fidelity and our study adopted Carrol's framework as it allows for measurements of the active ingredients of an intervention and factors that influence the quality of implementation (Durlak and DuPre, 2008b, Gearing et al., 2011).
Elements of fidelity as described by Carroll et al. (2007a) include adherence and potential moderators. Adherence refer to content, coverage, frequency and duration, these express the level of implementation fidelity achieved. Potential moderators are elements which are suggested to have some influence on the level of implementation achieved, these include; intervention complexity, facilitation strategies, quality of delivery and participant responsiveness (Carroll et al., 2007a).

School oral health programs have been in existence for over 20 years in South Africa however the oral health status of school pupils in South Africa remains poor with persistently high levels (80%) of unmet treatment needs (Khoshnevisana et al., 2017, Reddy and Singh, 2015a). There is also no evidence of monitoring and evaluation of school oral health by the Department of Health in South Africa. Therefore conducting this analysis may provide insight into fidelity elements affecting the dental decay outcome of the school pupils receiving school oral health programs.

The objectives of our study were to assess the level of fidelity achieved by the district school oral health programs; to determine how adherence elements of fidelity predict the risk of decay, and how potential moderating factors of fidelity predict the risk of decay.

7.2. Methodology

This cross-sectional study was conducted in the study district situated in the northern area of the Gauteng Province, South Africa. A multistage sampling technique was undertaken to select both schools and learners. There were 10 oral hygienists in the district providing oral health services and they were all invited to participate. Each of the oral hygienists had a list of schools receiving oral health programs; therefore one school from each of the hygiene list was randomly selected for participation. The schools selected for participation had to have been receiving the oral health program for more than one year.

In the first stage of sampling, one school was randomly selected from each oral hygienist list. Upon selecting the 10 schools, two grades in each school were selected to include children with ages ranging between 6 and 7 and 12 and 13 years as these are the ages recommended for dental programs in the National Oral Health Policy (National Department of Health, 2010). The last stage of sampling included a random selection of two classes within the chosen grades, which were grades 1 and 7's at each participating school. All the children in the selected classes were invited to participate in an oral health examination.

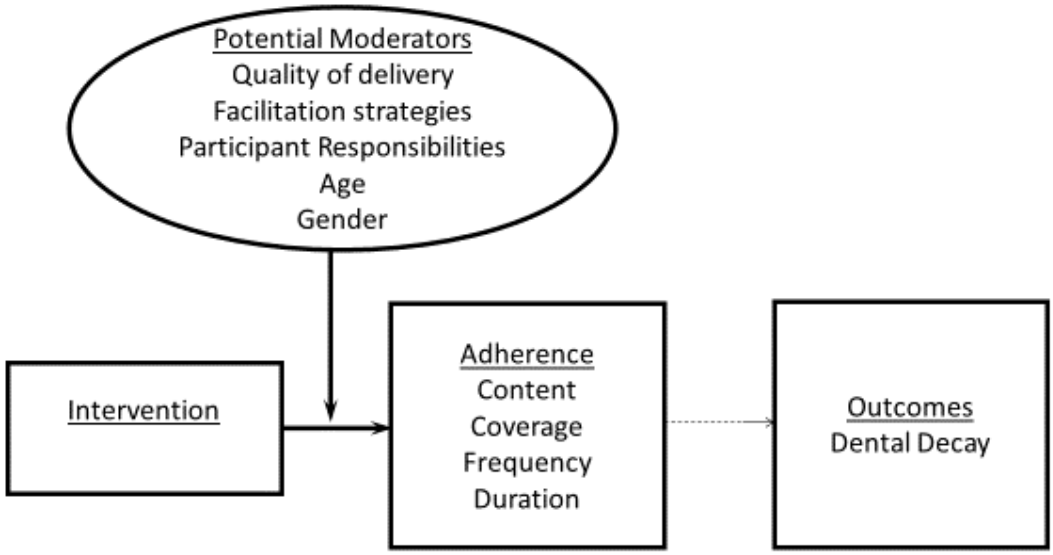
About 700 pupils were required to enable the estimation of the mean Decayed Missing Filled Teeth (DMFT) with a precision of ± 0.3, assuming the standard deviation was 2.0 with a design effect of 2. The calculation also took into account the clustering effect of pupils within schools (Statcalc,version 14).

Pupils were invited to have oral health examinations which were undertaken using the DMFT index, which provides information on the decay levels of the permanent teeth. All information was captured on an oral health assessment form and procedures were followed according to WHO guidelines (World Health Organization, 2013b). The first author and a research assistant conducted the oral health examinations. They were calibrated by a dental public health specialist not involved in the research and inter-rater reliability was established by conducting repeat examination of images up until the Cohen's Kappa score was ≥ 0.80.

The oral hygienists were also observed and interviewed as they carried out the activities of the program. Records were also reviewed to verify some information and the data collection was guided by an implementation fidelity checklist. The fidelity checklist included questions which assessed content, coverage, frequency, duration, quality of delivery, and potential moderators. As displayed in **Appendix P**, "content" assessed the key activities that were offered at each school. "Coverage" measured the number of children seen over two grades per school. "Frequency" measured the number of times the hygienist visited the school per year and "duration" the number of hours spent at a school per day by the hygienists. In terms of the moderators measured, quality of delivery referred to the manner in which the program was carried out in terms of preparedness, interaction with teams and communication of activities. Facilitation strategies assessed factors that existed to optimise fidelity such as availability of chair-side assistance, school support and functioning equipment. Participant's responsiveness assessed how the oral hygienists, teachers and parents engaged with the

program. Our study also included age and gender as potential moderators as they represent some of the key determinants that influence levels of dental decay among children (Mejàre et al., 2014), see **Figure 7.1.**

Figure 7.1: Modified framework adapted from Carroll et al. (2007)



Each of the fidelity elements had a different number of items as in **Appendix P**. The scores of content had 10 items and moderator items had 3 items. Coverage, frequency and duration were coded as low "0" or high "1",the benchmarks being 50% for coverage, twice a year for frequency and four hours for duration. This allowed for the coding of the elements as item scores. All the above components were then added to determine an adherence score out of 13. The adherence score of each school program had to be scored out of 13 and a percentage of the score was determined in order to express the level of fidelity, see **Table 7.1.** The collection of fidelity data was undertaken by the first author and the tools were pre-tested on a school oral health program not involved in the study in order to ensure repeatability (Wilson et al, 2018).

Ethics

Written informed consent was obtained from the study participants after explaining the purposes of the study. Ethical approval for this study was obtained from the Human Research Ethics Committee of the University of the Witwatersrand (M170115), and permission to access the schools was granted by the district's Department of Education.

Data management and analysis

The data from the oral health assessments consisted of continuous variables and that from the fidelity checklist included scores and binary variables. The levels of fidelity at the schools were derived from the adherence scores and were assessed using descriptive statistics, namely proportions. The decay level was assessed using mean scores and standard deviations.

Multilevel Poisson's regression analysis was then utilised to assess the predictive elements of fidelity on the risks of decay. Variables from the model were then fitted on a predictive margins plot in order to get an illustration of how fidelity related to decay. For the regression analysis, fidelity scores were categorised as low when they were less than 50% and high when over 50% (Harn et al., 2013). A simple regression analysis was also undertaken to determine the minimum amount of fidelity required for zero levels of dental caries.

For assessing the moderating factors, interaction effects had to be added to the multilevel Poisson regression model. This was in order to assess which of the moderating variables interacted with fidelity in influencing the dental decay outcome. Variables that had statistically significant interactions with fidelity were identified as moderators of fidelity. Quality of delivery and participant responsiveness were omitted from the model due to elements being collinear with fidelity. All the analysis was conducted on STATA version 16 at a 95% confidence interval.

7.3. Results

There were 736 pupils who participated in an oral health exam with ages ranging between 6 and 16 years old. Across the 10 schools involved in the study, only 28% of the program content was covered, however the average percentage of pupils exposed to the program in 2017 was high (109%). The elements of content that were adhered to mostly included brushing and fissure sealant activities **(Appendix P).** Adherence was poor on community and resource assessments, training, advocating for dietary practices and collective implementation

(Appendix P). The hygienist spent an average of 3.5 hours at a school per morning over 4 weeks; 50% of the hygienist revisited the school twice a year and the other 50% revisited once a year. As seen in **Table 7.1,** the lowest level of fidelity was 15%, the highest 61% and the average level of fidelity achieved across the schools was 39.6%. The mean decay (D) score of all the pupils was 0.54 (SD: 1.16). School number 2 had the lowest level of decay (0.19; SD: 0.46) while School number 6 had the highest level of decay (1.11; SD: 1.51).

Table 7.1: Description of services, levels of fidelity and dental scores at school level

Schools	**Number of learners seen/total of grades 1 & 7 per school**	**Proportion of learners covered for 2017**	**Content scores/10 & proportions**	**Fidelity scores/13 & proportions**	**Decay score (SD)**
1	155/322	48%	2 20%	3 23%	0.49 (1.10)
2	112/150	75%	3 30%	6 46%	0.19 (0.46)
3	229/136	168%	4 40%	8 61%	0.29 (0.68)
4	140/112	125%	3 30%	6 46%	0.26 (0.71)
5	205/113	181%	4 40%	7 53%	0.38 (1.76)
6	268/386	69%	4 40%	5 38%	1.11 (1.51)
7	91/200	45%	1 10%	2 15%	0.56 (1.17)
8	165/368	45%	1 10%	2 15%	1.09 (1.44)
9	724/380	190%	3 30%	7 53%	0.27 (0.75)
10	412/282	146%	1 30%	6 46%	0.38 (1.16)
Totals & average scores	**2501/2449**	**109.1%**	**Mean 2.8 (1.0) 28.0%**	**Mean 5.2 (2.0) 39.6%**	**Mean 0.54 (1.16)**

Upon fitting the variables of fidelity and the decay scores on a margins plot, the figure derived displayed how increasing levels of fidelity resulted in a decrease in the mean dental

decay across the 10 schools, see **figure 7.2.** In addition the simple regression analysis indicated that a minimum fidelity level of 79.8% was required for an ideal zero dental caries score.

Figure 7.2: Margin plot demonstrating relationship between fidelity and mean decay scores.

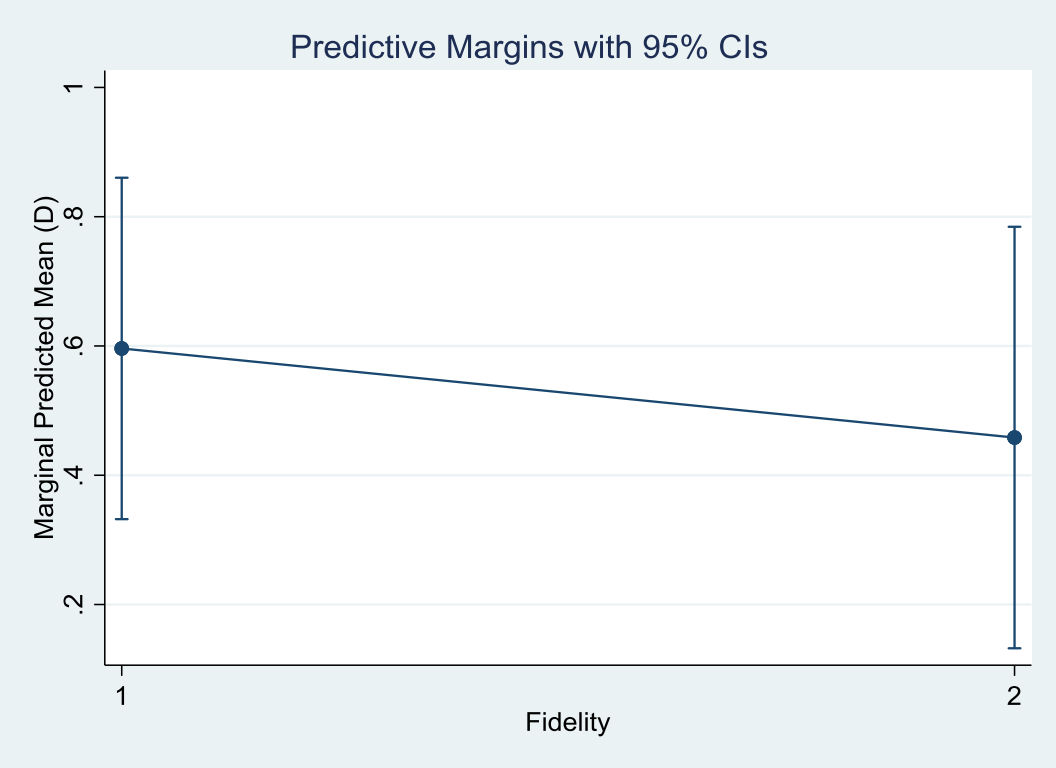


Table 7.2 demonstrates how the adherence elements of fidelity influence the decay experience after adjusting for age and gender. The Incidence Rate Ratio (IRR) was computed to measure the relative measure of risk of the outcome. The results therefore highlighted that the relative risk of duration, coverage, content and age were found to significantly predict decay levels. Duration (IRR: 0.49;p=0.02) and coverage (IRR:0.54;p=008) reduced the risk of decay, while content (IRR:1.36; p=0.03) and age (IRR:2.14; p=0.00) increased the risk of decay respectively.

Table 7.2: Relationship of fidelity elements with decay experience.

D	IRR	Std. Err	p	CI
Duration	0.49	0.15	0.02 **	0.26 - 0.90
Coverage	0.54	0.12	0.008**	0.34 - 0.85
Frequency	0.66	0.21	0.21	0.34 - 1.27
Content	1.36	0.20	0.03**	1.01 - 1.81
Age	2.14	0.25	0.00**	1.70 - 2.69
Gender	1.05	0.10	0.60	0.86 - 1.28

****p≤ 0.05**

Variables that were found to have moderating effects on fidelity included facilitation strategy, duration and age. When facilitation strategy interacted with fidelity, particularly the presence of a chairside assistant; the relative risk of caries is reduced by 92%, (IRR: 0.08; p=0.001). Furthermore when duration of the activities was a minimum of 4 hours and learners with ages between 8-16 interacted with fidelity, they reduced the relative risks of decay by 83%, (IRR:0.17;p=0.02) and 48% , (IRR:0.52;p=0.008), respectively. **See Table 7.3.**

Table 7.3: Moderating effects of fidelity on dental decay.

D	IRR	Std. Err	p	CI
Services offered*Fidelity	3.45	2.84	0.13	0.68 - 17.32
Quality of delivery*Fidelity	omitted			
Facilitation strategy*Fidelity *Chairside Assistance*	0.08	0.06	0.001**	0.02 - 0.36
Participant responsiveness*Fidelity	omitted			
Duration*Fidelity *4hours*	0.17	0.13	0.02**	0.03 - 0.80
Age*Fidelity *8-16*	0.52	0.12	0.008**	0.32 - 0.84
Gender*Fidelity *Male*	0.82	0.18	0.39	0.53 - 1.27

****p≤ 0.05**

7.4. Discussion

The oral hygienists covered about a quarter (28%) of the expected program content, however the overall coverage of the program was high (109%). The average level of fidelity obtained was 40% and was shown to be inversely correlated with the proportion of children with decay, as decrease in levels of decay was associated with increase in the level of fidelity. Fidelity elements that were found to be direct predictors of decay were program duration, its coverage, content and age of the children. The moderating factors of fidelity which indirectly influenced the levels of decay included facilitation strategy, duration and age.

The 40% level of fidelity in this study was similar to those reported elsewhere (Lynas and Hawkins, 2017, Wilson et al., 2018). Our results also demonstrated that to attain the ideal of

zero levels of decay, an 80% level of fidelity would be required. Furthermore, our observed low fidelity of 40% imply that much more effort needs to be made to improve the quality of implementation in addressing the high burden of untreated decay (89.6%) among affected primary school children (Molete et al., 2019).

Elements that were associated with reduced decay included duration and coverage. The average duration spent at a school was 3.5 hours per session and half of the schools received one follow-up visit a year, yet their coverage in terms of number of children seen, was high. This meant that one contact time was spent per child in a year, and more children beyond the targeted grades of 1 and 7 were reached. It can therefore be assumed that the many children covered were attended to quickly as the content achieved was low (28%) in the single contact per year. A study in Kuwait demonstrated how the synergy between duration and coverage effectively reduced the need for restorative work in school services, as the oral health practitioners involved spent a lot more time covering large numbers of children (80%) and offering preventative activities without compromising quality (Ariga et al., 2014).

One of the predictors of increasing levels of decay was age (IRR:2.24). The effect of age was expected, particularly among children between the ages of 8-16. As children get older and transition to the adolescent stages, their oral health knowledge, attitude and practices tends to be low (Haque et al., 2016). In addition they often opt for sugary snacks and sugar sweetened beverages which contribute to dental caries (Curtis et al., 2018). Our results further demonstrated that as age interacted with fidelity, it significantly reduced the relative risk by 48%, from (2.14) to (0.52). This finding also implies that fidelity can moderate the effect of age on dental caries by reducing the risk of decay (Durlak and DuPre, 2008b).

Content was also shown to be associated with an increase in levels of decay (IRR:1.36). We also noted the worst performing content elements to include items such as, community resource assessments, advocating for dietary health practices and multi-sectoral collaboration (see Appendix 1). These have been cited as some of the key elements of success in oral health programs (Khoshnevisana et al., 2017, Baltag et al., 2015). In our study, high content was associated with increased levels of decay possibly because of the limited time given to the elements of program content. Therefore, a high content within the limited time was likely to affect the quality of implementation and clinical outcomes (Van den Branden et al., 2015).

The elements that were found to moderate and indirectly influence the levels of decay included the facilitation strategy, duration and age. These elements interacted with fidelity to buffer the risk of dental decay. Among all the facilitation strategies assessed, the availability of a dental assistant superseded the other factors and was predicted to reduce decay by 92%. This may be because dental procedures such as fissure sealants require extra precautionary measures in creating a moisture free environment for effective longevity of the restorations, hence the need for chair side assistance (Yengopal et al., 2009). Thought should be given to offering alternative similar effective preventative procedures that do not require a dental assistance, such as fluoride varnishing or rinsing activities (Nakre and Harikiran, 2013).

When duration interacted with fidelity, it influenced the outcomes of dental caries by further reducing the relative risk by 83%. This therefore emphasised the need for the oral hygienist to spend more hours at the school not only for carrying out preventative techniques, but also for other activities such as thorough planning, training of educators and garnering support from key stakeholders such as parents and community health workers (World Health Organization, 1986b). Community health workers are lay health workers in South Africa who are deployed to improve community access to primary health care services by engaging closely with communities, linking communities to healthcare and providing health education and promotional activities (Horwood et al., 2017). These community health workers have been effectively used to support HIV programmes and management of childhood illness in South Africa (Schmitz et al., 2019). However, their potential support in oral health has not been explored.

7.5. Conclusions & Recommendations

The extent of implementation fidelity was 40% and adherence elements that were shown to reduce the risk of decay included duration and coverage. Those that increased the risk of decay were content and age. Potential moderators included facilitation strategies, duration and age; these were predicted to reduce the risk of decay.

The implications of this study are that, in as much as the hygienists covered a high number of children for the purposes of meeting their annual performance targets, they compromised on the program content and levels of fidelity (Molete et al., 2020). This negatively impacts on the effectiveness of school programs in controlling the decay burden (Singh, 2011).

Increasing the duration contact time at the schools also emerged as a key for reducing decay; therefore more time needs to be invested in the carrying out the program at the school sites. Additional support for the oral hygienists at school sites is therefore required for them to effectively carry out their work. Thus the potential for training community health workers in oral health education should be explored as they can assist teachers in providing oral health education and facilitating group tooth brushing activities. This would allow the oral hygienists to spend longer focused time on fissure sealants, curative care, and program reinforcement. The increased duration on the program will improve fidelity and hence quality (Van den Branden et al., 2015).

Process mapping tools and checklists of the program content needs to be introduced to the oral hygienists in order that they have a clear understanding of the key components of the program and be aware of the necessary activities they need to attend to for achieving their intended outcomes (Harn et al., 2013). This would assist the hygienist in monitoring themselves and additionally provide guidance towards improving the delivery of the program content. Improving adherence to the key program components would subsequently improve fidelity and the outcomes of decay (Carroll et al., 2007a).

While our study was not designed as a controlled experiment and could not validate the efficacy of the program, we were able to understand the extent of implementation of the program elements. In addition the predictive regression analysis was used in order to predict effects of the direct and indirect associations between fidelity and the levels of decay among the children. This information will be useful for future program planning. The elements of fidelity identified to influence the risks of decay reemphasize the need to invest more time and human capacity into the program.

Linkage

Linking notes between chapters 6 & 7. This section contains information to clarify the link between Chapters 6 and 7. In-depth discussions in findings of individual papers are in the discussion sections of each paper, while an overall discussion follows in Chapter 8.

The findings in Chapter 6 illustrated how the exposure to the school oral health services influenced the dental status of the children. Although the prevalence of dental caries was relatively low in comparison to that of children in similar socio economic backgrounds (Thekiso et al., 2012, van Wyk and van Wyk, 2004, Reddy and Singh, 2015a), there were high levels of unmet treatment need. Chapter 7 then provides a comprehensive reflection of where the weaknesses of the programmes stem from. It provides information on how elements of an intervention contributes to desired outcomes, the level of fidelity achieved and direct and indirect elements that affect the outcomes of the decay and programme.

Chapters 6 and 7 both used cross-sectional quantitative study designs in investigating the dental status and fidelity elements affecting the dental outcomes of the participating children. Chapter 6 measured the variables influencing dental status such as location, type of services offered and gender. The key findings from the chapter were that children who lived in urban areas suffered from dental caries the most and that those who received fissure sealants in addition to the brushing programme were associated with low levels of dental caries. Chapter 7 assessed how the variables such as duration, coverage, frequency, content and moderating factors affected fidelity and dental decay. The variables that had a positive influence over fidelity and decay included; duration, coverage and facilitation strategy. The two chapters therefore demonstrated that the outcomes of dental needs were poor as a consequence of the poor processes of implementation as described in chapters 4 and 5.

8. CHAPTER EIGHT: DISCUSSION & RECOMMENDATIONS

8.1. Introduction

My study investigated the scope, implementation approaches and outcomes of school oral health programmes in Tshwane, Gauteng South Africa. It was conducted by assessing perceptions on the scope of policy implementation at both a strategic management and frontline operational level. The dental health status of the children participating in the oral health care programme was examined in relation to policy implementation and the quality of implementation was measured by determining the extent of implementation fidelity. The school programmes offered activities that ranged from oral health education, fissure sealant delivery, coordinated tooth brushing activities and atraumatic restorative techniques (ART). There were variations in implementation approaches as some oral hygienists focused on single activities while others on a combination of activities. The approaches were fragmented due to poor understanding of the policy content, inconsistent target setting among the oral health practitioners; and inadequate human and material resources for service delivery. The programmes lacked technical support, capacity building and the necessary multi-sectoral collaboration. Although the oral hygienists covered a high number of schools, above what the policy recommended (109%), this high coverage was to the detriment of the content of the programme delivery (28%) and quality of the programme (40%). Consequently, the children examined revealed high levels of unmet treatment needs of the primary (89.6%) and permanent teeth (55.5%).

The outline of the discussion is structured according to the above key findings that emanated from the guiding conceptual framework. These include; policy translation, delivery of the intervention, the influence of fidelity and potential moderators; and clinical outcomes. The implications of these in terms of how policy translation affects intervention delivery, fidelity and clinical outcomes of the programmes are discussed in relation to other studies. This is then followed up by outlining the limitations of this study and evidence based recommendations.

8.2. Policy Translation

The National Oral Health Strategy is a policy document that is widely recognized and referenced in many key decision making platforms concerning oral health in South Africa. The strength of the document is that the proposed policy strategies are evidence-based and that there is an aspiration for the integration of disease prevention and health promotion in addressing the common risk factors in oral health and improving oral health outcomes (National Department of Health, 2010). One of its major weaknesses is that its development is based on outdated oral health surveillance data of 2002. Consequently, the findings of my study illuminated the gaps in the policy governance and present-day applicability.

Policy translation refers to the way in which policy is interpreted and applied. My study demonstrated it to have been poor and inconsistent, particularly in areas where the policy reflected sound clarity such as the strategic vision, responsiveness to health needs and equity. As evidenced in my study, there was a lack of training of local managers and hygienists on planning, monitoring the policy and target setting. Secondly, there were poor communication systems and a lack of robust consultations as stipulated in the policy documents. These observations were similar to those reported by Reddy and Singh (2015b) as they assessed the viability of delivering oral health promoting activities at schools in KwaZulu Natal. This was supported by Singh et al. (2010) and Orem et al. (2012) as they echoed how poor consultation and dissemination often affected policy translation.

As a consequence of the poor policy translation, the implementing hygienists in my study were dependent on the policy interpretation from the district managers and in turn the managers could only meaningfully engage with the national office on policy matters alongside the support of the university oral health experts. There existed therefore some form of a bureaucratic top down system that has been suggested as being unsuccessful in improving policy implementation (Mascini, 2013). Thus, the managers and oral hygienists consequently varied in their approaches on how to initiate the programme as aligned to community needs, and yet the policy was clear on such matters. It is therefore suggested that hybrid approaches to healthcare governance that integrate top down and bottom up mechanisms create a favourable environment for capacity building and proactive service improvement (McDermott et al., 2015).

Poor stakeholder engagement in spite of the policy aspiration was also observed in my study. The oral health managers lacked the competence to establish the collaborative approaches that were expected of them at a local level, and reported to having had no information on the collaborative agreement they were meant to have with the Department of Basic Education. This resulted in managers and implementing hygienists not having broad stakeholder support for facilitating service delivery and uptake as recommended by policy. Upadhaya et al. (2017) found that stakeholder engagement and participation improved programme governance in Nepal. Furthermore such engagements have been reported to curtail the fragmentation that was evident in my study (Bempah and Kanmiki, 2017).

Multi-stakeholder collaborations between policy makers, implementers and civil society have been demonstrated as essential for policy formulation, communicating objectives and obtaining support throughout policy development and implementation (Campos and Reich, 2019, Orem et al., 2012). They are most effective when initiated at a policy formulation stage in order to systematically form an interdisciplinary dialogue on a complex condition that requires various perspectives. The participatory component of dynamic simulation modelling has been suggested to facilitate multi-disciplinary teams in formulating shared evidence – based policy options by convening of stakeholders, conceptual problem mapping, synthesis of evidence, quantifying key dynamic relationships within the system, refining the model collectively and applying the model to support policy decisions (Freebairn et al., 2019).

My study findings also revealed that lack of sound operational guidelines impacted on policy translation. The operational plans developed by the implementing hygienists were incoherent and poorly disseminated, as was similarly observed in a study in Uganda (Orem et al., 2012). The oral hygienists engaged in the exercise in an attempt to make sense of the policy, to bridge the gap between the policy and implementation; and establish some form of uniformity (Boote et al., 2006, Lipsky, 2010). This task has however been shown to be challenging as it requires collaborative decision making, effective guidance, adequate competencies and resources which are often lacking among low level implementing officials (Weiss et al., 2016). Hence, the hygienists were not successful in their attempts of developing guidelines.

In turn, the above particular finding demonstrated that the implementing hygienists had some influence in maintaining a particular policy agenda whether it occurred in a beneficial way or

distorted way (Koduah et al., 2015). The reason is because actors have the power to set and maintain the policy agenda as influenced by their values and local contextual factors (May and Winter, 2009). For instance, Chipukuma et al. (2020) demonstrated how the low morale of community health workers/ actors contributed to a poor malaria prevention programme in Zambia. Whereas in Ghana, Koduah et al. (2015), found that policy actors were instrumental in sustaining the maternal fee exemption policy over four and a half decades. This highlights an opportunity for a coordinated bottom up approach where implementing hygienists could be integrated into policy formulation and translation processes in order to effectively use their influence in shaping policy that would have wider support and ownership (Lehmann, 2016).

8.3. Delivery of the intervention

There clearly was a positive response and acceptance of the school oral health policy in South Africa as there has been wide implementation of the programmes across the large provinces such as Gauteng, Kwa Zulu Natal and the Western Cape (Molete et al., 2020, Rudolph et al., 1996, Reddy and Singh, 2015a). However, both my and other South African studies concur that although policy implementation was undertaken, it was poorly coordinated and not adequately monitored for improvement.

My study further found that programme delivery was suboptimal potentially due to poor planning and coordination. Fernandez et al. (2019) echoes that this is often a challenging task for implementing officials. Furthermore, Kurji et al. (2016) observed that poor planning was associated with poor governance and inefficiency as they reflected on the lessons learned from analysing the health care system in Pakistan. In my findings, districts were expected by the national office to customize their interventions according to the specific needs of a community and the available resources; however, they failed to do so. There was no evidence of them using the operational tools that were at their disposal. It could also be suggested that they had a poor reading culture that inhibited them from fully appreciating the key planning aspects that were required of them, as observed in Uganda (Orem et al., 2012).

The lack of co-ordination caused a departure from the expected policy processes as adaptations were made to deal with uncertainty and subsequently resulted in poor programme delivery (Boote et al., 2006). This phenomenon is referred to as “street level bureaucracy”; it occurs when government officials tasked with implementing policy, translate

higher-level goals to street level actions that make it easier to cope within constrained work environments (Meyers et al., 2007). Hence it is important that high level policy makers and managers form communication links and collaborations with street level bureaucrats (implementing officials) in order to oversee and regulate the discretion they have at implementing sites (May and Winter, 2009). Furthermore there is a need to have multiple dissemination and training approaches that could be tailored to different audiences in order to ensure that policy understanding is clear and delivery is effective (Orem et al., 2012). Supportive supervision has additionally been suggested to optimize health care delivery by mentoring and supporting staff in providing training, technical assistance, and guidance in problem solving and resource prioritization (Bailey et al., 2016).

Intervention delivery was additionally found to be affected by inadequate resources. The reason behind the lack of resources was attributed to the lack of a dedicated budget; in addition the oral hygienists had no information on available programme resources as oral health finances are integrated within the district budget (Singh et al., 2010). Resource inadequacies have been shown to be common, as departments of health often fail to provide persuasive technical evidence on the financial needs of their policy proposals (Bempah and Kanmiki, 2017, Campos and Reich, 2019). Furthermore, Singh et al. (2010) echo that during policy formulations, power relations compete for health resources and allocation of budgets, which therefore implies that the departments or units with prominent agendas are the ones that likely benefit. It is therefore of no surprise that oral health is less prioritized as the leading causes of morbidity and mortality in South Africa include; HIV/AIDS, Tuberculosis, Injuries, and Non Communicable Diseases (NCD) such as diabetes (Bradshaw et al., 2007).

The consequences of inadequate resources resulted in shortages of staff and equipment to carry out the programme effectively. This finding has been reflected in similar studies conducted in low- middle income countries such as Nigeria & Uganda (Lawal and Taiwo, 2014, Muhirwe, 2006). Tanzania addressed such challenges by formally integrating oral health education into the primary school curriculum from 1982 (Carneiro et al., 2011). This resulted in good oral health outcomes having 88.4 % of secondary school students with adequate knowledge of oral disease prevention and 79% of them caries free (Mashoto et al., 2010, Carneiro et al., 2011). Furthermore they have low levels of dental caries (DMFT; 0.41) among 15 year olds in comparison to my participants of similar age showing a mean (DMFT of 1.1) (Carneiro et al., 2011). It is therefore worth advocating for moving towards formally

integrating oral health education into the primary school curriculum in order for teachers to focus on primary prevention such as oral health education and tooth brushing activities. While the oral hygienists could concentrate more on secondary prevention such as fissure sealants and curative care (Govender et al., 2013).

Programme delivery was additionally affected by conflicting priorities between the policy goals and work performance obligations. This was reflected in my study with the work performance targets being highly prioritized over the policy objectives; as seen in the particularly high coverage of 109%. This is contrary to the findings of Van den Branden et al. (2015) who considered the coverage of 88% on oral health promotion visits for post –natal mothers in Belgium, to be good. Moreover, looking at various intervention studies it is uncommon to have coverage of over 100% (Chipukuma et al., 2020, Naidoo and Singh, 2018). This therefore brought to light the peculiar behaviour exhibited by the implementing hygienists in my study. Koduah et al. (2015) suggest that when policy participants act within interrelated contextual factors there are possible hindrances or opportunities that affect implementation (Koduah et al., 2015). That means that contextual factors such as conflicting priorities within a system as was exhibited in my findings, drove policy actors to either action or inaction with regards to policy. Such competing interests compromise the focus on intended policy goals and hence weaken the quality and delivery of the programme (Koduah et al., 2015). These dilemmas can be addressed by establishing common understanding across levels of leadership and shared key priorities so that the implementing officials are not left conflicted (O'Toole Jr, 2003).

8.4. Fidelity and its determinants

There were gaps in terms of adhering to the key components of the programme. Despite the fact that a large number of schools had access to the programme and were covered, there was poor adherence to key activities such as community-resource assessments, training of educational staff, advocating for dietary practices and collective implementation. Sadly the activities that were not adhered to were essential to the planning phase of the intervention; particularly community assessment and training, as they facilitate effective initiation of the programme and create an environment for readiness and stakeholder commitments (Chamberlain et al., 2011, Rojas-Andrade and Bahamondes, 2019). This was similar to findings reported by Reddy and co-authors (Reddy and Singh, 2015a, Reddy and Singh, 2017). The failure in adhering to essential components of the programme led to poor clinical

service outcomes as seen in the high levels of unmet treatment need of over 70% and the prevalence of severe dental lesions found in primary teeth (5.2%). Good programme adherence was largely aligned with the fissure sealants and brushing activities and that may have perhaps contributed to the comparatively low dental caries levels dmft 2.5 (SD:2.8) and DMFT 1.8 (SD:2.3), in comparison to what other studies are showing (Gargano et al., 2019, Peres et al., 2019).

Fidelity was assessed by examining the adherence components of content, coverage, frequency and duration. The adherence scores of each of the schools were calculated and a percentage of the score was used to express the level of fidelity, the overall score of fidelity was 39.6%. My study was clear in demonstrating that poor adherence to key components of the programme ultimately affected implementation fidelity and that to attain the ideal of zero levels of decay, an 80% level of fidelity is required.

Understanding key components of an intervention assists in accurately attributing programme outcomes to the level of fidelity (Carroll et al., 2007a). Had the key components of the programmes that included; community assessments at school selection, school and parental mobilization, screening of targeted classes, selection of activities based on assessment and screening findings, and quarterly review of activities been adhered to, the level of fidelity would have been enhanced (Carroll et al., 2007a, Rojas-Andrade and Bahamondes, 2019). Furthermore, awareness of fidelity components facilitates in determining necessary programme adaptations as was needed in the programmes I assessed (Driediger et al., 2018). A study conducted in Zambia assessing fidelity of malaria prevention programmes reported a fidelity score of 14.7%. Adherence of essential components that involved; active detection, patient follow up, diagnosis and treatment and dissemination of preventative measures was low and only 5 of the 34 participating community health workers had a good quality score (Chipukuma et al., 2020). Such a weak malaria control programme was shown to contribute to the threat of resurgent malaria in Zambia. Hence identifying essential programme components is useful in improving clinical outcomes and refining interventions (Harn et al., 2013).

The data from my study assisted in quantifying the effect of fidelity elements on outcomes and also provided the context in which the programme is being implemented. The results of the quantitative data predicted that with increased fidelity there was a reduction of decay. The

important elements of fidelity noted in my study were duration and the facilitation strategy, both of which were mostly lacking. These key elements are supported by findings from Ariga et al. (2014) who evaluated a school oral health programme in Kuwait. In my study, the implementing hygienists spent a maximum of four hours at a school and were not able to do multiple visits. Although many more schools were covered (109%), the quality of delivery was not adequate as there existed high levels of untreated decay among the learners. Such observations are supported by Kalafat et al. (2007) and Harn et al. (2013).

The facilitation strategy relating to obtaining additional dental assistance was also found to have been essential for enhancing implementation in a way that would improve the clinical service delivery, particularly given that the oral hygienists were expected to carry out moisture sensitive restorative work that required four handed dentistry (Nakre and Harikiran, 2013). Lay community support may have been an additional facilitation strategy for the co-ordination of the brushing programme by assisting with the large classes and easing the burden of the teachers as some studies have suggested (Breitenstein et al., 2010, Monse et al., 2013a). However there is not much evidence reported on the effects of such community involvement in strengthening school oral health programmes in developing countries, studies mostly explore the role of teachers and nurses (Thema and Singh, 2013b, Kolisa, 2016, Nyandindi et al., 1995, Mwangosi et al., 2001). Yet community health workers, who are lay health workers involved in primary health delivery and health promotion in South Africa, have been successfully incorporated into HIV prevention programmes and management of childhood illnesses (Schmitz et al., 2019). Hence, their potential use in supporting school oral health programmes should be considered.

8.5. The influence of moderators

Moderating factors were assessed by the way in which different potential moderators interacted with fidelity in influencing programme outcomes. The level of adherence and fidelity across my study was found to be moderated by the context, participant responsiveness and governance processes. The contextual barriers identified were linked to limited infrastructure, staff and financial resources, and this resulted in compromising the level of content that could be delivered and the number of visits and duration that could have been dedicated to the programme. This is not surprising given the conditions that the oral hygienists in Gauteng and KwaZulu Natal work under (Govender et al., 2013). Furthermore,

only half of the hygienists in my study were able to successfully offer a coordinated brushing programme because some schools did not have appropriate water and sanitation facilities. Reddy and Singh (2017) reported a similar phenomenon as they assessed the delivery of a tooth brushing programme in KwaZulu Natal. In addition, some schools had insufficient teachers and capacity to facilitate such an activity for large classes (Reddy and Singh, 2017). Such implementation barriers were identified by the proceedings of the WHO Global Conference on Health Promotion in Kenya as being common in low middle-income countries (Petersen and Kwan, 2010).

A systematic review assessing fidelity components which were essential in improving socio—emotional skills in school-based mental health programmes, identified participants' responsiveness of the school learners as one of the most frequently linked components to expected outcomes (Rojas-Andrade and Bahamondes, 2019). In my study participant responsiveness largely affected the adherence of the content that could be delivered. There was a lack of co-operation among other stakeholders that were key for the success of activities such as the brushing programme and healthy nutrition. The school and teachers did not show much support for the brushing programme as they were overwhelmed by their teaching priorities and large classes. In terms of healthy nutrition, the school snack vendors were not willing to sell healthy food items at school premises, as it was not financially viable for them. In turn parents were not co-operative concerning health and welfare matters affecting their children at the schools. These findings were similar to that of Reddy and co-authors when they assessed school health services in the KwaZulu Natal Province (Reddy and Singh, 2015a, Reddy and Singh, 2017).

The governance elements that were key in influencing fidelity and outcomes such as; strategic vison, participation and consensus, responsiveness to patient health needs and equity and inclusiveness were not well translated into practice. Hence there existed a lack of shared understanding of intended services and goals (Goldthorpe et al., 2018). School health programmes in South East Asia that have demonstrated success in their implementation include interventions such as ; group daily hand washing, group daily tooth-brushing with fluoride toothpaste and biannual deworming. All of the intervention activities resulted in favourable outcomes over three years (Duijster et al., 2017, Monse et al., 2013a). The authors attributed the enablers of success to factors such as; the availability of clear vision and values; supporting multilevel advocacy: formalized inter-sectoral collaboration and

contribution to the broad developmental agenda (Benzian et al., 2011a, Duijster et al., 2017). These attributes were missing in the programme I assessed.

8.6. Clinical Outcomes

The prevalence of dental caries in the permanent dentition was 25.9% and in the primary dentition, 30.2%. This is comparatively lower than the prevalence trends displayed from low-middle income countries (Bourgeois and Llodra, 2014, Kassebaum et al., 2017). This result may be attributed to levels of fluoride exposure and plaque control measures outside of the school environment that were not assessed in my study. However, of concern in the clinical outcomes is that the Unmet Treatment Need (UTN) for the permanent dentition (DMFT) was 55.5% and for the primary dentition (dmft) 89.6%. This implies that close to 90% of the children went untreated for dental disease, particularly the primary teeth. Similar findings across the country exist, which means that many children in South Africa bear the burden of untreated caries and suffer from discomfort that affects their nutrition, function and quality of life (Peres et al., 2019).

The SiC index was significantly higher ($p<0.001$) than the mean DMFT/dmft in both the primary (3.7) and secondary dentitions (2.7) indicating that the concentration of the disease was narrowly distributed among one third of the children in the population. This implies that a few of the children were carrying the burden of the disease, and my findings suggests that this could be among the 6-7 and 8-10 year olds as they had the highest dmft's [2.5 (2.8)]; [1.8 (2.3)] and pufa scores [0.2 (0.6)];[0.3(0.9)] respectively. A differentiated care approach needs to be carefully considered when selecting preventative strategies in order to provide appropriate care according to contextual needs (Grimsrud et al., 2017). Two common public health preventative strategies are described; these include the risk and population based approaches. The risk approach also referred to as the targeted approach, pays attention to a population subgroup identified to have been at risk. Its limitations are that it is palliative in nature but can be useful when there is uneven distribution of disease and resources are limited such as is the case in my study (Bourgeois and Llodra, 2014, Daly et al., 2013, Rose et al., 2008). The population approach on the other hand aims to reduce the level of risk for the whole population by paying attention to underlying determinants of disease. It is ideal in addressing long-term behavioural change however, it is costly and requires adequate

resources (Rose et al., 2008, Watt, 2005). These are the considerations local managers ought to be deliberating on when making priority decisions.

Caution needs to be taken when interpreting the clinical outcomes in my study as there were no baseline epidemiological data to compare changes in epidemiological trends and make an assessment on whether the outcomes were directly linked to the performance of the programme (Joubert et al., 2007). However what is important about the findings is that they provided information on the burden of disease and the needs of the children in the programme (Gargano et al., 2019). In addition, the data were used to make predictions on how the elements of fidelity can improve clinical outcomes for the benefits of appropriate decision making (Van den Branden et al., 2015, Weinstein et al., 2014).

8.7. Summary of discussion

The elements of my conceptual framework not only guided me in examining the questions relating to the scope, implementation and outcomes of the school programmes, but they also illuminated the gaps that needed to be addressed for improvement. Policy translation was shown to be poor as a result of a lack of training on policy content, poor stakeholder consultations and inadequate information and communication systems. The intervention was poorly coordinated and experienced resource constraints. Adherence to key planning components was lacking and compromised the fidelity of the programme and its ability to improve outcomes. The moderators that were found to hinder quality of delivery and desired outcomes included; context, participation responsiveness and governance. The clinical outcomes indicated that the high prevalence of untreated disease particularly in the primary dentition was unresolved and that improving fidelity is essential for improving clinical outcomes.

8.8. Study Limitations

There were no baseline data to compare the changes in the oral health status over years and to accurately assess the true effects of the oral health programme. In addition, as this was an observational study and not controlled, confounding factors of home oral health behaviours such as tooth brushing and diet could not be controlled. Hence the use of regression analysis that used explanatory variables to predict the outcome variables of interest. This guided in making inferences on how fidelity and its moderators influenced outcomes.

As the oral hygienists mostly offered a single dose of services in a year, the schools were only observed once and could not be observed multiple times to track trend changes in the school programme. In addition, individuals being observed possibly experienced the Hawthorne effect by altering their behaviour during the process of being observed (Breitenstein et al., 2010). Hence, data were collected from multiple sources including; observations, policy reviews, interviews and the fidelity checklist to triangulate and confirm my findings.

8.9. Recommendations

The highest risk period for caries development in the permanent teeth occurs in the first few years after tooth eruption (Mejàre et al., 2014, Carvalho, 2014). Hence, most efforts to prevent dental caries are aimed at children and adolescents. This therefore makes school oral health services an essential platform for the treatment of present caries and prevention of and future occurrence of caries (Mejàre et al., 2014). School oral health interventions are therefore necessary as they potentially influence oral health in both the school environment and wider community as well as integrate the management of childhood illness in one setting (Langford et al., 2015b). Careful planning and co-ordination therefore needs to be invested into the policy development, translation and implementation of these interventions in order to obtain cost efficient and effective outcomes (Mason et al., 2019). Thus, my study was able to illuminate implementation gaps that emanated from the aspects of policy, intervention delivery, fidelity, moderators and clinical outcomes. In addition I was able to provide evidence based recommendations to address the above mentioned gaps, as pointed out below.

Policy

As the policy gaps identified in my study included aspects on rule of law, transparency, intelligence and information; and ethics as according to the framework by Siddiqi et al (2009). I recommend the following;

- that the policy needs have mechanisms in place to regulate the provision of services by frontline officials in order to address the aspect on the rule of law.
- that there needs to be transparent information on how school oral health services are financed and how to access required resources.

- that oral health surveillance and programme output information at schools need to be collected regularly in order to ensure that there is relevant intelligence and information available for making appropriate decisions.
- that information concerning ethical considerations of school oral health programmes needs to be integrated into the policy.

Intervention Delivery

- Oral health practitioners should be supported to undertake community and resource assessments at the start of undertaking school oral health services in order to improve their planning and co-ordination (Durlak and DuPre, 2008b).
- In settings where there is poor infrastructure or inadequate water supply, it is suggested that the practitioners offer bi-annual fluoride varnishes instead of fissure sealants as they require less manpower and use of water, furthermore their preventative effectiveness has been shown to be similar to that of fissure sealants (Humphreys et al., 2017).
- Increased time needs to be invested in teacher training and support their ability to effectively drive the oral health education at schools (Mwangosi et al., 2001, Orem et al., 2012).

Fidelity

- In order to ensure a clear understanding of essential programme components that need to be adhered to, process mapping tools or checklists could be used by the oral hygienists in planning their work systematically and monitoring themselves for improvement (Harn et al., 2013, Weiss et al., 2016).
- Community health workers need to be trained in oral health in order to support the teachers by assisting in oral health education and coordinated tooth brushing activities for large numbers of children. This would allow the oral hygienists to spend concentrated time on fissure sealants, curative care and program re-enforcements. The increased time duration is predicted to improve fidelity and hence quality (Van den Branden et al., 2015).

Moderators

- As the moderators of context, participant responsiveness and governance were lacking in strengthening fidelity, it can be suggested that the starting point of addressing these factors is by re-organizing the programme through planning, training of educators and garnering support from key stakeholders.
- Community health workers have been shown to be effective in engaging closely with communities, linking communities to healthcare services and providing health education and promotional activities (Horwood et al., 2017). Their involvement could potentially contribute to community engagement and mobilization of oral health activities, oral health awareness and linking the school and parent community to local oral health services.

Clinical Outcomes

- Considering the high levels of unmet treatment needs amidst limited human resource constraints, a differentiated care approach would need to be considered where services are adapted to specific client populations and context (Grimsrud et al., 2017). For instance in large schools a targeted approach could be used where primary school children are prioritized over secondary school children for fissure sealants and curative care (Bourgeois and Llodra, 2014, Daly et al., 2013).
- The secondary school children could receive oral health screening and referrals to local dental facilities.

In summary, in order to improve the scope, implementation and outcomes of school oral health in Tshwane, the following actions need to be considered; there needs to be regular training and supportive supervision of provincial and district oral hygienists on the key aspects of policy implementation. This would improve the scope of services and implementation approaches. In addition, there is a greater need for integration across existing structures such as school governing bodies and community health forums, throughout the policy development and implementation stages for shared agreement and understanding across all levels. This would improve policy adherence, programme fidelity and outcomes.

8.10. Recommendations for future research

- To undertake an updated National Oral Health epidemiological survey assessing the oral health status and needs of the child and adult populations in South Africa.
- To explore the barriers and facilitators that the oral health sector may experience in establishing and sustaining multi-sectoral relationships.
- To explore the role of community health workers and their potential participation in strengthening school oral health programmes.
- To determine the economic costs of school oral health programmes and how they could be effectively scaled up.
- To assess the effectiveness of participatory simulation modelling techniques among provincial and district officials in policy decision making at a local level.
- To conduct a longitudinal study for assessing epidemiological changes and trends that are shaped by school oral health services over time.

9. CHAPTER NINE - CONCLUSION

My study provided an in depth description of school oral health programmes located within the district of Tshwane in Gauteng Province, South Africa. It highlighted the gaps that caused the disconnection between the stages of policy translation and implementation. In addition, it provided information on how the quality of the programme could be improved to achieve the desired outcomes.

Objective 1 and 2 results shown in Chapters 4 and 5 revealed that there was inconsistent translation of the school health policy on the part of the managers and implementing oral hygienists. The inconsistencies were largely as a result of poor communication and interpretation of policy. These shortcomings resulted in fragmentation where implementing hygienists used their discretion in response to contextual challenges.

Objective 3 results in chapter 6 found that although the prevalence of dental caries was relatively low in comparison to that of children in similar socio economic settings, the outcomes of unmet treatment needs was high and service delivery were poor.

Objective 4 results in chapter 7 provided information on how elements of school oral health programmes contributed to influence dental outcomes. There was a 39.6% level of fidelity achieved and direct and indirect elements that affected the overall outcomes and programme included duration, facilitation strategy and participant responsiveness. In KwaZulu Natal, a substantial amount of work on school oral health has been documented, and the results of the assessments made in the province, are similar to my results in terms of the challenges and barriers linked to ineffective implementation. This implies that much attention still needs to be given to school oral health services in South Africa to improve child oral health and address oral health inequities.

The information that was derived from my study is valuable for use by the public oral health sector in reviewing school oral health strategies. The epidemiological data that were obtained provide current information on the burden of disease and needs of the children in Tshwane. The data can be further used as a baseline for further monitoring of the programme in the district or making comparisons across other districts for planning purposes. The process

mapping tool compiled can be used as an instrument for supportive supervision in facilitating the planning and target setting among provincial and district managers. In addition the tool can be used for reaching agreement on essential programme elements through a consultative process in order to ensure fidelity. The evidence based recommendations that were informed by the findings may also contribute to the ongoing integrated school health services and primary health care reforms in the country.

Looking at the gaps that have emerged from the findings, it appears that what was commonly missing was multi-sectoral collaboration. Considering that a major component of policy implementation is about governing actors and organizations working together towards attaining policy objectives, broad coalitions have a key role to play in implementing such multifaceted interventions as oral health on its own cannot overcome the challenges of social determinants of health. The processes of governance therefore need to be strengthened across all key stakeholders throughout processes of planning and implementation. There are existing community health workers who play a significant role in primary health care reforms in South Africa by linking communities to health services and promoting health. Hence, consideration needs to be given to building on their role into supporting school oral health programmes.

The findings of my study were clear in demonstrating that for improving the scope, implementation approaches and outcomes of school oral health, there is a need for greater collaboration between role players in planning and putting measures in place to harness available human and material resources.

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11. APPENDIX A

Process mapping template

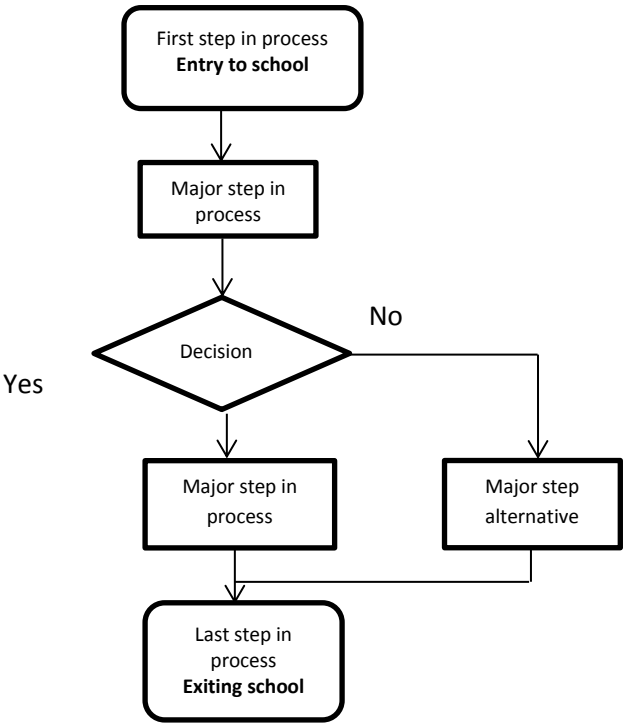
Name of School: Date:

Locality:

1. Role?
2. Describe to me the processes involved in coordinating the school oral health programme activities using the template below.
3. How long do you conduct your activities for?
4. How many children do you reach out to?
5. How often do you come to the school?
6. When you are completed with your activities who do you hand over to and what processes are involved?

Modified Process Mapping template (*Biggs & Lawrence, 2014)*

To be completed by participants:



12. APPENDIX B

Appendix C – Implementation Fidelity Checklist

Name of school: District:

Location: Number of learners participating:

Teacher/learner ratio: Oral Hygiene/learner ratio:

Program Components	Special features	Adherence	Exposure	Quality	Participants responsiveness
		1= Low 2=Moderate 3=High	Number Frequency Duration	1=poor quality 2=moderate quality 3=high quality	1=poor engagement 2=moderate engagement 3=high engagement
School health services	• Oral health screening • Diagnosis • Clinical preventative care • Treatment of oral diseases • Referral				
School health education	• Provision of specific oral health subject. • Oral health integrated into other subjects. • Oral health included as extra-curricular. • Oral health education given from primary to secondary school.				
Healthy school environment	• Safe water and sanitation • Healthy dietary practices • Support on health promotion behaviors • Smoke free zone • Teachers acting as role models				

13. APPENDIX C

ORAL HEALTH SURVEY FORM

Modified Oral Health Assessment Form for Children (WHO, 2013)

Name of School: **Class grade:**

District:

Date:

Code no .

General Information

Date of birth

Gender

M	F

Dental Status

18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28

48	47	46	45	44	43	42	41	31	32	33	34	35	36	37	38

Permanent teeth

0 = sound
1 = decayed
2 = filled & decayed
3 = filled, no decay
4 = missing due to caries
5 = missing for any other reasons
6 = sealant, varnish
7 = bridge abutment/ special crown
8 = unerupted tooth
9 = excluded tooth

DMFT

DMFT component	**Number of Teeth**
D	
M	
F	
Total DMFT	

Treatment Need of Individual Teeth:

O-None
P- Preventive, caries arresting care.
F- Fissure Sealant
1-One surface filling
2-Two or more surface fillings
3- Crown for any reason.
4- Veneer or laminate.

14. APPENDIX D

Appendix A

Interview guide for study: **School-based oral health programmes in the Gauteng Province: Scope, Implementation and Outcomes.**

The guide is informed by : WHO Information Series on School Health (2003)

1. Demographic information

- Location
- Position

2. School health service

- What are the types and extent of oral health services provided?
- Are the school and students satisfied with the services provided?
- How well and to what extent do the school dental services work with their collaborators?

3. School health education

- How well is oral health integrated into the school curriculum?
- Are all learning activities implemented as planned?
- Are these activities effective in promoting oral health and healthy behaviours and, if so, to what extent?
- Is training provided to staff as planned?
- What do teachers and others think of the curriculum?
- Do they feel comfortable and competent implementing the curriculum?

4. Policy

- Does the school have a comprehensive oral health policy or, if not, policies that relate to oral health?
- Is/are the policy or policies implemented and enforced as written?
- Are resources and responsible people designated to support oral health promotion inventions? What do the students, teachers and parents think of the policy or policies?
- Are students, parents, school staff and members of the community involved in the planning, development and implementation of policies?

5. Goals and objectives

- Are goals and objectives well-defined and do they establish the criteria against which to assess interventions and outcomes?
- Are the objectives specific, measurable and realistic?
- Do they cover all important areas?

6. Health promotion for school staff

- Are there any tailor-made oral health promotion programmes for staff?
- If yes, what do the staff members think of them?
- Have they been effective?

7. School and community relationships and collaboration

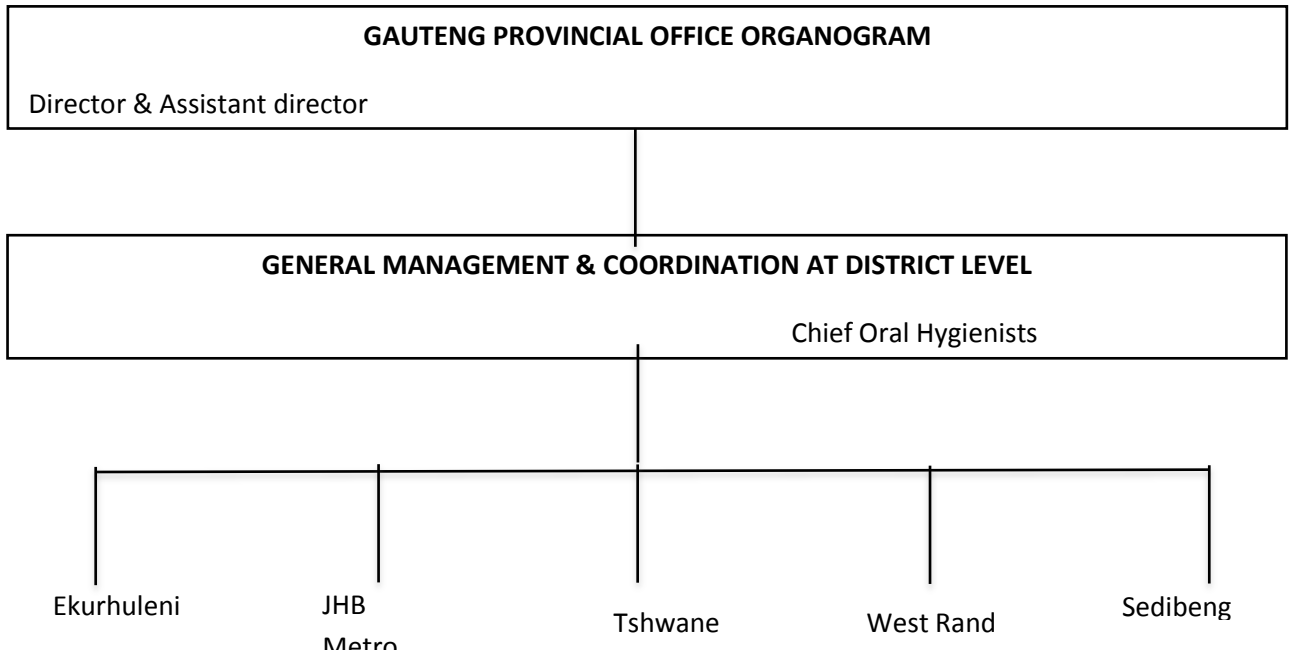
- To what extent is the community involved in interventions for the promotion of oral health?
- Does the school provide any oral health training courses for parents and members of the community?
- If so, have they been effective in promoting oral health at home?
- What do parents and the community think of the oral health promotion efforts?

8. Nutrition and food services

- How well is oral health integrated into the healthy nutrition interventions in school and the community?
- Are the food service providers aware of their role in promoting oral health?

15. APPENDIX E

Staff coordinating school oral health programmes in Gauteng



16. APPENDIX F

R14/49 Dr Mpho Molete

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)

CLEARANCE CERTIFICATE NO. M170115

NAME: (Principal Investigator)	Dr Mpho Molete
DEPARTMENT:	School of Public Health Gauteng Oral Health Directorate, Johannesburg 14 Quintile Schools, Tshwane District
PROJECT TITLE:	School-Based Oral Health Programmes in the Tshwane District of Gauteng: Scope, Implemetation and Outcomes
DATE CONSIDERED:	27/01/2017
DECISION:	Approved unconditionally
CONDITIONS:	
SUPERVISOR:	Prof Aimee Stewart and Dr Jude Igumbor
APPROVED BY:	Professor P. Cleaton-Jones,Chairperson, HREC (Medical)
DATE OF APPROVAL:	10/03/2017

This clearance certificate is valid for 5 years from date of approval. Extension may be applied for.

DECLARATION OF INVESTIGATORS

To be completed in duplicate and **ONE COPY** returned to the Research Office Secretary in Room 10004,10th floor, Senate House/2nd floor, Phillip Tobias Building, Parktown, University of the Witwatersrand. I/We fully understand the the conditions under which I am/we are authorised to carry out the above-mentioned research and I/we undertake to ensure compliance with these conditions. Should any departure be contemplated, from the research protocol as approved, I/we undertake to resubmit to the Committee. **I agree to submit a yearly progress report.** The date for annual re-certification will be one year after the date of convened meeting where the study was initially reviewed. In this case, the study was initially review in January and will therefore be due in the month of January each year. Unreported changes to the application may invalidate the clearance given by the HREC (Medical).

Principal Investigator Signature Date

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES

17. APPENDIX G

GAUTENG PROVINCE
Department: Education
REPUBLIC OF SOUTH AFRICA

8/4/4/1/2

GDE RESEARCH APPROVAL LETTER

Date:	11 April 2017
Validity of Research Approval:	06 February 2017 – 29 September 2017 2017/69
Name of Researcher:	Moleta M.P
Address of Researcher:	148 Gertrude Street
	Randparkridge
	Randburg, 2160
Telephone Number:	064 752 3890
Email address:	Mpho.Molete@wits.ac.za
Research Topic:	School-based oral health programmes in Tshwane District of Gauteng: Scope, Implementation and Outcomes
Number and type of schools:	Seven Primary Schools and Seven Secondary Schools
District/s/HO	Tshwane North, Tshwane South and Tshwane West

Re: Approval in Respect of Request to Conduct Research

This letter serves to indicate that approval is hereby granted to the above-mentioned researcher to proceed with research in respect of the study indicated above. The onus rests with the researcher to negotiate appropriate and relevant time schedules with the school/s and/or offices involved to conduct the research. A separate copy of this letter must be presented to both the School (both Principal and SGB) and the District/Head Office Senior Manager confirming that permission has been granted for the research to be conducted.

11/04/2017

Making education a societal priority

Office of the Director: Education Research and Knowledge Management
7th Floor, 17 Simmonds Street, Johannesburg, 2001
Tel: (011) 355 0488
Email: Faith.Tshabalala@gauteng.gov.za
Website: www.education.gpg.gov.za

18. APPENDIX H

PARTICIPANT INFORMATION DOCUMENT .I (Managers)

Study title: School-based oral health programmes in the Gauteng Province: Scope, Implementation and Outcomes

Greeting: Good day

My name is Mpho Molete and I am inviting you to take part in this study. I am conducting research on School oral health programmes in Gauteng. In this study we want to learn how school oral health programmes operate and how we can find ways of improving them.

Invitation to participate: We would like to invite you to take part in the research study.

What is involved in the study? In this study we would like to understand the thinking behind your strategic vision on the planning of school-based programmes in Gauteng. We will therefore request an appointment to come to your offices in order to conduct an in depth interview. The interview will take about an hour and there will be no risks involved with the study.

Benefits: The results of the research findings may provide us with information that might enable you to strengthen your school oral health programmes in the Province.

Voluntary participation: Should you choose to participate in the study, you will not be penalized. Or should you wish to discontinue participation in the study at any time, there will be no penalty.

Confidentiality: Efforts will be made to keep your personal information confidential and anonymous, your name will not be used in any way and your documents will be kept safe in a locked folder. Organizations that may inspect your research records for quality assurance and data analysis include the research supervision team and the research ethics committee.

Contact details of researcher/s: Should you have further questions regarding the research, do not hesitate to contact: Dr Mpho Molete; Department of Community Dentistry (Wits); contact no: 011 717-2241; mpho.molete@wits.ac.za.

Contact details of REC administrator and chair – For reporting any complaints or problems, contact the Wits Human Research Ethics Committee: Prof P Cleaton Jones, Tel: 011 717-2301; email: peter.cleaton-jones1@wits.ac.za.

19. APPENDIX I

PARTICIPANT INFORMATION DOCUMENT.II (Oral Hygienists/teachers)

Study title: School-based oral health programmes in the Gauteng Province: Scope, Implementation and Outcomes

Greeting: Good day

My name is Mpho Molete and I am inviting you to take part in this study. I am conducting research on School oral health programmes in Gauteng. In this study we want to learn how school oral health programmes operate and how we can find ways of improving them.

Invitation to participate: We would like you to take part in the research study

What is involved in the study? We will be coming to your school in order to observe how you carry out the oral health programme among your learners. As we observe, a few questions about the programme will be asked from you. The interview will take about 30 minutes and there will be no risks involved with the study. Permission for the interviews has been granted by the GDoH Service Manager of the Oral Health Directorate.

Benefits: The results of the research finding may provide us with information that would potentially enable you to improve your school oral health programmes.

Voluntary participation: Should you chose to participate in the study, you will not be penalized. Or should you wish to discontinue participation in the study at any time, there will be no penalty.

Confidentiality: Efforts will be made to keep your personal information confidential, your name will not be used in any way and your documents will be kept safe in a locked folder. Organizations that may inspect your research records for quality assurance and data analysis include the research supervision team and the research ethics committee.

Contact details of researcher/s: Should you have further questions regarding the research, do not hesitate to contact: Dr Mpho Molete; Department of Community Dentistry (Wits); contact no: 011 717-2241; mpho.molete@wits.ac.za.

Contact details of REC administrator and chair – For reporting any complaints or problems, contact the Wits Human Research Ethics Committee: Prof P Cleaton Jones, Tel: 011 717-2301; email: peter.cleaton-jones1@wits.ac.za.

20. APPENDIX J

PARTICIPANT INFORMATION DOCUMENT .III (Parents)

Study title: School-based oral health programmes in the Gauteng Province: Scope, Implementation and Outcomes

Greeting: Good day

My name is Mpho Molete and I am inviting your child to take part in this study. I am conducting research on School oral health programmes in Gauteng. In this study we want to learn how school oral health programmes operate and how we can find ways of improving them.

Invitation to participate: We would like you to give us permission to include your child in the research study.

What is involved in the study? We will be coming to observe how the teachers and oral hygienists carry out the oral health programme at your child's school. We will then look at your child's teeth for about 15 minutes. The child will be sitting on a chair and a mirror and source of good light will be used to look into their mouth. The procedure will be painless and there will be no risks involved with the study.

Benefits: The results of the research finding may help us in providing solutions to improve the school oral health programme and your child's oral health.

Voluntary participation: Should you choose for your child to participate in the study, you will not be penalized. Or should you wish to withdraw him or her from participation in the study at any time, there will be no penalty.

Confidentiality: Efforts will be made to keep your child's personal information confidential, your name will not be used in any way and your documents will be kept safe in a locked folder. Organizations that may inspect your research records for quality assurance and data analysis include the research supervision team and the research ethics committee.

Contact details of researcher/s: Should you have further questions regarding the research, do not hesitate to contact: Dr Mpho Molete; Department of Community Dentistry (Wits); contact no: 011 717-2241; mpho.molete@wits.ac.za.

Contact details of REC administrator and chair – For reporting any complaints or problems, contact the Wits Human Research Ethics Committee: Prof P Cleaton Jones, Tel: 011 717-2301; email: peter.cleaton-jones1@wits.ac.za.

21. APPENDIX K:

Consent Form for parents

Please complete this form after you have read the Information Sheet and/or listened to an explanation about the research.
Title of Study: **School-based oral health programmes in the Gauteng Province: Scope, Implementation and Outcomes**

- If you have any questions arising from the Information Sheet or explanation already given to you, please ask the researcher before you decide whether your child can participate or not. You will be given a copy of this Consent Form to keep and refer to at any time.

- ***Please note that your child has a choice on whether to participate or not. Furthermore should you or the child decide at any other time during the research that you no longer wish to participate in this project, you can notify the researchers involved and be withdrawn from it immediately.***

- ***I consent to the participation of my child for the purposes explained to me.***

Participant's Statement:

I _____

Agree that the research project named above has been explained to me to my satisfaction and I agree to take part in the study. I have read both the notes written above and the Information Sheet about the project, and understand what the research study involves.

Signed **Date**

Investigator's Statement:

I _____

Confirm that I have carefully explained the nature, demands and any foreseeable risks (where applicable) of the proposed research to the volunteer.

Signed **Date**

22. APPENDIX L

Consent Form for participants

Please complete this form after you have read the Information Sheet and/or listened to an explanation about the research.
Title of Study: **School-based oral health programmes in the Gauteng Province: Scope, Implementation and Outcomes**

- Thank you for considering taking part in this research. The person organizing the research must explain the project to you before you agree to take part.

- If you have any questions arising from the Information Sheet or explanation already given to you, please ask the researcher before you decide whether to join in. You will be given a copy of this Consent Form to keep and refer to at any time.

- ***I understand that if I decide at any other time during the research that I no longer wish to participate in this project, I can notify the researchers involved and be withdrawn from it immediately.***

- ***I consent to the processing of my personal information for the purposes explained to me.***

Participant's Statement:

I _____

Agree that the research project named above has been explained to me to my satisfaction and I agree to take part in the study. I have read both the notes written above and the Information Sheet about the project, and understand what the research study involves.

Signed **Date**

Investigator's Statement:

I _____

Confirm that I have carefully explained the nature, demands and any foreseeable risks (where applicable) of the proposed research to the volunteer.

Signed **Date**

23. APPENDIX M

Consent Form

CONSENT FORM FOR RECORDING THE INTERVIEW

Title of Study: **School-based oral health programmes in the Gauteng Province: Scope, Implementation and Outcomes.**

- **I am aware that the interview process will be audio recorded, however I have the choice to consent or not to consent for my interview to be audio recorded.**

Kindly provide your signature alongside your choice:

- ***I consent to be audio recorded during the interview process…….***
- ***I do not consent to be audio recorded during the interview process……..***

Participant's Statement:

I _____

agree that the research project named above has been explained to me to my satisfaction and I agree to take part in the study. I have read both the notes written above and the Information Sheet about the project, and understand what the research study involves.

Signed **Date**

Investigator's Statement:

I _____

confirm that I have carefully explained the nature, demands and any foreseeable risks (where applicable) of the proposed research to the volunteer.

Signed **Date**

24. APPENDIX N

Participant Information sheet for children

Title of Study: School-based oral health programmes in the Gauteng Province: Scope, Implementation and Outcomes.

Good day, my name is Mpho Molete, a PhD student conducting research on School oral health programmes in Gauteng. In this study i want to learn how school oral health programmes operate and how i can help in finding ways of improving them.

- Your parents have given us permission to have a look into your mouth today with a mirror but you have a choice on whether you would like to participate or not. I want to let you know that it does not hurt. I need you to sit on a chair and open your mouth so that I can look at your gums and teeth.

- A mouth mirror as shown on the picture below will be used and I will only take 10 minutes. Should you feel any discomfort or would like me to stop what I am doing; you are welcome to let me know.





- Thank you for your time and co-operation.



25. APPENDIX O

Assent form for children 8 years and older

Please complete this form after you have read the Information Sheet and/or listened to an explanation about the research.

Title of Study: School-based oral health programmes in the Gauteng Province: Scope, Implementation and Outcomes.

- ***I understand that if I decide at any other time during the examination that I no longer wish to participate in this project, I am allowed to withdraw from the process immediately.***

- ***I assent to the examination of my mouth.***

Participant's Statement:

I _____

Agree that the research project named above has been explained to me to my satisfaction and I agree to take part in the study.

Signed **Date**

26. APPENDIX P

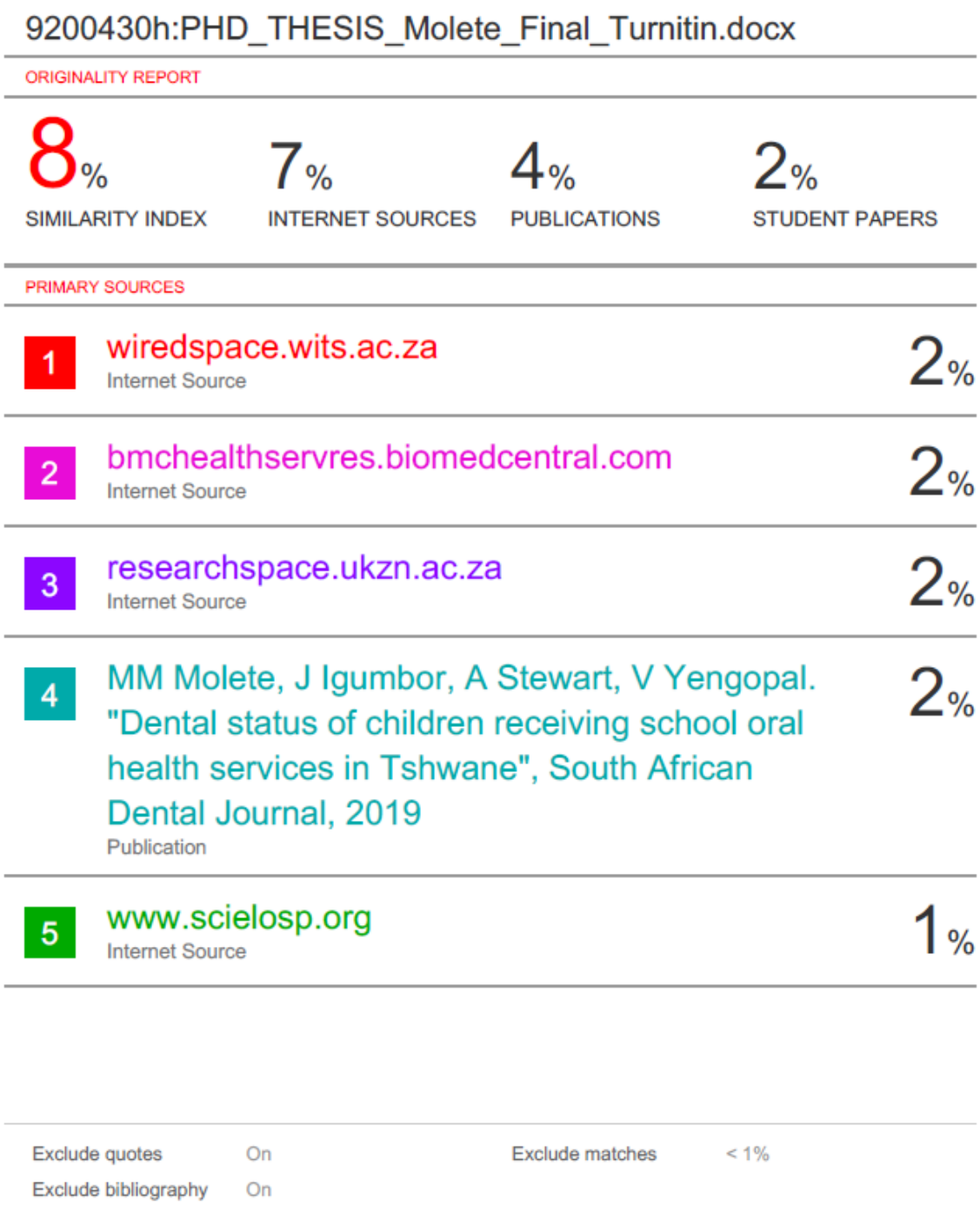
Presentation of fidelity elements and how they were measured

Appendix P

Fidelity Elements	No schools adhering	Definition	Measurement Classification
Content Community Assessment Resource Assessment Screening Brushing program F/S children 7/8 yrs F/S children 12/13 yrs ART Dietary Health Practice Oral Health training for staff Collective implementation	 0 0 2 5 6 7 2 2 3 1	Key activities of the program. Schools scoring 5 ≤ on content =1Adherence Schools scoring < 5 on content =0 Adherence	**ADHERENCE**
Coverage	7	Number of pupils reached / Total number of children in grades 1 & 7 per school. (More than 50% school coverage = 1; less =0)	
Duration	8	Number of hours spent at a school per day. (Minimum 4 hours = 1; less =0)	
Frequency	5	Number of times a school was revisited in a year. (Minimum 2/year = 1; less =0)	

Quality		Quality of delivery	**POTENTIAL MODERATORS**
Preparedness	7	(Yes = 1; No= 0)	
Interaction with teams	8		
Communication	7		
Facilitation Strategy		Facilitation strategies	
School staff support	8	(Yes =1; No = 0)	
Dental assistance availability	0		
Functioning equipment	3		
Availability of water	8		
Participant responsiveness		Participant responsiveness	
Stakeholder engagement	5	(Yes = 1; No = 0)	
Stakeholder satisfaction	3		
Perception of relevance	9		
Parental participation	4		

27. APPENDIX Q : TURNITIN REPORT



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