Implementation of School-based Oral Health Activities in Special Schools in the Kingdom of Saudi Arabia

Ashwag Saleh Al-Otaibi

School of Clinical Dentistry

A thesis submitted to the University of Sheffield in partial fulfilment of the requirements for the degree of Doctor of Philosophy

Supervised by

Zoe Marshman and Fiona Gilchrist

April 2024

Declaration of Authorship

I, Ashwag Saleh Alotaibi, declare that this thesis, titled "Implementation of School-based Oral Health Activities in Special Schools in the Kingdom of Saudi Arabia" is my work, and I confirm that all the work presented in this document is original and created by me unless otherwise stated. This work has not been submitted elsewhere for any degree or qualification. Furthermore, I affirm that I have read and understood the copyright associated with this work, as specified by the University of Sheffield Guidelines, and that I am fully aware of my rights and responsibilities as the author.

Name: Ashwag Saleh Alotaibi

Registration number: 190188078

PhD Dental Public Health

School of Clinical Dentistry

University of Sheffield, Sheffield, United Kingdom

Date: 16-04-2024

Abstract

Background: Oral diseases are prominent among socially marginalised populations, including children with disabilities. Such children often experience high levels of oral diseases and unmet dental needs and are at a greater risk of poorer oral health. The WHO recognises schools as a key platform for promoting oral health. Understanding the barriers and facilitators for school-based oral health activities (OHAs) is crucial for their successful implementation, however, no existing studies have explored the implementation of OHAs in the Kingdom of Saudi Arabia (KSA) special schools. This research aims to fill this gap by exploring the current provision of OHAs in the KSA's special schools and identifying the barriers and facilitators to their implementation using the Consolidated Framework for Implementation Research (CFIR).

Methods: Two studies were conducted to address the research aims.

Study One: To map the literature on OHAs in special schools, identify research gaps, and provide guidance for Study Two, a scoping review employing the Levac et al. (2010) framework was performed. This review outlined the OHAs used, examined their outcomes, and identified the factors affecting their application. Eleven studies were included in the review. The results indicate that very few studies have examined school-based OHAs for children with disabilities, and that school-based OHAs help to improve oral hygiene and oral health-related knowledge in the short term. It highlights a lack of understanding of the contextual factors impacting OHAs in special schools.

Study Two: Qualitative semi-structured interviews with a sample of staff and children's parents/carers at the KSA's special schools were conducted (n=30). Subsequently, framework analysis was conducted using the CFIR to analyse the facilitators and barriers to school-based

OHAs at these schools. Although some oral health education (OHE) activities were implemented, adequate planning, adaptation to children's needs, evaluation, and reinforcement were lacking. Furthermore, staff members in the KSA special schools need to improve their knowledge, attitudes, and self-efficacy towards OHAs. As an inner setting, the KSA special schools experience barriers to implementing OHAs, including low relative priority, inadequate financial and human resources, and lack of tailored educational resources and toolkits. Moreover, the lack of external policies and incentives could hinder the implementation. Accordingly, this study recommends key concepts underpinning an oral health promotion (OHP) implementation toolkit.

Conclusion: Research examining the implementation of OHAs in special schools is lacking. Overall, research indicates that providing school-based OHAs benefits children with disabilities, with a short-term positive impact on children's oral hygiene level and oral health-related knowledge and behaviours. It also suggests involving parents and teachers in the activities and follow-up for longer periods. Furthermore, it reveals that, although OHE had been implemented in some of the KSA special schools, none of the activities fulfilled the definition of OHP. This study has found that several factors hinder the implementation of OHAs, including poor adaptability, lack of financial and human resources, and poor stakeholder engagement. Moreover, a need to develop an OHP implementation toolkit to guide the implementation of OHAs in the KSA special schools has been highlighted. Based on the identified barriers, research recommends four concepts to underpin the toolkit development: embracing OHP principles, developing adaptable oral health resources, using a collaborative approach and evaluation. These findings can significantly impact the work of

researchers, policymakers, educators, and healthcare professionals aiming to promote oral health in the KSA's special schools.

Acknowledgements

I would like to express my sincere gratitude to the following individuals, without whom this thesis would not have been possible.

- Professor Zoe Marshman and Dr. Fiona Gilchrist: Your guidance, expertise, and unwavering support throughout this research journey have been invaluable. Your insights and feedback have shaped the direction of my work. Thank you for sharing your expertise and contributing to the depth of this study.

- King Saud University and the Saudi Cultural Bureau in London: I am deeply grateful for the financial support which enabled me to conduct this research and dedicate myself to academic pursuits.

- The University of Sheffield: For providing access to resources, facilities, and a conducive academic environment.

- My dear family and friends: Your unwavering encouragement, patience, and understanding have not only sustained me during challenging times but also propelled me towards my achievements. Each of you has played a unique role in my journey.

Presentations and publications

Poster presentations

- Promotion of oral health in the Kingdom of Saudi Arabia's special schools- Poster presentation at British Society of Paediatric Dentistry Annual Conference, Newcastle, September 2023.

Abstracts

- Promotion of oral health in the Kingdom of Saudi Arabia's special schools - Conference abstract published at International Journal of Paediatric Dentistry.

Table of Contents

Chapter 1. Introduction and study context 17

1.1 Introduction 17

1.2 Study context and background 22

1.2.1 Overview of the concept of the child 22

1.2.2 Overview of the concept of disability in children 26

1.2.3 Overview of the Kingdom of Saudi Arabia 41

1.2.4 Summary 51

Chapter 2. Literature review 52

2.1 Definition of health 52

2.1.1 Social determinants of health 54

2.2 Oral health 60

2.2.1 Definitions of oral health 60

2.2.2 Social determinants of oral health 62

2.2.3 Burden of oral diseases 63

2.2.4 Oral health status among children in the Kingdom of Saudi Arabia 67

2.2.5 Oral health status of children with disabilities 71

2.3 Health promotion in the context of public health 82

2.3.1 Public health 82

2.3.2 Health education 84

2.3.3 Health promotion 85

2.4 Summary of the literature 126

2.4.1 Aim and objectives 127

Chapter 3. Study one: school-based oral health activities in special schools – A scoping review 128

3.1 Background 128

3.1.1 Aims and objectives 129

3.2 Methodology and methods 130

3.2.1 Concept of scoping review 130

3.2.2 Scoping review frameworks 133

3.3 Results 139

3.3.1 Descriptive numerical results 144

3.3.2 Thematic analysis 147

3.4 Discussion 158

3.4.1 Strengths and limitations 160

3.5 Conclusion 161

Chapter 4. Methodology and methods – The implementation of school-based oral health activities in special schools in the KSA- A qualitative study 165

4.1 Background 165

4.1.1 Aim and objectives 166

4.2 Implementation science and the consolidated framework for implementation research (CFIR) ..... **Error! Bookmark not defined.**

4.2.1 Implementation science ..... **Error! Bookmark not defined.**

4.3 Research design 167

4.3.1 Research paradigms 168

4.3.2 Research methods 171

4.3.3 Data collection methods and procedures 185

4.3.4 Data analysis methods and procedures 190

4.3.5 Quality assurance 203

4.4 Summary 207

Chapter 5. Findings of the implementation of school-based oral health activities in special schools in the KSA- A qualitative Study 209

5.1 Introduction 209

5.2 Perspectives of school staff members towards school-based oral health activities 210

5.2.1 Identified themes 211

5.2.2 Factors influencing the implementation of oral health activities in KSA special schools, according to school staff 212

5.3 Perspectives of parents and carers towards school-based oral health activities 276

5.3.1 Identified themes 277

5.3.2 Factors influencing the implementation of oral health activities in KSA special schools, according to parents/carers 278

5.4 Summary of the findings of the qualitative study 313

5.4.1 Key concepts to underpin an oral health promotion implementation toolkit for KSA special schools..... 315

Chapter 6. Discussion.....323

6.1 Introduction 323

6.1.1 Research objectives.....324

6.1.2 Research questions.....324

6.2 Scoping review of oral health activities at special schools.....325

6.2.1 Strengths and limitations.....328

6.3 Implementation of school-based oral health activities in special schools in the KSA- a qualitative Study.....330

6.3.1 Key findings of implementation of school-based oral health activities in special schools in the KSA- a qualitative Study..... 331

6.3.2 Methodological considerations 357

6.3.3 Strengths and limitations 365

6.3.4 Research contribution and implications 370

Chapter 7. Conclusions and Recommendations 376

7.1 Background 376

7.2 Summary of the findings 378

7.3 Conclusion 380

Chapter 8. List of references 382

Chapter 9. Appendices 398

List of Figures

Figure 1-1 International Classification of Functioning, Disability and Health (ICF), (World Health Organization, 2001). 32
Figure 2-1 Dahlgren and Whitehead rainbow model 1991 (above) and 2007 (down) versions. 55
Figure 2-2 Conceptual model for oral health inequalities (Watt and Sheiham, 2012) 63
Figure 2-3 Components of Childsmile Oral Health Promotion Initiative, Scotland (Childsmile, 2016). 96
Figure 3-1 Study selection flow chart diagram 140
Figure 3-3 Country of origin of the reviewed articles (n=11). 144
Figure 3-4 The target population in the reviewed articles (n=11). 145
Figure 4-1 The adopted research paradigm, methodology, and methods to explore the school-based oral health activities implementation in KSA special schools. 167
Figure 4-2 The procedure for recruiting participants 178
Figure 4-3. Five stages of framework analysis (Ritchie et al., 1994, Ritchie and Spencer, 2002, Ritchie et al., 2003). 194
Figure 4-4 illustrates the loop of the data collection and analysis phases. 197
Figure 4-5. Quirkos interface displaying coded data(Ritchie et al., 1994). 201
Figure 5-1 Themes identified from KSA special school staff interviews according to the Consolidated Framework for Implementation Research domains. 211
Figure 5-2 The Consolidated Framework for Implementation Research domains: intervention characteristics, individual characteristics, inner setting, outer setting, and implementation process and their underlying constructs. 212
Figure 5-3 Themes of The Consolidated Framework for Implementation Science – Intervention Characteristics domain. 213
Figure 5-4 Summary of the perceived barriers and facilitators to oral health activities implementation in KSA special schools concerning the Intervention Characteristics Domain of the Consolidated Framework for Implementation Research, according to staff members. 229
Figure 5-5 Identified themes and sub themes according to the Consolidated Framework for Implementation Research- Characteristics of Individuals domain, from KSA special schools' interviews 230
Figure 5-6 Subthemes of staff knowledge, beliefs, and feelings toward school-based oral health activities implementation theme 231
Figure 5-7 Summary of the identified barriers and facilitators to implementing oral health activities at KSA special schools under the Consolidated Framework for Implementation Research— Characteristics of Individuals domain, according to school staff members. 244
Figure 5-8 Themes under the Consolidated Framework for Implementation Research -Inner Setting domain. 245
Figure 5-9 Summary of the perceived barriers and facilitators to the oral health activities implementation at KSA special schools under the Consolidated Framework for Implementation Science- Inner Setting domain, according to staff members. 261
Figure 5-10 The identified themes under the Consolidated Framework for Implementation Research- Outer Setting domain 262
Figure 5-11 The perceived barriers and facilitators of implementing oral health activities within the Consolidated Framework for Implementation Research- Outer Setting domain, according to staff members. 266

Figure 5-12 Three themes within the Consolidated Framework for Implementation Research - Implementation Process domain 266
Figure 5-13 The barriers and facilitators to implementing oral health activities in KSA special schools related to the Consolidated Framework for Implementation Research- Implementation Process domain, according to staff members. 275
Figure 5-14 Parents or carers interviews' identified themes and subthemes, according to the Consolidated Framework for Implementation Research. 277
Figure 5-15 The Consolidated Framework for Implementation Research domain: intervention characteristics, individual characteristics, inner setting, outer setting, and implementation process and their underlying constructs. 278
Figure 5-16 Themes and subthemes related to the Consolidated Framework for Implementation Research- Characteristics of Individuals domain, according to parents/carers interviews. 279
Figure 5-17 Sub themes and underlying facets within participants' knowledge, attitude, and feelings toward the implementation of school-based oral health activities theme, according to parents/carers interviews. 280
Figure 5-18 Sub themes under the self-efficacy theme of the Characteristics of Individuals domain, according to parents/carers interviews. 288
Figure 5-19 The perceived barriers and facilitators to the oral health activities implementation at KSA special schools under the Consolidated Framework for Implementation Research- Characteristics of Individuals domain, according to parents/carers. 293
Figure 5-20 Summary of the perceived barriers and facilitators to OHA implementation in KSA special schools concerning the Intervention Characteristics Domain of the Consolidated Framework for Implementation Research, according to parents/carers. 300
Figure 5-21 The identifies themes within the Consolidated Framework for Implementation Research – Inner Setting domain, according to parents/carers interviews. 301
Figure 5-22 Summary of the perceived barriers and facilitators to the oral health activities implementation at KSA special schools under the Consolidated Framework for Implementation Research- Inner Setting domain, according to parents/carers. 307
Figure 5-23 Themes related to the Consolidated Framework for Implementation Research – Implementation Process domain, according to parents/carers interviews. 309
Figure 5-24 The barriers and facilitators to implementing oral health activities in KSA special schools related to the Consolidated Framework for Implementation Research- Implementation Process domain, according to parents/carers. 312
Figure 5-25 The key identified barriers to school-based oral health activities implementation at KSA special schools according to the Consolidated Framework for Implementation Research. 314
Figure 5-26 The key concepts to underpin an oral health promotion implementation toolkit for KSA special schools. 315

List of Tables

Table 1.1 The number of persons with disabilities (General Authority for Statistics, 2017) 39
Table 2.1 Implementation science theories, models, and frameworks description and examples, adapted from (Nilsen, 2015) 111
Table 2.2 Description of the Consolidated Framework for Implementation Research Intervention Characteristics Domain constructs considering the school-based oral health activities implementation in KSA special schools (Damschroder et al., 2009). 116
Table 2.3 Description of the Consolidated Framework for Implementation Research the Characteristics of Individuals' Domain constructs considering the school-based oral health activities implementation in KSA special schools (Damschroder et al., 2009). 117
Table 2.4 Description of the Consolidated Framework for Implementation Research the Inner setting Domain constructs considering the school-based oral health activities implementation in KSA special schools (Damschroder et al., 2009). 118
Table 2.5 Description of the Consolidated Framework for Implementation Research the Outer setting Domain constructs considering the school-based oral health activities implementation in KSA special schools (Damschroder et al., 2009). 119
Table 2.6 Description of the Consolidated Framework for Implementation Research the Implementation Process Domain constructs considering the implementation of school-based oral health activities in KSA special schools (Damschroder et al., 2009). 120
Table 3.1 Key Search Terms 135
Table 3.2 Reviewed studies in the scoping review. 141
Table 4.1 Characteristics of KSA special schools enrolled in the study. 180
Table 4.2 A summary of the demographic characteristics of staff members in KSA special schools who participated in the study. 182
Table 4.3 A summary of the demographic characteristics of parents/carers of children with disabilities who participated in the study. 184
Table 5.1 KSA special schools staff members' recommendations to improve the school-based oral health activities adaptability. 219

List of Appendices

Appendix 3.1: Levac et al. (2010) methodological framework.

Appendix 3.2: A table of the search terms according to population, concept, and context.

Appendix 3.3: Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) Checklist.

Appendix 4.1: Consolidated framework for implementation research constructs definitions.

Appendix 4.2: Ethical approval for implementation of school-based oral health activities in special schools in the KSA- A qualitative study

Appendix 4.3: King Saud University approval letter

Appendix 4.4: Informed consent for potential participants (special schools staff members version)

Appendix 4.5: Informed consent for potential participants (parents/carers version)

Appendix 4.6: Information sheet to potential participants (special schools staff members version)

Appendix 4.7: Information sheet to potential participants (parents/carers version)

Appendix 4.8: Interview guide (special schools staff members version)

Appendix 4.9: Interview guide (parents/cares version)

Appendix 4.10: An example of the interview's transcript

Appendix 4.11: An example of the first stage of theme identification

Appendix 4.12: Consolidated Criteria for Reporting Qualitative Research (COREQ) checklist.

List of Abbreviations

Abbreviation	Stand for
ATP	Audio-Tactile Performance
CFIR	Consolidated Framework for Implementation Research
CRFA	Common Risk Factor Approach
CAQDAS	Computer-assisted qualitative data analysis software
DI-S	Dental Debris Index
DMFT	Decayed, Missing due to caries, and Filled Teeth
dmft	decayed, missing due to caries, and filled Teeth
EU	European Union
FDI	World Dental Federation
GBD	Global Burden of Disease
GBI	Gingival Bleeding Index
GI	Gingival Index
HPS	Health-promoting schools
ICF	International Classification of Functioning, Disability, and Health framework
ID	Intellectual disability
IDs	Intellectual disabilities
IDDs	Intellectual developmental disabilities
JBI	Joanna Briggs Institute
KSA	Kingdom of Saudi Arabia
MoE	Ministry of Education
MoH	Ministry of Health
NCDs	Non-communicable diseases
OHP	Oral health promotion
OHE	Oral health education
OHAs	Oral health activities
OHPAs	Oral health promotion activities
OHI-S	Simplified Oral Hygiene Index
PHP	Patient Hygiene Performance
PI	Plaque Index
SD	Standard deviation
SDH	Social Determinants of Health
SMD	Standardised Mean Difference
UN	United Nations
UNCRC	United Nations Convention on the Rights of the Child
UNCRPD	United Nations Convention on the Rights of Persons with Disabilities
UNICEF	United Nations International Children’s Emergency Fund
UPIAS	Union of the Physically Impaired Against Segregation
WHO	World Health Organization

Chapter 1. Introduction and study context

1.1 Introduction

According to the United Nations Children's Fund (2021), there are around 240 million children with disabilities worldwide. The latest published report on disability in the Kingdom of Saudi Arabia (KSA) demonstrates that 209,574 children with disabilities live in KSA which has a total population of 35 million (General Authority for Statistics, 2017). Research demonstrates that people with disabilities experience poorer health and inferior access to high-quality health services than the general population (World Health Organization, 2022), including dental services (Bhadauria et al., 2024, da Rosa et al., 2020, El-Yousfi et al., 2019).

Oral diseases impose a considerable burden on socially marginalised populations, including children with disabilities. In addition, the literature shows that children with disabilities have a high level of untreated dental caries and are at higher risk of poor oral health with significant challenges into adulthood (Oliveira et al., 2013, Yesudian et al., 2012, Zhou et al., 2019). Robertson et al. (2019) reported no difference in dental caries prevalence in children with learning disabilities, but the burden and consequences of dental caries are significantly greater than for children without learning disabilities. The oral health of children with disabilities in the KSA poses a public health concern due to its detrimental impact on the health and well-being of the population. However, research in this area is inadequate (Asiri et al., 2022, Asiri et al., 2023). Consequently, promoting the oral health of this group must be a priority.

The World Health Organization (WHO) and the FDI World Dental Federation argue that evidence-based oral health promotion (OHP) policy and practice are essential to address oral health problems and widening inequalities in oral health (Eaton et al., 2023, Lee et al., 2020, Petersen et al., 2020, Turunen et al., 2017). According to the WHO, schools have a unique advantage in promoting oral health (Kwan et al., 2005, Lee et al., 2020, Petersen and Ogawa, 2016, Turunen et al., 2017).

The opportunity for an integrated approach to oral health improvement is significant for children with disabilities. Several systematic reviews of OHP have been published over the past thirty years, but none have addressed special schools (AlJameel et al., 2023, Waldron et al., 2016, Wilson et al., 2019). Some evidence suggests that school-based oral health promotion activities (OHPAs) benefit children with disabilities. However, they noted significant limitations regarding the implementation of OHPAs in special schools (AlJameel et al., 2023, Lai et al., 2020, Waldron et al., 2016, Wilson et al., 2019). Surprisingly, little research has been conducted on the factors influencing implementation, including personal, organisational, social, and environmental factors (Lai et al., 2020, Wilson et al., 2019).Moreover, guidelines for implementing and maintaining OHPAs were also lacking (Wilson et al., 2019).

This research aims to explore current OHAs in special schools in the KSA and the barriers and facilitators to their implementation. A Consolidated Framework for Implementation Research (CFIR) approach was adopted in this study to assess the barriers and facilitators to

implementing OHAs in special schools in the KSA (Damschroder et al., 2009). As part of our study, the KSA's special schools were examined for contextual factors that might influence the implementation of OHAs from the perspectives of school staff and parents/carers. This study provides recommendations for key concepts to underpin OHP implementation toolkit to improve the OHAPs in special schools in the KSA.

The main objectives of this research were to summarise the literature related to OHAs in special schools and identify research gaps using a scoping review, and then, based on the scoping review findings, to identify the current school-based activities related to oral health in special schools in the KSA, which are referred to here as oral health activities (OHAs). A distinction between OHPAs and OHAs was made as these activities tended to fit the definition of oral health education (OHE) rather than OHP. Next, this thesis aims to explore the factors associated with implementing OHAs in KSA's special schools and provide recommendations to inform the development of an OHP implementation toolkit.

It is worth noting that the terms Oral Health Education (OHE) and Oral Health Promotion (OHP) are used interchangeably in school-based literature. Thus, the term "OHAs" refers to all types of activities in this work, except for those that fit the definition of "OHP," which are called "oral health promotion activities" (OHPAs).

Study rational

Oral health is a public health concern and a fundamental right for children with disabilities. While Wilson et al. (2019) have identified several strategies that can be utilised to assist people with disabilities in maintaining optimal oral health, few studies have examined the implementation of OHAs in special schools. Some studies show that OHAs are effective for adolescents with learning disabilities, but the quality of these studies is low (AlJameel et al., 2023, Lai et al., 2020). In the KSA, no studies have been published regarding the implementation of school-based OHAs for children with disabilities. The findings of this thesis will inform the development of an OHP implementation toolkit to benefit the KSA's special schools. In the KSA, this project will have policy implications regarding improving the oral health of children with disabilities.

Aims and Objectives

This research aimed to explore the current provision of OHAs in special schools in KSA and the barriers and facilitators to their implementation.

Objectives:

1. To summarise the literature about OHAs in special schools and identify research gaps
2. To identify the OHAs currently being conducted in special schools in the KSA
3. To explore factors that influence the implementation of OHAs in special schools in KSA from the perspectives of school staff and parents/carers

4. To recommend key concepts on which to base an OHP implementation toolkit to improve the OHPAs in special schools in the KSA

Research questions

1. What is known from the literature about school-based OHAs in special schools? Their types, outcomes, and factors affecting their implementation?
2. In the KSA's special schools, what OHAs are currently taking place?
3. What is the experience of school staff and parents/carers of children attending the KSA's special schools in efforts to promote oral health?
4. From the perspective of staff and parents/carers of children attending special schools in the KSA, what factors hinder or facilitate the implementation of OHAs?
5. What are the key concepts to guide the development of an OHP implementation toolkit for the KSA's special schools?

The following section overviews the study context regarding the concepts of child and disability and provides background information on the KSA.

1.2 Study context and background

This section provides a comprehensive overview of the study's context. It provides an overview of the concept of child and disability in children, an overview of the KSA where the study was conducted, and a discussion of disability in the KSA. This information is presented before the literature review to allow the reader to better understand the context of the study.

1.2.1 Overview of the concept of the child

The United Nations Convention on the Rights of the Child (UNCRC) is a crucial agreement between countries that have pledged to safeguard children's rights (United Nations, 1989). The Convention outlines who children are, all their rights, and the duties of governments. The UNCRC recognises the human rights of all children, including those with disabilities. (United Nations, 1989). The KSA ratified the UNCRC in 1998.

Regarding the definition of children, Article One of the UNCRC defines the child as "*a child means every human being below the age of 18 years unless under the law applicable to the child, majority is attained earlier*"(United Nations, 1989).

In 2008, the KSA raised the legal age of majority from 15 to 18 years. Currently, the KSA considers anyone under 18 years old to be a child, following the UNCRC's definition (Al Saud, 2023).Moreover, it is essential to note that the KSA's special schools cater to children with disabilities aged between 3 and 18 years old.

Article Two of the UNCRC establishes that all children's rights must be promoted without discrimination, which also significantly impacts the perception of children with disabilities.

"*The UNCRC is crucial for all children, regardless of their race, family, colour, religion, language, politics, sex, nationality, social origin, ethnicity, disability, birth, or other differences*" (United Nations, 1989).

Furthermore, Article 23 of this Convention emphasises the significance of providing children with disabilities with adequate healthcare services. It promotes the idea of ensuring that children with disabilities receive effective and appropriate healthcare services that cater to their specific needs.

This article states that:

"*A mentally or physically disabled child should enjoy a full and decent life, in conditions which ensure dignity, promote self-reliance and facilitate the child's active participation in the community. States Parties recognise the right of the disabled child to special care. They shall encourage and ensure the extension, subject to available resources, to the eligible child and those responsible for his or her care of assistance for which the application is made, and which is appropriate to the child's condition and to the circumstances of the parents or others caring for the child*" (United Nations, 1989).

In addition, UNCRC recognises health promotion as one of children's rights, including those with disabilities. Article Three argues that children's best interests should be prioritised, their well-being should be considered, and all institutions should maintain and protect their health:

"*In all actions concerning children, whether undertaken by public or private social welfare institutions, courts of law, administrative authorities or legislative bodies, the best interests of the child shall be a primary consideration*" (United Nations, 1989).

Along with the UNCRC, the Convention on the Rights of Persons with Disabilities (UNCRPD) provides a powerful impetus to promote the human rights of persons with disabilities (United Nations, 2006). The UNCRPD is a human rights treaty adopted by the United Nations in 2006 and addresses accessibility, education, employment, and health, all aimed at promoting the rights and well-being of persons with disabilities worldwide (United Nations, 2006). Many countries have committed to implementing the principles outlined in the Convention by ratifying it (United Nations, 2006). The KSA ratified the UNCRPD in 2008.

Article Three of the UNCRPD highlights fundamental principles such as dignity, autonomy, non-discrimination, full and effective participation, and social inclusion (United Nations, 2006).

Article Three states "*The principles of the present Convention shall be: Respect for inherent dignity, individual autonomy, including the freedom to make one's own choices, and independence of persons, non-discrimination, full and effective participation and inclusion in society, respect for difference and acceptance of persons with disabilities as part of human*

diversity and humanity, equality of opportunity, accessibility, equality between men and women, and respect for the evolving capacities of children with disabilities and respect for the right of children with disabilities to preserve their identities" (United Nations, 2006).

Parties to the UNCRPD are expected to ensure that children with disabilities have equal rights and absolute legal equality. This Convention represents a significant shift from viewing children with disabilities as objects of medical care, social security, and charity to recognising them as equal and complete society members with human rights (United Nations, 2006). This can also be seen clearly in Article Seven of the UNCPRD, which specifies that "*In all actions concerning children with disabilities, the best interests of the child shall be a primary consideration*" (United Nations, 2006).

The UNCRPD promotes the right of children with disabilities to have the best health services, including health promotion. Article 25 of the UNCRPD reaffirms that people with disabilities have the right to receive the best possible standard of healthcare without discrimination as follows:

"Provide persons with disabilities with the same range, quality and standard of free or affordable health care and programmes as provided to other persons, including in the area of sexual and reproductive health and population-based public health programmes" (United Nations, 2006).

This section overviewed the UNCRC, defined the concept of a child according to the convention, highlighted the definition of a child in the KSA, defined UNCRPD, and emphasised the rights of children with disabilities to receive the best interests and adequate healthcare services according to the conventions. To provide context for the research, the following section reviews the concept of disability in children.

1.2.2 Overview of the concept of disability in children

This section summarises the literature on children's disabilities, including an overview of the concept, definitions, and models. It also provides an understanding of children's disabilities, challenges in estimating them, global estimates of children's disabilities, and the case in the KSA. The goal is to explore how disability definitions and models impact research on school-based OHAs for children with disabilities.

1.2.2.1 Overview of disability concepts and definitions

Over the years, disability has been defined in various ways as the social and environmental contexts have changed (Oliver, 2018). Disability is "*an umbrella term covering a range of abilities.*" (Oliver, 1996). It is a complex and controversial concept encompassing human function and structure, activities, and participation in all aspects of life. The "term disability" refers to an individual's ability to perform in specific social and environmental contexts (Oliver, 2018). This concept views the disability from both a medical and social perspective. Therefore, disability should not be viewed as purely medical or purely social (Oliver, 2018). In

the following section, the various models of disability and how they have influenced the definitions will be presented.

1.2.2.2 Models of disability

This section critically analyses the three most utilised models for understanding disabilities: the medical, social, and biopsychosocial models. Examining these models makes easier to comprehend the differences in defining disabilities in children, the challenges in measuring disabilities among children, and variable estimates of childhood disability prevalence.

1.2.2.2.1 Medical model of disability

The three models have different perspectives on the definition of "disability". By the early 19th century, the medical approach to disability had gained widespread support in Western industrialised cultures (Oliver, 2018). According to the medical model, disability is perceived as a personal issue resulting from disease, trauma, or other medical conditions that require ongoing medical attention through individual treatment. This view is supported by scholars such as Kiesler (2000) and Smart and Smart (2006) (Oliver, 2018).

This model categorises individuals based on functional restrictions resulting from physical abnormalities or dysfunction caused by injury or disease processes. However, when individuals are solely defined by their disabilities, their lack of ability becomes the focal point of their lives and might lead society to view them as dependent (Oliver, 2017).

Unfortunately, this narrow viewpoint has resulted in social policies aimed at simply helping people with disabilities to cope with their challenges rather than empowering them to live fulfilling and independent lives. As a result, this perception is not always supportive of persons with disabilities (Finkelstein, 1993; Oliver, 1996).

In addition, the objective of disability management within this model is to attain a cure or an individual's adjustment and behavioural changes that can lead to successful recovery. Consequently, the proposed solution is a rehabilitative and therapeutic intervention, and the primary political response is to revise or reform healthcare policies (Oliver, 2018).

The medical model of disability has faced much criticism from social scientists and politicians for its sole focus on the medical condition. As a result, there has been a shift in viewing disability to encompass psychological and physiological processes, according to the bio-psychosocial model, which is presented later in Section 1.2.2.2.3 (Townsend, 1979). Furthermore, a significant criticism of this model is that it primarily revolves around medical definitions instead of considering how societal barriers hinder the lives of people with disabilities (UPIAS, 1976; Oliver, 1996).

Moreover, it suggests that overcoming a disability requires rehabilitative and therapeutic methods while disregarding the hindering constraints of society. Finally, society is responsible for involving persons with disabilities rather than placing the weight of adaptive change on

them. The criticism and limitations of the medical model of disability resulted in the emergence of the social model.

1.2.2.2.2 Social model of disability

The social model of disability stresses the importance of societal barriers in causing disability. It perceives disability because of the way society is structured rather than an individual's impairment. This model advocates for removing barriers, fostering inclusivity, and adapting the environment to ensure equal participation for persons with disabilities. It shifts the emphasis from "fixing" the individual to transforming society to become more accessible and inclusive .

In the 1970s and 1980s, groups advocating for persons with disabilities rejected the medical model. The Union of the Physically Impaired Against Segregation (UPIAS) redefined disability by highlighting the social barriers that result in disability (UPIAS, 1976).

The UPIAS publication, 'The Fundamental Principles of Disability', was the first to recognise the social model of disability. It argued, "*Our own position on disability is quite clear and is fully in line with the agreed principles. In our view, it is the society which disables physically impaired people. Disability is something imposed on top of our impairments by the way we are unnecessarily isolated and excluded from full participation in society*." (UPIAS, 1976, p.4).

UPIAS fundamentally altered the definition of disability, as follows:

"*The disadvantage or restriction of activity caused by a contemporary social organisation which takes no or little account of people who have physical impairments and thus excludes them from participation in the mainstream of social activities*". (UPIAS, 1976, p. 14).

This publication's concept of disability is the foundation for Mike Oliver's social model of disability (Oliver, 2018)Oliver (2017) argues that society must be reformed to meet the needs of persons with disabilities. He believes that overcoming disabling barriers can challenge stigmatising and inequitable conditions.

In contrast to the medical model, "Impairment" refers to an individual's physical or mental limitations, while "disability" is a result of societal barriers preventing individuals with impairments from fully participating in daily life. In addition, the social model of disability considers disability as a socially created condition that must be addressed for the full integration of persons with disabilities into society. Disability is not just an individual characteristic but a complex combination of various physical, social, and political factors. Therefore, addressing issues related to disability requires collective social action (Oliver, 2018).

Critics argue that the social model of disability oversimplifies the interplay between impairment and societal barriers, neglecting individual experiences and medical conditions and undermining the significance of addressing personal challenges alongside social factors. Moreover, critics argue that the model might not effectively address severe impairments or

conditions where medical interventions are essential (Crow, 1992; French, 1993; Morris, 1991).

The social model of disability has been revised to address some of its criticisms. Advocates stress the significance of recognising both social and medical aspects, acknowledging that impairments and disabling conditions could have a variety of influences. This promotes a holistic perspective aiming to bridge the gap between social and medical models and foster a comprehensive framework for addressing diverse aspects of disability.

1.2.2.2.3 Bio-psychosocial model of disability

The biopsychosocial model of disability considers the physical or medical aspects but along with the psychological and social factors that contribute to a person's experience of disability. This model acknowledges that impairments alone do not determine disability, as impairments themselves are also affected by individual perceptions, societal attitudes, and environmental factors. It takes a holistic approach to disability, promoting a comprehensive understanding and support system (Oliver, 2018).

Although the biopsychosocial model is widely accepted as valuable for understanding disability, it has been criticised for its broad scope, which makes it challenging to apply consistently, and because it lacks clear operationalisation. Despite these criticisms, researchers continue to support the model for its holistic perspective (Oliver, 2017).

The WHO's International Classification of Functioning, Disability and Health (ICF) framework describes health and health-related states with a standardised language, which is an example of the application of the biopsychosocial model (Stucki et al., 2002)(Stucki, 2003).

The ICF has two main components: "functioning and disability" and" contextual factors". It is conducive to understanding disability since it provides a comprehensive framework to assess various aspects related to functioning and disability. It considers an individual's health condition or impairment, their participation in activities, and the impact of environmental and personal factors. This comprehensive approach offers a nuanced understanding of disabilities, enabling professionals and researchers to design interventions that address the multifaceted nature of an individual's experience with disability. These components together create a comprehensive framework that helps assess and describe an individual's health and functioning within their environment. The ICF divides difficulties of functioning into three related categories (World Health Organization, 2001) as presented in Figure 1.1.

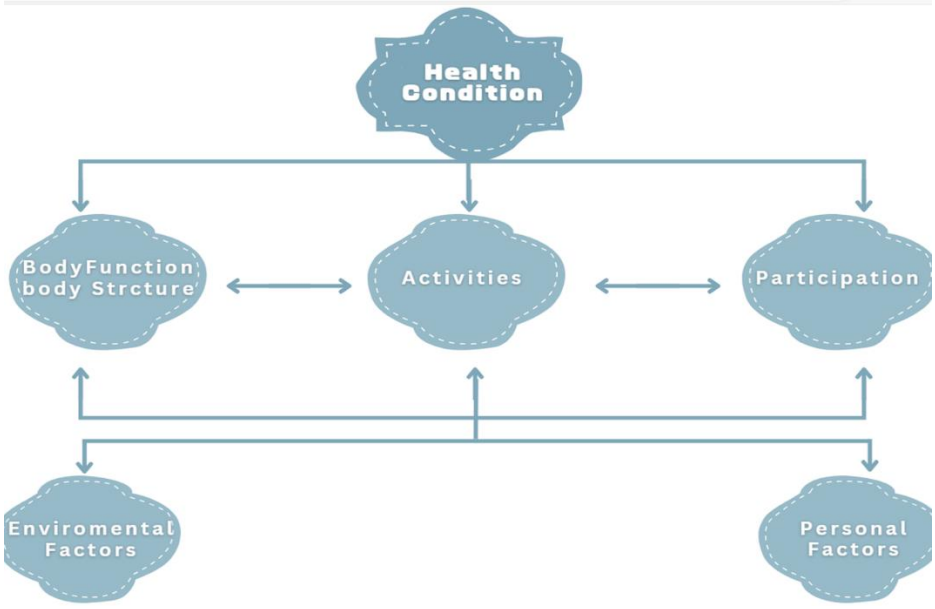

Figure 1-1 International Classification of Functioning, Disability and Health (ICF), (World Health Organization, 2001).

The ICF is a framework that combines both social and medical models of disability. However, it places greater emphasis on the social model, as it perceives disability as a negative outcome of an individual's interaction with their external environment rather than a label assigned to them (Bickenbach et al., 1999; Bornman, 2004).

In addition, the Child Functioning Module is another example of a disability framework based on the biopsychological model. UNICEF and the Washington Group on Disability Statistics collaborated to develop the Child Functioning Module for censuses and surveys to tackle the limited availability of accurate information on the burden of disability among children worldwide. Two sets of surveys are included: one for toddlers between two and four years old and another for children aged between 5 and 17.

These surveys gather information on physical, sensory, cognitive, and psychosocial functioning aspects. The Child Functioning Module follows the biopsychosocial model, which emphasises the extent of functional limitation and presence of limitation instead of focusing on impairment type or medical diagnosis. For instance, mobility restrictions could stem from a range of issues, such as cerebral palsy, paralysis, muscular dystrophy, or limb loss.

The Child Functioning Module surpasses previous methods for gathering data on disability because earlier approaches depended only on diagnosable conditions, which could result in unreliable data collection. By incorporating information about a child's basic functioning

abilities, this module provides a more comprehensive and accurate depiction of the child's disability.

Moreover, focusing on functional status rather than the medical cause is integral for understanding the impairments' impact on the child's life and social participation. For illustration, a child with cerebral palsy might have a mild speech impairment, while another might be unable to speak, posing communication challenges.

This section reviewed the concept of disability, definition, and models and provided a foundation for understanding disability. The biopsychosocial model of disability was adopted in this research as it identifies how impairments, health conditions, activity limitations, participation restrictions, and environmental, and social barriers impacted school-based OHAs for children with disabilities in the KSA's special schools as this model offers a subtle understanding of disabilities, allowing professionals and researchers to design interventions that address the multifaceted nature of an individual's experience. The following section focuses on disability among children.

1.2.2.3 Understanding disability in children

According to UNCRPD, children with disabilities "*include those who have long-term physical, mental, intellectual or sensory impairments which in interaction with various barriers may hinder their full and effective participation in society on an equal basis*".

Children with disabilities form a diverse and extensive group, encompassing children with genetic conditions affecting their physical, mental, or social development; those impacted by injury, malnutrition, or infections leading to lasting functional issues; and those exposed to environmental toxins resulting in developmental delays or learning disabilities. The group also includes children who have developed anxiety, depression, or psychological disorders.

1.2.2.3.1 Global estimates and trends of disability in children

Childhood disabilities represent a significant global public health burden in terms of physical, psychological, and economic impact. The global burden of childhood disabilities is significant and affects 10%-16% of children worldwide. Epilepsy, intellectual disability (ID), and hearing or visual impairments are the most common types of disability, with significant geographic disparities (Olusanya et al., 2020; Vawter-Lee & McGann, 2020).

However, collecting data on children with disabilities is challenging due to the varying definitions, measurement tools, and non-inclusive methods used across different countries. In addition, disability assessments often neglect psychosocial functioning, focusing mainly on physical and sensory functioning, leading to inaccurate evidence and underestimations of the number of children with disabilities. Furthermore, measuring functional difficulties in children is complex because they develop at different rates. Therefore, differentiating between typical development and developmental delay or impairment is crucial. Therefore, a comprehensive measurement should encompass physical, psychosocial, sensory, and cognitive aspects and consider personal and environmental barriers to active social participation.

The latest report by UNICEF uses the Child Functioning Module to provide comprehensive statistics on global and regional estimates of children with disabilities. The report found that almost 240 million children worldwide are experiencing some form of disability, which surpasses previous statistics as it represents a more inclusive understanding of disability, measuring various aspects of functioning, including psychological and mental well-being. In

the Middle East and North Africa region, where the KSA is located, approximately 21 million children are living with disabilities.

Furthermore, over 52.9 million children under five years old worldwide have developmental disabilities, and this number has not changed since 1990. This suggests an inadequate focus on the developmental potential of children who have survived childhood, particularly in sub-Saharan Africa and South Asia (Olusanya et al., 2018).

Understanding the prevalence and distribution of disabilities among children is crucial for designing effective policies and interventions to address their needs (Olusanya, O, B. et al., 2020). However, these estimates represent the current knowledge and available data on children with disabilities worldwide.

To summarise, disabilities in children are becoming a more pressing issue in public health. This section aimed to offer a global perspective on disability prevalence among children. These data will help to provide context for understanding the prevalence of disability in children in the KSA, which will be discussed in the following section.

1.2.2.3.2 Disability estimates and trends in the Kingdom of Saudi Arabia

This section reviewed the estimates and trends of disability in children in the KSA. While disability is a crucial social, economic, and medical issue in the KSA (Al-Jadid, 2013), there is a lack of appropriate research in this area, which makes it difficult to determine the incidence

and prevalence of impairment, disability, and socio-demographic characteristics compared to developed countries.

It is challenging to determine the burden of disability in the KSA due to the absence of standard measures and definitions of disability and limited epidemiological research (Al-Jadid, 2013, Al-Jadid, 2014, Bindawas and Vennu, 2018). Moreover, researching disability in the KSA is culturally sensitive, as some individuals and their families avoid participating in studies (Al-Jadid, 2013).

As per the most recent published report by the General Authority for Statistics, persons with disabilities in KSA constituted 7.1% of the total population, 1.4 million out of 32.5 million, based on the elaborated definition of the Washington Group on Disability Statistics. Males account for 52.2% of the total KSA population with disabilities (General Authority for Statistics, 2017).

Regarding geographical distribution, Riyadh region has the highest disability rate of 25.13% compared to other regions in the KSA. On the other hand, the Najran region has the lowest disability rate at only 0.87%. Various factors contribute to the difference in disability prevalence between Riyadh, the capital city of the KSA, and Najran, a small city with rural villages. Residents of Riyadh have better access to healthcare, which could lead to earlier identification of disabilities. Furthermore, Riyadh provides more support services and rehabilitation centres for children with disabilities, which is why many people choose to move

there, and this could affect the estimates. In addition, the city is more accessible to researchers. Moreover, demographics, lifestyle factors, pollution levels, and occupational hazards might differ between Riyadh and Najran, influencing the prevalence of specific disabilities.

Table 1.1 The number of persons with disabilities (General Authority for Statistics, 2017)

Different disabilities in the Kingdom of Saudi Arabia	Number of cases among (n= 1.4 million)
Physical disabilities	833,136 (63%)
Visual impairments	811,610 (57%)
Hearing impairments	289,355(20%)
Autism Spectrum Disorders	53,282 (3.7%)
Hyperactivity and Deficit Attention Disorder	30,155 (2.3%)
Down's Syndrome	19,428 (1%)

Regarding disability among children, out of 7,849,953 children surveyed, 2.7% or 209,574 have a disability, equivalent to a prevalence rate of 2,669.9 per 100,000 population. This prevalence is lower than the global prevalence of 10-16%, as presented earlier in Section 1.2.2.3.1.

Multiple factors could contribute to a lower prevalence of disability in children in the KSA in comparison to global rates, for example differences in healthcare access, such as late detection or misdiagnosis of disabilities. In addition, cultural practices and societal attitudes could affect the reporting of disabilities in research, because the topic of disability is often culturally sensitive.

Furthermore, the statistics presented here are also based on door-to-door surveys, which could result in under-reporting. Furthermore, there is a shortage of nationwide surveys that rely on accurate disability assessments, such as ICF or Child Functioning Module. In contrast, these assessments were used in the earlier-mentioned studies to provide global estimates of children with disabilities.

Among the common causes of disability in the KSA were cerebral palsy, head and spinal cord injuries, infections, inflammation, and genetic disorders (Al-Jadid, 2013). According to Shawky et al. (2002), certain modifiable maternal risk factors affect child health in the KSA community, including early and late-age marriage and childbearing, low education, and consanguineous marriages. These risk factors are found to increase the likelihood of the mother giving birth to a child with a hearing and visual impairment, or ID (Shawky et al., 2002).

For illustration, consanguineous marriages, or marriages between close relatives, are common in the KSA. A study has shown that the overall prevalence of consanguinity is 56%, with 33.6% being first-degree cousin consanguinity, which increases the risk of genetic disorders leading to disabilities in the KSA (Middle et al., 2007).

1.2.2.3.3 Categories of childhood disability (definition of the study terminology)

1.2.3 Overview of the Kingdom of Saudi Arabia

It is crucial to acknowledge children with disabilities in KSA society. This section presents the context of the KSA as a Muslim country and provides insights into the KSA's background, healthcare, and education systems. It covers various topics, such as family life and disability, from an Islamic perspective. The section concludes with an overview of disability in the KSA. This information is crucial as it offers readers a glance at the cultural and social factors that could impact the oral health of children with disabilities in the KSA.

1.2.3.1 Background

The KSA is a developing Middle Eastern country located in Southern Asia. It spans 2 million square kilometres (Wilson and Sahab, 2021). The total population of the KSA is approximately 35,080,643, based on the latest estimates (Worldmeters,2021).

The KSA is known for its rich cultural heritage, Islamic landmarks, and significant role in the global oil industry. Riyadh is the capital, while Mecca and Medina are Muslims' holiest cities in the KSA. Millions of Muslims go to the Holy Mosques every year to carry out the pilgrimage of Hajj and the lesser pilgrimage of Umrah (Al-Farsy, 2012). The constitution of the KSA is

founded on the Quran and Islamic law, Sharia. Islamic values and local customs mostly dictate the culture of the KSA.

During the 18th century, the House of Saud, under the leadership of Muhammad bin Saud, allied with Muhammad ibn Abd al-Wahab, a religious leader. In the early 20th century, Abdulaziz Ibn Saud unified a significant portion of the Arabian Peninsula, leading to the establishment of the KSA in 1932. Since that time, the country has experienced modernisation and development.

The KSA is implementing Vision 2030, which aims to diversify the economy by developing the tourism, entertainment, technology, and renewable energy sectors. In addition, it enhances women's role in society, allowing them to drive and increase their involvement in the workforce. Also, it emphasises investment in technology and innovation as vital components of KSA Vision 2030. Furthermore, the vision prioritises environmental sustainability by implementing renewable energy and reducing the ecological impact of economic activities. Among the targets are better public health programmes (focusing on reducing obesity and smoking), as well as better quality of life and primary care.

1.2.3.2 Kingdom of Saudi Arabia's education system

The Ministry of Education (MoE) was developed in 1953, and by 1958, the government had organised the educational system into primary, intermediate, and secondary levels to

conform to Gulf standards. Universities and colleges provide higher education (Rugh, 2002). Under the slogan “Education for All”, the MoE has highlighted the importance of education. Education is free at all levels, including postgraduate (Rugh, 2002).

The KSA’s education system is heavily centralised. All educational policies are administered by the MoE, which is directly accountable to the government. The national curriculum, syllabus, and textbooks are uniform. The curriculum is standardised throughout the KSA.

The curriculum has been updated recently to incorporate critical thinking, creativity, research, innovation, practical skills, and formal subjects, resulting in a more well-rounded and globally competitive education. Moreover, technical and vocational education has been improved to meet the demands of the job market and reduce reliance on foreign labour in specific sectors.

1.2.3.3 Kingdom of Saudi Arabia’s health system

The KSA has a well-established healthcare system that has experienced significant developments. The KSA developed healthcare services in the first quarter of the twentieth century. The Ministry of Health (MoH) was established in 1954. The healthcare system in the KSA consists of both public and private healthcare sectors. Health centres and clinics offer primary, secondary, and tertiary levels of health care, while hospitals provide secondary and tertiary care. The government has implemented health insurance programmes to ensure broader accessibility to healthcare services. In addition, healthcare infrastructure and

technology investments have been a government priority. For example, advanced medical equipment is now present in modern hospitals, and there is an emphasis on adopting digital health solutions. Furthermore, specialised medical cities, such as the King Fahd Medical City in Riyadh, have been established to deliver specialised health services and medical research. Even though the MoH has taken several steps to reshape the health system, there are still some barriers to providing health care, including the physical inaccessibility of certain healthcare facilities, an insufficient number of healthcare providers, and the shifting pattern of various diseases (Al-Yousf et al., 2002; Almalki et al., 2011). Despite the government's high priority for providing healthcare services at all levels—primary, secondary, and tertiary—access to some healthcare facilities for people with disabilities remains a barrier to care (Almalki et al., 2011). Unfortunately, their medical and dental needs still necessitate additional effort to integrate them into the health system.

Dental health services are integral to the KSA's healthcare system and are available in public and private healthcare facilities. Dental healthcare encompasses preventive measures such as regular check-ups, education on oral hygiene, and curative services, including restorative procedures and simple extractions available at centres and clinics. Furthermore, hospitals offer specialised dental services such as orthodontics, endodontics, oral surgery, and periodontics. According to the most recent statistics, the total number of dentists in the KSA is 19622, with a dentist-to-population ratio of 2.80 per 5000 persons, but they are not evenly distributed across the KSA (MOH, 2020). Furthermore, in the KSA, special care dentistry is not a recognised speciality and as such does not form a major part of the undergraduate or postgraduate dental curricula (Abed, 2017). Paediatric dentists often treat people with

disabilities under general anaesthesia. This practice is common in several countries, but it may not be appropriate since these individuals are not children.

1.2.3.4 Culture and family structure within the Kingdom of Saudi Arabia

For decades, the most critical distinguishing aspects of the KSA's society have been religion and tradition (Danish & Smith, 2012). In the KSA, the family structure is traditionally patriarchal. Extended families are typical; the nuclear family is the core unit, and roles are often defined by gender, with men as providers and women as caregivers. Society places males in charge of family responsibilities while placing women in charge of child-rearing duties (Hamdan, 2005; Ahmad, 2011). It is generally expected in the KSA's society that mothers accept most childcare responsibilities, and as such are responsible for their children's oral health. However, societal changes have led to more diverse family dynamics in urban areas (Long, 2005).

In the KSA, families are the primary caregivers for children with disabilities as they uphold the values of dignity and integrity within their community. However, many family members lack the knowledge to provide the appropriate care to a child with a disability (Alsaif, 1992). While there is a cultural emphasis on family responsibility, the government has also worked to improve services for persons with disabilities, including education and healthcare programmes. In addition, awareness and support networks are growing, contributing to a more inclusive approach to caring for children with disabilities in families in the KSA.

Furthermore, Islam acknowledges the dignity and rights of children with disabilities. Islamic teachings promote compassion and support for those facing challenges, including disabilities. The Quran and Hadith stress inclusion, kindness, and the significance of caring for all members of society, regardless of their abilities. Many Muslim communities aim to create accessible environments and promote understanding and acceptance of persons with disabilities. Charitable and social support is also crucial, emphasising the need to assist those requiring additional care, including children with disabilities.

In the KSA's culture, there is an increasing awareness and recognition of the rights of children with disabilities, enhancing their inclusion and support within families and communities. The KSA government has implemented various programmes to promote inclusion and access to education and healthcare services for children with disabilities. Furthermore, there is a cultural emphasis on family support and community involvement to address the unique challenges faced by children with disabilities. The following section discusses disability in the context of the KSA.

1.2.3.5 Understanding disability in the Kingdom of Saudi Arabia

Disability in the KSA is defined by cultural, legislative, and Islamic perspectives (Al-Jadid & Al-Jadid, 2013). According to the KSA's Labour and Workmen Law, a "person with a disability" is "*any person whose capacity to achieve and continue a suitable job has diminished because of a physical or mental infirmity*."

Persons with disabilities are described as having one or more of the following impairments: hearing, visual, motor, cognitive, speech and language, learning disabilities, pervasive developmental delay, and behavioural difficulties. This description reflects the KSA's medical model of disability orientation, which considers impairment as the primary cause of disability rather than social barriers that might impact policies affecting persons with disabilities. The following section presents the rights of persons with disabilities in the KSA, including their education, health, and employment rights.

1.2.3.5.1 Rights of persons with disabilities in the Kingdom of Saudi Arabia

Sharia, the Islamic legal system, governs the KSA and emphasises human rights, particularly for persons with disabilities, including the right to live with dignity and benefit from welfare. For the past two decades, the KSA has prioritised persons with disabilities as part of its economic and social development policies (Ramady, 2005).

The Disability Legislation Law was approved in 1987, indicating that persons with disabilities have equal rights to non-disabled individuals. The disability code was passed by the government of the KSA in 2000, which promised to provide free and appropriate psychological, medical, social, rehabilitation, and educational services to persons with disabilities across all public agencies (Al-Jadid & Al-Jadid, 2013).

In addition, the KSA ratified the UNCRPD in 2008 and has fully integrated it into its local system to ensure compliance (The United Nations Convention on the Rights of Persons with Disabilities, 2006). As a result, a committee was established within the KSA Human Rights Commission by the KSA to assess persons with disabilities and advocate for practical approaches in implementing the Convention to create a supportive infrastructure. The committee collaborates with other countries to promote global cooperation in addressing problems associated with the implementation of the Convention.

Furthermore, the government encouraged inclusive education, offering support services and accessible facilities for students with disabilities to participate in mainstream schools. Also, initiatives to promote employment opportunities for persons with disabilities include creating an inclusive work environment, offering vocational training, and encouraging businesses to hire persons with disabilities. In addition, there is a growing emphasis on improving physical accessibility for persons with disabilities in public spaces, transportation, and buildings to ensure their full participation in society. Furthermore, the government facilitates assistive technologies to enhance the daily lives and independence of persons with disabilities. Moreover, efforts have been made to raise awareness and change societal perceptions about disabilities through public awareness campaigns to foster understanding and acceptance.

The following section describes the development and structure of the special education system in the KSA.

1.2.3.5.2 Special education in the Kingdom of Saudi Arabia

A little over half a century ago, no special education was available in the KSA. Persons with disabilities had to rely on their families and communities for support, with no access to formal education (Al-Kheraigi, 1989).

The first formal special education program in the KSA began in 1958, according to Al-Kheraigi (1989). This programme provided services for adults with visual impairments and was developed by Ahmad Aba Hussain, a blind man, and his colleagues. Later, they reached out to the MoE, which established an evening programme at one of the public schools in Riyadh. Two years later, the KSA government established Al-Noor Institute, Riyadh's first school for persons with visual impairments.

In 1960, the MoE established a new department for Special Education (Bin Battal, 2016a). This department provides academic, social, and vocational education to students with visual, hearing, and learning disabilities (Al-Mousa, 2010).

In 1964, the MoE established two Al-Amal Institutes in Riyadh for students with hearing impairments, the first in KSA for both boys and girls. By 1987, the KSA had 27 separate special education schools and institutes for students with visual and hearing impairments, and ID (Al-Kheraigi, 1989). Between 1987 and 2000, the KSA's special education system expanded to 54 special schools, providing services to students with disabilities (Al-Mousa, 2010).

The Department of Special Education began the inclusion of children with disabilities into mainstream schools in 1994 (Bin Battal, 2016b). This shift towards inclusive education marked a change in understanding disability from compassion to one that incorporates human rights and development.

In the KSA, there are two types of inclusion for students with disabilities. The first type is full inclusion, where students attend general education classes at least half the time. However, they receive special education services from special education teachers only in subjects where they require additional assistance (Al-Mousa, 2010). Students with minor disabilities, such as physical impairments, low vision, behavioural disturbances, and communication disorders, are examples of students who benefit from full inclusion (Bin Battal, 2016b).

In contrast, partial inclusion is designed for students with moderate to severe disabilities, such as those with hearing impairments or ID. These students attend special classes but can join their peers during breaks and extracurricular activities.

The KSA has recognised the significance of education for persons with disabilities, and efforts have been made to improve the quality of special education services. Special education centres and schools provide personalised education and support to students with disabilities. These centres offer varied services, including academic instruction, therapy, and vocational training. Moreover, the curriculum for students with disabilities is adapted to meet their

specific learning needs through modified teaching methods, materials, or assessments. Teachers and educational staff are trained to support this student group effectively.

This section discussed the special education system in the KSA, outlining its various structures, including full and partial inclusive education, and separate special schools for children with disabilities. This research explored the implementation of OHAs in KSA's separate special education schools, specifically catering to children with disabilities.

1.2.4 Summary

This chapter introduced the work and provided details on the study context and background by elaborating on the concepts of child and disability. It highlighted the burden of childhood disabilities globally and in the KSA. In addition, it described the categories of disabilities and their working definition in the KSA. Furthermore, it provided information essential to understanding childhood disabilities from the perspectives of the KSA's culture and society. The KSA views disability from the medical model. In KSA society, the nuclear family is considered the core unit, and mothers are primarily responsible for caring for children with disabilities. The government of the KSA ratified the UNCRC and UNCRPD, emphasising the rights of persons with disabilities to health, education, and employment.

Chapter 2. Literature review

When exploring school-based OHAs for children with disabilities in the KSA, understanding the concept of health, oral health, their social determinants, and how to address them to promote oral health is essential. Furthermore, this chapter reviews the burden of oral diseases, the oral health status of children without and with disabilities, alongside presenting the concepts of public health and how health promotion addresses oral health inequalities through a setting-based approach in the form of health-promoting schools (HPS). In addition, it provides evidence for HPS and the different approaches of school-based OHAs, such as OHE, OHP, supervised toothbrushing, and topical fluoride application, alongside reviewing the evidence regarding school-based OHAs for children with disabilities. Moreover, it provides details pertaining to OHP evaluation and the application of implementation science to evaluate the barriers and facilitators to school-based intervention implementation, including OHAs.

2.1 Definition of health

The definition of health has evolved, reflecting changes in medical knowledge, societal attitudes, and cultural perspectives. In the 19th century, for example, scientific medicine identified pathogens, developed treatments, and created the biomedical model of health, which focuses on the absence of disease or pathology as the primary indicator of health (Porter, 2020, Turner, 2001). The biomedical model of health has been criticised for its narrow focus on the absence of disease, with critics arguing that it fails to consider the essential aspects of wellbeing, such as mental, social, and environmental factors (Porter, 2020, Turner,

2001). Thus, a holistic approach is required to ensure a more comprehensive understanding of health and overall quality of life (Porter, 2020).

In 1948, the WHO broadened the concept of health beyond the absence of disease to incorporate mental and social wellbeing, emphasising functionality and promoting an overall sense of wellbeing: " *A state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity*" (World Health Organization, 1948).

In recent decades, recognition of the impact of social determinants of health (SDH) has grown, emphasising the impact of factors such as socioeconomic status, education, and living conditions. In modern medicine, for instance, health is now viewed holistically, encompassing physical, mental, emotional, and spiritual aspects that hope to achieve balance and harmony within an individual. Furthermore, the behavioural health definition assesses lifestyle choices and behaviours, acknowledging the behaviours' impact on health has been proposed (Porter, 2020, Turner, 2001).

During the 1980s, the health promotion movement significantly impacted the understanding of health, with this movement emphasising the significance of implementing preventive measures and healthy lifestyle choices. It also emphasised the importance of addressing broader determinants of health that ultimately lead to a more proactive approach (Wills, 2022). Consequently, there has been a growing recognition of societal wellbeing and

communities' essential role as settings for health promotion (Wills, 2022). Therefore, the following section reviews the SDH.

2.1.1 Social determinants of health

It is essential to consider SDH when creating public health interventions to reduce health inequalities and promote well-being. Nowadays, public health efforts acknowledge the significance of addressing the broader determinants of health to create conditions that both promote health for everyone and reduce health inequalities (Dahlgren and Whitehead, 2021, Dyar et al., 2022, Marmot et al., 2008).

Specifically, SDH are "the conditions in the environments where people are born, live, learn, work, play, worship, and age that affects a wide range of health, functioning, and quality-of-life outcomes and risks" (Office of Disease Prevention and Health Promotion, 2023).

Notably, the Dahlgren-Whitehead model represents the person-environment-disease link. They developed a framework in 1991 and updated it in 2007 to describe the socioeconomic determinants of health (Dahlgren and Whitehead, 2021, Whitehead and Dahlgren, 2021), as presented in Figure 2.1.

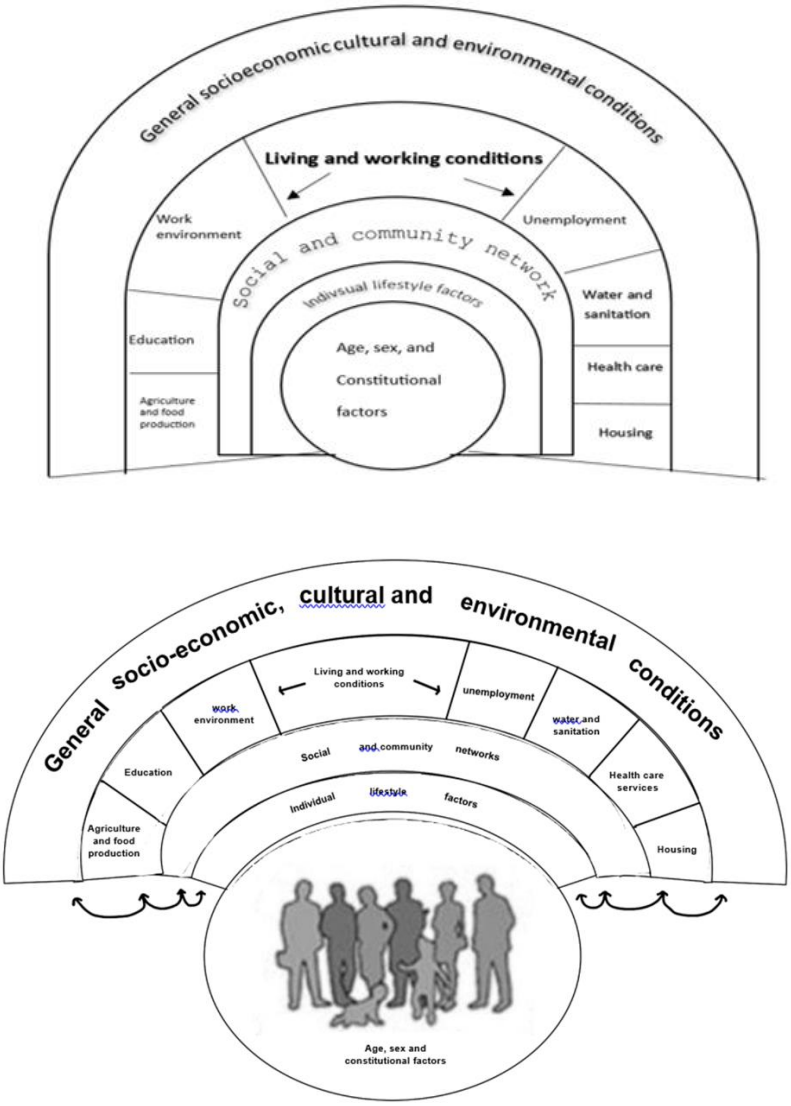

Figure 2-1 Dahlgren and Whitehead rainbow model 1991 (above) and 2007 (down) versions.

The Dahlgren-Whitehead model, also known as the 'Rainbow Model', is a framework that demonstrates that health is determined by a complex interplay of factors at different levels. This model emphasises the interdependence of individual lifestyle factors, the social and community networks, the living and working conditions, and the general socioeconomic, cultural, and environmental conditions that existed. Furthermore, the Dahlgren-Whitehead Model comprises five concentric rings, each representing a different level of influence on

health (Dahlgren and Whitehead, 2021, Whitehead and Dahlgren, 2021), as depicted in Figure 2.1.

Accordingly, the Dahlgren-Whitehead model promotes a holistic, multi-level, and systemic approach to health promotion and public health. In this approach, health promotion strategies address various factors, from individual behaviours to societal structures, and subsequently aim to target these simultaneously. Furthermore, recognising structural factors has dominated public health efforts in targeting societal structures, economic policies, and cultural norms to promote improved health for all (Dahlgren and Whitehead, 2021, Whitehead and Dahlgren, 2021).

A criticism of the Dahlgren-Whitehead model is that it may oversimplify the complex and dynamic nature of health determinants. Critics argue that the model suggests a linear relationship between levels of influence with concentric circles. However, health determinants frequently interact in complex, non-linear ways that are challenging to represent accurately. As such, the model needs to capture the complexity of contextual factors that can influence health outcomes (Dyar et al., 2022). Similarly, it fails to consider intersectionality, which acknowledges the presence of multiple layers of privilege or disadvantage based on factors such as racial identity, gender, nationality, disability, and socioeconomic status (Al-Faham et al., 2019, Moodley and Graham, 2015). Also, it has been suggested that the model overlooks personal responsibility and disregards the importance of empowering individuals to make healthier decisions (Dyar et al., 2022).

Dahlgren and Whitehead (2021) reflected on their model's 30-year journey, its widespread use and impact globally, and its ability to encourage holistic consideration of health determinants. Ultimately, the model does promote collaboration across sectors. However, further development is required to address vertical links between the social, economic, and cultural determinants of health and those of lifestyle. Furthermore, it highlights the significance of considering the commercial factors that affect health and the impact of racism on health outcomes.

Moreover, Dyar et al. (2022) explored the significance of rainbow models in public health from a historical perspective, arguing that an updated model is necessary to address contemporary health concerns whilst maintaining the original model's fundamental principles. In addition, they emphasised the need to visualise the relationships between various determinants of health, arguing that the new model should be adaptable to different contexts and locations.

Although the Dahlgren-Whitehead model provides a practical framework for understanding health determinants, it does have limitations, and it is therefore essential to consider additional factors when addressing health inequalities, such as intersectionality and context. Indeed, an unequal distribution of health determinants can cause health inequalities, which are the "*inequalities in individuals' abilities to function and make choices*" (Commission on Social Determinants of Health, 2008). Moreover, "*they are the systematic, avoidable and unfair differences in health outcomes that can be observed between populations, between*

social groups within the same population or as a gradient across a population ranked by social position" (McCartney et al., 2019).

Creating the Commission on SDH in 2008, the WHO defined SDH as" the *structural determinants and conditions of daily life that contribute significantly to health inequalities among and within countries*" (Commission on Social Determinants of Health, 2008). Furthermore, this framework explains how SDH are interrelated with the mechanisms involved in creating health inequalities.

There are two types of social determinants of health inequalities in this framework (Commission on Social Determinants of Health, 2008). This framework highlights how social, economic, and environmental conditions influence health and identifies several key areas. Key components of the WHO SDH framework include structural determinants involving socioeconomic and political context, which encompasses a society's broad set of structural, cultural, and functional aspects, including governance, policies, and cultural norms that shape social hierarchies and influence social and economic conditions. It also includes individuals' social position within the social hierarchy, determined by income, education, occupation, gender, race/ethnicity, and social connections.

Furthermore, it encompasses intermediate determinants, including the material circumstances, which are the physical conditions in which people live and work, including housing, working conditions, and neighbourhood environments. In addition, it includes psychosocial factors involving social and psychological experiences that could influence

health, such as stress, social support, and mental well-being, and behaviours and biological factors, including individual lifestyle choices (e.g., smoking, diet) and genetic predispositions, that can affect health outcomes.

Moreover, the WHO framework also represents the health systems' availability, accessibility, and quality of healthcare services, which play a critical role in health outcomes. The WHO emphasises that addressing the social determinants of health requires comprehensive policies and interventions that target these broad determinants to reduce health inequities and improve overall population health.

The WHO framework on SDH is a specific framework designed to understand how societal factors affect health outcomes. It addresses health inequities by identifying and intervening in the social, economic, and environmental factors influencing health (Commission on Social Determinants of Health, 2008). It distinguishes it from the causal direction model, a general framework used to identify and infer cause-and-effect relationships between variables. It is employed to determine how changes in the cause influence the effect and is concerned with the methodology of establishing causal links. It includes tools like structural equation modelling and methods to control for confounding variables. It focuses on accurately identifying and modelling causal relationships to make predictions or understand complex systems (Scherpenzeel and Saris, 1996).

This section reviewed health and the wider determinants of health that contribute to health inequalities to provide a foundation for oral health and its determinants, as the oral health definition originates from the health definition.

2.2 Oral health

Oral health is considered integral and essential to general health and determines the quality of life (Baiju et al., 2017). Like general health, oral health denotes not merely the absence of disease but general well-being so that a person can perform functions like eating, talking, smiling, and contributing to the community (Baiju et al., 2017). Dental caries and periodontal diseases are the most common oral health issues for children and young people. Subsequently, this section reviews the definition of oral health, the social determinants of oral health, and the burden of oral diseases.

2.2.1 Definitions of oral health

The definitions of oral health have evolved from those of general health, with Dolan (1993) defining oral health as: "*A comfortable and functional dentition that allows individuals to continue their social life*"(Dolan, 1993). Meanwhile, Sheiham and Spencer (1997) broadened this definition further: "*Oral health is the ability to chew and eat the full range of foods native to the diet, to speak clearly, to have a socially acceptable smile and dentofacial profile, to be comfortable and free from pain and to have fresh breath*".

Furthermore, Glick et al. (2016), proposed the need for a new definition of oral health for the FDI's 2020 agenda, contending that a standard definition could unite all stakeholders to advocate for the significance of oral health, shape care parameters, and influence health

policies, research, education, and reimbursement methods. Moreover, this definition would shift the focus of dentistry from disease treatment to oral health care and support.

Suggesting a more detailed definition emphasising the psychosocial significance of oral health, the FDI declared that: "*Oral health is multi-faceted and includes the ability to speak, smile, smell, taste, touch, chew, swallow and convey a range of emotions through facial expressions with confidence and without pain, discomfort, and disease of the craniofacial complex (head, face, and oral cavity). Oral health means the health of the mouth. No matter what your age, oral health is vital to general health and wellbeing*" (Glick et al., 2016).

Evidently, the definition of FDI - as various national organisations worldwide have adopted - has a subjective aspect regarding oral health. This is particularly important to consider when dealing with people with limited communication abilities, and who may face difficulty communicating their oral health needs. Furthermore, while the FDI's definition is exhaustive, it is unrealistic; for example, as most people have some degree of gingivitis, oral health under this definition would be challenging to attain. Oral health is complex and determined by the interplay between several factors, including social determinants of oral health, presented in the following section.

2.2.2 Social determinants of oral health

Oral health inequalities are a primary concern in dental public health, with oral diseases significantly impacting marginalised communities, including children with disabilities, and are linked to the poor socioeconomic conditions these groups often experience. In addition, the lack of access to dental services and the lack of priority given to oral health could be attributed to social, political, behavioural, and medical factors (Jeavons and Chana, 2022, Steele et al., 2015, Peres and Heilmann, 2015). Indeed, there is a correlation between an individual's socioeconomic status and their oral health, with research worldwide demonstrating that people of lower socioeconomic statuses tend to have worse oral health outcomes –with this being explained as a social gradient (Sheiham et al., 2011, Jeavons and Chana, 2022).

Meanwhile, Watt and Sheiham (2012) presented a model based on the WHO Conceptual Framework on the Social Determinants of Health (Commission on Social Determinants of Health, 2008, Watt, 2012), highlighting the social determinants influencing oral health, including socioeconomic factors, social structure, and living conditions. Therefore, as presented in Figure 2.2, both social and environmental factors play a role in oral health behaviours and outcomes. Addressing these broader social determinants is crucial to improving oral health outcomes. The burden of oral diseases is presented in the following section.

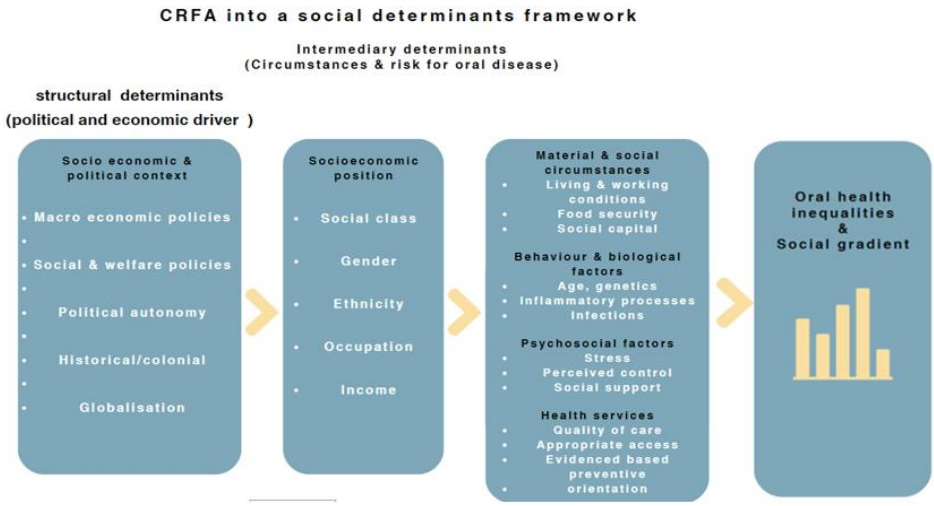

Figure 2-2 Conceptual model for oral health inequalities (Watt and Sheiham, 2012) .

2.2.3 Burden of oral diseases

Based on information from the GBD report, since 1990 oral diseases have continued to be the most widespread condition (Institute of Health Metrics and Evaluation, 2019, World Health Organization, 2022). Almost half the global population (3.5 billion) has untreated oral diseases, with 75% of those affected residing in middle-income countries (Jain et al., 2023, World Health Organization, 2022, Winkelmann et al., 2023). Specifically, the most burdensome oral diseases are untreated dental caries, severe periodontal disease, edentulism, and oral cavity/lip cancers (Institute of Health Metrics and Evaluation, 2019, World Health Organization, 2022).

The worldwide prevalence of these oral diseases is greater than the total number of cases for the five primary non-communicable diseases (NCDs), comprising mental disorders, cardiovascular disease, diabetes mellitus, chronic respiratory diseases, and cancers (Institute of Health Metrics and Evaluation, 2019). Untreated dental caries in permanent teeth is the

most common oral disease, with around two billion cases and a prevalence of 29%. Furthermore, severe periodontal disease is the second-most prevalent in individuals over 15 years, with approximately one billion cases (18.82%). In addition, untreated dental caries in primary teeth accounts for approximately 510 million cases (38-46%) among children aged from one to nine years. Moreover, edentulism affects approximately 350 million people aged 60 years and above, with a prevalence of 7% (World Health Organization, 2022). Globally, between 1990 and 2017, dental caries remained a significant burden, with only a 4% reduction observed in the prevalence of untreated dental caries. The prevalence of dental caries in primary and permanent teeth among children worldwide was 46.2% and 53.8%, respectively (Vos et al., 2020b).

Oral diseases can often be severe since they affect both individual and population-wide physical health, functional abilities, alongside emotional, mental, and social wellbeing. Furthermore, they can significantly impact quality of life, work productivity, and social participation. Evidently, having untreated dental caries significantly impacts the daily lives of children and their families, causing pain, anxiety, infections, eating and sleep disruptions, lost school days, negative effects on educational attainment, and hospitalisation (Jain et al., 2023, Vos et al., 2020a).

Moreover, oral diseases burden healthcare infrastructures and economies owing to their substantial impact and common risk factors with other NCDs. For example, the global expenditures on oral health care worldwide amount to approximately $390 billion., with oral

diseases emerging as developed countries' fourth-most expensive health conditions (Peres et al., 2019, World Health Organization, 2022). According to Righolt et al. (2018), untreated dental caries is responsible for 45% of the global oral disease burden and 52% of tooth loss, directly or indirectly. Moreover, it was estimated that oral diseases cost the global economy $544 billion, comprising $357 billion in direct health expenses and $187 billion in productivity losses.

Consequently, the burden of oral diseases on individuals and society requires less pathogenic and more salutogenic approaches for improving oral health (Watt et al., 2019). Aaron Antonovsky coined the term 'salutogenesis', an approach that promotes variables that contribute to human health and wellbeing over factors that contribute to disease (Mittelmark and Bauer, 2022). It has been suggested that the conventional curative model of oral healthcare is too expensive, regarding human and financial resources, to remain viable against increasing demand.Instead, an OHP approach has been advocated that effectively tackles oral health problems and their widening inequalities (Eaton et al., 2023, Jain et al., 2023).

The primary risk factors for dental caries and periodontal diseases include a high-sugar diet, inadequate oral hygiene, and less than optimum fluoride exposure. Since these risk factors are shared by several other chronic diseases, such as heart disease, cancer, strokes, and diabetes, employing the common risk factor approach (CRFA) is strongly indicated (Watt and Sheiham, 2012).The concept was developed and applied to oral health in 2000, focusing on

shared chronic disease risk factors (Sheiham and Watt, 2000), in which the core idea is to improve general health by targeting particular risk factors linked to multiple diseases with greater efficiency and effectiveness than disease-specific interventions. Specifically, CRFA emphasises improving health conditions for the entire population and targeting high-risk groups to reduce inequalities (Sheiham and Watt, 2000). An example of the CRFA is the development of a comprehensive nutrition programme aimed at improving preschool children's overall nutritional status. If effective, this strategy would reduce sugar consumption and improve the overall nutritional content of preschool children's diets, thereby supporting their development (Sheiham and Watt, 2000).

However, oral diseases have a behavioural component, and an individual's behaviour is not established freely; that is to say, socioeconomic circumstances influence it. Although the CRFA has significantly impacted how oral health is integrated into overall health, dental policymakers have oversimplified the CRFA. They have excessively emphasised shared behavioural risk factors rather than the broader socioeconomic determinants of health (Watt and Sheiham, 2012).

As discussed in Section 2.2.2, Watt and Sheiham (2012) updated the CRFA critically concerning the social determinants and developed a revised theoretical framework for understanding oral health inequalities. While oral diseases produce a considerable burden, most are preventable through individual self-care or evidence-based interventions targeting populations. Accordingly, addressing social, economic, and political factors could lessen the

burden of oral disease and its adverse effects, particularly amongst high-risk groups, including children with disabilities.

The following section reviews the oral health status of children in the KSA, including the prevalence of dental caries, gingival and periodontal diseases, and traumatic dental injuries.

2.2.4 Oral health status among children in the Kingdom of Saudi Arabia

This section reviews the prevalence of dental caries, gingival and periodontal diseases, and traumatic dental injuries among KSA children.

According to the 2019 GBD report, KSA has a high prevalence of common oral diseases, thus indicating a higher occurrence of oral diseases compared to both the WHO Eastern Mediterranean Region, to which it belongs, and the global estimates (Institute of Health Metrics and Evaluation, 2019). The prevalence of dental caries in primary teeth in KSA is estimated to be between 45.8% and 53.2%, which is higher than the WHO Eastern Mediterranean Region at 45.1% and the global average of 38.5%. In addition, the prevalence of untreated dental caries in permanent teeth among the KSA population ranges between 35.6% and 40.6%, which is higher than the global estimates of 29% and the WHO Eastern Mediterranean region's 32.3%. Furthermore, severe periodontal disease in the KSA population over 15 years ranges between 19.6% and 27.3%, thus higher than either the WHO Eastern Mediterranean Region (17.4%) or globally (18.8%). Moreover, edentulism in

individuals aged 60 years and above in KSA varies from 16.4% to 26.2%, which is greater than the global prevalence of 7% and the WHO Eastern Mediterranean Region at 5.9% (Institute of Health Metrics and Evaluation, 2019).

In addition, several studies have been conducted on the prevalence of dental caries in KSA, indicating a high rate of occurrence among children. Notably, Al Agili (2013), in a systematic review, found the prevalence of dental caries among children in KSA to be approximately 80% for primary teeth, with an average decayed-missing-filled teeth (dmft) score of 5.0. For permanent teeth, the prevalence was approximately 70%, with a mean Decayed-Missing-Filled Teeth (DMFT) score of 3.5. However, this review overlooks the evaluation of the reviewed studies' quality. Moreover, it suggests that the varied prevalence of dental caries could be attributed to factors such as oral health knowledge and practices, dietary habits, socioeconomic variables, and disparities in fluoride levels in drinking water across different regions. For instance, areas like Hail, Makkah, and Qassim report high levels of fluoride in their drinking water, thereby further contributing to the prevention of dental caries.

The need for a national strategy for conducting routine dental caries surveys to understand the epidemiology and trends of dental caries more rigorously was highlighted by the authors. For example, the United Kingdom conducts regular epidemiological surveys, such as those undertaken by the Office of Health Improvements and Disparities, which can inform the development of dental public health policies (Public Health England, 2019).

Regarding oral hygiene and periodontal diseases, a cross-sectional study examined the prevalence of gingivitis and dental hygiene practices among a 15-to 18-years-old random sample of KSA schoolchildren. Of the sample, 21.0% had mild gingivitis, 42.3% had moderate gingivitis, and 1.8% had severe gingivitis. In addition, the group with severe gingivitis had a significantly higher mean dental plaque index than the group with a healthy periodontium (2.4 vs 0.79). Overall, 83.5% of the sample brushed their teeth once or twice daily, and 16.5% brushed more than twice daily. One of the study's limitations was that it may have underestimated disease prevalence owing to its half-mouth design. Moreover, the data concerning dental hygiene practices were self-reported, thus introducing the risk of social desirability bias (AlGhamdi et al., 2020).

Regarding traumatic dental injuries among schoolchildren, a study examined the prevalence of self-reported dental trauma to permanent anterior teeth in 258 students in the Eastern Province of KSA, with a mean age of 14 years. Dental trauma was reported by 39.5% of participants (Al-Ansari and Nazir, 2020), which is higher than the estimated global prevalence of 20-30% (Petti et al., 2018). These findings show that tooth fracture is the most frequent type of dental trauma, accounting for 22.7% of cases, with tooth displacement and tooth loss following at 8.7% and 8%, respectively. Dental injuries are usually caused by falls (9.3%) or accidental hits with objects (8.9%), and it was found that most occur at home (19.8%), with a smaller percentage occurring at school (5%) and playgrounds (4.2%) (Al-Ansari and Nazir, 2020).

In summary, the prevalence of dental caries among children in the KSA is considered to be high. The evidence concerning the oral health status of children with disabilities, the prevalence of oral diseases, challenges in daily dental care, and utilisation of dental services are analysed in the following section.

2.2.5 Oral health status of children with disabilities

Studies indicate that people with disabilities generally encounter more health inequalities and have limited access to quality healthcare services. Accordingly, this section presents the literature on oral health status among children with various disabilities, comprising the prevalence of dental caries, gingival and periodontal diseases, and traumatic dental injuries. Furthermore, it explores their challenges in daily dental care and the barriers faced when accessing and utilising dental healthcare services.

The literature on the oral health of children with disabilities includes several studies focusing on specific oral diseases, typically comparing the prevalence of these diseases in children with disabilities to the prevalence in children without disabilities. For example, people with learning disabilities are at higher risk of developing oral disease (Oliveira et al., 2013, Yesudian et al., 2012, Zhou et al., 2019). Several reasons for this higher risk have been suggested, including sugar-containing diets, difficulties maintaining daily oral hygiene, and challenges in receiving dental care. Moreover, different social determinants of oral health could determine these risk factors, including low socioeconomic status (Wilson et al., 2019).

In a systematic review by Zhou et al. (2019), the oral health of children with IDs was compared to that of the general population. The study found that children with IDs had poorer periodontal health, significantly lower levels of oral hygiene, severe gingival inflammation, more missing teeth, and fewer filled teeth. Nevertheless, it is essential to note that the sample size in the reviewed studies was small.

In another systematic review, Robertson et al. (2019) found that while there was no difference in the prevalence of dental caries in children with learning disabilities, the burden and consequences of dental caries were worse than for children without learning disabilities. This study comprised twenty-five cross-sectional studies comparing 3,976 children from eighteen countries. Of these children, 1,819 had learning disabilities, while 2,157 did not. The age range of the participants was one- to eighteen-years-old, and were primarily children with Down's syndrome, autism spectrum disorders, or various learning difficulties. The mean DMFT for children with learning disabilities was 2.31 (SD±1.97; range 0.22 to 4.27), and for those without was 2.51 (SD±2.14; range 0.37 to 4.76).

Moreover, after conducting a meta-analysis of 16 studies and using standardised mean difference (SMD), no statistically significant difference was found between groups regarding dental caries experience (SMD = -0.43; 95%CI = - 0.91 to 0.05). Notably, the review's strength is that it was conducted without language or time limitations, that the studies screening and data extraction were undertaken separately and in duplicate, and that the reviewed papers were evaluated and qualified. However, it is essential to acknowledge the heterogeneity of the data, which could be attributed to the variety of disabilities studied and particular differences in the indexes utilised.

Similarly, Yesudian et al. (2012) surveyed the oral health of 366 children aged 5 to 19 years old with mild to moderate learning disabilities attending five special schools in Sheffield. The

study found evidence of poor oral hygiene, gingivitis, dental plaque, and calculus among the children. A total of 58 children (15.8%) had dental caries, and approximately one-third of the participants (n=90, 30.7%) had calculus. This was particularly noticeable in the older age group (16+), with thirteen out of eighteen participants having calculus (72.2%). In addition, approximately one-third of the sample showed signs of gingivitis (n=91, 31%), and over half of the students had a visible dental plaque on their anterior teeth (n=155, 52.9%). The authors discussed how the prevalence of dental caries was lower than the national average for England in 2003 and attributed this to socioeconomic characteristics and the OHP programmes that run in special schools, which included regular dental assessments, daily supervised toothbrushing clubs, and topical fluoride application. This study was included as it focused on special schools to improve the OHP for children with disabilities and demonstrated a lower prevalence of dental caries that could be attributed to the implemented OHP programme.

Furthermore, a paired study in Brazil utilised sibling matching to control for social factors. With a sample comprising 103 participants between the ages of 12 and 15 years old with Down's Syndrome, cerebral palsy, or autism spectrum disorders, it was found that 63.1% of the sample group had fair oral hygiene, whereas 55.3% of the control group had good oral hygiene. The difference between the two groups was statistically significant, with a p-value of 0.001. Moreover, children with disabilities' experience of dental caries was found to be higher than that of their siblings. This difference was statistically significant, with a p-value of

0.026. Notably, individuals with disabilities had more decayed (3.52; p =.001), missing (1.17; p =.001), and filled (1.67; p =.012) teeth than their siblings (Oliveira et al., 2013).

Regarding traumatic dental injuries among children with disabilities, a systematic review was conducted to investigate whether children with disabilities experience a higher rate of traumatic dental injury. However, relationships between traumatic dental injuries and autistic spectrum disorder, epilepsy, or mental disability were observed - (OR 1.12 [0.70, 1.78], OR 1.28 [0.13, 12.27], and OR 1.04 [0.20, 5.35], respectively, while a positive correlation between traumatic dental injuries and hyperactivity disorder, cerebral palsy, and Down's Syndrome was observed (OR 2.67 [1.22, 5.87], OR 1.89 [1.06, 3.37], and OR 6.18 [2.24, 17.05] respectively). Overall, evidential certainty ranged from very low to low (Silveira et al., 2020).

In summary, this section has analysed the existing literature regarding the prevalence of oral diseases and conditions in children with disabilities, with the findings suggesting that children with disabilities tend to have worse outcomes from dental caries, suffer with poorer oral hygiene, poorer periodontal health, and have a higher risk of traumatic dental injuries. However, some results are contradictory, which may arise from differences in disability definitions, types, or degrees and different measuring methods. The following section will review the oral health status of children with disabilities in the KSA.

2.2.5.1 Oral health status of children with disabilities in the Kingdom of Saudi Arabia

A limited amount of literature exists concerning the oral health of children with disabilities in the KSA.

Asiri et al. (2022) in a systematic review assessed the oral health status, oral health-related behaviours, and dental health care utilisation among persons with disabilities in the KSA. Thirty-eight studies were included, comprising 35 cross-sectional studies, one longitudinal study, and two retrospective studies, and encompassed data from 4,441 individuals with disabilities in the KSA ranging from 3 to 60 years old, most of whom were children. The conditions included Down's syndrome, autism spectrum disorder, cerebral palsy, visual impairments, hearing and/or speech impairments, ID, and learning disabilities. The review indicates that most people with disabilities in KSA have a high prevalence of dental caries. In addition, children with IDs and cerebral palsy have a higher risk and prevalence of dental caries compared to children with physical disabilities. Furthermore, a higher prevalence of gingival and periodontal diseases was observed in children with autism spectrum disorders, hearing impairments, and visual impairments, with significantly higher rates of gingival inflammation and dental plaque accumulation. Also, individuals with Down's Syndrome exhibit a higher need for orthodontic treatment, ranging between 66% and 81.9%, due to Class III malocclusions. Moreover, children with visual and hearing impairments and cerebral palsy are at higher risk of traumatic dental trauma.

One of this study's limitations was the over-reliance on cross-sectional studies, which generally provide a lower level of evidence. Moreover, the studies included in the analysis received a low overall quality grade, suggesting potential issues with study design, data collection, and analysis. Despite these limitations, this review still provides valuable insights into the oral health of people with disabilities in the KSA. Nevertheless, future research must strengthen the evidence base and improve oral healthcare for disabled people in the KSA.

Another systematic review was conducted to summarise the evidence concerning oral health outcomes of children with cerebral palsy in the KSA. The review included seven cross-sectional studies with sample sizes ranging from 46 to 400 participants, all between the ages of 2 and 18 years old, yielding a total sample of 1359. The studies' quality assessment was undertaken using AXIS to evaluate the quality and potential biases in cross-sectional research studies, ultimately concluding that children with cerebral palsy in the KSA have a high prevalence of dental caries, ranging from 52.9% to 98.6%. Furthermore, between 34.6% and 66.2% of these children have poor oral hygiene, with dental trauma found in 47.5% of cases. However, most studies were undertaken in specialised populations in clinics or centres, which may have introduced selection bias and not represented the general population with cerebral palsy. Furthermore, several studies failed to account for socioeconomic status, dietary habits, and access to dental care, all potential confounders that may influence oral health. As such, this review indicates the need for more rigorously designed studies with clearly defined and standardised methodologies. Moreover, further comparative studies are essential to better understand the oral health status of individuals with cerebral palsy compared to those without (Asiri et al., 2023).

The oral health of children with disabilities in the KSA is a public health concern regarding its impact on people's health and daily lives. Children with disabilities in the KSA often face challenges in accessing oral health services, have poor oral health status, and encounter a lack of awareness regarding oral health, thus emphasising the apparent need to improve oral health care services and policies to address their needs better (Asiri et al., 2023, Asiri et al., 2022).

Among the reasons that children with disabilities are at a higher risk of oral diseases could be their limited ability to maintain optimal oral hygiene independently. Accordingly, the following section will elaborate on the challenges in daily dental care for children with disabilities.

2.2.5.2 Challenges in daily dental care for children with disabilities

This section covers the literature related to oral health behaviours of disabled children and the challenges they face during dental care, specifically toothbrushing.

Parents and carers are advised to actively participate in their children's oral health by limiting their children's exposure to sugary diets. It is recommended that parents begin brushing their children's teeth with a smear of fluoride toothpaste as soon as their teeth erupt, gradually increasing to a pea-sized amount when the child is three years old and supervising toothbrushing until the child is seven. Effective toothbrushing with fluoride toothpaste is a cornerstone of oral health (Office for Health Improvement and Disparities, 2021). For dental caries prevention, fluoride in toothpaste is the most critical aspect of toothbrushing, as it

helps prevent and arrest caries. Toothbrushing should occur at least twice daily, with the guidance being to clean teeth last thing before going to bed at night and at least one other time each day (Office for Health Improvement and Disparities, 2021). Children with disabilities, especially those who have limited manual dexterity and intellectual abilities, may need help with toothbrushing, with some potentially finding it beneficial to use a powered toothbrush, whilst others may require modifications such as a grip handle to assist with toothbrushing (Office for Health Improvement and Disparities, 2021). Furthermore, parents should schedule a dental visit for their child within their first year of life and continue with regular visits after this point (Office for Health Improvement and Disparities, 2021).

Children with IDs can struggle to brush their teeth properly and maintain adequate oral hygiene due to cognitive factors, thus having difficulty comprehending the importance of such activity. Furthermore, physical limitations, manual dexterity, and high sensitivity, were reported as challenges to daily dental care among children with disabilities (Chadwick et al., 2018).

In the KSA, the recent systematic review by Asiri et al. (2022), mentioned in the previous Section 2.2.5.1, explored oral health-related behaviours. It observed that the frequency of toothbrushing among children with disabilities was varied and low. For example, children with visual impairments had a statistically significant lower toothbrushing frequency than those without ($p = 0.043$). Also, 60% of children with autism spectrum disorders were unable to brush their teeth independently. In addition to their limited abilities to maintain optimum

daily dental care, the evidence suggests that children with disabilities had limited access to dental services, as it is reviewed in the following section.

2.2.5.3 Access to dental services by children with disabilities

As explained in Section 1.2.2, Article 25 of the UNCRPD reaffirms people with disabilities' right to receive the best possible standard of healthcare without discrimination (United Nations, 2006); unfortunately, many countries fail to provide adequate and high-quality services for such individuals (World Health Organization, 2022).

While access is an essential concept in health research and policy, it is poorly defined and widely perceived. For example, some researchers define access as using the health system, while others define it as the characteristics influencing its utilisation (Bhadauria et al., 2024). Consequently, access is offered to evaluate the fit between health services, customer attributes, and expectations (Penchansky and Thomas, 1981).Patients and the system must be compatible, and in this context, access encompasses five dimensions: Availability, accessibility, accommodation, affordability, and accessibility, all of which have been established as valid access measures and are interrelated. Moreover, patient satisfaction, healthcare utilisation, and physician practice patterns are all impacted by access variations (Penchansky and Thomas, 1981).

Furthermore, after the shift from institutional care to community-based support, family members or support staff to disabled individuals are usually responsible for providing care rather than qualified healthcare professionals. However, caregivers with lower levels of

education are less likely to prioritise preventative dental care. Additionally, carers' attitudes towards oral health for children with disabilities are often inadequate, thereby complicating the challenges faced by individuals with disabilities and their families during this transitional phase without adequate guidance (Beadle-Brown, 2022).

The literature on utilising dental services by disabled individuals highlights numerous barriers to accessing dental care, including physiological, structural, geographical, professional, political, and behavioural factors (da Rosa et al., 2020).Research has also highlighted challenges this group faces in finding a dentist willing to treat them owing to organisational barriers such as lack of accessible transportation, waiting spaces, and toilet facilities. It was also observed that information regarding oral health was not easily accessible to individuals with disabilities in appropriate formats (El-Yousfi et al., 2019).

In the KSA, a systematic review on oral health care attendance and barriers has shown that a large proportion of children with disabilities have never visited a dentist (28%-53%), and the majority of those who have visited only went for emergency treatment due to dental pain. The most reported barriers to visiting the dentist were the fear of the dentist (52.1%) and high costs (48.7%). Other factors include difficulty adjusting to the dental clinic environment for children (43.4%), parents being occupied with providing medical care to their children (30.1%), transportation issues (26.9%), inaccessibility of dental clinics (26.5%), distance (18.5%), and lack of skilful dentist (16.5%) (Asiri et al., 2022).

In the previous sections, it became evident that oral diseases significantly impact children with disabilities in the KSA. The challenges they face when maintaining proper oral hygiene and accessing dental health services - compounded by various social determinants of oral health - can exacerbate these impacts. Subsequently, the following section illustrates the literature on health promotion concepts and their application when addressing the high burden of oral diseases and oral health inequalities.

2.3 Health promotion in the context of public health

Regarding the broader context, the social determinants of oral health, and the CRFA, it is crucial to shift from a focus on clinical dentistry to community-based OHP and disease prevention through dental public health efforts. As discussed before, oral diseases are among the most common preventable diseases, and reducing their burden is a top priority for dental public health. This section will explore the fundamentals of public health, health education, and health promotion, their relationship to advocating for oral health, and the application of these approaches when tackling inequalities in oral health.

2.3.1 Public health

The history of public health dates to the 19th century, when it emerged as a response to rapid industrialisation. The primary focus of public health was on environmental and social issues. An excellent example of a public health approach is John Snow's successful efforts to control cholera, an infectious water-borne disease, in London in 1875 (Snow, 2000, Thomas, 1968).

During the early 20th century, public health moved its focus to biomedical issues, highlighting the behavioural and biological risk factors of diseases. Notable achievements in public health during the second half of the 20th century include vaccination and screening programmes. This scope hoped to enhance public health through community-based interventions, such as immunisations, fluoridation of drinking water, and policy regulations (Sperber, 2023). However, the limitations of modern medicine, comprising a treatment-oriented approach, resource maldistribution, and disparities in health access, became apparent in the 1970s and

1980s. Consequently, prominent academics have expressed concern with medical services, criticising their limited impact on improving population-wide health (Sperber, 2023).

Consequently, the new public health movement has emphasised a holistic approach that addresses the SDH, as reviewed in Section 2.1.1. This approach integrates broader factors such as social justice, equity, and community engagement into traditional health interventions, engendering a more comprehensive and inclusive well-being perspective. Furthermore, it coincides with the evolution of health promotion, which aims to take a more comprehensive approach to well-being (Tulchinsky and Varavikova, 2014, Wills, 2022). The following sections present two public health functions: health education and promotion.

2.3.2 Health education

It is essential to consider health education in the development and evolution of health promotion. Its origin can be traced back to the late 18th century in the UK, with the sharp increase in city population density following the migration of people due to the Industrial Revolution. Overcrowding, the poor state of housing, and poor sanitation led to life-threatening severe infections (Wills, 2022)

However, in the latter half of the 19th century, doctors disseminated widespread information regarding the link between communicable diseases and environmental factors such as housing and water supply. The Central Council of Health Education was founded in 1927 and initiated several curriculum projects between 1970 and 1980 (Koelen and Van den Ban, 2023).

During that time, there was a rise in interventions aimed at improving health by modifying individuals' behaviour through provision of information alone, which generated significant debate regarding whether health is the responsibility of the individual or a collective responsibility. However, it became increasingly clear that health education alone was insufficient to meet the population's health needs (Koelen and Van den Ban, 2023). Further, by focusing on lifestyle changes, one risks engaging in so-called 'victim blaming', with potentially widening health inequalities (Watt, 2007). Tone's health education model expanded the focus of health education from a singular emphasis on lifestyle and human behaviour to the promotion of social and environmental change (Tones, 1986). Accordingly, the following section reviews health promotion.

2.3.3 Health promotion

In recognition of the limited capacity of health education to achieve sustainable health improvements and reduce health inequalities, the WHO organised an international conference in Canada to develop a more radical public health approach. Following discussions held at the conference, the Ottawa Charter was published to provide the guiding principles for health promotion (World Health Organization, 1986).

Subsequently, the Ottawa Charter defined health promotion as: "*The process of enabling individuals and communities to increase control over the determinants of health and thereby improve their health. Health promotion represents a mediating strategy between people and their environment, combining personal choice and social responsibility for health to create a healthier future*" (World Health Organization, 1986)

World Health Organization (1986) produced the following five principles for health promotion:

- Promoting health through public policy: Focusing on the health implications of various sectors' policies.
- Creating supportive environments: Recognise the physical, social, and political environment's impact on health and implement health-promoting reforms.
- Developing personal skills: Beyond knowledge, empower individuals to take action to improve their health.

- Strengthening community action: Individuals, families, and communities are empowered to participate in health promotion.
- Reorienting health services: Reorienting the health services to focus on health promotion and disease prevention.

Health promotion involves a more comprehensive approach that includes education and other strategies to create healthy environments that support healthy living. As such, it is essential to clarify the differences between health promotion and health education, although related concepts differ in scope, objectives, and approaches.

The health promotion scope involves activities and strategies to improve overall health and well-being, including education, policy development, community engagement, and environmental changes that support healthy behaviours. It aims to promote and support positive health behaviours, create supportive environments, and address social determinants of health to empower individuals and communities. It takes a comprehensive approach, considering various health determinants such as lifestyle, social, economic, and environmental factors (Wills, 2022). One of the health promotion approaches is to create health-promoting settings that can promote a community's health and well-being where people live, study, and work (Wills, 2022). The following section will outline the setting-based approach to health promotion.

2.3.3.1 Setting-based approach to health promotion

The setting-based approach to health promotion has developed during the past 40 years and was encouraged by the Ottawa Charter for Health Promotion (World Health Organization, 1986). In particular, the Charter recognised the role settings played in the health of individuals: "*Health is created and lived by people within the settings of their everyday life, where they learn, work, play and love*" (World Health Organization, 1986).

The WHO defines 'settings for health' as: "*the place or social context in which people engage in daily activities in which environmental, organisational, and personal factors interact to affect health and well-being where people actively use and shape the environment and thus create or solve problems relating to health. Settings can normally be identified as physical boundaries, a range of people with defined roles, and an organisational structure.*" (Nutbeam and Kickbusch, 1998).

Different terms have been used interchangeably to describe this approach. These include the 'settings-based approach', 'settings for health', the 'settings approach', 'health-promoting settings', and 'healthy settings' (Nutbeam and Kickbusch, 1998). However, it has been suggested that the term 'health-promoting' be used rather than 'healthy setting' as the latter suggests a static environment that is always healthy (Kokko et al., 2014).

According to, Dhar et al. (2019) schools are recognised as potential settings for promoting health, in which students could be accessed during school years, from childhood to adolescence. Considering that children and adolescents spend more time at school than in any other setting aside from their primary home, schools can positively influence health-related behaviours during this stage of life. Schools are essential for secondary socialisation, involving individuals learning about and adopting societal norms, values, and behaviours beyond what they learn from their families. This influences people's behaviour and beliefs when interacting with a broader community. The following section elaborates on the definition of health-promoting schools' (HPS) framework and characteristics.

2.3.3.1.1 Health promoting schools

The HPS framework was developed under the WHO during the 1980s (Lee et al., 2020, Turunen et al., 2017, World Health Organization, 1996). Europe's WHO Regional Office took the initiative in defining HPS, being further developed by the European Network of HPS (Lee et al., 2020, World Health Organization, 1996).

A HPS is characterised by the following six key factors defined by the WHO (World Health Organization, 1996):

- Develops and enforces health and wellbeing policies in schools.
- Provides safe, secure, clean, sustainable, supportive and healthy learning environments.
- Fosters a social environment for promoting strong relationships between students, their faculties, parents, and the wider community.

- Establishes and maintains connections and collaborations with families, communities, schools, organisations, and other stakeholders to strengthen community links.
- Integrates action competencies for healthy living into formal and informal curricula to help students improve their knowledge and life skills.
- Facilitates access to healthcare services and health promotion programmes.

The WHO and UNESCO have launched an activity entitled: "*Making Every School a Health Promoting School*" by developing the eight Global Health Promoting Schools Standards. This activity, which will serve over two billion school-age children worldwide, underscores the global impact and importance of the HPS framework (Organization et al., 2021)

The whole-school approach to health is holistic and aims to improve health within a school setting, with evidence indicating that the HPS approach could positively impact children's physical health by reducing body mass index and promoting physical activity. Furthermore, it addresses the social aspects by decreasing smoking and bullying, with results indicating that HPS significantly impacts students' health behaviours and academic performance (Lee et al., 2020, Turunen et al., 2017).

Effective health promotion in schools involves modifying both the physical and social environments, comprising the development of action competencies, provision of health services, the establishment of community links, and the enactment of curriculum changes.

Furthermore, effective implementation means addressing the cultural context, community encouragement, parental involvement, comprehensive planning, and any associated resources. The success of HPS is influenced by several factors, including having a participatory school community that involves policymakers, students, and parents, including utilising diverse learning strategies and providing resources to support teachers (Lee et al., 2020, Turunen et al., 2017).

Health-promoting schools are consistent with the broader life-course approach (Celeste et al., 2020, Nicolau, 2001), "*the study of long-term effects on chronic disease risk of physical and social exposures during gestation, childhood, adolescence, young adulthood and later adult life*" (Nicolau et al., 2007).

In the KSA, a national study was undertaken to explore the implementation of HPS, incorporating a self-administered postal questionnaire that was sent to all supervisors of school health departments across all educational regions. Of the forty respondents, 95% had already implemented the HPS framework. The initiative had reached over 400 schools, two-thirds of these being primary schools. However, some regions revealed disparities in implementation without clear justification (AlZahrani, 2022).

The HPS programme primarily revolved around a traditional health education model which intends to modify behaviour through the provision of knowledge alone with less emphasis on comprehensive health promotion interventions. Notably, the integration of healthy school policies and the school social environment were rarely involved in the programme, with the survey revealing that most of the sample required financial assistance, teacher training, reduced educational responsibilities, enhanced involvement of local communities, and opportunities to share experiences. Moreover, the study emphasised that more explicit guidelines, strategic planning on a national level, and a guidance document or toolkit for explaining and evaluating HPS concepts are required (AlZahrani, 2022).

In a further study, AlZahrani (2023) explored the implementation of the HPS framework in the KSA over the past two decades. The review comprises various data collection methods, such as reviewing relevant literature, conducting surveys to examine the implementation of the HPS framework in different regions of the KSA, and gathering expert feedback. Furthermore, the review emphasises the discrepancy between the concepts of the HPS framework and their current implementation in the KSA mainstream schools, recommending the provision of financial resources, building capacity for school staff, and fostering collaboration between MoE and MoH to engender continuous monitoring and evaluation. However, few studies have assessed the HPS framework in the KSA, thus suggesting the urgency for more robust research and evaluation efforts. Accordingly, the integration of oral health within the HPS framework and its effectiveness is discussed in the following section.

2.3.3.1.2 Oral health promotion through health promoting schools

Based on the principles of the Ottawa Charter (World Health Organization, 1986), the WHO's Global Oral Health Programme (2009) outlined ten areas of priority action for improving oral health worldwide in the 21st century (Petersen and Kwan, 2009, Petersen, 2009). One of the priority action areas is improving children's oral health through schools (Jürgensen and Petersen, 2013, Petersen and Kwan, 2009, Petersen, 2009).

Meanwhile, Petersen et al. (2020) evaluated the implementation of the WHO's Global Oral Health Programme, with a survey conducted a decade later suggesting that the availability of primary oral healthcare and emergency services differs based on national income. High-income countries provide more effective preventive services than low-income countries, in which population-based initiatives such as water fluoridation and school oral health programmes are less prevalent. Moreover, there is a global disparity in oral healthcare services; for example, disadvantaged populations are underserved, and despite the preventable nature of most oral diseases, prevention and promotion efforts vary significantly based on a country's income level.

However, the WHO has highlighted schools' unique advantage in promoting oral health (Jürgensen and Petersen, 2013, Petersen and Kwan, 2009, Petersen et al., 2020). For example, an integrated approach that combines (upstream) school health policy, (mid-stream) health-promoting school environment, and (downstream) skills-based health education alongside preventive dental services could control oral diseases effectively by addressing the broader

SDH (Jürgensen and Petersen, 2013, Kwan et al., 2005, Petersen and Kwan, 2009, Petersen et al., 2020, Lee et al., 2020).

Furthermore, Kwan et al. (2005) highlighted that although some industrialised countries have comprehensive on-site oral health facilities in schools, many schools in developing countries still lack the resources to provide such services. Several strategies exist for promoting oral health in schools, such as developing a healthy eating policy, incorporating oral health into staff training programmes, and engaging parents and the local community in OHAs and decision-making processes.

Schools can be an ideal setting for promoting good oral health practices, and having safe and well-maintained playgrounds could also reduce the risk of traumatic dental injuries caused by accidents. In a dental emergency, for instance, thorough protocols and guidelines must be in place to ensure timely and appropriate interventions. Schools should be able to implement policies and practices that promote healthy eating habits among students, including limiting the consumption of sugary food and drinks (Jürgensen and Petersen, 2013, Kwan et al., 2005, Lee et al., 2020, Petersen and Kwan, 2009, Petersen et al., 2020).

The effectiveness of HPS in promoting oral health among children was investigated by Moyses et al. (2003), indicating that schools in deprived areas of Curitiba, Brazil, with an OHP curriculum, had more children without apparent dental caries ($\beta = 6.27$, $p = 0.02$) and fewer children with traumatic dental injuries ($\beta = -5.04$, $p = 0.02$).

Furthermore, the evidence regarding the implementation of OHP utilising the HPS framework for children with disabilities was insufficient. However, Cristina Gaio et al. (2010) conducted a study to evaluate the effectiveness of the HPS framework in promoting oral health among students with mental disabilities. The study comprised 383 children aged 2 to 19 from seven special schools. The oral health of the sample was better than that of similar groups in the general population. In addition, the prevalence of dental caries, gingivitis, traumatic dental injuries, and dental pain was 49.3%, 23.8%, 11%, and 17.8%, respectively, over three months.

The study also revealed that the mother's education level and the children's age were significant factors associated with these oral health outcomes. This underscores the crucial role of social determinants of health in oral health outcomes. The research concluded that although these special schools promote health, the students' sociodemographic background significantly influences oral health outcomes. The study supported the concept of HPS as a setting that promotes oral health through healthy environments and community engagement. Nonetheless, it also notes that SDH, such as social, economic, and educational factors, contribute to health inequalities, especially in children with mental disabilities, who are more susceptible to societal barriers. The study demonstrated that health promotion strategies should be expanded in special schools and prioritised addressing the wider SDH.

In the KSA, the MoE and MoH collaborate to implement a "National Initiative for the Prevention of Dental Cavities" comprising educational components, screening, and referrals

in primary mainstream schools. However, data on the implementation and evaluation are lacking (Ministry of Health, 2021). In addition, the MoE approves and controls some school-based OHAs organised by volunteering dentists, interns, dental students, and dental assistants as part of their community dental services.

While the actions for promoting oral health outlined in the Ottawa Charter by World Health Organization (1986) are implemented in a limited way in schools, there are some practical examples of its success. For instance, Childsmile, a large-scale OHP programme promoting children's oral health, implemented a collaborative approach involving multiple agencies, as overviewed in the following section.

Childsmile

It is a national OHP programme in Scotland that focuses on promoting adequate oral health practices early, providing dental care, and includes a range of OHAs to promote oral health in children, as presented in Figure 2.1 (Childsmile, 2016).

Figure 2-3 Components of Childsmile Oral Health Promotion Initiative, Scotland (Childsmile, 2016).

Childsmile takes a holistic approach to OHP by emphasising community engagement, involving parents, teachers, and local communities in promoting oral health. Furthermore, it supports families from the early years, extends its reach to schools, provides nationally supervised toothbrushing programmes, and provides fluoride varnish applications for higher-risk groups. Childsmile works closely with dental professionals, including dental nurses, to deliver services within schools and address oral health inequalities by providing additional support for vulnerable groups such as individuals living in the most deprived areas or children with disabilities (Childsmile, 2016).

Childsmile has demonstrated its effectiveness through positive outcomes, notably a reduction in the prevalence of dental caries among participating children. A recent study evaluated the reach and impact of Childsmile on children's oral health, focusing on the prevalence of dental caries in the first cohort. The findings revealed that supervised toothbrushing in nurseries and regular dental practice visits significantly reduced the risk of developing dental caries. Importantly, the study showed that nursery toothbrushing had the most significant impact on children from deprived backgrounds. The supervised toothbrushing programme, with an 89.1% participation rate, was particularly successful in reducing the prevalence of dental caries within twelve months for the most deprived group, from 52.4% to 45.7%. Adding further significance to the above, all participating children benefited significantly when they participated for more than thirty-six months. Overall, implementing supervised toothbrushing in Childsmile resulted in reduced oral health inequalities, with children who were at higher risk of dental caries and those with learning disabilities such as autism spectrum disorders benefitting the most (Kidd et al., 2020).

Regarding Childsmile's cost-effectiveness, it was noted that Childsmile's supervised toothbrushing programme in nurseries costs £1.7 million per year. Significantly, however, it reduced dental treatment costs progressively, with expected savings exceeding implementation costs within three years (Anopa et al., 2015, Wright et al., 2015). Consequently, the Childsmile supervised toothbrushing programme has reduced costs, improved dental health, and reduced oral health inequalities.

However, most schools' approaches to promoting oral health implement single-component interventions, such as OHE, healthy eating programmes, supervised tooth brushing clubs, and topical fluoride administration, which are vitally applied OHAs (Jürgensen and Petersen, 2013, Lee et al., 2020, Petersen et al., 2020).

This section reviewed the HPS as an opportunity to promote oral health; subsequently, the evidence suggests a positive impact of promoting oral health in schools for children, including children with disabilities. Furthermore, it presented a success story of Childsmile in Scotland since it cost-effectively addressed the oral health inequalities. The following section critically reviews the evidence for various school-based OHAs.

2.3.3.1.3 Evidence of school-based oral health activities

Although the Ottawa Charter highlights a comprehensive range of actions that promote oral health, they are only sometimes fully implemented. Nonetheless, schools provide a crucial platform for OHAs to improve oral health. Typically, several crucial activities are undertaken in schools, such as educating students regarding oral health (OHE), OHP, supervised toothbrushing, and topical fluoride applications (Jürgensen and Petersen, 2013, Kwan et al., 2005, Petersen and Kwan, 2009, Petersen and Ogawa, 2016, Petersen et al., 2020, Lee et al., 2020).

Oral health education

One of the most applied school-based OHAs is OHE; however, long-term evidence suggests that while OHE effectively reduces dental plaque and gingival bleeding in the short term, there are no long-term benefits (de Silva et al., 2016b, Kay and Locker, 1996, Watt, 2005, Watt and Marinho, 2005).

However, these findings raised some concerns, such as the broad inclusion criteria, lack of controls in some trials, relatively short follow-up period, and the different methods adopted to calculate dental plaque and gingival bleeding scores. Therefore, future research should include extended follow-up periods to determine if positive short-term changes are sustained (de Silva et al., 2016b, Kay and Locker, 1996, Watt, 2005, Watt and Marinho, 2005).

Specifically, Watt and Marinho (2005) summarised the evidence concerning the efficacy of community-based OHE interventions for dental plaque control and gingival bleeding.

Although OHE reduced dental plaque levels and gingival bleeding in the short term, there is insufficient data to determine if these improvements are sustained in the long term – defined as being beyond six months. Furthermore, short-term behavioural changes are unlikely to be sustained without a supportive social environment, with limited evidence regarding the costs of OHE interventions. However, potentially high costs are associated with those relying on professional input, thus highlighting the need to consider resource allocation in OHE intervention planning. Furthermore, recent systematic reviews support this, demonstrating that there is sparse evidence for the effectiveness of OHE beyond changes in attitudes and some short-term behaviour modification (Atif et al., 2023, Stein et al., 2018).

Atif et al. (2023) assessed the effectiveness of different OHE methods for schoolchildren and highlighted the role of schools as critical settings for OHE, with the potential to impact children's oral hygiene habits significantly. They observed that interactive educational methods, such as games and audiovisual aids, are more effective in improving oral hygiene practices than didactic teaching methods, such as lectures. Furthermore, OHE should be designed to be engaging and adaptable to various learning styles to improve its effectiveness.

Moreover, in a systematic review, Stein et al. (2018) evaluated the effectiveness of OHE activities in schools, specifically in improving oral hygiene and preventing dental caries in schoolchildren aged 5 to 18 years old. They demonstrated that traditional OHE activities reduce dental plaque but not gingivitis. There is insufficient evidence of their effectiveness in reducing dental caries, thus highlighting the lack of long-term evidence. Moreover, it

emphasises the need to strengthen public health programmes, review OHE methods, and actively engage school communities and families.

Although OHE is widespread, its impact may be limited if not combined with other activities and regularly reinforced (Bramantoro et al., 2021, Jürgensen and Petersen, 2013, Petersen et al., 2020). Given OHE activities' limitations in reducing the burden of dental caries and oral health inequalities, clear evidence emphasises the need to shift from OHE to OHP. Accordingly, the following section reviews the OHP activities.

Oral health promotion

Considering the complexity of factors related to oral health, research recommends that OHPAs which recognise the social, political, and environmental determinants of health and prioritise moving beyond traditional OHE and behaviour change models are needed (Bramantoro et al., 2021, de Silva et al., 2016b, Elsadek and Baker, 2023, Petersen et al., 2020, Stein et al., 2018).

Oral health promotion activities incorporate a wide range, with de Silva et al. (2016b) reviewing various community-based OHPAs to examine the effectiveness of different strategies such as dietary interventions, OHE, supervised toothbrushing with fluoridated toothpaste, fluoride varnish applications, and preventive oral care in schools. Consequently, the review recommends that multi-component interventions - including OHE, supervised toothbrushing, fluoride applications, dietary advice, and policy development - should all be

considered over single-component interventions as a holistic approach that addresses the broader determinants of oral health would better focus on prioritising improvements in disadvantaged groups.

Accordingly, programmes should be tailored to different communities' needs and contextually and culturally specific. Understanding the influence of context in the design, delivery, and outcomes of interventions is vital for their success and, thus, should be a central consideration when developing new programmes. Moreover, consideration of other factors that affect the efficacy of interventions, such as socioeconomic status, access to care, and cultural considerations, is emphasised clearly. Nonetheless, the reviewed studies present some risk of bias and methodological limitations, and subsequently, the evidence was graded as moderate to deficient in quality. Therefore, improved research methods are required to gather more robust and generalisable evidence to guide the implementation of effective community-based OHPAs.

Furthermore, a scoping review examined integrating OHP in primary schools in developing countries. The OHP strategies applied by teachers, peers, or parents primarily involved OHE and sometimes included toothbrushing and dietary advice. These studies were conducted mainly in Asia, finding that comprehensive, theory-based, multi-component OHP strategies improved oral health outcomes and oral health-related quality of life for schoolchildren. For instance, a whole-school approach involving parents, teachers, and children effectively improved oral health outcomes. However, the review lacked high methodological quality and contained a limited number of studies focusing on OHP in schools, clearly highlighting the

need for further research on feasibility and implementation. One area of concern here was that it only included English-language publications. This is a significant limitation, particularly considering the focus on developing countries, as many studies conducted in non-English languages that were not included in the review may have provided additional robust evidence (Elsadek and Baker, 2023). The following section will critically analyse the literature regarding supervised toothbrushing activities.

Supervised toothbrushing

A supervised toothbrushing activity involves "*Children brushing their teeth under the supervision of a staff member at a suitable time during the day in nurseries for children aged two to four and schoolchildren aged four to six*." (Gray-Burrows et al., 2023).

These activities have been implemented as part of national OHP programmes in Scotland (Childsmile) (Anopa et al., 2015, Macpherson et al., 2019a) , as described earlier in Section 2.3.3.1.2, and Wales (Designed to Smile) (Nic Iomhair et al., 2020).

For example, Kidd et al. (2020) observed that Childsmile-supervised toothbrushing has contributed to positive outcomes, including significantly reducing the odds of developing dental caries among participating children. Additionally, implementing supervised toothbrushing in Childsmile reduced oral health inequalities, as presented in Section 2.3.3.1.2. Furthermore, supervised tooth brushing with fluoridated toothpaste is recommended for reducing dental caries levels in children, particularly in areas with a high risk or low natural fluoride exposure. It is also noted as an effective approach to promoting oral hygiene practices that benefit children's periodontal health (Jürgensen (Jürgensen and

Petersen, 2013, Lee et al., 2020, Petersen et al., 2020). The following section reviews school-based topical fluoride application.

Topical fluoride applications

Evidence supports the effectiveness of topical fluoride application in various forms. However, these studies are frequently of low quality. Furthermore, fluoride varnish was found to reduce dental caries in permanent dentition by an average of 43% (95% CI 30% to 57%) in DMFS. Similarly, for primary dentition, it has been observed to decrease dmfs by 37% (95% CI 24% to 51%) (Marinho et al., 2013).

Frequently, school-based OHPAs offer a promising future for addressing the burden of oral diseases, primarily through comprehensive, multi-component approaches. In the following section, the evidence about various school-based OHAs targeting children with disabilities is presented.

2.3.3.1.4 Oral health activities for children and adolescents with disabilities

This section provides an overview of the various OHAs targeting individuals with disabilities; unfortunately, limited research has been conducted on this topic. One scoping review by Waldron et al. (2016) mapped the literature regarding various OHAs delivered to children and adolescents with different disabilities. The authors categorised these OHAs into therapeutic, pharmacological, educational, skill, and behavioural types to improve oral health outcomes, such as dental caries prevention, periodontal health, and oral hygiene habits. The results indicated that therapeutic OHAs were the most common form of intervention, with a wide range of therapies available. Skills-based interventions followed this, primarily focused on developing toothbrushing skills for children with disabilities and their carers. Nevertheless, the review did not determine the effectiveness of the different OHAs since it aimed to map the range and nature of the research in this area rather than draw definitive conclusions about intervention effectiveness. Therefore, further detailed analysis and a systematic review are required to establish the effectiveness of specific OHAs in improving the oral health of children and adolescents with disabilities. Subsequently, it was found that although there are high-quality systematic reviews of school-based OHAs for the general population, none have specifically evaluated the efficacy of such interventions for children with disabilities.

Furthermore, Wilson et al. (2019) conducted a scoping review on strategies to improve oral health outcomes for individuals with intellectual and developmental disabilities (IDDs), focusing on individuals with IDDs as a general population without breaking down the findings by specific age groups. The review identified interventions for improving oral health outcomes

for individuals with IDDs, including educating carers on the importance of oral health, maintaining it for people with IDDs, and implementing supervised toothbrushing strategies. Moreover, outreach programmes and exclusive oral health services were recognised as successful strategies for increasing access to dental healthcare services for people with IDDs. Nevertheless, the review indicates that more research is required to determine the best strategies, concluding that a one-size-fits-all approach to promoting oral health for this population is unlikely to be successful owing to the population's diverse needs. Indeed, it calls for an approach that involves partnership between health, social care, and families.

In addition, Lai et al. (2020) completed a systematic review to evaluate the impact of OHE and interventions on adolescents with IDDs, compared to no interventions, when aiming to improve gingival health, reduce dental caries, and enhance their oral health-related quality of life. The results demonstrated low-certainty evidence supporting long-term dental caries reduction through fluoride interventions, with some evidence indicating reductions in dental plaque and gingivitis through chlorhexidine and moderate certainty evidence for short-term reductions in dental plaque from using modified toothbrushes with ergonomic handles, softer bristles, or vibrating elements in reducing dental plaque in the short term (Popple et al., 2016). These studies demonstrated positive findings; however, the systematic review emphasises that most studies generated low-quality evidence, thereby stressing the need for individual adaptation of oral health practices for individuals with IDDs. One of the limitations was the limited accuracy of the estimated intervention effects owing to the small sample size in most trials and the fact that participants had different degrees of disability. Therefore, future studies should use more robust approaches, larger sample sizes, and a consistent

definition of participant characteristics to reduce bias. Utilising standardised outcome measures will optimise comparisons (Lai et al., 2022).

Similarly, a recent systematic review by AlJameel et al. (2023) examined 16 studies, comprising five randomised controlled trials and 11 pre-post single-group studies. The studies implemented various OHAs among individuals with IDs to evaluate their impact on oral health knowledge, attitudes, and behaviours, with interventions that primarily consisted of OHE and led to short-term positive changes in behaviours and attitudes. Moreover, caregivers' knowledge concerning oral healthcare for individuals with IDs improved significantly. Overall, the review indicated that for such OHAs to be effective, they must be applied consistently over a prolonged time with regular monitoring. However, the review still contains limitations, including variability in the effectiveness of interventions due to differences in the sample characteristics and methodologies, which could make reaching a consensus about the best practices more difficult. Furthermore, the studies were brief, with some relying on self-reported practices that could have biased the results because of inaccuracies in reporting information or social desirability bias.

This section has demonstrated that the evidence regarding school-based OHAs for children with disabilities has been scarcely explored. No systematic reviews have been published regarding school-based OHPAs in special schools. As such, further research is required to inform evidence-based dental public health and policy development, thus highlighting the

significance of evaluating these activities. Accordingly, the following section reviews OHP evaluation.

2.3.3.1.5 Oral health promotion evaluation

Research has emphasised the importance of evaluating OHP interventions to understand their impact and effectiveness. Indeed, numerous OHPAs are inadequately evaluated, making it challenging to assess their success. Therefore, improving OHP evaluation standards is essential for evidence-based practice, optimal resource utilisation, and informing policy. Furthermore, researchers and intervention providers should collaborate and prioritise improving evaluation quality; adequate resources and training are crucial to achieving this goal. Accordingly, understanding the differential impact of interventions on various population groups would guide the development of targeted strategies to reduce oral health inequalities more effectively (Watt et al., 2001). Furthermore, appropriate evaluation designs are necessary, focusing on outcome and process measures (Petersen and Kwan, 2004).

The evidence highlights a tendency towards measuring health knowledge and behavioural outcomes, which are generally of poorer quality than other measures. The evidence advocates for better-quality measures to facilitate more effective OHP and policy formulation, whereby it was demonstrated that existing measures - particularly those focusing on health knowledge and behaviours - were not of consistently high quality, potentially hindering OHP's practical evaluation and progress (Watt et al., 2006).

However, research indicates the complexity of evaluating community-based OHP and the need for tailored approaches to ensure their effectiveness and sustainability. Specifically, this challenges the adequacy of randomised controlled trials as the sole gold standard for community health programme evaluation, alongside highlighting the importance of process evaluation, quality-of-life, self-care, and empowerment indicators, thereby signalling the need to look beyond the traditional disease-based indicators (Petersen and Kwan, 2004).

Therefore, the evaluation of school-based OHAs should not be confined to activities and measuring knowledge and behaviour improvements. Instead, it should encompass the complex implementation processes and the diverse cultural, personal, environmental, and policy factors that may influence their effectiveness. To summarise, comprehending the context and contextual factors that impact OHAs' implementation is fundamental to their success. The following section evaluates the applicability of implementation science in evaluating the implementation of evidence-based interventions and the contextual factors impacting them.

2.4 Implementation science and contextual factors

It is evident that the proven effectiveness and success of evidence-based interventions, including OHAs, do not guarantee their adoption, implementation, and sustainability in real-world settings. Indeed, implementation science has evolved to explore, analyse, and guide the integration of evidence-based interventions in real-world settings by adopting specific theories, models, and frameworks (Bauer and Kirchner, 2020, Moullin et al., 2020, Nilsen and Birken, 2020).

As history has shown, there is a significant disparity between research and real-world practices (Bauer and Kirchner, 2020). Despite the evidence-based interventions and policies available, there remains a substantial gap in what is delivered and implemented in communities and health systems (Bauer and Kirchner, 2020). Proven effectiveness does not ensure widespread adoption of interventions. Studies show it takes 17-20 years for scientific interventions to be implemented, and less than 50% are ever put into practice (Bauer and Kirchner, 2020). Moreover, it was estimated that 80% of medical research funding does not benefit public health (Chalmers and Glasziou, 2009).

Implementation science is "*the scientific study of methods to promote the systematic uptake of research findings and other evidence-based practice into routine practice and, hence, to improve the quality and effectiveness of health services*." (Eccles and Mittman, 2006). It is an emergent field that focuses on identifying the factors influencing the successful adoption and implementation of evidence-based interventions in real-world settings (Bauer and Kirchner, 2020).

The goal of this field is to speed up the process of translating research findings into practical applications. The implementation research strategies include identifying contextual multi-level determinants of effective implementation, including barriers and facilitators, and formulating strategies to address these determinants (Bauer and Kirchner, 2020, Nilsen and Birken, 2020).

2.4.1 Implementation science theories

Implementation science aims to describe the process of implementing evidence-based interventions into practice through models, understanding the factors influencing the implementation outcomes through frameworks (Damschroder, 2020, Nilsen and Birken, 2020).

While the terms “theories,” “models,” and “frameworks” are often used interchangeably in implementation science, they have distinct differences. Theories in this field are typically explanatory and involve predicting outcomes and explaining causal mechanisms. The value of theory lies in streamlining the knowledge base by linking implementation findings more efficiently (Damschroder, 2020, Nilsen and Birken, 2020).

However, descriptive models are commonly used to describe and evaluate the implementation practice. While frameworks determine factors impacting the implementation outcomes (Damschroder, 2020, Nilsen and Birken, 2020). According to Nilsen (2015), there are five main categories of implementation theories, models, and frameworks, as described in Table 4.1 (Nilsen, 2015).

Table 2.1 Implementation science theories, models, and frameworks description and examples, adapted from (Nilsen, 2015)

Category	Description	Examples
Process theories	They focus on understanding how interventions or innovations are implemented and achieving intended outcomes, which is crucial. Process theories focus on dynamic and context-dependent aspects of implementation.	Diffusion of innovations theory, which explores how new ideas or practices spread through a social system

Determinants frameworks	They refer to a structured approach for categorising and comprehending the factors that impact the success or failure of implementing a specific intervention. These frameworks help researchers identify crucial factors impacting the adoption, implementation, and sustainability of evidence-based interventions.	The consolidated framework for implementation research (CFIR)
Classic theories	Theories from external fields, such as psychology and sociology, are used in implementation science to enhance the adoption of evidence-based interventions.	Social cognitive theory is applied to understand how individuals learn from observing others and how social factors impact implementation.
Implementation theories	Explore the implementation	Normalisation process theory aims to understand how new practices are integrated and embedded over time into regular work.
Evaluation frameworks	It identifies the specific aspects that need to be evaluated to ensure the success of the implementation.	RE-AIM emphasises Reach, Effectiveness, Adoption, Implementation, and Maintenance of interventions.

This study explored the determinants of OHAs implementation in special schools in the KSA, using the CFIR as a framework. The CFIR was a suitable framework to address one of the study's objectives: identify the factors that hinder or facilitate implementing OHAs in KSA special schools. Using the CFIR as an implementation science determinant framework specifically met the study's objective.

2.4.1.1 Implementation science determinant frameworks

Implementation frameworks are valuable. These frameworks can serve as a foundation for building generalisable implementation knowledge (Nilsen, 2015). Using them in research can

guide the design and conduct of studies, inform research teams' theoretical and empirical thinking, and aid the interpretation of findings. In addition, they help organise, explain, and describe information and relationships between concepts, including delineating processes and are therefore helpful for communicating information (Damschroder, 2020, Moullin et al., 2020, Nilsen and Birken, 2020).

Determinant frameworks recognise that implementation is complex and influenced by multilevel contextual factors (Damschroder, 2020, Nilsen and Birken, 2020). Context plays a crucial role in all determinant frameworks. Context generally refers to the circumstances, facts, or events surrounding a particular situation or occurrence (Nilsen and Birken, 2020). . It is "*an important but poorly understood mediator of change and innovation in healthcare organisations.*" (Dopson and Fitzgerald, 2005).

2.4.1.1.1 Consolidated framework for implementation research (CFIR)

One of the most used frameworks in implementation science is the CFIR. Laura Damschroder and her colleagues developed it in 2009, and it was updated to CFIR.02 in October 2022 based on the user's feedback (Damschroder et al., 2009, Damschroder et al., 2022). The CFIR facilitates the design, evaluation, and implementation of evidence-based interventions (Damschroder et al., 2009, Kirk et al., 2016, Moullin et al., 2020). It provides a pragmatic framework for identifying potential influences on implementation.

As such, the CFIR provides a road map for enabling a comprehensive understanding of the complexity of implementation and a method for ensuring effective implementation through a more predictable process (Kirk et al., 2016). The CFIR allows the identification of the barriers and facilitators influencing implementation and assisting in understanding "*what works where and why*" across multiple contexts (Kirk et al., 2016).

The CFIR consists of five domains that have been shown to shape the implementation of interventions; these domains are intervention characteristics, the outer setting, the inner setting, the characteristics of individuals, and the process of implementation (Damschroder et al., 2009, Kirk et al., 2016). Each domain consists of various constructs, which help provide further details. The CFIR does not define any particular relationships between the various constructs it includes (Kirk et al., 2016).

A systematic review by Means et al. (2020) found that the CFIR can be applied at multiple stages of implementation. Before implementation begins, the CFIR can be used to prospectively investigate implementation barriers or facilitators. This will inform programme design and generate testable hypotheses on specific constructs.

To thoroughly explore the barriers and facilitators affecting the implementation of OHAs in KSA special schools, this study used the CFIR throughout the qualitative study to develop the interview guides, data collection and analysis (Damschroder et al., 2009).This is a novel

approach because it is one of the first studies to explore school-based OHAs for children with disabilities using CFIR.

Understanding the contextual factors that impact the implementation of OHAs in KSA special schools from the perspective of school staff and parents/carers of attending children is crucial. These findings are required to provide insight into multilevel factors that might facilitate or impede OHAs implementation and provide recommendations for developing an OHP implementation toolkit for KSA special schools. The following section describes the CFIR domains and constructs considering this study.

2.4.1.1.2 Consolidated framework for implementation research domains and constructs

This section defines the five CFIR domains and underlying constructs in light of this study. Moreover, Appendix 4.1 contains the definitions of CFIR constructs from the CFIR website: https://cfirguide.org/ (The consolidated framework for implementation research, 2009).

Intervention characteristics domain

According to the CFIR, the intervention characteristics domain examines the attributes of the intervention itself, including its source, adaptability, complexity, and quality (Damschroder et al., 2009, Damschroder et al., 2022). This domain explored the characteristics of school-based OHAs in this study. Table 4.2 below describes the constructs under this domain concerning the implementation of OHAs in KSA special schools.

Table 2.2 Description of the Consolidated Framework for Implementation Research Intervention Characteristics Domain constructs considering the school-based oral health activities implementation in KSA special schools (Damschroder et al., 2009).

Constructs	Description
Intervention source	The origin and development of school-based OHAs, including whether they were adapted from existing programmes, sourced from external experts, or developed by the school.
Adaptability	The extent to which the OHAs were adjusted or modified to fit the needs of KSA special schools and attending children and suggestions to enhance their adaptability.
Complexity	The perceived difficulty of implementing OHAs in KSA special schools and explored how its complexity affected implementation outcomes.
Design and quality	Factors include the clarity and specificity of OHAs components, the quality, and the presentation of the OHAs materials.

Characteristics of individuals' domain

This domain focused on the characteristics of individuals involved in implementation, including their knowledge, attitudes, beliefs, skills, and influence on implementation outcomes (Damschroder et al., 2022, Damschroder et al., 2009). In this study, this domain evaluated the knowledge, beliefs, attitudes, and self-efficacy of the KSA special schools' staff members and the parents/carers of children attending these schools regarding implementing school-based OHAs. Table 4.3 illustrates the constructs within this domain concerning OHAs implementation in KSA special schools.

Table 2.3 Description of the Consolidated Framework for Implementation Research the Characteristics of Individuals' Domain constructs considering the school-based oral health activities implementation in KSA special schools (Damschroder et al., 2009).

Constructs	Description
Knowledge and beliefs about the intervention	The characteristics of the KSA special schools' staff members and the attending children's parents/carers, including their knowledge, beliefs, and attitudes regarding the school-based OHAs.
Self-efficacy	Individual's beliefs in their capability to implement school-based OHAs successfully.

Inner setting domain

The CFIR inner setting domain assesses the characteristics of the setting where the intervention is implemented (Damschroder et al., 2022, Damschroder et al., 2009). In this study, KSA special schools were the inner settings, and their influence on implementing school-based OHAs was explored. Table 4.4 illustrates the constructs within this domain concerning the implementation of OHAs in KSA special schools.

Table 2.4 Description of the Consolidated Framework for Implementation Research the Inner setting Domain constructs considering the school-based oral health activities implementation in KSA special schools (Damschroder et al., 2009).

Constructs	Description
Culture	The impact of school culture on OHAs implementation, including shared values, norms, and practices.
Compatibility	The degree of fit and alignment of school-based OHAs with KSA special schools' values and practices.
Relative priority	Individuals' shared perception of the priority and importance of school-based OHAs at KSA special schools compared to other school activities.
Available resources	The availability and allocation of resources required for implementing OHAs in KSA special schools include finances, personnel, infrastructure, technology, time, and more.
Structural characteristics	The school-level features that influenced the implementation process and outcomes. It focused on the physical and educational aspects of the KSA special schools.
Leadership engagement	The active involvement, support, and commitment of leaders within the KSA special schools during the OHAs implementation. It emphasised the role of leaders in guiding and championing the implementation efforts.
Organisational incentives and rewards	The methods applied by the KSA special schools to encourage and reward individuals for their involvement in the OHAs implementation.
Networks and communications	The interactions and relationships among individuals and stakeholders involved in the implementation process. It emphasised the importance of effective communication, collaboration, and information exchange.

Outer setting domain

The focus of this domain was on the external environment that existed outside the inner setting, particularly concerning the KSA special schools. The aim was to explore the influence of external policies, MoE, and MoH on the implementation of OHAs. Table 4.5 describes the constructs within this domain concerning OHAs implementation in KSA special schools.

Table 2.5 Description of the Consolidated Framework for Implementation Research the Outer setting Domain constructs considering the school-based oral health activities implementation in KSA special schools (Damschroder et al., 2009).

Constructs	Description
Peer pressure	Perceived competitive pressure to implement school-based OHAs, typically because most KSA special schools have already implemented such activities.
External Policy and incentives	A broad construct that includes external policies or regulations to spread school-based OHAs implementation in KSA special schools.

Implementation process domain

This domain examined the implementation process (Damschroder et al., 2022, Damschroder et al., 2009), including the planning, evaluation, and stakeholders' engagement in the OHAs in KSA special school's implementation efforts. Table 4.6 describes the constructs within this domain concerning the implementation of OHAs in KSA special schools.

Table 2.6 Description of the Consolidated Framework for Implementation Research the Implementation Process Domain constructs considering the implementation of school-based oral health activities in KSA special schools (Damschroder et al., 2009).

Constructs	Description
Planning	The degree to which the methods and tasks for implementing the school-based OHAs were developed in advance and the involvement of the children's families.
Engagement	The degree to which the key stakeholders, including children and leaders, were engaged during the school-based OHAs implementation.
Reflecting and evaluating	Feedback or evaluation about the progress and quality of the school-based OHAs implementation process and outcomes.

This section described the implementation science, determinants frameworks, CFIR, and the five CFIR domains and their underlying constructs considering the implementation of OHAs in KSA special schools. The following section will review the literature on using CFIR, an implementation science determinant framework, to identify barriers and facilitators to school-based activities.

Determinants frameworks from implementation science, such as CFIR, have been adopted to evaluate school-based activities and the contextual factors that influence their implementation process (Damschroder et al., 2022, Damschroder et al., 2009). For example, a qualitative study explored the challenges and enabling factors in applying the European Union (EU) School Fruit and Vegetables Scheme, employing the CFIR for data collection and analysis. This scheme is a policy initiative aiming to deliver fruits and vegetables to schools, in addition to educational and informational activities, to promote better nutrition among children. The study comprised 23 semi-structured interviews with agriculture, health, and education officials from ten EU member states. It highlights the significance of receiving support with macro resources, alignment with school priorities, stakeholder collaboration, parental involvement, and the ability to foster positive perceptions among children. Moreover, the study findings indicate facilitators, such as flexibility in implementation and inter-ministerial cooperation, and barriers, such as budget allocation and goal ambiguity. The study's limitations could arise from its qualitative nature, which limited the findings' generalisation to all contexts and missed insights from other stakeholders such as teachers, parents, and children (Meshkovska et al., 2023a).

Moreover, a systematic review of 36 studies used the CFIR to determine the barriers and facilitators to implementing food policies in low and middle-income countries. The review observed that schools in these countries face barriers when implementing food policies primarily due to a lack of resources. Furthermore, schools frequently encounter structural issues that impede policy implementation, such as limited storage with cooling systems and

unfavourable school locations. Indeed, there are challenges surrounding the lack of external policies and incentives to promote healthy eating in schools.

Despite these challenges, however, factors that facilitated the implementation included the acknowledgement of the needs of children and families, the support and belief in the positive effects of the food policies by teachers, principals, students, and their parents, and essential collaboration between different stakeholders, such as community leaders and the public sector. One of the study's strengths was its utility of a comprehensive theoretical framework (CFIR), a systematic review process, and including a diverse range of studies to ensure a broader understanding of the topic. However, a potential limitation is variability in the included studies' quality (Meshkovska et al., 2023b).

In summary, this section highlighted the contribution of implementation research in exploring the context, barriers, and facilitators of implementing school-based activities. Common barriers were inadequate resources, inadequate leadership engagement, and a lack of incentives. Nevertheless, the facilitators were evident, such as activity compatibility with school priorities, stakeholder collaboration, parental involvement, flexibility in implementation, and inter-ministerial cooperation. Accordingly, the following section will analyse the application of implementation science to identify determinants of school-based OHAs.

This section reviews the implementation science evidence regarding the contextual factors that impede or enhance the implementation of school-based OHAs. For example, Chandio et al. (2022) systematically reviewed the literature via CFIR to identify the barriers and facilitators in implementing and sustaining schoolchildren's toothbrushing programmes, with this review comprising six studies implementing supervised toothbrushing programmes in early childhood settings and primary schools. The review demonstrates that the supervised toothbrushing programme's inflexibility regarding content and timing was a vital barrier. In addition, parents' limited understanding of the role of teachers in supervising toothbrushing, their difficulties in engaging with the programmes, and their lack of knowledge about oral health harmed its successful implementation. Therefore, the findings suggest that teachers who expected to face more difficulties with the implementation were less likely to sustain the programmes. Notably, several challenges at the school level hindered its effective implementation, including unclear leadership roles, work overload, inadequate information communication between staff, absence of tracking and evaluation systems, and financial resources limitations. Conversely, providing essentials such as toothpaste and toothbrushes and involving community volunteers in these programmes are possible facilitators, with the review also demonstrating the vitality of family involvement - particularly the connection between activities at school and home - when aiming to enhance sustainability. Furthermore, children's acceptance and active participation are crucial for the programme's success. However, relevant studies may have been missed since the review only included articles published in English. Furthermore, the studies' quality varied from moderate to low, thus potentially affecting the reliability and validity of the results. Moreover, the studies included encompassed a diverse range of settings and population groups, thereby contributing to

variability in the findings and possibly limiting the generalisability of the results. Together, these limitations suggest that the review provides valuable insights; however, any conclusions should be interpreted within the findings' constraints.

Similarly, a qualitative study utilised focus groups and interviews with a sample of 65 stakeholders to explore the facilitators and barriers encountered during the implementation of a pilot school-based supervised toothbrushing programme in Taiwan, taken from the perspectives of primary school students, teachers, staff, and nurses involved in the programme. The formation of toothbrushing habits was crucial for the programme's integration into the school schedule, which could be improved by providing fluoride toothpaste and toothbrushes at school, allowing teachers to choose the toothbrushing time, and providing peer support. The study emphasises that with staff support and child engagement, this type of programme can significantly assist in developing consistent oral hygiene practices among children. However, a lack of teacher training for conducting OHE and toothbrushing activities, limited engagement from school administrations, staff turnover, and an insufficiently coordinated team approach may compromise the programme's sustainability. Notably, the study findings are limited by the qualitative study's nature; for instance, the lack of generalisability, reliance on self-reported data, and the potential influence of researchers' biases in data interpretation (Wang et al., 2022). Furthermore, Gray-Burrows et al. (2023) examined the provision of supervised toothbrushing in England, ultimately observing the factors contributing to or hindering their implementation using CFIR. They found that approximately half of the local authorities in England have implemented supervised toothbrushing, in which several barriers to its implementation were identified.

These included challenges with funding, communication, prioritisation of oral health, logistical difficulties, and capacity constraints. Conversely, the positive facilitators included the integrated public health approach, collaborative support, clear guidelines, flexible delivery approaches, adequate resources, and staff empowerment.

In conclusion, literature on using CFIR to identify the factors influencing the implementation of different school-based OHAs is scarce. So far, only studies on supervised toothbrushing have been conducted in this area. This lack of research highlights a significant gap in the knowledge and emphasises the need for more studies in this field. Furthermore, supervised toothbrushing activities at schools face several barriers, including inflexibility in content and timing, poorly defined leadership roles, work overload, staff turnover, a lack of a coordinated team approach, financial resource limitations, inadequate communication among staff, and lack of evaluation.

To enhance the implementation process, evidence recommends that schools use evidence-based toolkits to guide the implementation of evidence-based interventions in real settings. Research emphasises that evidence-based toolkits can assist with implementing guidelines, informing policies, and training practitioners (Yamada et al., 2015). Significantly, the evidence demonstrates that nurseries and schools should utilise toolkits to ensure the provision of high-quality supervised toothbrushing programmes (Public Health Scotland, 2023). For example, the Childsmile Toothbrushing Standards are recognised as best practice guidance for delivering such programmes (Public Health Scotland, 2023). However, it is worth noting

that there is no research into OHAs implementation barriers and facilitators in special schools for children with disabilities, and toolkits that can inform and guide the effective implementation of OHAs in special schools are currently lacking.

2.5 Summary of the literature

This chapter presented the literature on health, oral health, the burden of oral diseases, SDH, health promotion, and health-promoting schools. Furthermore, it explored the various types of school-based OHAs and the application of implementation science in comprehending factors facilitating or hindering school-based activities, including OHAs.

Most research on promoting oral health for children with disabilities in special schools has focused on measuring improvements in knowledge and oral hygiene levels. However, there is limited research on the contextual factors affecting the implementation of school-based OHAs in special schools. Research on the implementation process and barriers and facilitators of these activities in mainstream schools has recently intensified. However, almost all this research has been conducted on supervised toothbrushing activities.

Although studies showing the significance of OHP for children with disabilities have surfaced, no studies have explored the implementation of school-based OHAs and contextual factors in the KSA's special schools. This thesis addresses these limitations of current research. The qualitative study undertaken for this thesis on barriers and facilitators to OHAs

implementation in the KSA's special schools provides insights into methods to promote oral health for children with disabilities. Moreover, recommendations of concepts to develop an OHP implementation toolkit have been highlighted.

2.5.1 Aim and objectives

This study aimed to explore current provision of school-based OHAs in special schools in the KSA and to identify the barriers and facilitators to their implementation.

Objectives:

This study's objectives were to;

1. Summarise the literature about OHAs in special schools and identify research gaps
2. Determine what OHAs are currently being conducted in the KSA special schools
3. Based on the CFIR, identify factors that influence the implementation of OHAs in the KSA special schools, including the barriers and facilitators
4. Recommend key concepts on which to base an OHP implementation toolkit to improve the OHAs in special schools in the KSA

The following chapter presents the first study conducted to address this thesis's aims and objectives.

Chapter 3. Study one: school-based oral health activities in special schools – A scoping review

This chapter presents the first study of this PhD research, a scoping review of OHAs in special schools for children with disabilities. It overviews the study's background, aims and objectives, methodology and methods, results, discussion, and conclusion.

3.1 Background

Based on the literature review, OHP aims to achieve long-term improvement in oral health by targeting the underlying determinants of oral health (Watt and Marinho, 2005, Watt, 2007, Watt, 2005). To ensure the sustainability of oral health promotion activities, strategies for promoting oral health must be integrated into broader school and community initiatives (Bramantoro et al., 2021, de Silva et al., 2016b, Eaton et al., 2023, Watt, 2005, Watt and Marinho, 2005).

Although the relevance and significance of OHP for children and adolescents with disabilities is well-established, few studies have explored this area (AlJameel et al., 2023, Lai et al., 2020, Waldron et al., 2016, Wilson et al., 2019). To illustrate, while several systematic reviews of OHP have been published over the past thirty years, none have focused on special schools (Waldron et al., 2016). This should be considered considering the evidence demonstrating the positive impact of school-based OHAs on children's oral health among mainstream schools (Atif et al., 2023, Bramantoro et al., 2021, de Silva et al., 2016a, Stein et al., 2018, Watt, 2005, Watt et al., 2006).

Research suggests that schools are valuable and effective settings for promoting oral health. School-based OHAs may include OHPAs such as school policies, fluoride-based activities (such as topical fluoride application, and supervised toothbrushing clubs) in addition to more OHE-type activities (Eaton et al., 2023, Elsadek and Baker, 2023, Lee et al., 2020, Petersen et al., 2020, Turunen et al., 2017). However, there is still scant evidence on the effectiveness of school-based OHAs in children with disabilities (Wilson et al., 2019).

In addition, Wilson et al. (2019) reported that a limited number of approaches and strategies have been developed to promote optimal dental hygiene for people with disabilities. The findings highlight that caregivers play a crucial role in delivering oral health support, emphasising the importance of caregivers' involvement. However, high-quality evidence is required to validate these conclusions. Therefore, it is necessary to conduct a scoping review to inform future developments in OHAs in special schools and to determine what research gaps exist. This scoping review was designed to map the existing studies about school-based OHAs in special schools, using Levac et al. (2010) framework.

3.1.1 Aims and objectives

This scoping review aimed to comprehensively describe school-based OHAs in special schools, identify research gaps, and inform the second study of this PhD research.

The specific objectives were:

1. To map the relevant studies in the field of OHAs in special schools.
2. To explore the types of OHAs applied in special schools.
3. To summarise the research findings on outcomes of these school-based OHAs.
4. To summarise factors influencing the implementation of the applied activities.
5. To identify gaps in the current research.
6. To provide recommendations for future research in this field.

3.2 Methodology and methods

This section described the scoping review's concept, indications, limitations, and compared it to the systematic review. It also detailed the scoping review process using the framework developed by Levac et al. (2010).

3.2.1 Concept of scoping review

A scoping review is a method of evidence synthesis that aims to map the key concepts in a particular field systematically and comprehensively (Arksey and O'Malley, 2005, Colquhoun et al., 2014, Munn et al., 2022). Evidence synthesis is crucial to ensure evidence-based decision-making and knowledge translation (Munn et al., 2022, Gough et al., 2020). It is "*the review of what is known from existing research using systematic and explicit methods to clarify the evidence base*." (Gough et al., 2020)(p.2)

In the early 2000s, scoping reviews gained prominence. The scoping review has since become widely used across various disciplines, contributing to advancing knowledge synthesis

methods in research (Munn et al., 2022). The Joanna Briggs Institute (JBI) Scoping Reviews Methodology Group provided the most recent definition of scoping review in 2020.

"*Scoping reviews are a type of evidence synthesis that aims to systematically identify and map the breadth of evidence available on a particular topic, field, concept, or issue, often irrespective of source (i.e., primary research, reviews, non-empirical evidence) within or across particular contexts. Scoping reviews can clarify key concepts/definitions in the literature and identify key characteristics or factors related to a concept, including those related to methodological research*." (Peters et al., 2022).

Regarding the scoping review indications, Munn et al. (2022) argue that a scoping review offers a valuable method to identify, map, and summarise the fundamental concepts present in the literature. Scoping reviews are often conducted to identify gaps in the literature so that future research can be guided. Therefore, researchers may prefer a scoping review rather than a systematic review if they aim to identify knowledge gaps, map literature, clarify concepts, and decide whether to conduct a systematic review.

Furthermore, there are several differences between a scoping review and a systematic review with a meta-analysis. Scoping reviews are more flexible regarding the research question and the included studies methodologies (Gough et al., 2012, Peterson et al., 2017).

Researchers commence a systematic review by defining a focused question and examining high-level research studies focusing on narrow parameters, known as PICO (Population, Intervention, Comparison, and Outcome) (Moher et al., 2015). Conversely, a scoping review has a broad conceptual range but less depth, using the PCC (Population, Concept, and Context) question outline to frame the review (Arksey and O'Malley, 2005). Additionally, a scoping review can capture a broader range of relevant literature and studies that employ different methodologies (Arksey and O'Malley, 2005, Levac et al., 2010, Munn et al., 2018, Pham et al., 2014). Therefore, it is ideal for exploring new subjects or rapidly evolving sciences to guide further studies (Munn et al., 2022, Peterson et al., 2017). A scoping review usually produces a descriptive report with limited statistical data describing what information is available and where there are gaps in knowledge (Munn et al., 2022). However, as with any developing methodology, the scoping review has been criticised for different reasons. A standard critique of scoping reviews is the inattention to study quality in the selection and reporting process because scoping reviews do not require evaluating the methodological quality of included studies, unlike systematic reviews (Daudt et al., 2013, Levac et al., 2010, Peterson et al., 2017).

Levac et al. (2010) questioned whether it is possible to achieve the objectives of a scoping review without evaluating the quality of evidence. In addition, concerns have been raised about the usefulness of scoping reviews for policymaking if the studies' quality is not evaluated (Daudt et al., 2013, Peterson et al., 2017). Although Arksey and O'Malley (2005) proposed that scoping reviews could be completed quickly , this assertion has been disputed. Conducting comprehensive and thorough scoping reviews requires significant time (Daudt et

al., 2013). Scoping reviews take, on average, around 20 months to complete (Pham et al., 2014).

The previous section overviewed the concept of the scoping review, its indications, how it differs from systematic reviews, and limitations. The chosen methodology is suitable for exploring school-based OHAs in special schools as the literature in this field is vast and complex. Moreover, it well fits the researcher's aim to conduct a literature review to identify research gaps and create a well-informed starting point for the second study of the PhD research. The scoping review process employed in this review will be elaborated in the following section.

3.2.2 Scoping review frameworks

Arksey and O'Malley (2005) proposed a six-stage framework for conducting scoping reviews, that was further refined by Levac et al. (2010) by providing specific recommendations to clarify or introduce additional processes in each step of the framework. The current study employed the framework developed by Levac et al. (2010). This section provided a detailed explanation of the framework (Appendix 3.1)

Levac et al. (2010) methodological framework comprises the following five stages:

3.2.2.1 Stage 1: Formulating research question

The research questions for this study were:

1. What is known from the literature about school-based OHAs in special schools?

2. What school-based OHAs are applied in special schools?

3. What is the impact of school-based OHAs on children with disabilities?

4. What factors facilitate or hinder these activities?

The scope of inquiry included school-based OHAs in special schools and the target population was children with disabilities attending special schools.

3.2.2.2 Stage 2: Locating relevant studies

The literature was searched using electronic databases covering the period 1986-2021. The researcher (AA) defined the search terms (see Appendix 3.2 for a table of the search terms according to population, concept, and context). The following databases were searched: Web of Science, SCOPUS, Psych INFO, Cochrane, and Medline. Terms were searched for in the title, abstract, and topic headings whenever applicable. The researcher also manually searched the reference lists and traced the citations, looking for additional related studies. The key search terms utilised to search the Medline database are presented in Table 3.1.

Table 3.1 Key search terms

1. "Learning disabilit*".ab,ti.
2. "learning difficult*".ab,ti.
3. exp Disabled Persons/
4. "mental disabilit*".ab,ti.
5. mental retardation.ab,ti.
6. mentally retarded.ab,ti.
7. cognitive impairment.ab,ti.
8. "cognitive disabilit*".ab,ti.
9. reduced cognitive functionality.ab,ti.
10. "developmental disabilit*".ab,ti.
11. "developmental difficult*".ab,ti.
12. developmental disorder*.ab,ti.
13. "intellectual disabilit*".ab,ti.
14. mentally handicapped.ab,ti.
15. special needs.ab,ti.
16. blind.ab,ti.
17. deaf.ab,ti.
18. down syndrome.ab,ti.
19. cerebral palsy.ab,ti.
20. autism.ab,ti.
21. ADHD.ab,ti.
22. handicapped.ab,ti.
23. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22
24. (fluorosis and dent*).ab,ti.
25. "periodont*".ab,ti.
26. Dental Caries/
27. oral health care.ab,ti.
28. special health care need.ab,ti.
29. oral hygiene.ab,ti.
30. oral treatment.ab,ti.
31. dental care.ab,ti.
32. dental treatment.ab,ti.
33. dental health.ab,ti.
34. special care dentistry.ab,ti.
35. oral health promotion
36. dental health education
37. school-based oral health activities
38. special schools
39. 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34
40. 23 and 35 or 36 or 37 or 38
44. limit 40 to (English language)"

Inclusion and exclusion criteria:

Inclusion criteria:

• Abstracts, full papers, and other literature containing the search terms.

• All types of studies about school-based OHAs in special schools

• Written in English or Arabic

• Studies from 1986 (the date when health promotion was first introduced in the Ottawa Charter) to October 2021.

Exclusion criteria:

• Studies where the full text was inaccessible

• Literature excluding school-based OHAs in special schools

• Studies not written in English or Arabic

• Studies before 1986.

3.2.2.3 Stage 3: Study selection

During the review process, there were two stages of screening. Firstly, the titles and abstracts of all the retrieved literature were examined based on the inclusion and exclusion criteria. Secondly, any literature that was deemed relevant during the first stage was further reviewed by researcher AA. The full-text review was conducted to determine whether the literature met the inclusion criteria.

3.2.2.4 Stage 4: Data visualisation

A data charting form was created to organise and visualise data. Articles were categorised using variables by Arskey and O'Malley (2005) as follows:

- Author(s), journal, publication year, geographical location
- Intervention aims, nature, and duration
- Population target (age, sex, and setting)
- Research methods and techniques
- Outcome measures used
- Highlights of key findings

3.2.2.5 Stage 5: Collating, summarising, and reporting the findings

Stage 5 was clarified by Levac et al. (2010) who broke it down into three steps.

The first step in stage five was data analysis. According to Arksey and O'Malley (2005), data analysis should contain a descriptive numerical summary analysis and a qualitative thematic analysis. The descriptive numerical summary describes the study's characteristics, such as the total number of relevant papers, publication year, study design, intervention type, geographical location, and study population.

The second step was to report the results. The data charting form was consistently used across the included studies to report the findings, as proposed by Arksey and O'Malley (2005). In addition, it allowed for comparisons between studies, detection of contradictions, identification of research gaps, and reduced potential reporting bias. Moreover, the data was

analysed using a thematic qualitative analysis. Moreover, the third step in stage five was to apply meaning to the results. The researcher (AA) discussed the findings and their implications for future research. This section reviewed the scoping review methodology and described the applied methods to conduct this study. The following section presents the results of the study.

3.3 Results

A scoping review was conducted to examine how school-based OHAs were implemented in special schools and their impact on children with disabilities' oral health. This section provides a summary of the reviewed literature. Results were grouped into two subsections. A descriptive numerical analysis was used initially to summarise the literature, and then a qualitative thematic analysis. A total of 560 articles were found using the selected databases. Then, the articles' titles, abstracts, and full texts were reviewed based on the inclusion/exclusion criteria, Section 3.3.2. A total of 263 studies were eligible for inclusion in the review after the initial scanning. Then, after the full-text review, 11 articles were eligible to be included, considering the inclusion criteria. PRISMA flow chart diagram is presented in Figure 3.1, and Table 3.2 below provides a summary of the reviewed studies respectively.

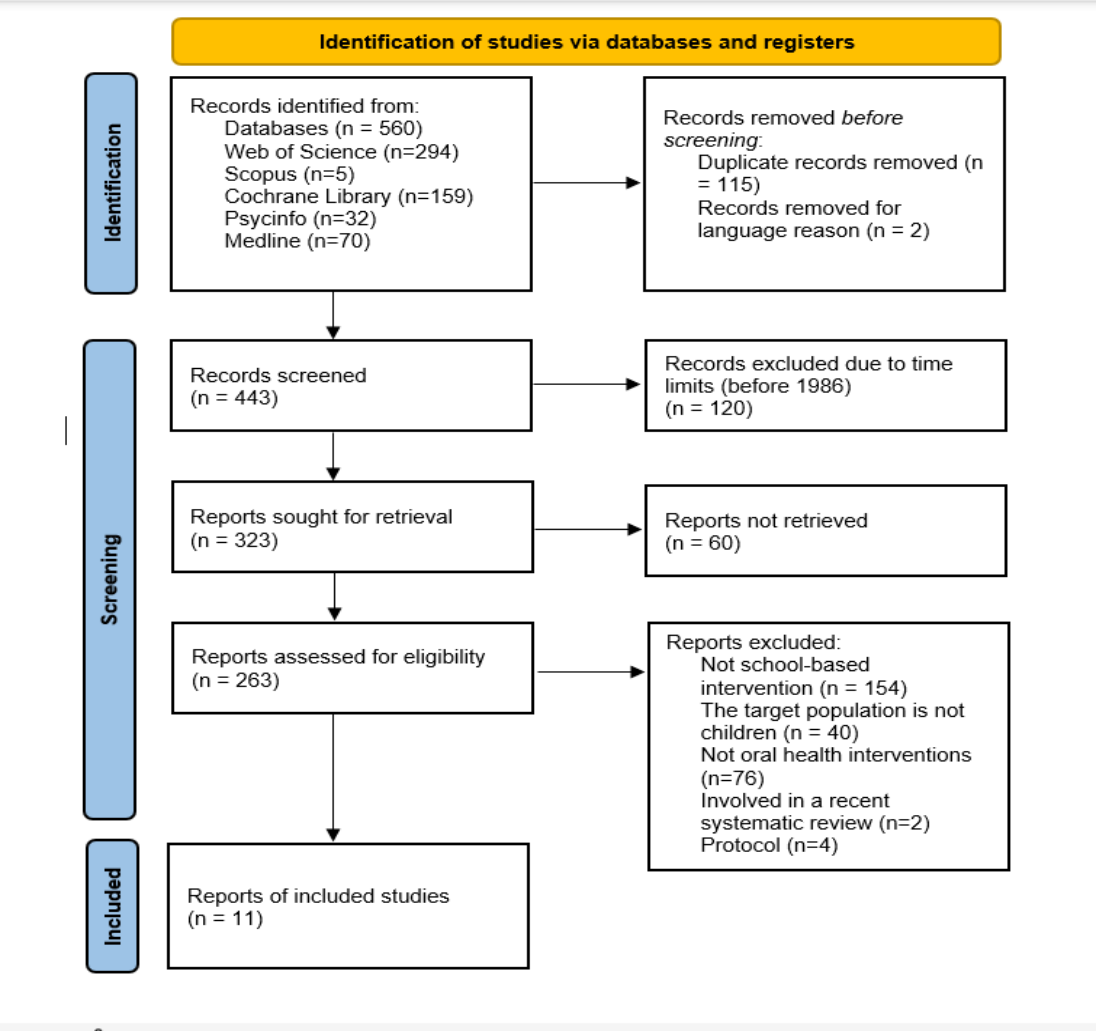

Figure 3-1 Study selection diagram

Table 3.2 Reviewed studies in the scoping review.

Authors/years	Country	Participants	Type of OHAs	Duration	Outcome measures	Key findings
Ganapathi et al. (2015)	India	Children aged 8 to 14 years with visual impairments (n=200)	Different sensory input methods (OHE)	8 weeks	Oral health knowledge and visible plaque index	Improvements in knowledge ($p < 0.001$). The leaflet group showed the lowest gain in knowledge, while the multisensory approach group showed the highest.
Mahantesha et al. (2015)	India	Children aged 6 to 20 years with visual impairments (n=50)	OHE with Braille and audio instructions for oral hygiene.	3 MONTHS	Patient hygiene performance (PHP) index to assess the oral hygiene status	Both groups demonstrated a reduction in plaque scores, but it was not statistically significant.
Shahabudin et al. (2016)	Malaysia	Children aged 6 to 17 years with visual impairments (n=38)	OHE with an oral health module	1 month	Simplified Oral Hygiene Index (OHI-S) scores	The educational tools significantly improved oral hygiene practices
(Sharififard et al., 2020)	Iran	Children aged 6 to 17 years with visual impairments (n=200)	OHE employing an Audio Tactile Performance technique	2 month	Simplified Oral Hygiene Index (OHI-S) and Bleeding on probing (BOP) scores	ATP effectively improved oral hygiene for children with visual impairments.

Relwani et al. (2016)	India	Children aged 6 to 15 years with specific learning needs (n=71)	OHE provided by schoolteachers and dental professionals	6 months	Simplified Oral Hygiene Index (OHI-S) scores	Significant reductions in OHI-S and schoolteachers could provide OHE to children with ”specific learning needs”.
Hashmi et al. (2019)	India	Children aged 11 to 20 years with hearing impairments (n=178)	OHE using sign language versus posters	3 months	Simplified Oral Hygiene Index (OHI-S), plaque index (PI), and gingival index (GI)	The mean reduction in sign language group was greater (p-value <0.05)
Pareek et al. (2015)	India	Children aged 6 to 15 years with hearing impairments (n=315)	Supervised toothbrushing provided by (parents, teachers, or both the researcher and teacher)	6 weeks	Plaque index (PI), and gingival index (GI)	A significant reduction in PI and GI scores, the study group under parental supervision shows better outcomes.
Shah et al. (2020)	The Kingdom of Saudi Arabia	Children aged 6 to 15 years with different disabilities (n=163)	Supervised toothbrushing using powered toothbrushes and fluoridated toothpaste.	6 months	Plaque index (PI), and dental caries risk using Cariogram	A significant reduction in PI, Cariogram model showed an increase in the chance of preventing new dental carious lesions from 5% to 73%.
Shyama et al. (2003)	Kuwait	Children aged 11 to 22 years with different disabilities (n=112)	Combined OHE and supervised toothbrushing	3 months	Plaque index (PI), and gingival index (GI)	Significant reductions in the scores

Stefanovska et al., 2010).	Macedonia	Children aged 9 to 16 years with learning disabilities (n=100)	Combined OHE and supervised toothbrushing	6 months	Plaque index (PI)	The combination of OHE and supervised toothbrushing produced encouraging outcomes and significantly lowered the PI levels

3.3.1 Descriptive numerical results

The first subsection provides an overview of the reviewed studies, including the study location, design, sample age, and type of disability. It also covered the types of OHAs types and their providers.

The reviewed articles originated from seven countries, with India contributing 46%. The information presented in Figure 3.1 shows the percentage of countries from where the reviewed articles originated. The articles were published between 2003 and 2020, and most were published during the last decade.

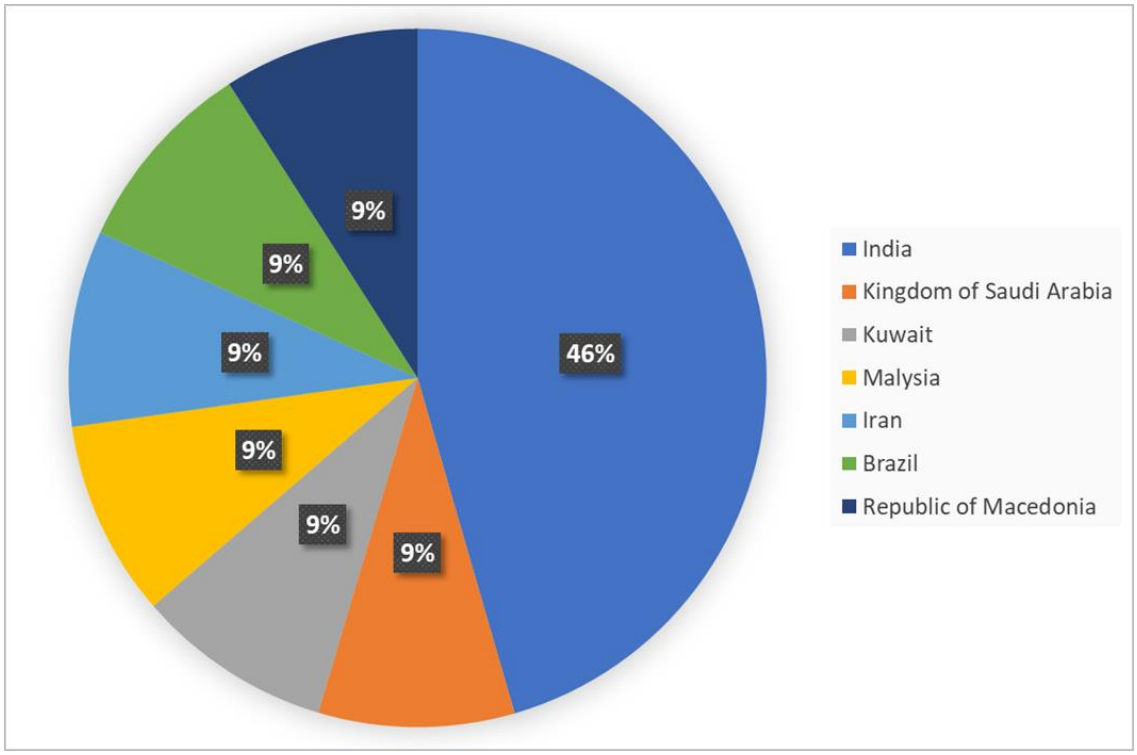

Figure 3-2 Country of origin of the reviewed articles (n=11).

The researchers used various research designs. For example, 45.4% (n = 5) of the included articles were randomised trials, whereas 36.3% (n = 4) included pre- and post-design studies, and a longitudinal and quasi-experimental study.

The age range of the children studied was between 6 and 24 years old. The studies conducted had different target populations as they focused on specific categories of disabilities. The studies involved children with visual impairments, hearing impairments, learning disabilities, ID, or other disabilities. The distribution of reviewed articles based on the target population is shown in Figure 3.2.

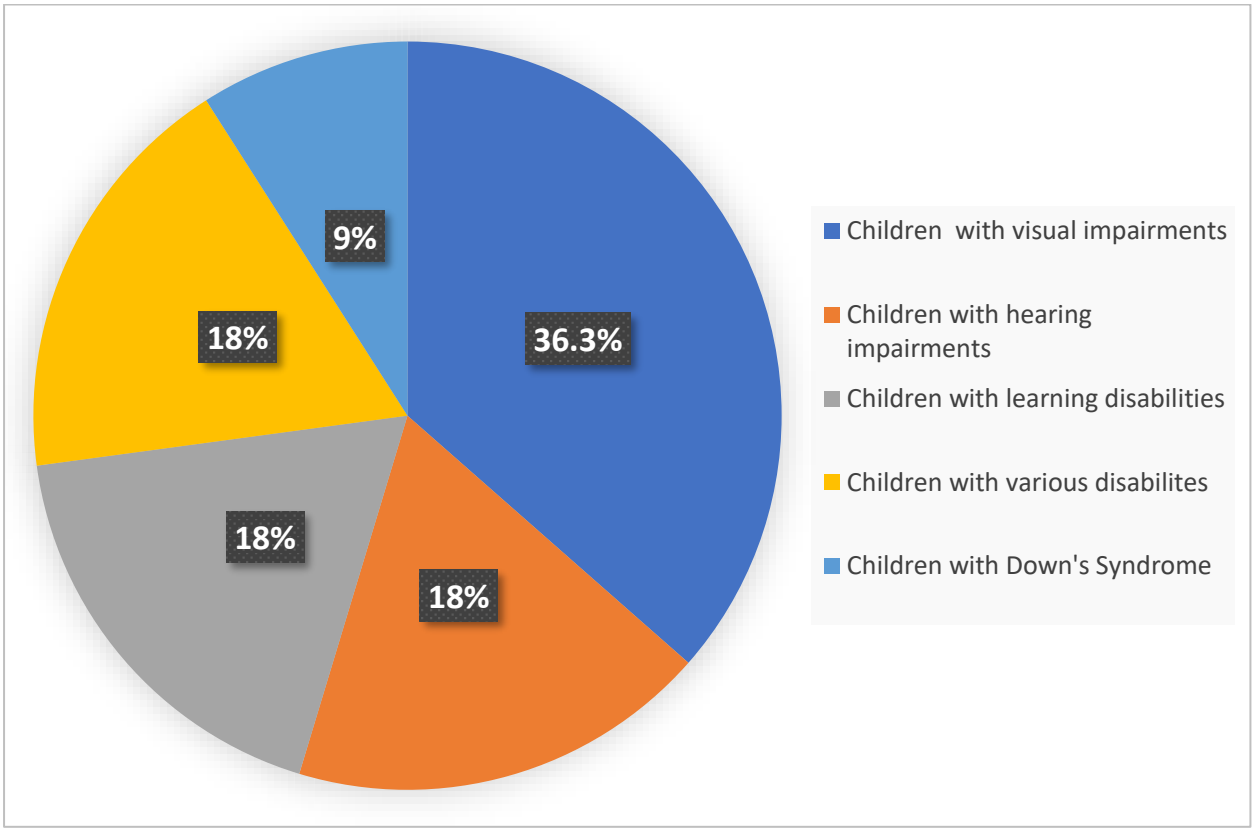

Figure 3-3 The target population in the reviewed articles (n=11).

Furthermore, the studies used different types of OHAs, such as OHE (n=6), supervised tooth brushing (n=2), and a combination of both (n=3). In addition, there were differences between the studies regarding the activities' providers. Researchers delivered over half of the activities (55%), while teachers and caregivers provided 27% and 18%, respectively.

As explained in the methodology, the scoping review produced descriptive and thematic analyses. Therefore, this section summarises the studies, while the next section presents the thematic analyses of the data.

3.3.2 Thematic analysis

Based on the research questions, this study qualitatively analysed the literature on two themes:

1. Oral health activities in special schools and their outcomes
2. Factors influencing the school-based oral health activities in special schools

3.3.2.1 Oral health activities in special schools and their outcomes

This theme presented the application of various OHAs in special schools, including OHE, supervised tooth brushing, and a combination of both. It outlined the key features of the applied OHAs, and how they were conducted and evaluated in each of the 11 included studies. In addition, this theme focused on the measured outcomes of OHAs on variables such as oral hygiene, gingival health, dental knowledge and behaviour, and dental caries risk to address the study question, "What is the impact of school-based OHAs on children with disabilities?"

3.3.2.1.1 Oral health education (OHE)

OHE activities relied on providing information about oral health to children with disabilities through various methods. Four studies evaluated applied OHE activities for children with visual impairments, one among children with specific learning needs, and one among children with hearing impairments.

In a study conducted by Ganapathi et al. (2015), the effectiveness of different sensory input methods in providing OHE for children aged 8 to 14 years with visual impairments was

assessed. The study was conducted in two residential schools for children with visual impairments in Hyderabad, India, with a sample size of 200 students. The participants were randomly assigned to one of five groups, with 40 students in each group. The first four experimental groups received OHE using various sensory input methods, including audio, leaflet Braille, the tactile on-tooth model, and a multisensory group, provided by a single trained examiner. The fifth group, which served as a control, did not receive OHE. After eight weeks of providing OHE to the children, their oral health knowledge and visible plaque index were assessed. All the groups demonstrated a significant increase in knowledge ($p < 0.001$). However, the leaflet group showed the lowest gain in knowledge, while the multisensory approach group showed the highest. Nevertheless, the study was limited by its short duration and the lack of long-term knowledge retention following the OHE evaluation's termination.

Additionally, Mahantesha et al. (2015) conducted a study in Raichur City, India, to improve oral hygiene among children with visual impairments aged 6 to 20 years living in institutions. The study included 50 participants who were provided with Braille and audio instructions for oral hygiene. A patient hygiene performance (PHP) index was used to assess the oral hygiene status of the participants after three months. Both groups demonstrated a reduction in plaque scores, but it was not statistically significant. However, the findings suggest continuous reinforcement of Braille and audio instructions is vital for improving oral hygiene in children with visual impairments. Nevertheless, the study has limitations, including a small sample size, a wide age range, and a need for follow-up on oral hygiene instructions.

In a similar study, Shahabudin et al. (2016) evaluated the effectiveness of OHE tools for children with visual impairments. The study was conducted at two public schools in Bukit Mertajam, Malaysia. The research was a pre-post study of 38 students aged 6 to 17 years. An oral health module consisting of Braille (for blind students) and font 18px (for partially blind students) educational materials was developed and validated by an expert panel. The study showed that the educational tools significantly improved oral hygiene practices and Simplified Oral Hygiene Index (OHI-S) scores among the students.

In addition, a study examined the impact of OHE employing an Audio Tactile Performance (ATP) technique on the oral health status of 200 children with visual impairments attending special schools in Tehran, Iran. The ATP technique is a unique OHE approach designed by Hebbal and Ankola (2012) specifically to bridge the communication gap between dentists and people with visual impairments and educate this group about their oral hygiene. This technique includes an interactive session (audio) to establish a friendly atmosphere. It allows individuals to feel their teeth on a large model (tactile) and then learn to brush on the model with assistance. They are then encouraged to touch their teeth with their tongue for deposits, which are identified by the feeling of roughness. This hands-on approach is a crucial feature of the ATP technique, making it a compelling method for OHE. Recent systematic reviews indicate the effectiveness of ATP compared to Brile-based OHE (Coutinho et al., 2023, Jawahar and Maragathavalli, 2021).

During this study, all three groups used ATP to obtain OHE. The ATP included a module that taught children about the significance of teeth, dental caries, and gingival health. Oral hygiene

instructions were also given, followed by each child demonstrating their toothbrushing method. Finally, the children were taught the proper toothbrushing technique by having their hands guided until they could properly handle it. In the first intervention group, telephone education was provided to parents, and the second intervention group was provided with an art package consisting of a game and music-based OHE. The researchers confirmed that using ATP effectively improved oral hygiene for children with visual impairments and recommended adopting this technique to promote oral health after two months of evaluation. A key strength of this study is that blinded outcome measures and data analysis were used to reduce bias, ensuring significant internal validity of findings. However, due to scheduling issues, the researchers could not conduct longer follow-ups (Sharififard et al., 2020).

In addition, Relwani et al. (2016) conducted a study to compare the effectiveness of OHE provided by schoolteachers and dental professionals to children with specific learning needs. The study included 71 students attending a special school in India. The authors used the term specific learning needs as synonymous with learning disabilities. The students were divided randomly into three groups. The first group received no additional OHE beyond the initial session. In the second group, teachers provided instructions on proper brushing techniques at 15-day, one-month, and three-month intervals. Finally, a dental professional gave OHE to the third group and demonstrated proper brushing techniques after 15 days, one month, and three months later. The authors evaluated OHI-S six months after the OHE and found a significant difference between baseline OHI-S scores after the OHAs. Moreover, they suggested that schoolteachers could provide OHE to children with ”specific learning needs”.

However, the long-term use of this method was challenging because it required continuous motivation and support from the teachers.

Likewise, Hashmi et al. (2019) conducted a double-blind, randomised, controlled trial at two government special schools for adolescents with hearing impairments in New Delhi, India. The study aimed to compare two distinct approaches to OHE to determine their effectiveness in improving oral hygiene among students aged 11 to 20 years with hearing impairments (n=178). The study compared the effectiveness of OHE delivered with sign language PowerPoint presentations in one school and visual posters in the other. After the activity, the investigator analysed OHI-S, Plaque Index (PI), Gingival Index (GI), and oral hygiene practices of the students in both schools one month later. The scores for the OHI-S, PI, and GI were reduced from 1.13, 0.81 and 0.66 to 0.31, and 0.58, and 0.32, respectively (P-value was 0.05). After three months, the proportion of students who reported not brushing their teeth regularly decreased from 12.6% to 1.1%, and those brushing twice daily increased from 20.7% to 25.3%. The authors argued that using sign language for OHE is practical and feasible, significantly improving oral hygiene and gingival health. However, the results should be analysed carefully, as when interviewing adolescents about their oral hygiene practices, it is essential to remember that over-reporting, recall bias, and social desirability bias may be present.

3.3.2.1.2 Supervised toothbrushing activities

Two studies have examined supervised toothbrushing activity in special schools. In a study conducted by Pareek et al. (2015), used a single-blind, parallel, and randomised controlled trial to examine the oral health outcomes of supervised toothbrushing among children with hearing impairments. The study was conducted in Jaipur, Rajasthan, India, and included 315 children aged 6 to 15 years old. The children were randomly divided into three groups of 105 each. Parents supervised toothbrushing for Group A students, teachers supervised Group B, and the study investigator supervised Group C. Children were taught to brush their teeth twice daily using the roll-on technique with fluoride toothpaste. The study investigator explained the programme to parents and teachers, and oral health counselling sessions were conducted every three weeks to reinforce good dental habits. The investigator took measurements of plaque and gingival indices at the beginning, three weeks into the activity, and six weeks after the activity. The authors observed that there was a significant reduction in PI and GI scores from the beginning of the study until the second follow-up, which took place six weeks later ($P < 0.001$). Furthermore, the activity outcomes significantly improved among the study group under parental supervision. The study emphasises the significance of a substantial home–school connection in promoting the gingival health of children with hearing impairments. The activity's effectiveness was also strengthened by reinforcing the oral hygiene instructions. However, a follow-up investigation is necessary to determine whether this improvement has been sustained.

In addition, in a longitudinal study a sample of 163 male students with disabilities attending eight primary schools in Al-Kharj, KSA, were examined. The sample included children with various disabilities as follows: 30% with learning disabilities, 20% with Down's Syndrome, 12% with autism spectrum disorders, and 12% with hearing impairments or other disabilities. The researchers provided supervised toothbrushing using powered toothbrushes and fluoridated toothpaste. Furthermore, the parents and teachers were requested to help and monitor the children while brushing their teeth. The parents were advised to use a powered toothbrush and assist their children in toothbrushing once a day before bed, and teachers were trained to use powered toothbrushes and support the children with toothbrushing once daily at school. The sample was re-evaluated three and six months after the initial assessment. The PI was measured to evaluate oral hygiene, and the Cariogram model was used to determine the dental caries risk. The initial mean of the PI was 1.55. After three months, the PI decreased to 1.35, and after six months, it significantly dropped to 1.1 ($p<0.05$). In addition, the Cariogram model showed an increase in the chance of preventing new dental carious lesions from 5% to 73%. The study suggests that combining OHE and supervised toothbrushing activities in special schools can reduce the risk of dental caries among children with disabilities. For the activity to be successful, the authors recommended that teachers and parents motivate and encourage one another. The study suggested that school-based OHAs could be implemented in the KSA for children with disabilities, which could help to prevent dental diseases (Shah et al., 2020b). However, this study used powered toothbrushes which are considered expensive.

3.3.2.1.3 Combined activities: Oral health education and supervised toothbrushing

Three studies have examined the combination of OHE and supervised toothbrushing activities in special schools.

Shyama et al. (2003) conducted research in Kuwait to examine the effectiveness of three-months school-based OHAs among 112 children with Down's Syndrome: 45 boys and 67 girls aged 11 to 22 (Mean, 14.8 years). To enhance students' awareness of dental health, the investigators displayed colourful posters in classrooms providing oral hygiene advice. Additionally, they conducted classroom activities that included the use of flip charts, films, and cartoons. The research team also arranged twice-weekly supervised toothbrushing sessions in the classrooms. Two dental hygienists educated children on the Bass technique and encouraged proper oral hygiene. After three months, participants were re-evaluated to determine any improvements in their oral hygiene, plaque, and gingivitis scores. The study found that the mean PI decreased significantly from 1.93 to 0.95 ($p<0.001$), and the mean GI also dropped significantly from 2.00 to 0.83 ($p<0.001$).

Another study was conducted in two special schools in Skopje, a city in the Republic of Macedonia. The study involved 100 students aged between 9 and 16 years old with mild to moderate learning disabilities. Over six months, the researcher facilitated supervised toothbrushing, as well as OHE workshops for the children which aimed to promote independent manual toothbrushing skills and dental health knowledge. At the start of the study, the mean PI level for the sample was 2.46, while at the end it had decreased to 0.73

($p<0.05$). The combination of OHE and supervised toothbrushing activities produced encouraging outcomes and significantly lowered the PI levels (Stefanovska et al., 2010).

Similarly, a study assessed the success of the applied activity to improve oral health among children with disabilities in Brazil. The study involved students between the ages of seven and 24 years old with Down's Syndrome, ID, developmental delay, cerebral palsy, or other disabilities. The activity lasted five weeks and was divided into two phases. During phase one, supervised toothbrushing and OHE activities were provided to the children for four weeks, followed by one week of OHE and oral hygiene demonstrations for caregivers. They evaluated dental debris (DI-S) and the gingival bleeding index (GBI) before and after the activity. Although, the study was conducted over a short period, it showed that offering OHE and supervised toothbrushing to students with disabilities improved their dental hygiene. After four weeks of the activity, there was a significant decrease in DI-S and GBI compared to the baseline ($p<0.05$). At the beginning of the activity, the average DI-S was 0.49, and the average GBI was 34.42%. After the activity, the average DI-S decreased to 0.28, and the average GBI reduced to 23.47%. Additionally, there was a considerable drop in the DI-S ($p <0.05$) during the study's second phase, which involved a meeting with the caregivers (Hartwig et al., 2017).

The findings suggest that school-based OHAs, such as OHE and supervised toothbrushing, could improve dental hygiene in special school students. However, a longer follow-up is necessary to evaluate the sustainability of the results. It is essential to exercise caution when considering this conclusion as it relies solely on four RCTs and a formal quality assessment

was not conducted. The following theme will elaborate on the factors affecting school-based OHAs in special schools.

3.3.2.2 Factors influencing school-based oral health activities in special schools

The literature on the types and outcomes of school-based OHAs in special schools has been presented. This theme explored what the reviewed studies presented regarding the factors that facilitate or impede OHAs in special schools.

A few of the included studies tried to briefly explore the factors that might affect the implementation of OHAs in special schools. Shah et al. (2020) reported difficulties applying OHAs over a long duration due to several points, such as the need for continuous support and motivation for parents and teachers. In addition, Pareek et al. (2015) found that parental compliance was a barrier to the activity's success. Additionally, integrating oral health into the curriculum for children with autism spectrum disorders was hindered by teachers' lack of expertise, training, and educational materials in dental health. Also, it has been found that the OHAs follow-up was limited by the school schedule (Sharififard et al., 2020). On the other hand, Shyama and her colleagues found that teachers were easily motivated to participate in supervised toothbrushing activities and were willing to continue monitoring the activity (Shyama et al., 2003). Despite this, no study has comprehensively examined the contextual factors influencing OHAs implementation in special schools.

3.3.2.3 Summary

According to the literature, some OHAs have been applied and evaluated in special schools, mainly OHE and supervised toothbrushing activities. The findings indicate that OHAs have a

short-term positive impact on the oral health of children with disabilities. Statistically significant improvements were noted in their oral health-related knowledge, oral hygiene levels, and dental caries risk. Furthermore, factors affecting OHAs in special schools were highlighted, including school schedules, teachers' and parents' compliance, teachers' experience and training, and the availability of OHE materials. Future research in this area is needed with a larger sample size, with more diverse groups of children with disabilities over a long period, to be able to assess the real impact of such preventive and promotional interventions. Future studies should also consider assessing in depth the factors that might facilitate or hinder the implementation of such promotional activities.

3.4 Discussion

This was the first scoping review to explore the evidence on OHAs in special schools for children with disabilities. This review provides an overview of the existing literature on how school-based OHAs are conceptualised in special schools. OHE and supervised toothbrushing activities have been implemented to a limited extent to promote better oral health in special schools. Similarly, a scoping review found a lack of approaches and activities to promote oral health for people with disabilities (AlJameel et al., 2023, Elsadek and Baker, 2023, Lai et al., 2022, Waldron et al., 2016, Wilson et al., 2019).

Most implemented OHAs focused on OHE, while evidence demonstrated their limited impact on promoting oral health and tackling oral health inequalities (Atif et al., 2023, Bramantoro et al., 2021, de Silva et al., 2016b, Elsadek and Baker, 2023, Kay and Locker, 1996, Stein et al., 2018, Watt, 2005). Similarly, applying school-based OHAs for children with disabilities, their caregivers, and teachers has a short-term positive impact on the oral health of children, which is consistent with the previous literature (Atif et al., 2023, Bramantoro et al., 2021, de Silva et al., 2016b, Elsadek and Baker, 2023, Kay and Locker, 1996, Stein et al., 2018).

Despite this, this scoping review lays the groundwork for future research by synthesising information on school-based OHAs in special schools. The literature consistently supports the short-term positive impact of school-based OHAs on children's oral health. The research shows that OHE resources explicitly designed for specific populations, like Braille books for children with visual impairments and sign language instructions for oral hygiene for children

with hearing impairments, are effective (Ganapathi et al., 2015, Hashmi et al., 2019, Shahabudin et al., 2016, Sharififard et al., 2020). Additionally, it highlights the criticality of involving the children's parents and teachers in the OHAs (Pareek et al., 2015, Shyama et al., 2003), which agrees with Wilson et al. (2019), who emphasise the importance of involving parents and teachers of persons with ID to promote oral health.

Furthermore, the literature primarily examined the outcomes of OHAs rather than their implementation process and associated factors. The scoping review found that the researchers' concerns were directed towards the impact of school-based OHAs on oral health in children with disabilities. However, none of the included studies focused on identifying the contextual factors facilitating or hindering the implementation of school-based OHAs. Furthermore, the findings showed that researchers did not explore the study's context, such as schools, families, communities, environmental, and political factors. These factors must be considered when designing and evaluating health promotion programmes (Poland et al., 2009). However, there were some limitations in the studies conducted, and further research is needed to address them.

Among the identified limitations, most studies focused on specific populations, such as children with visual impairments. This means the results cannot be generalised to children with other disabilities, as their oral health care needs and demands, as well as the support they need to care for oral health, might differ according to their disabilities. In addition, insufficient sampling may compromise the external validity caused by small sample sizes, lack

of control groups, and low response rates. Also, none of the studies precisely defined disability categories or characterised children's functioning levels. Clear definitions are vital for practical implementation in different contexts and targeted populations. In addition, the studies did not provide enough details about the questionnaires used, undermining the validity and reliability of the pre-and post-study designs. Also, the validity of the studies could be threatened by factors such as measurement bias, social desirability bias, maturation bias, non-blinded assessments, confounding variables, and attrition of subjects, as the studies lacked well-selected controls. Moreover, the studies were conducted over a short period ranging from five weeks to six months, which was not long enough for the changes to occur.

Future studies need to explore the role of teachers and parents in OHAs, as understanding their perspectives and involvement in these activities is crucial to improving school-based OHAs for children with disabilities. Furthermore, the contextual factors that either facilitate or hinder the successful implementation of OHAs should also be explored. It is recommended that more emphasis be given to the context of OHAs. Finally, the impact of these activities should be examined over a more extended period.

3.4.1 Strengths and limitations

3.4.1.1 Strengths

The review aimed to include all types of OHAs in special schools and no restrictions were placed on the region or study design, which broadened its applicability and relevance. In addition, a comprehensive search strategy was developed in conjunction with a librarian,

covering multiple databases. Moreover, the framework of Levac et al. (2010) was utilised to conduct this scoping review methodically and systematically to ensure clarity and reproducibility in the research process. Furthermore, the protocol was developed and submitted in the first-year confirmation review for the PhD. Moreover, this study is based on the best practice guidance and reporting items for scoping review, as presented in Appendix 3.3 (Tricco et al., 2018).

3.4.1.2 Limitations

There were some limitations in this scoping review. Firstly, the review was limited to publications in English and Arabic. Also, the search timeframe is until October 2021, as the findings of this scoping review were used to inform the second study; although there was no need to update this, the literature review in Chapter Two has been updated. Finally, there is no methodological quality assessment of the studies. However, it is an optional step in the scoping review methodology (Daudt et al., 2013, Levac et al., 2010, Peterson et al., 2017).

3.5 Conclusion

This study aimed to provide a comprehensive summary of the literature on school-based OHAs in special schools, examining their impact and influencing factors, identifying gaps in the literature, and informing Study Two. According to the current review, insufficient research has been conducted on OHAs in special schools. The majority of the studies report providing school-based OHAs benefits children with disabilities, with a short-term positive impact on children's oral hygiene, oral health-related knowledge, and dental caries risk. Furthermore, it

suggests parents and teachers should be involved in the activities to improve their impact. The school-based OHAs are influenced by multiple factors, including the school schedule, teacher training and experience, access to dental health education materials, and parental compliance. Moreover, no research is available on the contextual factors that affect the implementation of school-based OHAs in special schools, even though such factors are known to impact these OHAs.

The findings of this scoping review were used to inform the second study of the PhD research. The scoping review on OHAs in special schools yielded valuable insights into the existing literature, identified gaps in knowledge, and highlighted areas that require further exploration. Reviewing the existing literature helped with the planning of the qualitative study, as it identified common types of OHAs , measured outcomes, barriers, and facilitators related to OHAs in special schools. In addition, it identifies areas with limited or conflicting evidence and suggests areas for further research, including long-term impacts, contextual factors, and parental and teacher involvement.

Based on the scoping review findings, the researcher developed focused research questions that address gaps in the literature and explore specific aspects of OHAs, which are contextual multi-level barriers and facilitators to implementation in KSA special schools using the Consolidated Framework for Implementation Research (CFIR), a determinant framework from implementation science.

Furthermore, by reviewing the methods used in existing studies, the scoping review guided the researcher's decision about the most appropriate methodology and data collection methods for the second study. For example, the need to explore the successful implementation determinants, a thorough understanding of the views of school staff and parents on school-based OHAs and their involvement in such activities, and their preferences led the researcher to choose the semi-structured interview method. Generally, conducting a scoping review before planning the qualitative study on OHAs in the KSA's special schools assisted the researcher in enhancing their current understanding, building on existing knowledge, providing a comparison of the implemented OHAs in special schools, ensuring research questions were relevant and well-informed, and establishing the foundation for a comprehensive and rigorous study.

To sum up, this study motivated researcher AA to explore school-based OHAs in special schools in the KSA. She explored the implementation of school-based OHAs in the KSA's special schools and the factors that can either facilitate or hinder it by adopting the CFIR, which is a widely used framework for identifying and analysing the factors that influence the successful implementation of evidence-based interventions in real-world settings (Damschroder et al., 2009). No previous studies had adopted the implementation science theories and frameworks to explore the contextual factors influencing school-based OHAs in special schools.

The following chapter presents the methodology and methods of the Study Two of this PhD research, a qualitative study exploring OHAs in the KSA's special schools from the perspective of staff and parents of children with disabilities to identify the perceived barriers to and facilitators to implementing school-based OHAs, according to the CFIR. The findings of this study recommended four key concepts to underpin the development of an OHP implementation toolkit tailored for the KSA's special schools.

Chapter 4. Methodology and methods – The implementation of school-based oral health activities in special schools in the KSA- A qualitative study

4.1 Background

The aim and objectives of the current study are based on the literature review on school-based OHAs that promote oral health and the scoping review study in Chapter Two and Chapter Three, respectively.

Based on the evidence, it has been found that there is limited availability of OHAs in special schools (Lai et al., 2020, Wilson et al., 2019), even though they are crucial for promoting oral health among children with disabilities (Wilson et al., 2019). Furthermore, there has been a dearth of research on the factors contributing to this limited application (Wilson et al., 2019). Notably, guidelines for implementing and maintaining OHAs in special schools were lacking (Wilson et al., 2019). Therefore, this study is grounded in implementation science to explore the determinant factors influencing the implementation of OHAs in the KSA special schools based on the CFIR (Damschroder et al., 2009).

4.1.1 Aim and objectives

4.1.1.1 Aim of the study

This study aimed to explore current school-based OHAs in special schools in KSA and to identify the perceived barriers and facilitators to their implementation.

4.1.1.2 Objectives

This study's objectives were to;

1. Determine what OHAs are currently being conducted in KSA special schools
2. Based on the CFIR, identify factors that influence the implementation of OHAs in KSA special schools, including the barriers and facilitators
3. Recommend key concepts on which to base an OHP implementation toolkit to improve the OHAs in special schools in KSA

4.1.1.3 Research questions

1. In KSA special schools, what OHAs are currently taking place?
2. What is the experience of school-based OHAs for school staff and parents/carers of children attending KSA special schools?
3. From the perspective of the KSA special school staff and parents/carers of attending children, what factors hinder and facilitate implementing these activities?
4. What are the key concepts to guide the development of an OHP implementation toolkit for KSA's special schools?

This chapter explains the research design, paradigm, and methodology. It details the data collection and analysis methods used, and quality assurance methods implemented. The

reasoning behind the methodology, data collection, and analysis methods is also explained, along with any methodological limitations encountered.

4.2 Research design

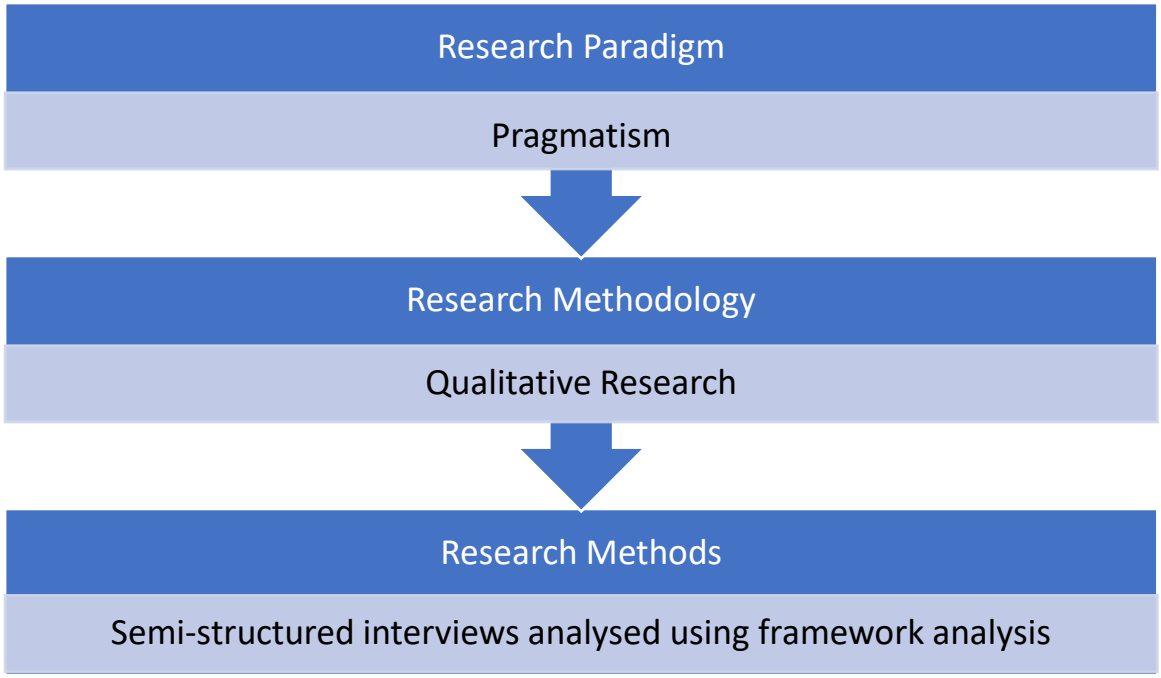

Figure 4-1 The adopted research paradigm, methodology, and methods to explore the school-based oral health activities implementation in KSA special schools.

This section discusses the research design choices made to address the study's aim and answer research questions. The research design framework comprised three elements: paradigm, methodology, and methods. It is essential to consider how each element influenced the others in research (Creswell and Creswell, 2017, Flick, 2018a, Flick, 2022). Figure 4.1 summarises the adopted research paradigm, methodology, and methods to explore the school-based OHAs implementation in KSA special schools, according to the CFIR.

4.2.1 Research paradigms

This section summarises the research paradigms, leading to the choice of pragmatism as the paradigm that underpinned this study. A paradigm is a belief system that shapes our perception of the world (Denzin and Lincoln, 2011, Guba and Lincoln, 1994). Paradigms are different ways of viewing the world (Davies and Fisher, 2018, Denzin and Lincoln, 2011, Guba and Lincoln, 1994). The research paradigm is a foundation that determines researchers' focus, views, and approach to research problems. The paradigm chosen influences how research questions are formulated and the data collection and analysis methods used (Davies and Fisher, 2018).

The research paradigm includes the set of assumptions around reality and the nature of knowledge (Davies and Fisher, 2018). Research paradigms differ in ontology, epistemology, and methodology (Creswell and Creswell, 2017, Davies and Fisher, 2018). Ontology refers to the nature of reality or truth; epistemology refers to the nature of knowledge; and methodology is the applied strategy (Creswell and Creswell, 2017, Denzin and Lincoln, 2011, Guba and Lincoln, 1994). There are several research paradigms; however, the main ones are positivism, interpretivism, and pragmatism (Creswell and Creswell, 2017, Guba and Lincoln, 1994, Lincoln et al., 2011).

4.2.1.1 Positivism paradigm

Positivism assumes that a single reality (ontology) can be known through objective and impartial study of a phenomenon (epistemology) (Creswell and Creswell, 2017). Studies from

a positivist perspective typically adopt quantitative methods, using experimental data collection and statistical numerical analysis methods to produce generalisable research results (Lincoln and Guba, 2000). Positivism has been criticised for neglecting individuality and the subjectivity of human experiences (Davies and Fisher, 2018, Creswell and Creswell, 2017).

4.2.1.2 Interpretive paradigm

An interpretive paradigm rejects positivism and instead adopts a relativist ontology that acknowledges reality as subjective and varies from individual to individual (Guba and Lincoln, 1994). The purpose of this paradigm is to describe, explore, and comprehend the natural events' context (Davies and Fisher, 2018). Qualitative research methods are typically used in interpretive research to provide rich and detailed data about the experiences of a small sample of participants (Schreier, 2018). Various data collection methods can be employed, such as observation, interviews, and focus group organisation (Flick, 2022, Flick, 2018b). Interpretive approaches have been critiqued for their lack of transferability and generalisability (Scotland, 2012).

4.2.1.3 Pragmatic paradigm

The pragmatic research paradigm focuses on practicality and real-world research applications rather than ontological and epistemological arguments between other paradigms (Feilzer, 2010). It emphasises the importance of research that can solve specific problems, inform decision-making, and have a tangible impact on society. Pragmatic researchers prioritise mixed methods and flexible approaches and value the context in which research is conducted (Feilzer, 2010). This paradigm is particularly relevant in fields like education, social sciences,

public health, and applied research, where the goal is to address real-world issues. Recently, it has gained popularity as researchers strive to implement practical solutions to "*do what works*" (Morgan, 2014). The advantages of pragmatic qualitative research include its relevance to real-world issues, flexibility in research design, and the potential for producing actionable insights for addressing practical problems (Pistrang and Barker, 2012).

This paradigm is criticised for its flexibility, which can lead to confusion during the design and interpretation of pragmatic studies (Scotland, 2012). In addition, critics argue that pragmatic qualitative research prioritises practicality over rigour, potentially compromising generalisability (Pistrang and Barker, 2012). To address these criticisms, the researcher explicitly acknowledged and discussed potential limitations, maintained methodological choices transparency, balanced practical relevance with theoretical considerations, employed robust research methodologies and was transparent about potential biases.

As this study explores a "real-world" phenomenon, the school-based OHAs implementation in KSA special schools and recommends solutions to improve their implementation process by providing key concepts to underpin an OHP implementation toolkit based on the identified barriers and facilitators, the pragmatic paradigm was chosen as the most appropriate. The pragmatic paradigm suggests a qualitative research method of inquiry would be a valuable tool to allow participants to share their experiences and reflections on the implementation of OHAs. This method allows participants to give a comprehensive account of their experiences, beliefs, and reflections on OHAs in KSA special school settings. This approach provides greater

flexibility in examining the barriers and facilitators to implementing OHAs in KSA special schools, resulting in valuable insights and recommendations for an OHP implementation toolkit (Alkahtani et al., 2014, Lincoln et al., 2011). The following section elaborates on the applied research methods.

4.2.2 Research methods

This section discusses the research methods used in this study. As described above, qualitative methods most apply to the pragmatism paradigm and the study's aim and objectives.

Qualitative research aims to interpret phenomena in their natural settings based on the meanings people attribute to them (Denzin and Lincoln, 2011). In addition, according to Creswell (2009), qualitative research involves exploring the perspectives of multiple participants to better understand a phenomenon. Qualitative research focuses on understanding experiences, while quantitative research emphasises measurement and breadth (Creswell and Creswell, 2017). Qualitative approaches offer comprehensive and intricate information, commonly called "*thick description*" (Geertz, 1973). Furthermore, qualitative research enables individuals to share their experiences in their native language, amplifying the voices of marginalised subgroups (Pistrang and Barker, 2012).

A qualitative method guided by CFIR was considered most appropriate for this study based on the research aim and objectives. Using other methods, such as quantitative experimental studies, would not address the study's exploratory nature. The following section presents the study's ethical approval.

4.2.2.1 Ethical approvals

This study received ethics approval from the University of Sheffield on 11/10/2022. See Appendix 4.2 for the approval letter, Reference Number 048464. In addition, the study was approved by King Saud University (refer to Appendix 4.3). Moreover, informed consent forms for potential participants are attached as Appendices 4.4 and 4.5.

Once the ethical approval was obtained from the University of Sheffield, the researcher contacted the Educational Guidance Department of the MoE via email. The email contained details of the researcher, study aims, methods, target population, and ethical approval document to facilitate the researcher's access to KSA special schools contact details.

The Educational Guidance Department was responsible for contacting the principals of KSA special schools to inquire if their schools would like to participate in the study. The recruitment procedures are explained in detail in Section 4.3.2.2.3. The following section describes the applied sampling methods, recruitment procedures, study settings, and participants' characteristics.

4.2.2.2 Sampling and recruitment strategy

In this section, a detailed account of the study sample and the methods employed is provided.

4.2.2.2.1 Sampling and sample size

Different sampling strategies address different methods. In quantitative studies, probability sampling is used to ensure representativeness and allow for data generalisability (Marshall, 1996), However, qualitative research requires an appropriate sample that answers the research question adequately rather than representativeness. In qualitative studies, the sampling is often iterative and theory-driven. The selection of participants is not based on the need to generalise about people but on identifying individuals likely to provide a range of detailed and reliable insights relevant to the research questions (Marshall, 1996).

The study employed two different sampling strategies. First, purposive sampling was implemented to select suitable participants for research questions (Tongco, 2007). Consequently, participants with relevant experience in implementing OHAs at KSA special schools were recruited (Tongco, 2007). Potential participants were selected based on their ability to provide insight into specific aspects relevant to the school-based OHAs implementation at KSA special schools, and a diverse group of informants with access to appropriate sources of knowledge was chosen.

A purposive sampling approach cannot assure representativeness. However, qualitative research aims to reflect personal perspectives and experiences rather than generalisation.

The study involved staff members from various educational stages of KSA special schools, without any age, sex, or job position restrictions, to ensure maximum heterogeneity and diversity of the participants' characteristics. All special schools in KSA were invited to participate in the study. Similarly, all parents or carers of children in the participating special schools were invited to facilitate diverse and informative data collection (Nabi-Burza et al., 2022).

Second, to recruit more participants, the researcher utilised snowball sampling, which involves a nonprobability method to locate hidden populations. This method relies on referrals from initially sampled individuals to others believed to have the characteristic of interest. This approach has several limitations, including reliance on the subjective judgments of informants and concerns about confidentiality. However, it is efficient and cost-effective (Parker et al., 2019). In this study, the purposive selection of participants was guided by the objective of the qualitative study. Moreover, a snowball sample was used to reach more potential participants.

4.2.2.2.2 Sample size

The sample size in quantitative studies is determined before data collection. However, in qualitative research, the number of necessary participants might only become evident as the study progresses and as themes are derived from the initial data collected (Francis et al., 2010).

Selecting an appropriate sample size for qualitative studies is a topic of debate, with practical ambiguity (Vasileiou et al., 2018). In qualitative research, achieving data saturation is discussed, but the literature does not clearly explain how to reach saturation (Abdul Majid et al., 2018). Indeed, there is no agreement on what constitutes data saturation, as qualitative studies vary in design (Fusch and Ness, 2015, Francis et al., 2010). However, there are commonly agreed-upon principles, including the absence of new data, themes, and codes in the research and replicability (Guest et al., 2006). "Replicability" refers to the ability to achieve similar results using newly acquired data. It involves the process of producing comparable outcomes to those obtained previously (Francis et al., 2010).

In this study, the stopping criterion suggested by Francis et al. (2010), which states that saturation is reached when no new themes emerge in the last three consecutive interviews, was used (Francis et al., 2010). The interviewer (AA) took notes of new information at the end of each interview and identified themes to determine data saturation. Based on that approach, it was concluded that data saturation was achieved, and recruitment stopped when no additional data in codes or themes were derived from three successive interviews.

The sample size in this study is comparable to other similar qualitative studies. For example, Mason (2010) analysed 560 qualitative PhD studies and found that the average number of participants was 31.

4.2.2.2.3 Recruitment procedures

As mentioned earlier, the MoE Educational Guidance Department contacted the KSA special schools regarding the study. The department then provided the researcher with a list of special schools that had agreed to participate in the study. Potential participants were first identified by their schools under the following inclusion and exclusion criteria.

Inclusion criteria

- Staff working in KSA special school who agree to participate

  Parents or carers of children with disabilities aged three to 18 years who attend KSA special schools at recruitment and agree to participate in the study

Exclusion criteria

The following exclusion criteria were used:

- Those who do not wish to participate in this study
- Staff who do not work in KSA special schools
- Parents/carers who do not have a child with disabilities currently at KSA special school

After obtaining a list of the schools, the researcher contacted the principals of these schools, provided them with information about the study, and sent them the information sheets, consent forms, and study announcement message via email. Appendices 4.4 and 4.5 contain informed consent forms and Appendices 4.6 and 4.7 are information sheets.

The school principals announced the study via WhatsApp groups, including staff and parent groups. The announcement message introduced the researcher and the study to the

members of the WhatsApp groups. Moreover, the announcement contained two links to Google Forms. These links directed the members to an information sheet and the researcher's contact details if they had any questions. Potential participants were directed to a consent form where they could agree or disagree with each element, allowing them to choose whether they would like to participate (self-selection), and provide their contact information. In the consent form, the participants were assured that they had complete authority to accept or refuse any item in the consent form without facing consequences. The potential participants were provided with details on information management, confidentiality, data anonymity, and their right to withdraw from the research at any point in time. The school principals shared announcements every two weeks via WhatsApp groups. Moreover, an invitation letter and information sheet were posted on the school notice board for all staff to access.

The initial approach to recruiting participants failed to yield sufficient participants. As a result, the researcher decided to use a snowball sampling technique by asking participants to share the announcement with their friends or relatives who could be eligible for the study. Figure 4.2 below summarises the recruitment procedures followed. The following section describes the settings and participants' characteristics.

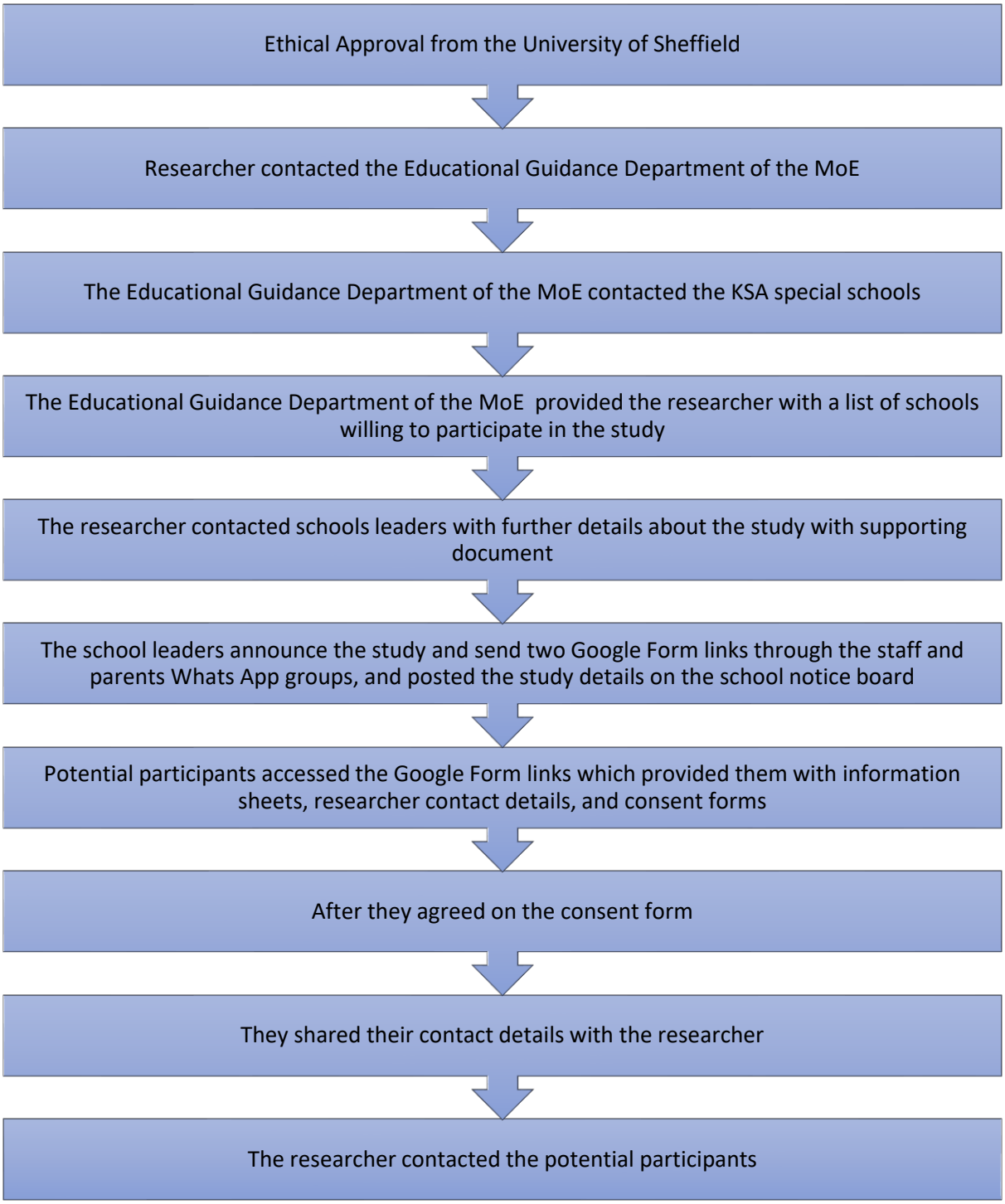

Figure 4-2 The procedure for recruiting participants

4.2.2.3 Setting and participants

4.2.2.3.1 Settings

This section describes the characteristics of the special schools in KSA involved in the study. As described in the previous section, enrolment in the study was subject to the school principal's discretion. This study involved 13 governmental and private special schools from all regions of KSA. The students were male and female, ranging in age from three to 18 years old. Table 4.7 below provides details regarding the KSA special schools participating in the study.

Table 4.1 Characteristics of KSA special schools enrolled in the study.

School name	Location	School Type	Disabilities Type	Student age range (years)	Total student number
School A	Hally, Southern region	Governmental	Autism and behavioural disorders	7 -12	46
School B	Jeddah, Western region	Private	Autism spectrum disorders	3-7	115
School C	AlAhsa, Eastern region	Governmental	Intellectual disabilities	13-18	120
School D	Al Madina, Western region	Governmental, composed of multiple centres for different disabilities	Autism spectrum disorders Intellectual disabilities Physical disabilities Hearing impairments Visual impairments	6- 18	460
School E	Qassim, Central region	Governmental	Visual impairments	4-12	227
School F	Riyadh, Central region	Governmental	Physical disabilities	3-18	78
School G	Riyadh, Central region	Governmental	Intellectual disabilities and autism spectrum disorders	6-12	45
School H	Jazan, Southern region	Governmental	Intellectual disabilities	15-18	67
School I	Abha, Southern region	Private	Down's Syndrome	15-18	35
School J	Makkah, Western region	Private	Autism spectrum disorders and intellectual disabilities	3-12	188
School K	Dammam, Eastern region	Governmental	Learning disabilities	6-12	325
School L	Hail, Northern region	Governmental	Hearing impairments	12-18	82
School M	Riyadh, Central region	Private	Physical disabilities	3-12	125

4.2.2.3.2 Participants

A total of 30 interviews were conducted with 18 staff members and 12 parents/carers. Most participants were responsive, cooperative, and optimistic regarding the interview topic. The participating school staff members held different positions at the schools, held various educational degrees, and ranged in age from 25 to 55 years. Table 4.8 presents an overview of the characteristics of the participating KSA special school staff members.

In addition, the parents/carers of 12 children with disabilities participated in the study. All participants were parents except one brother and one sister. They range in age from 25 to 55 years. Table 4.9 presents an overview of the demographic characteristics of parents/carers of children with disabilities who participated in the study.

Table 4.2 A summary of the demographic characteristics of staff members in KSA special schools who participated in the study.

School name	Participating staff	Job Title	Degree	Gender	Age group	Years of Experience	Student Disabilities
School A	S1	Teacher	Bachelor of Special Education	F	35-40	10	Autism spectrum, Attention deficit and hyperactivity, and hyperactivity disorders.
School B	S2	School agent, Autism spectrum disorders programme supervisor	Bachelor of Special Education	F	45-50	20	Autism spectrum disorders
School C	S3	Special education teacher	Bachelor of Special Education	F	25-30	7	Mild intellectual disability and multiple disabilities
	S18	Health counsellor	Bachelor in nurser	F	35-40	12	Intellectual disabilities
School D	S4	Speech therapist	Master in speech therapy	F	30-35	5	Autism spectrum and speech disorders
	S5	Director of the Intellectual Disability Programme	Bachelor of Special Education	F	45-50	21	Intellectual disabilities
School E	S6	School principal	Master in special education	F	50-55	22	Visual impairments
School F	S7	Social worker	Master in social sciences	M	30-35	7	Physical disabilities
School G	S8	Teacher	Master in special education	F	25-30	5	Autism spectrum disorders and intellectual disabilities
School H	S9	Psychological specialist	Master in psychology	F	30-35	8	Intellectual disabilities
	S17	Activity leaders	Bachelor of Special Education	F	40-45	13	Intellectual disabilities
School I	S10	Teacher	Bachelor of Special Education	F	25-30	3	Down's Syndrome
School J	S11	Teacher	Master in special education	M	25-30	5	Intellectual disabilities

	S12	Physical therapist	bachelor degree	M	40-45	15	Autism spectrum disorders
School K	S13	Activities Leader	Bachelor degree	M	50-55	25	Learning disabilities
School L	S14	Teacher	Master in special education	M	30-35	7	Hearing impairments
	S15	School principal	PhD in speech therapy	M	45-50	10	Hearing impairments
School M	S16	Physical therapist	Bachelor degree	F	30-35	8	Physical disabilities

Table 4.3 A summary of the demographic characteristics of parents/carers of children with disabilities who participated in the study.

School name	Nu.	Relationship to the child	Gender	Age range	Child age (years)	Child disability
School F	P1	Mother	F	40-45	13	Physical disabilities
	P9	Father	M	40-45	10	Physical disabilities
School L	P2	Mother	F	50-55	16	Hearing impairments
School B	P3	Mother	F	25-30	6	Autism spectrum disorders
	P12	Mother	F	30-35	4	Autism spectrum disorders
School I	P4	Sister	F	25-30	17	Down's Syndrome
School E	P5	Father	M	35-40	8	Visual impairments
	P8	Brother	M	30-35	12	Visual impairments
School G	P6	Mother	F	35-40	11	Autism spectrum disorders
School K	P7	Father	M	40-45	7	Learning disabilities
School F	P9	Father	M	40-45	10	Physical disabilities
School A	P10	Mother	F	50-55	12	Attention deficit and hyperactivity, and hyperactivity disorders
School D	P11	Mother	F	40-45	9	Intellectual disabilities

This section presented the sampling techniques, recruitment procedures, sample size, involved settings and participants. The following section illustrates data collection methods and procedures.

4.2.3 Data collection methods and procedures

This section elaborates on the qualitative method employed for data collection and the rationale for selection. For the present study, the researcher selected a semi-structured interview method guided by CFIR to collect data regarding OHAs implementation at KSA special schools.

Semi-structured interviews are appropriate for a deeper understanding of a participant's perspective. It facilitates the exploration of individuals' viewpoints, emotions, and beliefs regarding a particular subject (DeJonckheere and Vaughn, 2019, McGrath et al., 2019). Semi-structured interviews utilise open-ended questions to explore responses within a flexible but predefined interview guide. In addition, due to their flexibility, new inquiries can emerge based on interviewee responses (Ruslin et al., 2022). Consequently, exploring beyond interview guide questions can yield "unexpected and insightful data" (Mackey and Gass, 2015) (p. 93).

A semi-structured interview balances flexibility and structure, allowing for the systematic collection of qualitative data while enabling in-depth exploration. Flexibility to probe further, capturing rich data, accommodating diverse participant perspectives, and facilitating a more natural and conversational flow are among the advantages of semi-structured interviews (Adeoye-Olatunde and Olenik, 2021, Ruslin et al., 2022).

Conversely, there are some limitations to using semi-structured interviews as a data collection method, including potential interviewer bias, the potential for participants to provide socially desirable responses, and challenges in data analysis due to the nature of responses (Adeoye-Olatunde and Olenik, 2021, Ruslin et al., 2022). However, to minimise these limitations, the researcher ensured clear interview guides, allowed flexibility for follow-up queries, and used a diverse sample to attempt to obtain a range of views.

Face-to-face interviews can offer richer non-verbal cues and rapport-building. However, the researcher selected telephone interviews to enhance accessibility, reduce logistical challenges, and encourage participants to feel more at ease, potentially leading to honest responses. Logistically, telephone interviews were helpful to accommodate professional commitments, different locations, and time constraints of the participants. The researcher opted for telephone interviews instead of video calls due to privacy concerns and cultural considerations, as some female participants covered their faces as a part of the Hijab in Islam. So, to preserve their privacy, the researcher used telephone interviews to address the study objectives and for practical reasons.

To sum up, semi-structured interviews were chosen as an appropriate method to obtain valuable insight into OHAs implementation in KSA special schools and to allow the researcher to identify barriers and facilitators based on the CFIR (Adeoye-Olatunde and Olenik, 2021). The following section provides details regarding the Interview guide and interviewing process.

4.2.3.1 Interview guide

This section describes the development and contents of the interview guides. The interview guide is a list of questions or topics used to interview participants (Smulowitz, 2017). Semi-structured interviews are conducted with a flexible interview guide that allows the interviewer to ask questions in different ways or orders and add new questions as data collection progresses based on previous participants' responses. The interview guide aims to gather as much valuable information from participants as possible to answer the research questions (Lindlof and Taylor, 2017).

The researcher utilised the CFIR Interview Guide Tool available on the CFIR website https://cfirguide.org/guide/app/#/ to develop the interview guides (The consolidated framework for implementation research, 2009). Two question-based interview guides were created for staff member interviews and parent/carer interviews. Each interview guide had two versions – one for KSA special schools implementing OHAs and one for those not.

The interview–guides included a list of open-ended questions and several prompts or probes to delve deeper into the topic, based on CFIR (Damschroder et al., 2009, Damschroder et al., 2022, Kirk et al., 2016). Appendix 4.8 and 4.9 contain copies of the interview guide for school staff members and parents/carers, respectively.

In qualitative research, piloting the interview guide to ensure its quality is essential. The supervisors reviewed the interview guides in this study for potential leading questions and clarity. Furthermore, the interview guides were sent to a professor at King Saud University, an expert in school-based OHAs in KSA Arabia with 27 years of experience in dental public health.

Moreover, the researcher conducted pilot interviews with two KSA special school staff members and two parents/carers of children attending KSA special schools who were not participating in the main study. The interviewees reported repetition and difficulties with some questions, prompting amendments to the interview guides. In addition, the supervisors' comments on the interview guide's content, format, and applicability were considered. The study was implemented after the language and format modifications were made. The following section provides a description of the interview process that was followed.

4.2.3.2 Interview process

Eighteen staff members and 12 parents/carers were interviewed over ten months between 20/10/2022 and 30/08/2023. Interviews were conducted over the telephone while the interviewer (AA) was in a private room at home in the UK (distanced from other rooms) or a private study room at the University of Sheffield, without the presence of any individual. The consent form was read out initially, and consent was obtained verbally and recorded. Participants were informed about their right to stop the interview, skip questions, or stop the recorder at sensitive information. The OLYMPUS Digital Voice Recorder WS-813 was used as an external audio recording device while the interviewer's phone was on speaker during the interviews.

The interviews with the staff at the special school lasted from 50 to 80 minutes, with a mean of 65 minutes. The interviews with the parents lasted between 35 and 60 minutes, with a mean of 47.5 minutes. It was recognised that parents might not have access to school information, such as structural characteristics, available resources, leadership engagement and some other constructs. Therefore, not all the CFIR constructs in the school staff interview guide were included in the parents' interview guide. Appendix 4.10 presents an example of the interview's transcript. The following section describes the applied data analysis methods and procedures.

4.2.4 Data analysis methods and procedures

This section describes the preparation of collected data for analysis, including transcription, translation, and storage. Then, the applied data analysis method is presented.

4.2.4.1 Transcription

All interviews were conducted in Arabic and recorded after permission was taken. The researcher transcribed a randomly selected 40% (six staff interviews and six parent interviews). The researcher listened to the interview immediately after it was conducted, transcribed the recorded interview verbatim and wrote a reflection.

The remaining 60% (18 interviews) of the transcription was completed by external professional services. After the transcription, the researcher reviewed and revised the external professional services work.

The researcher identified the types of information that need to be anonymised, including names, locations, school names, and other specific details that could identify an individual and replace real names with pseudonyms such as S1 (staff number 1). The researcher used manual transcription in Microsoft Word, a word processor that offers basic text editing features to anonymise sensitive information. Manual transcription is more time-consuming but could offer greater accuracy and control over the anonymisation process. The anonymisation key was securely stored on an encrypted file on Google Drive. The file was only

accessible to the research team. The key will be discarded promptly once the research course is completed.

4.2.4.2 Translation

The researcher translated 30% of the interview transcripts into English (five staff interviews and four parent interviews) as the research team agreed to translate 30% of the interviews (n=9) into English for review and follow-up on the initial analysis and theme identification during supervision meetings. To retain the original meaning, the researcher followed the recommendation that a fluid description of the meaning be used instead of a word-by-word translation (Van Nes et al., 2010).

After that, two interviews were back-translated into Arabic by external professional services. Finally, the researcher reviewed the back-translated interviews while listening to the recording to ensure the translation was accurate and the meaning transfer chain was preserved during translation (Van Nes et al., 2010).

Subsequently, due to time pressure and funding limits, the research team agreed to continue the analysis in the participants' language as long as possible without additional supervisor review. The researcher found it more feasible to transcribe the remaining interviews in Arabic directly, and it was beneficial to preserve the original meaning, as evidence indicates (Temple and Young, 2004, Van Nes et al., 2010). It has been suggested that the translation of

individuals' quotes can dilute the intended meaning of the context, which is rooted in personal experiences when presented in a different language (Younas et al., 2022).

4.2.4.3 Data storage

The researcher stored the transcribed data in a secure Google Drive. Once the transcripts were developed, checked, and stored securely, the researcher deleted the audio recordings. The researcher handled the sensitive data according to consent agreements. The following section discusses the data analysis methods and the applied procedures.

4.2.4.4 Data analysis

In qualitative studies adopting the CFIR, researchers have applied various methods of analysis such as content (Varsi et al., 2015), thematic (Shi et al., 2016), or framework analysis (Warner et al., 2018, Phulkerd et al., 2017).

Other studies have used a combination of qualitative and quantitative CFIR coding and construct rating methods (Bekelman et al., 2016, Damschroder and Lowery, 2013, Soltoff et al., 2022). For this study, the specific nature of the objectives suggested framework analysis would be the most appropriate (Furber, 2010, Gale et al., 2013, Goldsmith, 2021).

4.2.4.4.1 Framework analysis

Framework analysis is a qualitative approach originally employed in applied policy research (Ritchie et al., 1994, Ritchie and Spencer, 2002, Ritchie et al., 2013). Over time, it has gained popularity as a method for qualitative analyses in various research contexts, including health research (Gale et al., 2013, Ritchie and Spencer, 2002). It is a pragmatic approach that answers specific questions for real-world investigations rather than generating new theories (as per grounded theory) (Gale et al., 2013, Ward et al., 2013). It could be conducted inductively by identifying data themes or deductively by using existing frameworks (Gale et al., 2013). In addition, it is an excellent method for evaluating policies and procedures from the perspective of those impacted by them (Gale et al., 2013).

Framework analysis is a well-structured and rigorous process for managing data that allows qualitative inquiry to be conducted flexibly. It is a flexible method for identifying patterns and summarising data while preserving links to the original data (Ritchie et al., 2003).

However, framework analysis is time-consuming, as with all qualitative data analysis methods (Ward et al., 2013). In addition, it has been criticised for lacking theoretical underpinning (Smith et al., 2011). (Pope et al., 2000) also argued that the flexibility of the framework analysis might lead to shortcuts being taken by researchers. The framework method consists of five stages to filter, organise, and analyse data according to key themes that are distinct yet related (Ritchie et al., 1994, Ritchie and Spencer, 2002, Ritchie et al., 2003), as presented in Figure 4.3.

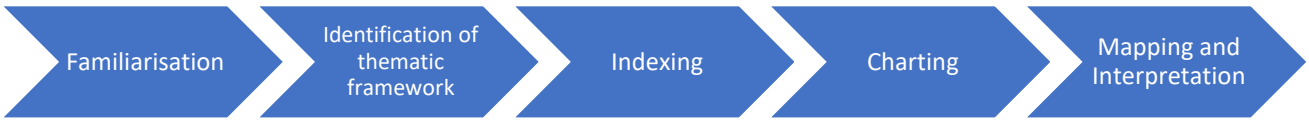

Figure 4-3. Five stages of framework analysis (Ritchie et al., 1994, Ritchie and Spencer, 2002, Ritchie et al., 2003).

Stage one: familiarisation

Before analysing the data, researchers are required to familiarise themselves with it thoroughly by listening to audio recordings, reading, and re-reading transcripts with consideration of the study's aims and objectives. They also note the main issues, similarities, differences, and any recurring patterns in the data (Ritchie et al., 1994, Ritchie and Spencer, 2002, Ritchie et al., 2003).

Stage two: identification of the thematic framework

The notes taken during the familiarisation stage are then used to identify the key issues and themes expressed by the participants. These notes aid in creating a thematic framework to filter and classify the collected data (Ritchie et al., 1994, Ritchie and Spencer, 2002, Ritchie et al., 2003, Ritchie et al., 2013).

Stage three: indexing

The thematic framework created is then used to extract relevant information by identifying specific data sections corresponding to a particular theme. For convenience, Ritchie et al., 1994 recommended that a numerical system be used to index references and annotate in the margin beside the text (Ritchie et al., 1994). In addition, qualitative data analysis tools like Microsoft Word (Furber, 2010), Microsoft Excel (Dixon-Woods, 2011, Swallow et al., 2003), or computer assisted qualitative data analysis software (CAQDAS) can facilitate this stage (García-Horta and Guerra-Ramos, 2009, Lewins and Silver, 2009, Wickham and Woods, 2005).

Stage four: charting

During the fourth stage, the indexed data is organised into charts based on the identified themes by taking the data out of its original textual context and placing it under different headings created during the thematic framework stage (Ritchie et al., 1994, Ritchie and Spencer, 2002, Ritchie et al., 2003, Gale et al., 2013, Ritchie et al., 2013).

The information from all the interviews is compiled into a single chart or matrix depending on the identified thematic framework to allow comparison between and within the cases and themes (Gale et al., 2013, Ritchie et al., 1994, Ritchie and Spencer, 2002, Ritchie et al., 2003,

Ritchie et al., 2013). The researchers condense the original data into easily understandable summaries, then categorised into appropriate themes in the theoretical framework chart to visualise the data and enable researchers to understand and interpret the data (Gale et al., 2013, Ritchie et al., 1994, Ritchie and Spencer, 2002, Ritchie et al., 2003, Ritchie et al., 2013).

Stage five: mapping and interpretation

To synthesise the data, the researchers then meticulously examine the chart and comprehend the entire data set. This process may involve cross-checking the summaries on the chart with the original data or comparing the different themes and sub-themes with each other (Gale et al., 2013, Ritchie et al., 1994, Ritchie and Spencer, 2002, Ritchie et al., 2003, Ritchie et al., 2013). Additionally, the sub-themes and themes may be combined to give a clearer picture of the overall data (Ward et al., 2013). The mapping and interpretation stage involves analysing critical chart characteristics to guide data interpretation (Gale et al., 2013, Ritchie et al., 1994, Ritchie and Spencer, 2002, Ritchie et al., 2003, Ritchie et al., 2013). The following section presents the researcher's method for exploring the implementation of school-based OHAs in KSA special schools using framework analysis.

4.2.4.4.2 Data analysis procedures

For data collection and analysis, framework analysis was used, guided by the CFIR. The CFIR provided the a priori framework which guided the study; however, the analysis was not entirely deductive. The researcher was open to any issues in the data and included them in developing the thematic framework, e.g., the availability and types of OHA. This section

details how the researcher (AA) applied the framework analysis procedure and used the computer-assisted qualitative data analysis software (CAQDAS), Quirkos, to facilitate data management and analysis.

Stages of data collection and analysis

The data collection and analysis were coordinated to inform each other. According to the collected data, the researcher reviewed the interview guides and focused on little-explored topics; accordingly, Figure 4.4 represents these steps.

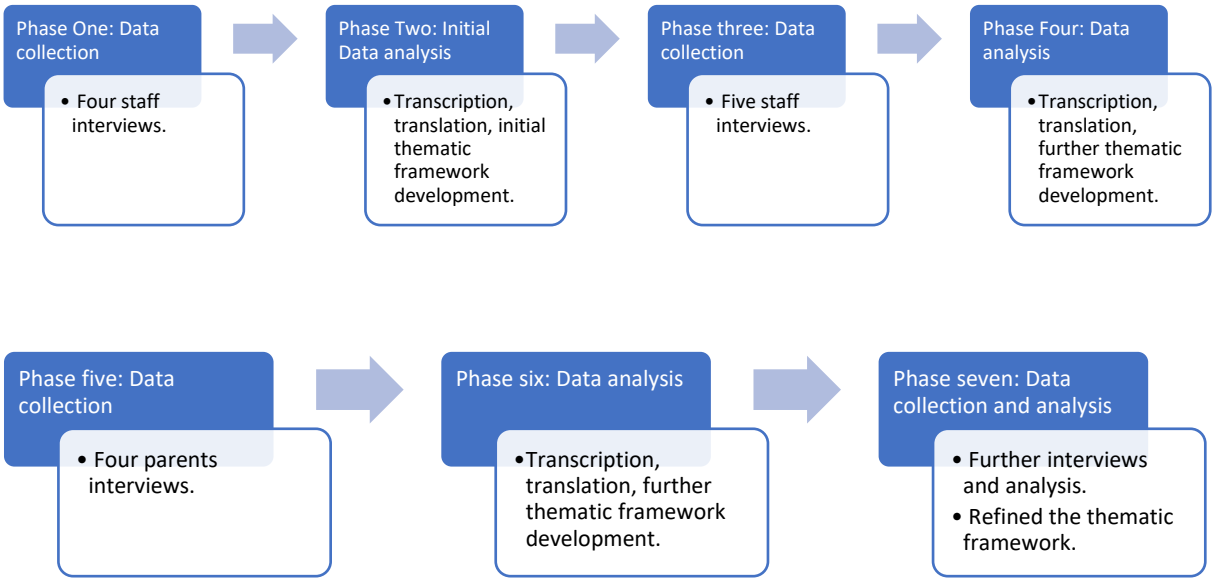

Figure 4-4 illustrates the loop of the data collection and analysis phases.

Stage one: familiarisation

This stage facilitates the researcher's deep engagement to understand the whole data and identify recurring themes. AA familiarised herself with the data by conducting interviews, listening to audio recordings, and reviewing transcripts. In addition, she read the reflections taken during and after each interview along with the transcripts to ensure that the context was considered. The reflective journal documents the researcher's thoughts, personal experiences, and insights during data collection and analysis. It includes details of the

researchers' actions, thoughts, and emotions during data analysis. The components include description, analysis, interpretation, evaluation, and future application. The information recorded in the journals included initial impressions, the researcher's first thoughts and feelings about the interview, participant behaviour, cultural factors, and the emotional responses of both the researcher and the participant during the interview. In addition, thoughts on the interview process, including the questions' effectiveness, difficulties encountered, and areas for improvement, were recorded. Also, it included analytical insights such as emerging themes and patterns that arose during the interview or immediately afterwards. Furthermore, the researcher reflected on the research methodology, including ethical concerns, the impact of the researcher's biases, and the dynamics of the researcher-participants relationship. Moreover, the researcher's learning journey was recorded, including how the research experience affected their understanding of the topic and research skills. It also included plans for the next steps in the research process, such as revising the interview guide, seeking additional literature, or planning follow-up interviews.

Initially, tables were created to code the initially identified themes. Appendix 4.11 contains an example of the first stage of theme identification with 47 codes. After that, the comments feature on the Microsoft Word transcript file was utilised to highlight crucial themes mentioned in the transcripts. The initial codes were 65 for staff interviews and 30 for parents' interviews. The researcher undertook this stage alone, and the supervisors reviewed three transcripts.

Stage two: identification of the thematic framework

Following a thorough review of the data's preliminary ideas regarding the primary themes formed, the researcher (AA) constructed a thematic framework using both the CFIR constructs and the data itself using combined deductive and inductive methods. Organising initial codes into themes is a crucial step in qualitative data analysis. This process involved grouping similar codes and identifying broader patterns by thoroughly reviewing all the initial codes that emerged from the data. After that, the researcher grouped similar codes by identifying patterns, similarities, and differences. The researcher then organised codes into clusters that relate to a familiar concept using Quirkos software. After that, she assigned a provisional name to each cluster that reflects the essence of the grouped codes. Then, she refined the themes by checking whether the codes within each cluster coherently supported the proposed theme. Followed by re-examining the theme in the context of the entire data set to ensure they accurately represent the data and define the themes. After that, the researcher created a thematic map to visualise the relationships between themes and established a hierarchy where sub-themes support the main themes and ensure that each theme is coherent and distinct. Also, confirm that all relevant data is captured within the themes.

To develop the thematic framework, the researcher utilised the commenting feature of Microsoft Word. Staff interviews revealed 19 themes and 63 subthemes, while parent interviews had 16 themes and 8 subthemes. Box 4.1 below outlines the themes identified during this stage. This stage was undertaken by the researcher (AA) alone, and the supervisors revised the thematic framework twice.

Box 4.1 Outlines the themes identified during the identification of the thematic framework stage of framework analysis from staff interviews (left side) and parents' interviews (right side).

1- Availability and types of OHAs
2- OHAs Source
3- Complexity
4- Adaptability
5- Design and quality
6- Knowledge and beliefs about the Intervention
7- Self-efficacy
8- Culture and compatibility
9- Relative priority
10- Leadership engagement
11- Available resources
12- Structural characteristics
13- Networks and Communications
14- Organisational incentives and rewards system
15- Peer pressure
16- External policies and incentives
17- Reflecting and evaluating
18- Planning
19- Engagement

1- Parents' source of dental health information
2- Parents' management of child dental care
3- Child's previous dental treatment
4- Availability of OHAs
5- Adaptability
6- Relative priority
7- Design and quality
8- Parents' knowledge, attitude, and feelings toward OHAs
9- Self-efficacy
10- Culture
11- Leadership engagement
12- Network and communication
13- External policies and incentives
14- Planning
15- Evaluation and reflection
16- Engagement

Stage three: indexing

The thematic framework was used to organise the data by identifying data corresponding to a particular theme. Quirkos was used for this task. The themes and sub-themes were refined, combined, and developed during this stage. Figure 4.5 below is a screenshot illustrating the data visualisation using Quirkos.

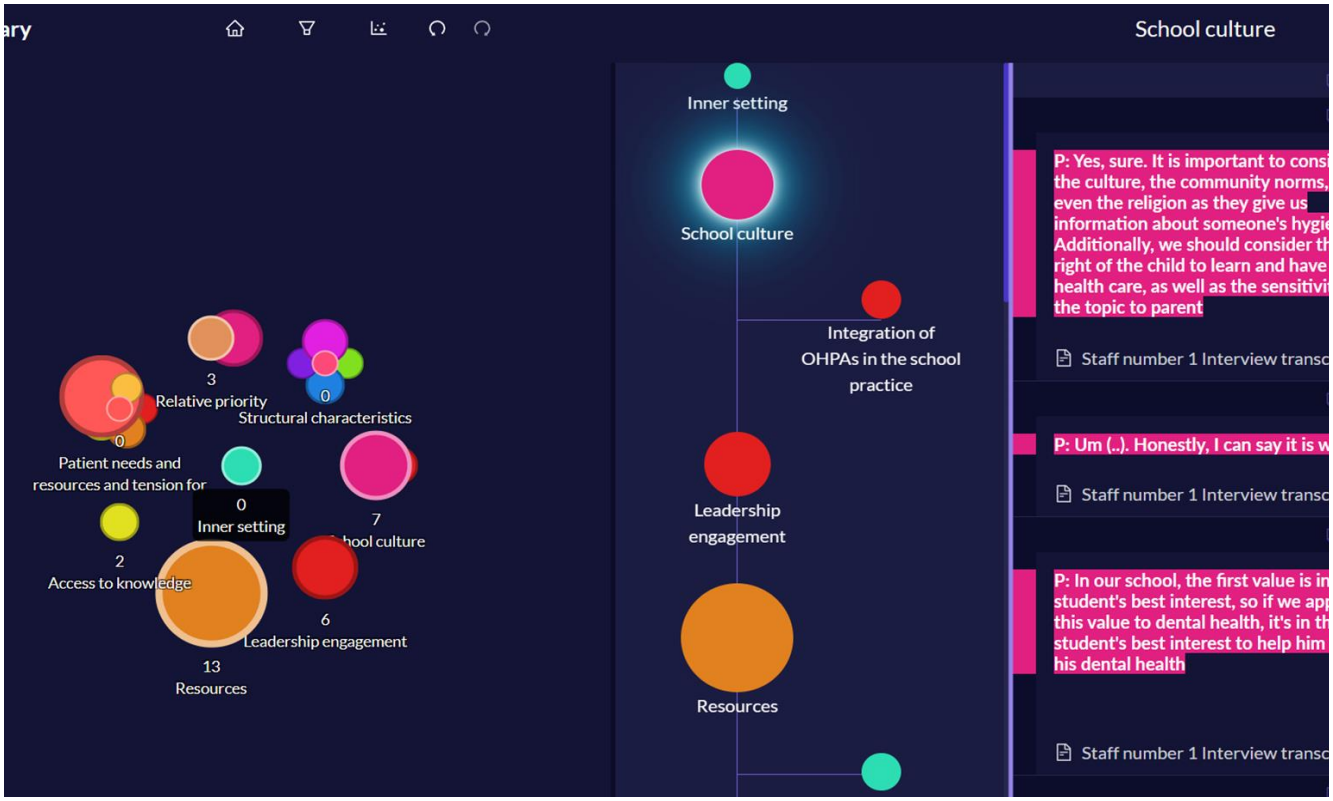

Figure 4-5. Quirkos interface displaying coded data(Ritchie et al., 1994).

Stage four: charting

The researcher used Quirkos to manage data by linking summaries to full transcripts and then summarising the data into the identified thematic framework (Swallow et al., 2003).

Stage five: mapping and interpretation

The researcher completed the data synthesis process by mapping and interpreting it. To understand the dataset comprehensively, the researcher carefully examined the charts by cross-referencing the summaries with the original data and evaluating the themes and sub-themes (Ritchie et al., 2013). No changes were made to the themes or sub-themes at this stage. Finally, the researcher and supervisors agreed upon the final thematic framework. The KSA special schools staff members and the parents/carers of attending children were analysed separately using CFIR. The CFIR was used to analyse the data by identifying the school-based OHAs implementation barriers and facilitators per CFIR domains and constructs. Then, the identified barriers and facilitators informed the recommendations for an OHP toolkit addressing the identified barriers.

Quirkos

Quirkos was developed in 2013 by Dr Daniel Turner and his team, providing a simple, comprehensive, and affordable tool for qualitative data analysis (Turner, 2013). It simplifies data coding and categorisation, facilitating pattern and theme identification in qualitative data through a user-friendly interface (Turner, 2013). It offers a clear and systematic approach to code definition, modification, data retrieval, and word search (Friese, 2022). However, no qualitative software could automatically understand the text and analyse it (García-Horta and Guerra-Ramos, 2009). More details about Quirkos software are available on their website https://www.quirkos.com/about.html.

4.2.5 Quality assurance

To ensure the rigour of qualitative research, it is essential to use transparent, reproducible, unbiased, and open methods and findings (Creswell and Miller, 2000). Lincoln and Guba (1985) propose four processes to establish trustworthiness in qualitative research: credibility, transferability, dependability, and confirmability (Lincoln and Guba, 1985).

4.2.5.1 Credibility

There has been a significant amount of literature published on credibility (Guba, 1981, Stahl and King, 2020). Tobin and Begley (2004) argue that credibility depends on the consistency between participant responses and researcher reporting.

The researcher implemented rigorous measures to establish credibility in this study. During and after the interview, participants were asked to confirm that the researcher accurately reflected their intended meanings. In addition, data-rich descriptions were used to ensure the accuracy and completeness of the information. Moreover, the researcher spent an extended period collecting, reading, and analysing the data. In addition, the researcher transcribed most of the data and applied steps to check the accuracy of transcription and translation as described earlier. Furthermore, the outlined analytical procedure was designed to improve credibility and validity (Creswell and Miller, 2000, Creswell and Creswell, 2017).

4.2.5.2 Dependability

Refers to the consistency and reliability of study findings. It is the degree to which independent researchers can obtain similar outcomes to a study (Klenke, 2016). The researcher must be aware of and responsive to changes in the research context, as they affect the study's dependability (Klenke, 2016).

The principal researcher (AA) conducted all the semi-structured interviews using these interview guides and followed the respondent validation technique. Respondent validation involves comparing the investigator's account with those of the interviewees. A helpful technique is to provide participants with feedback on critical points during the interview. This allows them to confirm or modify the accuracy of the researcher's interpretation.

Additionally, the researcher used the Consolidated Criteria for Reporting Qualitative Research (COREQ) checklist to enhance the transparency and completeness of this study report (Tong et al., 2007), refer to Appendix 4.11.

4.2.5.3 Transferability

It refers to the possibility that the study outcomes might be repeated in a different unique context and that its effectiveness remains constant (Creswell and Miller, 2000). A clear sample and study context description enable transferability (Creswell and Miller, 2000).

4.2.5.4 Confirmability

In qualitative research, confirmability refers to the objectivity and neutrality of the research findings. It ensures that the data collected and the researcher's biases or preferences do not influence interpretations (Lincoln and Guba, 1985).

4.2.5.5 Applied strategies to ensure the study rigour

The researcher implemented key strategies to ensure the research rigour, including audit trails, prolonged engagement, maintaining researcher reflexivity (awareness of biases), and peer debriefing (supervisors) (Denzin and Lincoln, 2011).

4.2.5.5.1 An audit trail

In research, the term audit trail refers to a systematic and detailed documentation of the process, from the initial stages to the outcomes. It includes detailed records of data collection methods, research design decisions, changes, and analytical processes. The purpose of an audit trail is to provide transparency, allowing other researchers to follow the steps taken and understand the researcher's choices. This documentation is crucial for ensuring the credibility and dependability of qualitative research (Carcary, 2009).

4.2.5.5.2 Prolonged engagement

The researcher spends significant time on the research process, including data collection, analysis, listening to audio records and reading transcripts.

4.2.5.5.3 Researcher reflexivity

Researcher reflexivity in qualitative research involves the researcher's awareness and examination of their background, biases, and preconceptions. It emphasises acknowledging and understanding how the researcher's perspectives may influence the research process and outcomes. This self-awareness contributes to the credibility of the study (Berger, 2015).

The researcher acknowledged and documented her biases and preconceptions to maintain transparency and minimise their impact on the study. Chapter six, Discussion, presented the researcher's role and reflexivity in Section (6.3.2.1).

4.2.5.5.4 Peer debriefing

Peer debriefing is a process in qualitative research where the researcher discusses and reflects on their findings, interpretations, and decisions with a peer or colleague (Janesick, 2007). This external perspective helps ensure rigour and enhances the study's credibility by providing insights and offering alternative viewpoints. It serves as a form of quality control, promoting thorough examination of the research process, findings, and decisions with colleagues to gain external insights and address potential biases. The researcher reviewed the study process and findings in detail with the supervisors in this study.

4.3 Summary

This chapter detailed the second study of this PhD research methodology and methods. This is a pragmatic, qualitative study conducted using telephone-based semi-structured interviews with a purposive and snowball sample of KSA special schools staff members (n=18) and parents/carers of attending children (n=12) conducted over ten months between 20/10/2022 and 30/08/2023, from 13 special schools catering children with a wide range of disabilities from all KSA geographic/administrative regions. The data collection and analysis were based on CFIR, which was utilised to inform the development of the interview guides and the identification of the theme during the framework analysis.

The interviews were audio-recorded using an external audio recording device, transcribed verbatim, translated, and saved in a secure Google Drive following rigours and consistent methods. The researcher deleted the recordings once the transcripts were developed, checked, and stored securely. The data analysis was conducted inductively and deductively by identifying themes from the collected data and linking them to CFIR constructs, if applicable. This method ensured that no valuable data was missed. Furthermore, framework analysis was performed as it is a suitable pragmatic approach that answers specific questions for real-world research. In addition, it provides a valuable means of evaluating policies and procedures from the perspective of those affected. Moreover, the researcher utilised the CAQDAS, Quirkos, to facilitate data management and analysis. To ensure the rigour of qualitative research, the researcher followed transparent, reproducible, unbiased, and open methods and implemented key strategies, including audit trails, prolonged engagement,

researcher reflexivity, and peer debriefing. This chapter provided a comprehensive description of the research design, paradigm, methodology, and methods. Moreover, it detailed the quality assurance methods implemented, justifications for the chosen methodology, data collection and analysis methods, and any methodological limitations encountered. The next chapter presents the findings obtained through qualitative, semi-structured interviews.

Chapter 5. Findings of the implementation of school-based oral health activities in special schools in the KSA- A qualitative Study

5.1 Introduction

This study explored the school-based OHAs in the KSA special schools from the perspective of staff and parents/carers of children with disabilities. Furthermore, the study examined perceived barriers to and facilitators of school-based OHAs implementation according to the CFIR.

The research objectives were as follows:

1. Determine what OHAs are currently conducted in KSA special schools
2. Based on the CFIR, identify the factors influencing OHAs implementation in special schools, including barriers and facilitators
3. To recommend key concepts on which to base an OHP implementation toolkit to improve the OHAs in special schools in KSA

The previous chapter discussed the study methodology, sample selection technique, and data collection and analysis methods. This chapter presents the findings of semi-structured interviews conducted with a sample of staff and parents/carers of children attending special schools in the KSA. The findings chapter is divided into three main sections:

1. Perspectives of school staff members towards school-based OHAs
2. Perspectives of parents and carers towards school-based OHAs

3. A summary of how the findings shaped the recommendations for key concepts to underpin an OHP implementation toolkit for KSA special schools

5.2 Perspectives of school staff members towards school-based oral health activities

This section focuses on the findings of interviews with staff members about the implementation of OHAs in KSA special schools. A total of 18 interviews were conducted with employees holding different job positions from 13 KSA special schools. The characteristics of participants are presented in Table 4.8. First, the identified themes from the framework analysis results will be outlined. Then, factors influencing OHAs implementation in KSA special schools, including barriers and facilitators according to CFIR, are presented. Representative quotes illustrate the key concepts arising from the discussion. To protect the participants' anonymity, the quotes are identified according to the interview number (e.g., S1 for the first staff member interviewed).

5.2.1 Identified themes

The identified themes during the data analysis process were grouped according to the CFIR five domains into 19 major themes, as shown in Figure 5.1 below.

Figure 5-1 Themes identified from KSA special school staff interviews according to the Consolidated Framework for Implementation Research domains.

5.2.2 Factors influencing the implementation of oral health activities in KSA special schools, according to school staff

The researcher employed the CFIR to explore OHAs implementation in the KSA special schools as it is a valuable tool that helps analyse various contexts and identify potential barriers and facilitators to the implementation process. As defined in the methods chapter, it consists of five main domains associated with implementation, which were used to organise the data within the framework. Figure 5.2 shows the CFIR domains and underlying constructs adopted in this study.

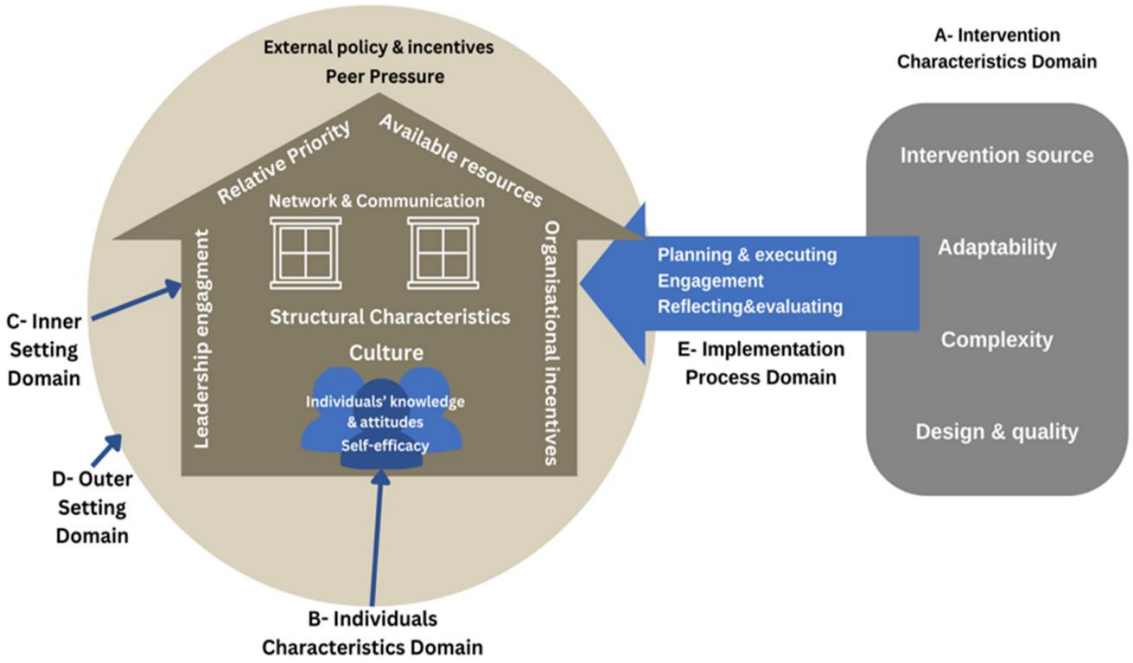

Figure 5-2 The Consolidated Framework for Implementation Research domains: intervention characteristics, individual characteristics, inner setting, outer setting, and implementation process and their underlying constructs.

5.2.2.1 Intervention characteristics domain

The first CFIR domain examined the OHAs characteristics and how they impacted their implementation process in KSA special schools. This domain covers five themes related to OHAs, including their availability and types, source, adaptability, complexity, and quality, as illustrated in Figure 5.3.

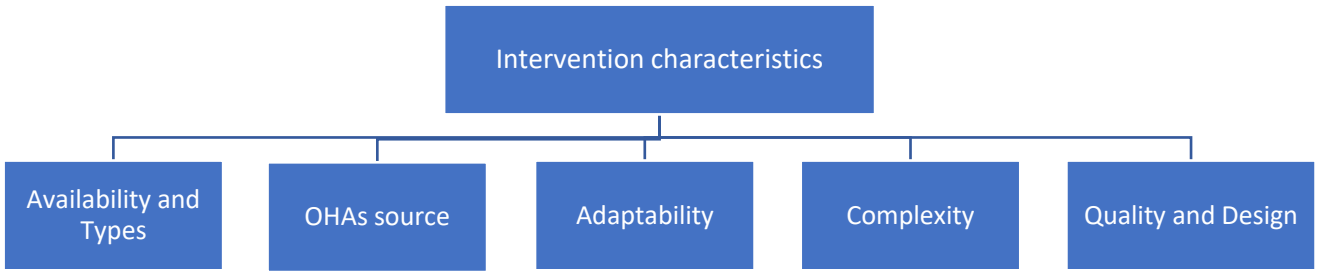

Figure 5-3 Themes of The Consolidated Framework for Implementation Science – Intervention Characteristics domain.

5.2.2.1.1 Availability and types of oral health activities

This theme concerns OHAs provision and types in the KSA special schools. Although this theme is not directly related to CFIR, it emerged from the collected data to address the first research objective, the determination of the current OHAs in the KSA special schools. Since this theme describes the availability and types of OHAs in the KSA special schools, it is categorised under the intervention characteristics domain for ease of understanding.

The interviews revealed that KSA special schools provided OHAs to varying extents. KSA special schools differ mainly in the availability of OHAs, the type of OHAs that are applied, and the implementation process.

In some schools, dental examinations, referrals, a policy banning sweets, and a healthy meal plan for students were all part of a comprehensive dental health programme. Other schools, however, do not offer such programmes.

"*Yes. Tiba Educational City has clinics where doctors from different disciplines, such as dentists, come on Tuesdays and Wednesdays. They screen the children and provide referrals in coordination with parents. In addition, the curriculum includes a life skills module where children learn to wash their hands and clean their teeth. In addition, healthy breakfasts are served daily at school. Bringing sweets home is prohibited since they increase hyperactivity. In addition, we celebrate World Dental Health Day*." (S4)

"*Our dental clinic hosts visiting dentists weekly to examine and provide referrals. Additionally, sometimes lectures are also provided to parents*." (S5)

Moreover, the findings indicate the integration of dental health education into the school curriculum.

"*We have a health and safety unit in the school curriculum; during this unit, we conduct dental health activities, assisted by a volunteer dentist. We plan and collaborate to do this activity*.

This activity discusses how to care for dental health and how desserts can harm teeth. I have worked at the school for eight years and perform this activity annually." (S2)

"*I have been a school member for nearly three years and have not noticed any specific initiatives promoting children's dental health. While no organised activities or events exist, daily life skills are incorporated into each student's educational plan, including instruction on tooth brushing as needed*." (S11)

Additionally, some schools conduct dental health education sessions to raise dental health awareness among children, while others celebrated World oral health day.

"*Our approach to activity planning during the semester is based on the needs of students. We identify areas of neglect, such as dental health, and present dental health education sessions to inform them. We do not have a set annual schedule but instead, tailor our activities to meet the specific needs of our students*." (S12)

However, some participants reported that no OHAs were present.

"*None. I have worked in this school for five years and have never had dental health activities. However, before that, I worked in an autism centre where they did activities to improve dental health. Each year, they invite a dentist and nurse to do a check-up. They must brush after the school meal on the student's daily schedule*." (S1)

"*Oh, I wish! Especially since I see many cases of front teeth decay and lack of hygiene*." (S3)

"*No, we do not have this type of activities*." (S14)

Overall, OHAs among KSA special schools vary with no national oral health promotion programme. While some special schools conducted dental health education activities to enhance student dental health awareness, none of the activities applied met the definition of OHP. The following theme explores how the activities were developed.

5.2.2.1.2 Oral health activities source

In the CFIR framework, the intervention characteristics domain assesses different features of the intervention, including its source, as this influences its credibility, compatibility with existing practices, and the availability of support and resources for its implementation.

This theme describes the participants' perceptions of OHAs development in KSA special schools. Specifically, it examines whether the development of OHAs is carried out internally by school staff or externally. The data indicates that the applied OHAs in KSA special schools were developed internally without involving the MoE, MoH or a third party such as researchers, experts, or health organisations. For instance, schools created their OHAs internally through an agreement signed by the school committee.

"*The administration decides to act based on the study units and then discusses them with the school committee*." (S2)

"*The officer assigned the health counsellor to activate the activity, and the health counsellor communicates with the teachers to plan and implement*." (S4)

Generally, the OHAs employed in KSA special schools were developed internally without the involvement of a third party. The adaptations of the OHAs to cater to the learning needs of children with disabilities will be discussed in the subsequent theme.

5.2.2.1.3 Adaptability

In CFIR, adaptability is modifying an intervention to meet the target population's needs and preferences. Highly adaptable interventions can be tailored to specific populations, making them more feasible and acceptable.

Accordingly, this theme evaluates the adaptability of OHAs to the learning needs of the children attending KSA special schools. The participants highlighted the need to improve the adaptability of school-based OHAs.

"*In my opinion, it is not entirely adapted. For example, the video shown is an educational video for l children without disabilities. We got it from YouTube, which may not be suitable for children with autism. Also, the length and complexity of information may not suit them. It might be because there is no special scientific material for them*." (S4)

"*It is not adjusted to the children's special needs. For example, it used general education resources not in Braille*." (S6)

However, adapting materials to suit the specific needs and sensory preferences of students with autism spectrum disorders by utilising tailored visuals and sensory engagement strategies effectively was discussed.

"*We plan and tailor the activity to suit them from the outset. We activated the five senses. We used picture-based education to teach them the proper way to brush their teeth in small steps."* (S2)

Furthermore, the findings outline several recommendations for enhancing the school- based OHA's adaptability, as shown in Table 5.1.

Table 5.1 KSA special schools staff members' recommendations to improve the school-based oral health activities adaptability.

Approaches to improve OHAs adaptation	Recommendations for adaptable activities
Sensory adapted tools	Virtual reality
Tailored visuals and educational materials	Social stories
Modelling	
Reminders and rewards	
Collaboration with parents	
Collaboration with health services	
Individualised oral health education plan	

Overall, sensory-adapted tools, tailored visuals, and sensory engagement could help adapt OHA. For example, tailored visual aids such as pictures, short educational videos, and sensory-engaging models are among the recommended approaches to adapt OHAs. Since these methods suit the students' specific learning needs, they are believed to be more effective than traditional lectures.

"*Children with autism suffer from hypersensitivity to toothpaste foam or taste and maybe the brushing action. I heard about new tools that suit them*." (S2)

"*This group cannot receive too much information. Lectures, lessons, and PowerPoint presentations are not beneficial. Pictures, videos, and tactile sensory things help them, such as brushing the teeth on the jaw model. I apply and let the students apply*." (S3)

"*It is useful to demonstrate the toothbrushing method on a large model so they can see the details and apply by themselves*." (S10)

"*Some students prefer hands-on learning, so I give them toothbrushes and puppets during our lessons.*" (S11)

Additionally, visual aids were suggested as a viable method for instructing proper tooth brushing techniques.

"*Demonstrating toothbrushing with pictures is appropriate for children with autism. Rely on pictures to remind them to brush their teeth, put them somewhere they can see daily*." (S4)

Furthermore, the participants suggested ways of encouraging children with disabilities to maintain good oral hygiene habits, including frequent reminders, providing brushing diaries, and offering rewards for regular toothbrushing. For example, they highlighted the necessity of continuous reminders to facilitate the OHAs effectiveness.

"*Continuous reminders are needed for activity effectiveness. For example, I can print her a schedule to brush her teeth and hang it in her book. Whenever a student brushes her teeth, I give her a star sticker. At the end of the week, I give gifts to students who brush their teeth because they love gifts so much*." (S3)

"*Most of my students are very passionate about rewards for doing a particular kind of activity*." (S1)

In addition, this theme highlights the necessity of flexibility and repetition to address unique learning preferences.

"*Teaching children is challenging, as each child has their own learning style, although all styles converge at some point. It is essential to note that there are differences, particularly for those with disabilities. Some children learn best through videos and songs, while others prefer playing games and colouring. Some prefer hands-on learning, so I give them toothbrushes and puppets during our lessons. It is crucial to use multiple teaching methods to convey the same information. I often repeat the same information in different ways four to five times to cater to each student's needs. I always open myself to multiple methods, which may work for some but not others*." (S11)

In order to address individual differences in children's needs, it was suggested to develop personalised oral health education plans to support the implementation of OHAs. "*It is necessary to work for each student separately because each child has special abilities. We can develop a personal plan*." (S4)

Furthermore, the findings suggested that involving parents is critical in facilitating the OHAs implementation for students with intellectual disabilities, as parental support is crucial for promoting healthy habits.

"*Targeting parents is the most critical point*." (S3)

"*Directing information and education to parents is better than relying on children and asking parents to set a routine since children depend on it*." (S4)

It was also suggested that collaboration with health centres and universities would be beneficial in adapting educational materials to suit children with additional learning needs.

"*The educational contents adaptation would be possible if there were a collaboration with health centres and dental colleges in universities*." (S2)

Social stories and virtual reality were recommended as practical activities to enhance OHA adaptability.

"*We can engage in numerous activities, including creating a social story appropriate for children with high or moderate perceptions. The social story should be written from the child's perspective. Social stories about dental health might be available in English, though not necessarily in Arabic. Similarly, wearing virtual reality glasses can simulate a visit to the dentist to help individuals better prepare for the experience. They can be used to teach them how to brush their teeth properly."* (S11)

The data indicated that most of the school-based OHAs applied in KSA special schools needed to be adapted to children's learning needs. Among the perceived facilitators of OHAs implementation in KSA special schools were adapted educational materials, suitable visual aids, and tailored approaches such as frequent reminders, social stories, modelling, virtual reality, and collaboration with parents and health services.

However, the lack of adapted dental health educational materials for children with disabilities hindered OHAs implementation in KSA special schools. This theme is critical to inform the

recommendations for OHP implementation toolkit. The following theme will discuss the perceived complexity of school-based OHAs implementation in KSA special schools.

5.2.2.1.4 Complexity

In the CFIR, the complexity construct refers to how difficult an intervention or its implementation process is perceived.

This theme assesses the complexity of implementing OHAs in KSA special schools, considering factors such as duration, scope, and the number of steps involved. The focus is on evaluating the complexity of the school-based OHAs and how it could impact the implementation outcomes.

The findings highlight the cost of implementing OHAs as a barrier. Specifically, the participants highlighted the cost of designing and printing suitable dental health educational material.

"*The cost of printing and designing can hinder certain activities like brochure and educational materials distribution*." (S1)

Moreover, implementing OHAs at KSA special schools faced difficulties in teaching toothbrushing techniques due to lack of training, challenging student behaviour, limited student attention, children's sensitivity to toothpaste, and limited parental cooperation.

"*I see it was relatively easy. Just play a video and teach the children how to brush their teeth. However, we had difficulties in teaching them the brushing technique, such as some of the*

students' behaviours, some students did not respond very well, parents did not cooperate, and some children suffered from sensitivity." (S4)

"*I feel it was difficult for me to inform my students how to brush their teeth properly. Maybe because I am not trained on it*." (S6)

Additionally, sensory hypersensitivity to high-volume sounds in the displayed videos was a perceived challenge.

"*The loud sound during the video made it difficult for the children to concentrate because they were uncomfortable*." (S5)

Furthermore, the participants described the steps and duration of the implemented OHAs and its impact.

"*Previous activities took about two to three weeks to plan and prepare, followed by a week of explanations by the teacher during the health and safety unit. At the end of the week, the dentist and the teachers presented a full day of activities and corners. The school took a long time to finalise and implement the activity*." (S2)

Moreover, it was suggested that approval processes for dentists to implement school-related activities take time.

"*Approval processes can take up to two school terms for dentists or health professionals to visit special schools and conduct activities. This lengthy process may contribute to the scarcity of such visits and programs*." (S13)

In summary, staff at KSA special schools identified activity cost, challenges in teaching toothbrushing technique, and required approvals as barriers to implementing OHAs. The upcoming theme will focus on the views of staff members regarding the quality and design of the OHAs in KSA special schools.

5.2.2.1.5 Design and quality

This theme evaluates the design and quality of OHAs implemented in KSA special schools. The participants had differing views depending on their experiences.

"*This activity was even better than excellent because the dentist put much effort into it. Brochures, toothbrushes, and toothpaste were distributed. Teachers also taught each student individually. We receive positive feedback, and everyone is happy with the current situation. Children are becoming more aware of dental health and healthy practices, and their parents thank us for our actions*." (S2)

"*I believe in the effectiveness of the applied dental health education and the school clinic and visiting doctors. I am satisfied with the school's efforts*." (S5)

However, while the existing OHAs at KSA special schools is considered satisfactory, the findings highlight criticism of the need for reliable resources, such as a toolkit, guidance document, and support materials to facilitate the implementation process.

"*Although we made a great effort with the dentist's support. However, the program lacked scientific resources which we can depend on it to have the information from a valuable source. I wish we had a guideline*." (S2)

Conversely, some findings suggested that the quality of the applied OHAs was average.

"*Average, nothing outstanding, just that International Day is held annually.*" (S6)

In addition, this theme discusses the participants' expectations regarding the school-based OHAs design and quality. The findings indicate the need to adapt the OHAs to the student's learning preferences, as indicated earlier under the adaptability theme (Section 5.2.2.1.3). For example, using jaw models provides tactile sensations and delivers information engagingly.

"*We need to engage the tactile senses of students, especially those with visual impairments*." (S6)

Moreover, using social media and digital platforms to promote oral health can overcome the cost barrier of printing mentioned earlier during the complexity theme (Section 5.2.2.1.4).

"*Social media can be used to raise necessary awareness. Rather than printing brochures, barcodes and digital information can be used instead*." (S1)

While some staff members found the design and quality of the school-based OHAs satisfactory, others felt that adapting the learning materials to suit students' abilities can enhance quality and facilitate implementation.

5.2.2.1.6 Summary

The CFIR Intervention Characteristics domain included five key themes relating to OHAs implementation in KSA special schools.

First, there was wide variation among KSA special schools in the availability and types of applied OHAs. Some KSA special schools had a comprehensive dental health programme, integrated dental health into the curriculum, or held annual World Dental Health Day celebrations, while others completely lacked OHAs. Indeed, none of the special schools provided oral health promotion activities.

Second, the OHAs in KSA special schools were developed internally without involving the MoE, MoH, or a third party.

Third, many employees stressed on modifying the OHAs to meet children's abilities. This can be achieved by simplifying information, incorporating tailored visual aids, and actively engaging parents and dentists.

Fourth, the special schools found that implementing OHAs was challenging for various reasons, such as cost and challenges in teaching proper toothbrushing techniques as barriers to the successful implementation process.

Finally, the design and quality of OHAs were generally satisfactory to the staff members. However, tailoring the OHAs to the students' abilities would significantly improve their quality.

This CFIR's domain investigated the opinions of the staff at KSA special schools on the availability, source, adaptability, complexity, and quality of school-based OHAs. Figure 5.4 summarises the identified barriers and facilitators to OHAs implementation at KSA special schools under the intervention characteristics domain. Addressing these barriers will play a significant role in developing the recommendations for an OHP implementation toolkit for KSA special schools.

The following CFIR domain will examine the characteristics of those responsible for implementing OHAs. This includes their knowledge, attitudes, and self-efficacy in implementing school-based OHAs.

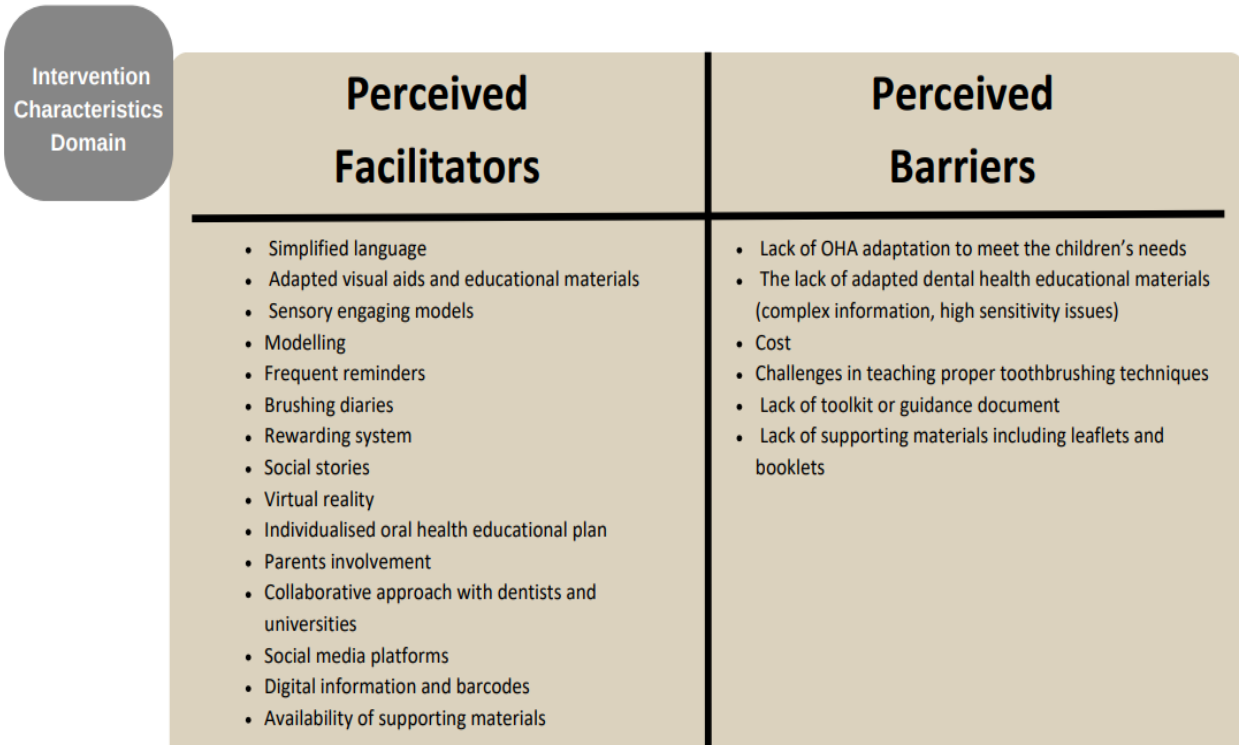

Figure 5-4 Summary of the perceived barriers and facilitators to oral health activities implementation in KSA special schools concerning the Intervention Characteristics Domain of the Consolidated Framework for Implementation Research, according to staff members.

5.2.2.2 Characteristics of individuals domain

The second domain of the CFIR focused on the characteristics of the implementers rather than the intervention. As the implementation depends on individuals, their cultural, professional, and individual backgrounds dictate their interests. Therefore, this domain presents participants' knowledge, beliefs, feelings, and self-efficacy in implementing OHAs at KSA special schools through two themes and four subthemes, as illustrated in Figure 5.5.

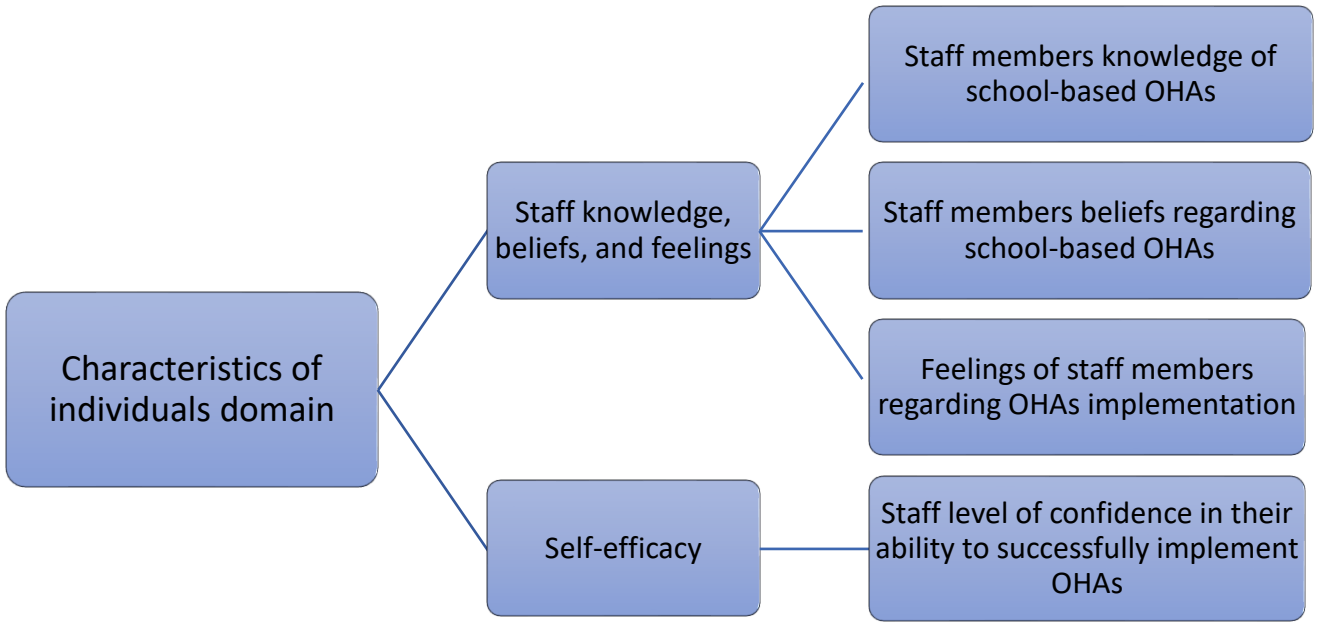

Figure 5-5 Identified themes and sub themes according to the Consolidated Framework for Implementation Research- Characteristics of Individuals domain, from KSA special schools' interviews.

5.2.2.2.1 Staff knowledge, beliefs, and feelings toward school-based oral health activities

According to the CFIR, this theme focused on studying the participants' attitudes toward OHA and how much they value their implementation. It represents familiarity with facts and principles related to implementing OHAs in special schools. This theme includes three subthemes, as presented in Figure 5.6.

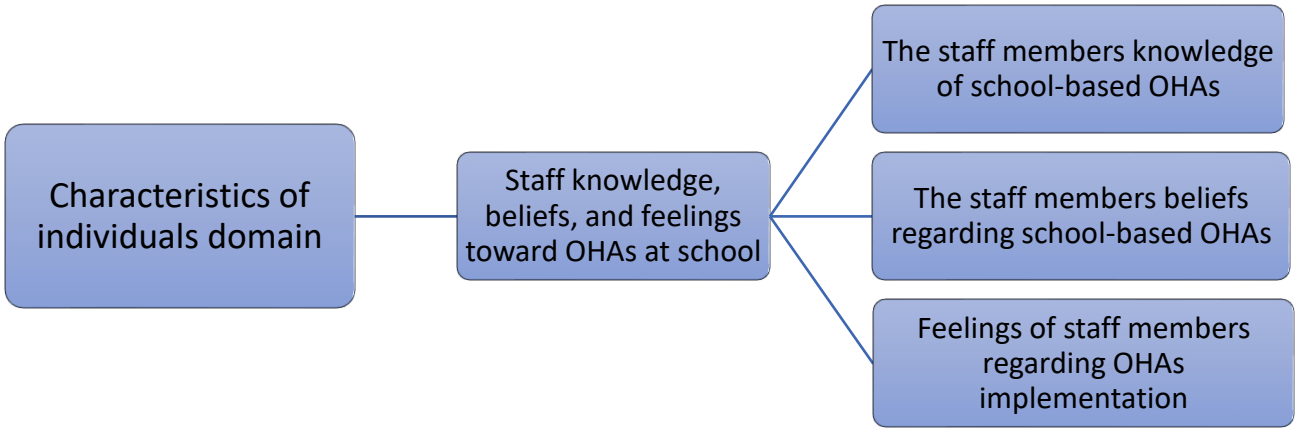

Figure 5-6 Subthemes of staff knowledge, beliefs, and feelings toward school-based oral health activities implementation theme.

4. Staff members' knowledge of school-based oral health activities

This subtheme demonstrated the participants' knowledge of different school-based OHAs. The interviews revealed a clear understanding of the role of dental health education activities in raising children's awareness about maintaining a healthy mouth and protecting their teeth from dental caries. The participants stated that OHE can include lectures, lessons, oral presentations, educational videos, and booklets or leaflets. Noting that:

"*Provide lessons or animated videos on dental care and diet. I think*." (S1)

"*Presentations or talks about dental health*." (S15)

However, the participants exhibited a general lack of knowledge regarding wider oral health programme-type programmes such as topical fluoride and its relevance to OHAs conducted in schools.

"*(.) Honestly, I do not have information on topical fluoride. Also, there is no awareness of it*." (S2)

"*I heard about it as a gel placed on the teeth. This is just my information*." (S13)

Also, they expressed their desire to gain further knowledge on topical fluoride. For instance,

"*I do not know about it; please explain it to me*." (S14)

Furthermore, there was limited knowledge regarding the supervised toothbrushing clubs.

"*I think the students brush their teeth after the school meal*." (S10)

In summary, this subtheme assessed the staff's understanding of various types of school-based OHAs. The KSA special school staff demonstrated knowledge of OHE activities but lacked knowledge of fluoride-based programmes such as topical fluoride application or supervised toothbrushing clubs. A subsequent subtheme focuses on staff beliefs regarding school-based OHAs.

B. Staff members' beliefs regarding school-based oral health activities

This is the second subtheme of the knowledge and beliefs about OHAs theme. It includes three facets that specifically address staff beliefs regarding school-based OHAs, including beliefs about the dental health needs of children with disabilities, the importance of school-based OHAs, and their effectiveness.

a. Beliefs regarding the dental health needs of children with disabilities

This facet explores the beliefs of staff working in KSA special schools regarding the dental health needs of children with disabilities and the challenges they face to maintain their dental health. Overall, there was an apparent understanding of the relationship between dental health needs and the children's disability.

"*I believe disability and dental health are very related. Frankly, there is widespread ignorance about dental health for people with disabilities. It is possible that dental health is affected by disability, and disability affects dental health, such as in kids with autism as they have hypersensitivity*." (S1)

Participants reported halitosis, visible dental caries on anterior teeth, and fractures among the children, negatively impacting their self-esteem.

"*They suffer from bad-smelling breath*." (S12)

"*I saw cases where even the front teeth were fractured. In addition, children with disabilities have low self-esteem because they feel less than others. The low level of self-esteem increases when teeth are not clean*." (S3)

Participants recognised that children with disabilities might face challenges in receiving adequate daily dental care due to the parents' attention diversion, child's behaviour, or sensory hypersensitivity.

"*Parents usually focus on autism more than other aspects, including dental health*." (S8)

"*A child's disability may hinder his parents' attention to his teeth and make it more difficult to manage the child's behaviour during brushing*." (S2)

"*Children with autism also have sensory problems, so they may refuse toothpaste taste."* (S12)

Additionally, it was noted that children with disabilities often face challenges maintaining proper dental hygiene, as they rely on others for routine dental care. Therefore, training and support for these children could help them to independently take care of their dental hygiene, which is crucial.

"*They need training and support to be independent and care for their dental health, as most of them depend on a caregiver*." (S1)

Also, the findings indicate that the children's disability might impact their access to dental health services.

"*A child with autism can be disturbed by the dentist's loud sound and high-intensity light. Also, the difficulty of dealing with the dentist, if they need treatment, most of them are referred to general anaesthesia due to the problems in dealing with them*." (S18)

School staff generally understood that dental health is impacted by the children's disability. Furthermore, the participants were aware of some challenges children with disabilities face

during daily dental care and in receiving dental treatment. In the next facet, we will focus on staff members' beliefs regarding the importance of implementing school-based OHA in special schools.

b. Beliefs about the importance of school-based oral health activities for children with disabilities

This domain highlights the importance of school-based OHA for children with disabilities. The findings reveal that the participants believed school-based OHAs are essential for children with disabilities.

"*Of course, they are essential because they show the child the importance of this part of his body and how to keep it healthy*." (S2)

The participants identified reasons for school-based OHAs' significance to children with disabilities. First, due to challenges in accessing dental treatment, school-based OHAs are essential to promote dental health in this group.

"*I see the importance of caries prevention for these children as they do not visit dentists regularly and have barriers to getting dental health services. So, prevention and education can help them*." (S9)

"*They have limited access to dentistry services, and not all dentists accept to treat them*." (S16)

Children with disabilities may have difficulty communicating their dental pain, which can disrupt daily activities. For example, a teacher mentioned how dental pain could interfere with daily activities, including eating and learning.

"*Indeed, these activities are essential, and their need is more pronounced than for normal children. This is because a child with autism often does not know how to express a toothache. He may scream for a long time, and his parents do not understand that his crying is due to a toothache. So, it is essential for them*." (S4)

"*I know it is a crucial topic. I have seen cases where the education process was interrupted because the child had tooth pain. He could not concentrate or eat his food. As a teacher, I am personally affected by students who have dental problems*." (S1)

Then, a discussion was held about how school-based OHAs could meet the dental health needs of student. According to the participants, including dental health in the curriculum would improve dental health awareness. Moreover, implementing OHA could help students develop healthy habits and improve their dental health.

"*Despite the broad topic requiring cooperation, I believe that the activity will improve family knowledge. Continuous motivation and including this activity in the curriculum will benefit them."* (S10)

"*Having a policy on healthy food options in schools can promote better eating habits among students*." (S12)

As a conclusion to this facet, the importance of school-based OHAs for children with disabilities was explored. Participants agreed that OHAs are essential for children with disabilities as this group had limited access to dental services and might have difficulty communicating pain symptoms. Moreover, the participants believed that OHAs at schools could improve the student dental health awareness and encourage them to develop healthy habits. The following facet will evaluate staff perceptions of the effectiveness of OHAs.

c. Staff beliefs regarding the effectiveness of school-based oral health activities

In the previous facet, the KSA special school staff members emphasised the importance of school-based OHAs for children with disabilities. Consequently, this facet explores beliefs concerning the effectiveness of school-based OHAs.

The findings demonstrate that the participants hold different perspectives regarding the effectiveness of OHAs at KSA special schools. According to participants, OHA carried out in schools was generally believed to be effective.

"*At our school, we only engage in activities once we clearly understand how they work and the school administration is convinced of their effectiveness. These activities raise awareness, and I have evidence from our activities that highlight their positive impact*." (S2)

"*Yes, we believe in that, and I see that children can be influenced by learning with their colleagues*." (S12)

Conversely, other participants reported limited knowledge of the OHA effectiveness due to a lack of evaluation.

"*I do not know about their effects, as there is no evaluation*." (S4)

"*To be honest, I have never looked into it. But I believe that it is applicable with administrative support."* (S1)

"*Frankly, as scientific information, no, but I see its importance, and I believe that if it is applied correctly and with everyone's cooperation, it will be effective in educating parents and children, improving dental health, and reducing the fear of visiting the dentist*" (S3)

The participants believed in the effectiveness of OHAs in improving dental knowledge and reducing dentists' fear. The participants believed that implementing oral health programmes in schools could raise dental health awareness among students and families and reduce fear of visiting dentists, as learning with peers was deemed a practical approach. However, some staff reported a lack of knowledge about the effectiveness of OHAs, despite believing in its importance. The following subtheme discusses the participants' feelings regarding implementing school-based OHAs at KSA special schools.

C. Staff members' feelings about the implementation of school-based oral health activities

This subtheme discusses staff members feelings about implementing OHAs. Overall, the interviews indicated that participants had positive feelings towards OHAs implementation. For instance, "*I would be very excited because I want to support creative activities that have not been applied before*." (S1)

"*I love when the child is taught daily life skills. This helps them become independent and serve themselves*." (S11)

Additionally, the participants expressed their happiness as the teachers and parents were satisfied with the results of the applied OHA.

"*We are excited and happy about our school's dental health activity because we know the results are positive. When the child works on activities, they work independently and apply the information practically. We are satisfied with the results and the teachers' and parents' satisfaction and desire."* (S2)

Moreover, the idea of establishing a school clinic was pleasing and perceived as a school achievement.

"*It is a great idea to develop a clinic within our school. It is very exceptional in providing the right dentist for these children and referring them accordingly. I support the idea*." (S4)

Participants generally anticipate cooperation and positive responses, considering the KSA special school staff's feelings about implementing a new OHAs.

"*The teachers are proactive, present ideas to the administration, and arrange classroom activities such as personal hygiene activities. We distribute personal hygiene kits to students based on their budgets. I think we will find cooperation from them*." (S3)

Generally, the findings indicate that the participants were optimistic about OHAs implementation in KSA special schools. The second theme of the Characteristic of Individuals domain, self-efficacy, will be described next.

5.2.2.2.2 Self-efficacy

The second theme of the CFIR's Characteristics of Individuals domain is self-efficacy, as shown previously in Figure 5.5. This theme assesses the confidence of KSA special school staff members in implementing OHAs.

According to the findings, there was a range of views from participants regarding their confidence in successfully implementing OHA, drawing on their experience working with students and completing similar activities.

"*Able and thanks God*." (S4)

"*I can communicate with my students well and understand them*." (S15)

"*I can deliver the information in multiple methods to address my student's learning needs.*" (S17)"*As a teacher, I have limits for my knowledge. So, I am not an expert in dental health topics.*" (S11)

There was a desire for a supportive team and collaboration with dental professionals to address this barrier.

"*I will need an integrated team that includes dentist, physical, behavioural, and sensory therapists*." (S1)

"*Obviously, we can execute, but I think a dentist will be more effective. Better than me gathering information from the internet*." (S2)

In general, KSA special schools' staff members exhibit some confidence in implementing school related OHAs while stressing the need for dental professional involvement and a multidisciplinary support team.

5.2.2.2.3 Summary

This CFIR domain explored the implementation personnel characteristics. In the first theme, the interviews revealed that the participants had inadequate knowledge about the potential for programmes delivering topical fluoride or supervised toothbrushing clubs. In contrast, they were aware of dental health education activities, suggesting a focus on dental health education rather than oral health promotion. Promoting oral health was generally considered relevant to children with disability, and dental needs were recognised. There was a commonly held belief that children with disabilities need school-based OHAs to promote oral health and reduce the fear of dentists.

Moreover, the participants were optimistic about integrating these activities into KSA special schools. Positive views and feelings expressed by the participants could facilitate OHAs implementation in the KSA special schools. The findings indicate the staff members' beliefs in their capability to implement OHAs. However, multidisciplinary teamwork and the collaboration of dental professionals would facilitate successful implementation. Figure 5.7 illustrates the identified barriers and facilitators to the implementation of OHAs at KSA special schools within this domain. The third CFIR domain will be presented next, which analyses the inner setting (KSA special schools) characteristics that might impact OHAs implementation.

Perceived Facilitators	Perceived Barriers
• Staff awareness of the children oral health needs & DHE • Staff awareness about dental health education activities • The interest in teaching daily life skills • Positive staff feelings towards the OHA implementation • Staff members confidence in their abilities to implement OHA successfully	• Limited awareness of: - Fluoride-based programmes such as topical fluoride application or supervised toothbrushing clubs - Pits and fissure sealants - Effectiveness of school-based OHA • Lack of supportive team • Lack of dentists' involvement • Need for reliable scientific dental information source

Figure 5-7 Summary of the identified barriers and facilitators to implementing oral health activities at KSA special schools under the Consolidated Framework for Implementation Research—Characteristics of Individuals domain, according to school staff members.

5.2.2.3 Inner setting domain

This domain evaluates the relationship between the characteristics of KSA special schools and OHAs implementation. Figure 5.8 illustrates seven themes within this domain.

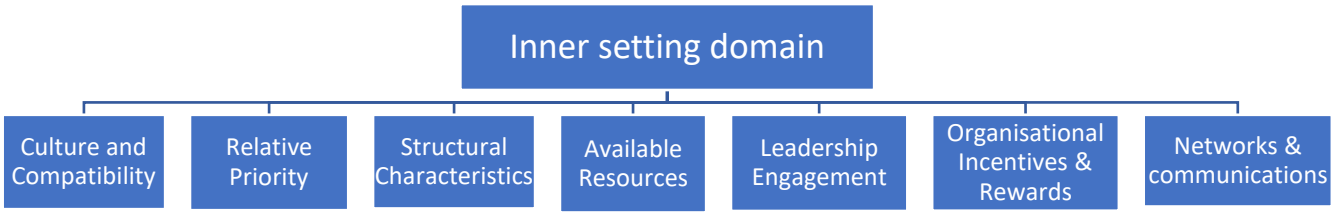

Figure 5-8 Themes under the Consolidated Framework for Implementation Research -Inner Setting domain.

5.2.2.3.1 Culture and compatibility

This theme explores the integration of OHAs into the culture, values, and practices of KSA special schools. The findings highlighted the significance of considering cultural and community norms during OHA implementation. For instance, Islam's role in personal hygiene practices has been emphasised.

"*Our society values religion and community norms; although personal hygiene is essential to us as Muslims, and that is why we recognise the need to participate in the World's dental health awareness day to promote healthy dental practises*." (S6)

"*We follow Islam's rules regarding personal hygiene and Prophet Muhammad's Sunnah. These values support our applied dental health activities*." (S4)

Furthermore, the data indicated that schools value the well-being and interests of the attending students.

"*We hold children's health in high regard, and our community and Islamic values emphasise caring for children, especially those with disabilities. We prioritise the needs of children, and therefore, the school culture will support activities related to oral health*." (S7).

"*The school's culture is to support students' interests, teach them daily skills, provide a healthy breakfast, and prohibit sweets*." (S4)

"*The first value is the student's best interest. If we apply this value to dental health, it is in the student's best interest to help him with his dental health*." (S17)

The theme also highlights the link between implementing OHAS and enhancing social adaptation in students, a vital school value.

"*At our school, we value helping students adapt socially so they feel comfortable and accepted among their peers. This includes encouraging good self-care habits, like brushing teeth and maintaining personal hygiene, which we fully support*." (S5)

In addition, the data indicates the cruciality of integrating OHAs into other school practices. For example, the interviews revealed that a supervised toothbrushing club could potentially be implemented in the daily class routine, but there were concerns that children's behaviour could impact its feasibility.

"*It does not contradict the schedule because they bring food home, so I have ten extra minutes to supervise them brushing their teeth in pairs. But sometimes the student is nervous, or his behaviour is poor*." (S11)

However, the findings reveal that entering schools and implementing activities is challenging due to restricted access and a lengthy approval process, as mentioned earlier during the complexity theme (Section 5.2.2.1.4).

" *The entry of the school is very limited and needs approvals. For dentists to be able to apply certain activities in the schools, they must go through the approval process*." (S12)

The participants generally agreed that the OHAs taking place are consistent with KSA special schools' culture and practices. Additionally, OHAs align with KSA special schools' religious, prioritising the child's best interests, teaching life skills, and fostering social adaptation values. The consistency of OHAs with KSA special schools' culture could facilitate the OHAs implementation. The following theme will discuss the priority of implementing OHAs in KSA special schools.

5.2.2.3.2 Relative priority

The second theme of the CFIR's inner setting domain explores the shared perceptions of the priority of implementing OHAs within KSA special schools compared to other school activities.

The KSA special schools prioritise curriculum activities, sports, and recreational activities. Health-related activities are a secondary priority. Furthermore, KSA special schools celebrate international events, including the International Day of Disability, World Autism Day, and World oral health day.

"*The priority is given to the curriculum, scientific achievements, and World Day programmes. Unfortunately, we do not focus on life skills. Health activities could be a second priority for the school*." (S1)

"*Sadly, it is not a priority; the proof is that there is no activity and harmful foods are prepared in the school canteen*." (S13)

Some participants noted the lack of priority on OHAs as a source of regret.

"*I apologise to say that, but we did not prioritise it, and I know that was a fault. But I will consider it in the next academic year's activities planning*." (S7)

However, the participants reported that OHAs were not a top priority due to insufficient knowledge, difficulties with children's abilities, or a perceived lack of parental cooperation.

"*It is not given an absolute high priority because of a lack of awareness about the school role, low children's comprehension abilities, and the parents cooperate poorly. However, activities run annually on World Day of Oral and Dental Health*." (S4)

The KSA special schools generally prioritised curriculum activities, international days, sports, and recreations with less emphasis on OHA, although their value was acknowledged. The next theme will discuss the impact of KSA special school structural characteristics on the implementation of OHAs.

5.2.2.3.3 Structural characteristics

This theme assesses the impact of schools' structural characteristics on OHAs implementation process, including factors such as the schools' location, size, and layout. It also explores the necessary modifications to the schools; structural characteristics, such as policies, practises, and curriculum.

The findings show that the implementation of OHAs was significantly affected by the size and location of the school, with limited access to dentists being a particular issue for schools in remote areas.

"*Because I am in a remote area, accessing services and hosting a dentist is difficult. Additionally, there are no halls or yards for activities at the school because it is tiny. Usually, the activities are done in the same classroom*." (S1)

In addition, some schools preferred holding activities in the schoolyard, while others felt the classroom was more appropriate.

"*We carried out the program in the schoolyard to set up corners for different activities, such as toothbrushing, healthy food, and visiting the dentist corner*." (S2)

"*We always hold awareness programs in the classroom as there are no distractions*." (S11)

During a discussion on necessary changes to school policies, practices, and curriculum, recommendations were made to incorporate OHAs into the MoE curriculum, adopt policies

to promote healthy eating habits and supervised toothbrushing clubs, and perform toothbrushing after school dinner.

"*The MoE may include oral health activities in school activities or incorporate the topic into the curriculum*." (S1)

"*It may be necessary to legislate a food policy and introduce a toothbrushing policy*." (S18)

"*One suggestion for introducing toothbrushing at school is to make it a part of the daily schedule, allowing students to brush their teeth after meals*." (S9)

The limited number of sinks was reported as a barrier to implementing a school-based toothbrushing policy. However, supervised toothbrushing is carried out dry, so no sinks are needed.

"*We have only one sink. We cannot let all the children brush their teeth after school dinner*." (S10)

In addition, the school's radio can reinforce dental health messages, making it a valuable structural characteristic for implementing OHAs.

"*School radio can promote dental health and encourage students to brush their teeth after breakfast. In addition, they can help with continuous support and motivation*." (S1)

Interestingly, using mobile dental units to provide dental care in schools, including fluoride varnish application, has been suggested.

"*I am looking for dentist visits to schools and students' treatment. For example, during my scholarship in New Zealand, I witnessed a unique experience in which dentists visited schools to provide treatment and apply topical fluoride to students. Mobile clinics were set up in special schools for a month to ensure that students received proper dental care.*" (S9)

The structural characteristics of KSA special schools influenced OHAs implementation. Several recommendations were made regarding integrating oral health into the school curriculum, establishing a healthy school dinners policy, and implementing supervised toothbrushing clubs. In addition, the idea of having a mobile dental unit visit schools was proposed. The following theme will evaluate the resources available to support the OHAs implementation process.

5.2.2.3.4 Available resources

In the previous theme, we discussed KSA special schools' structural features linked to OHAs implementation. This theme focuses on the available resources to implement OHAs, including financial, human, educational resources, and the allocated time.

The interviews revealed that OHAs were not a priority in the schools' budgets, and there were limited financial resources to support implementation. For example, most schools' funds are directed toward educational tools and references, while teachers cover the costs of OHAs.

"*No, there is no financial support. Although the school has a particular budget, it is spent on learning activities. However, the teacher usually covers simple costs since the number of students is small*." (S4)

In addition, there was no external financial support to implement OHAs.

"*The teacher and the visiting dentist provided tools, materials, and educational means. There was no external support*." (S2)

"*Although we are a supportive society and people care about charity. I find it tough to ask for external funds*." (S6)

"*It is only permissible by the MoE to request external funding from an organisation working with the MoE for community engagement.*" (S8)

Furthermore, the data indicates the essential need for volunteers from the dental sector to facilitate the implementation process.

"*Definitely. We look for experienced workers, dentists, or health professionals; I mean, we need more human resources than physical ones. The difficulty we have encountered is the labour force. I do not have a special committee of four to five people for these activities*." (S2)

"*School members are busy with their duties. So, I need volunteers to carry out the program*." (S5)

Moreover, oral health educational tools and resources were scarce, and the participants expressed the need for oral health educational guidance or a toolkit to facilitate OHAs implementation.

"*There are no educational tools in our school for dental health education*." (S1)

"*Including dental health education in special education curricula is crucial, but some teachers may lack knowledge of this topic. So, providing guidance or a package for teachers and parents can help them better support students' dental health needs. I can teach the students, but I need your help as a dentist to provide a package. Let us work together to promote dental health awareness and involve everyone, not just dentists.*" (S10)

According to the findings, OHAs are usually conducted during class time.

"*Each teacher takes part of the lesson time and does the activity*." (S4)

"*There was no specified time given to the activity. It took from class time*." (S6)

In summary, KSA special schools were expected to face financial, educational, and human resources barriers during OHAs implementation. Volunteers, educational resources, and the availability of a dental health educational guidance or a toolkit could support the school-based OHAs implementation. The coming theme will evaluate the extent of school leaders' engagement in OHAs implementation.

5.2.2.3.5 Leadership engagement

In CFIR, leadership engagement refers to leaders' involvement and commitment during implementation, emphasising leaders' role in the implementation process's success. Accordingly, this theme focuses on KSA special school leaders' influence in implementing OHA. Participants perceived school principals and department leaders as leadership sources.

The data shows that school leaders impact OHAs implementation, either positively or negatively. Overall, school staff reported various methods of effective leadership engagement in OHAs implementation. For example, school leaders' visible support and beliefs facilitate OHAs implementation, foster a culture of commitment, and prioritise the implementation process.

"*The school principal can enhance the school commitment in the activity if he/she believes in the importance of activities*." (S3)

"*Be aware of the school's role and support the program through verbal endorsement and meetings*." (S9)

Moreover, school leaders could take an active role in planning and implementing the OHA and encourage teachers' participation through rewards or providing training opportunities, which will be discussed further in the next theme (Section 5.2.2.3.6).

"*The school leaders tried to apply our dental health education programme. They formed a school committee and meet with them regularly, take their ideas, motivate, and support them*." (S2)

"*The school leaders could motivate the staff to be involved in the activities in different ways, such as appreciation letters or self-development opportunities*." (S11)

Furthermore, effectively engaged school leaders could communicate with children's parents to ensure better collaboration for OHA implementation.

"*They can communicate with parents to request cooperation in children's interests*." (S3)

Also, the data indicates that school leaders should allocate the necessary resources to support OHA implementation.

"*The school principals are the ones regulating the school budget. So, they could ensure needed resources*." (S15)

Contrastingly, effective implementation of OHAs in KSA special schools might face barriers from school leaders who lack awareness about OHAs, do not support its implementation, do not allocate adequate resources for the activity, do not allow teachers to be relieved from other duties to implement OHAs or do not enforce healthy food policies.

"*Not giving priority to these activities, but there is certainly a reason for, for example, their lack of dental health awareness*." (S4)

"*If the school leaders do not provide financial support to teachers for their activities, teachers will not be able to complete them. Additionally, if they do not reduce the workload of teachers. They will present a challenge*." (S3)

"*Some of school leaders lack the obligation to provide healthy food in the school cafeteria*." (S4)

In KSA, special school leaders play a crucial role in implementing OHAs. Their influence can be positive or negative depending on their awareness and prioritisation of school-based OHAs. Financial support, active participation, and family communication can ensure effective KSA special schools leadership engagement. The following theme examines the role of organisational incentives and rewards in implementing OHAs.

5.2.2.3.6 Organisational incentives and rewards

The CFIR's construct of organisational incentives and rewards refers to an organisation's methods for encouraging and rewarding individuals involved in the implementation process. The use of incentive systems can be achieved through various means, such as financial and non-financial rewards and opportunities for personal development. This theme examines whether special schools in KSA have implemented incentives and reward systems to encourage the staff members' participation in OHA implementation and their impact.

The findings indicate that organisational incentives and reward systems for staff participation in OHAs vary across KSA special schools. For example, the participants revealed that some schools have established incentives and reward systems to recognise and encourage staff participation in OHAs, such as certificates, appreciation letters, or the teacher's annual evaluation.

"*Leaders provide certificates for participating teachers: a sense of motivation, admiration for the activity*." (S2)

"*Yes, the school principals usually send us appreciation letters for our efforts in the program*." (S4)

"*Our school include the staff participation in activities as points in the yearly evaluation*." (S6)

While other participants criticised their schools for lacking incentives and reward systems.

"*No, we do not have a rewards system for the staff participation in the dental health educational activity. It would be nice if we find appreciation from the school administration.*" (S11)

Furthermore, the participants suggested some reward systems and how they might affect their active participation in implementing OHAs.

"*The school principal could consider our work as community service, which we need for job promotion*." (S4)

"*They could offer us training opportunities in different skills*." (S12)

"*Staff will be motivated to carry out dental health activities if there are rewards. It would be a good source of encouragement*." (S10)

Generally, in the context of KSA special schools, the reward systems depend on the schools' specific policies. Moreover, active staff participation in OHAs is hindered by a lack of reward systems, whereas their availability would facilitate it. The upcoming theme will assess the communication and information sharing related to the implementation of OHAs in KSA special schools.

5.2.2.3.7 Networks and communications

The networks and communications construct of CFIR highlights how stakeholders interact during implementation and stresses the significance of communication and information sharing to ensure successful implementation. This theme focuses on the characteristics and effectiveness of social networks and communication with various stakeholders, including the school staff, students' families, MoE, and MoH.

Overall, the data show that meetings, email groups, or other forms of communication were not utilised to keep KSA special schools staff updated with the OHAs development and progress.

"*Nothing was applied. It was an activity held by the school's activities leader and a group of teachers. We did not communicate about it further*." (S11)

Moreover, the interviews revealed that KSA special schools rarely communicate the OHAs to students' families. However, some schools informed parents about the OHAs they conducted.

"*No, we did not send the parents information regarding our activity*." (S11)

"*At the start of the unit, we send the unit announcement to the families and remind them of the learning objectives and activities. Additionally, we send them family-related tasks*." (S2)

Furthermore, none of the OHAs implemented were communicated to the MoH or MoE.

"*We do not contact ministries about our dental health education programme*." (S4)

"*We do not communicate it with the Ministry of Education, but we record it in the school records*." (S12)

The limited communication about OHAs appears to hinder their implementation in KSA special schools, as effective implementation requires the involvement of stakeholders.

5.2.2.3.8 Summary

In this domain, we examined the connection between KSA special schools' characteristics and the OHAs' implementation process. It was evident that the KSA special schools' culture, priorities, structural features, available resources, leadership, incentive systems, and networks are vital determinants in the success of OHAs implementation, as presented below in Figure 5.9. Moreover, the inner setting domain findings are central to identifying the key concepts for an OHP implementation toolkit for KSA special schools.

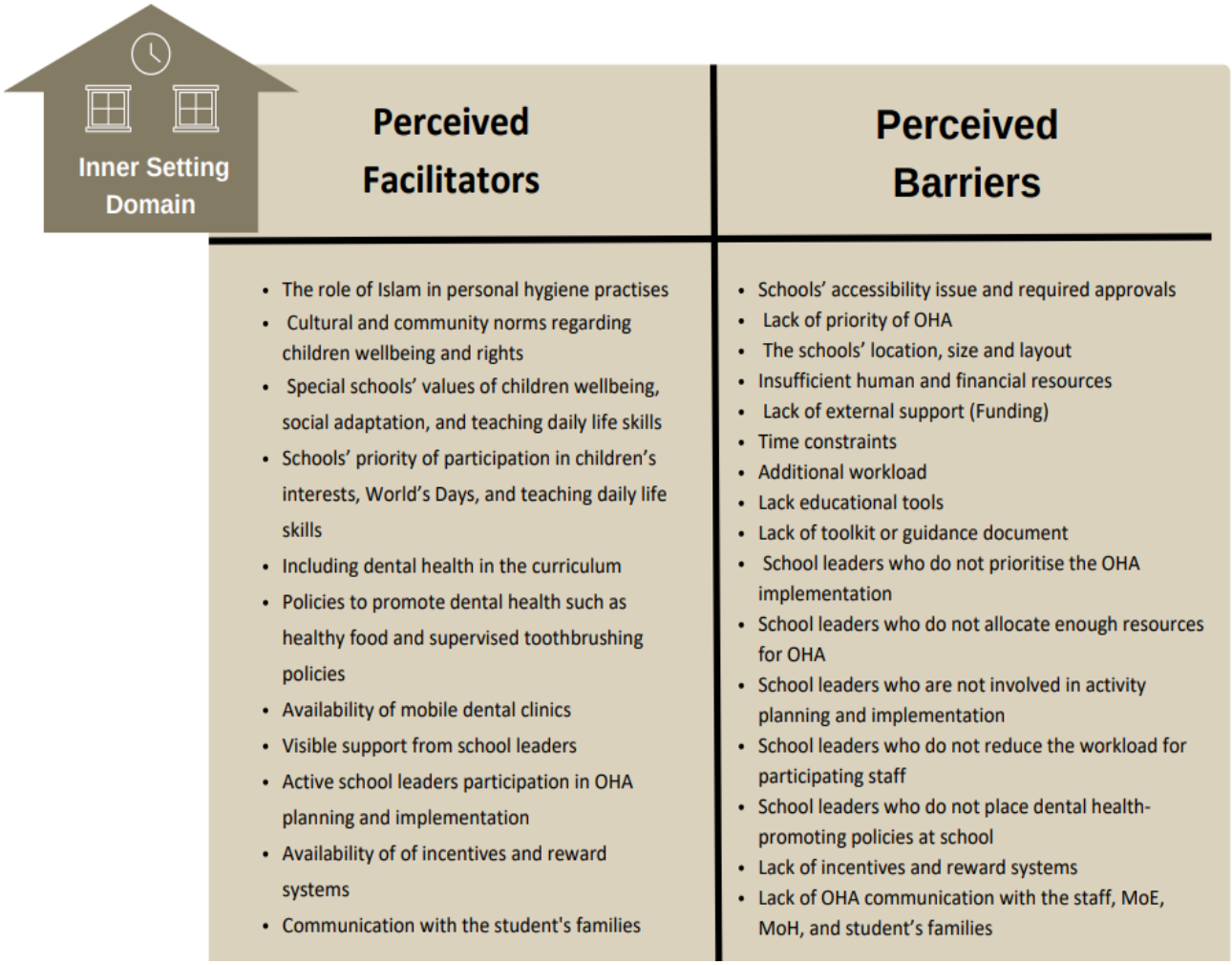

Figure 5-9 Summary of the perceived barriers and facilitators to the oral health activities implementation at KSA special schools under the Consolidated Framework for Implementation Science- Inner Setting domain, according to staff members.

5.2.2.4 Outer setting domain

The relationship between the outer setting CFIR domain and the implementation of OHAs in KSA special schools was explored. Figure 5.10 illustrates two themes within this domain.

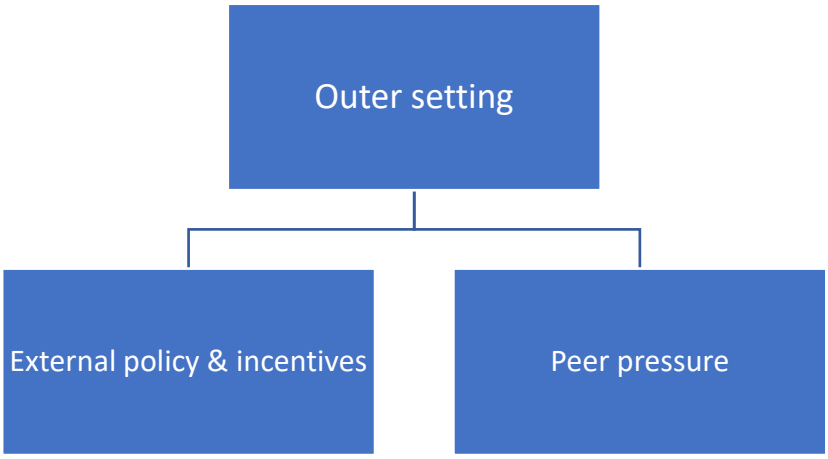

Figure 5-10 The identified themes under the Consolidated Framework for Implementation Research-Outer Setting domain.

5.2.2.4.1 External policy and incentives

This construct in the CFIR focuses on the impact of external policies and incentives on the implementation process, as it is recognised that external policies beyond the school can influence implementation. Accordingly, this theme discusses the national, regional, or local policies influencing the implementation of OHAs in KSA special schools.

The interviews revealed the presence of the national initiative for the prevention of dental caries among primary schoolchildren. However, it was noticed that the KSA special schools were not included in the initiative.

"*There is a country-based initiative to prevent dental caries between schoolchildren conducted by the MoH in schools, but we are not a target*." (S13)

"*We need to be involved in the MoH dental caries prevention initiative. I do not know why they did not include us*." (S16)

However, Aramco Company provides an annual recognition for the best school health promotion activity in the Dammam region as a regional incentive. Aramco is a leading integrated energy and chemicals company based in Dhahran, in the eastern province of KSA.

"*Aramco yearly honours schools that hold the best health promotion programs in the Dammam region*." (S13)

Generally, external policies, if available, influence the OHAs' implementation in KSA special schools.

5.2.2.4.2 Peer pressure

The peer pressure construct in CFIR recognises peers' role in shaping attitudes and adopting new interventions. The positive peer pressure comes from many or all peer schools competing in similar activities. To illustrate, peers can influence implementation by establishing social norms and expectations that help overcome resistance to change.

This theme explores the KSA special schools staff members' perceptions of positive peer pressure, including the extent to which they feel influenced by their peers to adopt school-based OHAs.

The data indicates that KSA special schools did not face peer pressure to perform OHAs through simulations or competitions.

"*No, there is no peer pressure, as there are very few oral health activities in special schools*." (S12)

"*We do not have this kind of pressure, maybe because we did not hear about extraordinary dental health programmes on the special schools' level*." (S18)

Furthermore, the participants expressed that if the OHAs were available on a larger scale in KSA special schools, it would create positive peer pressure.

"*If we have too many programmes about dental health, this will encourage the schools to compete in this kind of activity as it enhances the school's reputation and evaluation*." (S2)

Generally, there was no evidence that the participants felt pressured or motivated by other schools to adopt OHAs in the KSA special schools with emphasis on the positive peer pressure effect on OHAs implementation, if available.

5.2.2.4.3 Summary

During the CFIR outer setting domain, the impact of external policies, incentives, and peer pressure on the OHA implementation in KSA special schools was explored. The data indicates that external policies and incentives regarding the implementation of OHAs in KSA special schools are lacking, except for Aramco company incentives in the Dammam region. Additionally, participants in KSA special schools reported the lack of positive peer pressure and highlighted its impact on OHAs implementation. In KSA special schools, the absence of external policies, incentives, and peer pressure could impede the implementation of OHAs. Figure 5.11 presents the barriers and facilitators of implementing OHAs within the CFIR Outer Setting domain. The upcoming domain is the fifth CFIR domain, which assesses the implementation process of the OHAs.

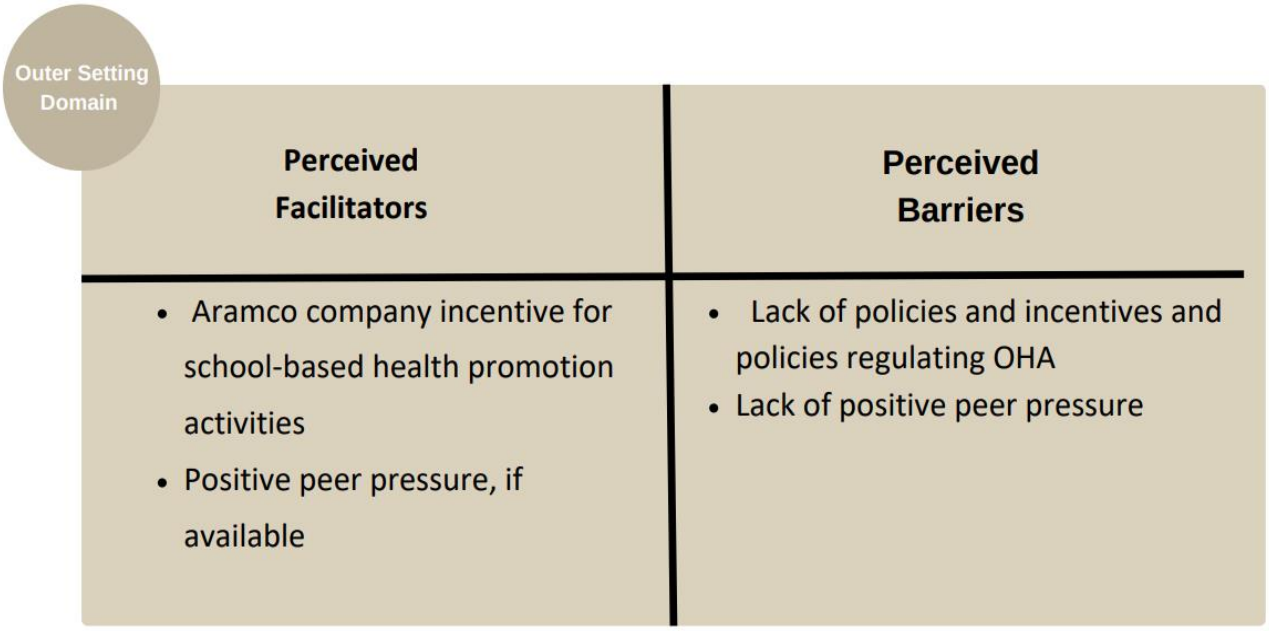

Figure 5-11 The perceived barriers and facilitators of implementing oral health activities within the Consolidated Framework for Implementation Research- Outer Setting domain, according to staff members.

5.2.2.5 Implementation process domain

The researcher evaluated the CFIR implementation process domain relation to the OHAs implementation process at KSA special schools. Figure 5.12 illustrates three themes within this domain.

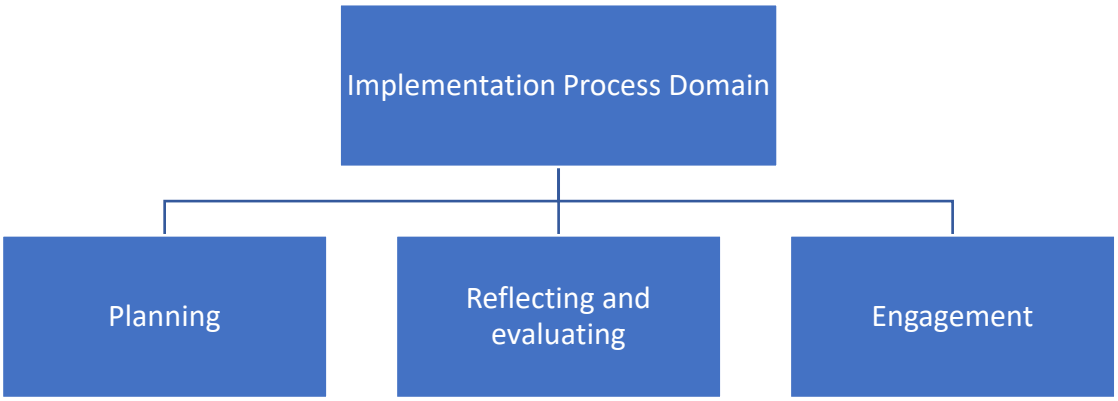

Figure 5-12 Three themes within the Consolidated Framework for Implementation Research - Implementation Process domain

5.2.2.5.1 Planning

The CFIR planning construct focuses on developing a well-structured implementation plan and highlights the importance of thorough planning to ensure successful implementation. According to this, this theme discusses the planning process for OHAs implementation within KSA special schools. An evaluation of the presence of an implementation plan, its components, and how it guides the implementation process is conducted.

According to the findings, special schools in KSA lack proper OHA planning, and implementation is ad hoc.

"*There was no formal plan. The activity provider just discussed it and applied it.*" (S6)

However, School B developed oral health educational materials during the OHAs implementation planning process, created an activities schedule, identified necessary time, and selected staff members.

"*Previous activities took about two to three weeks to plan and prepare, followed by a week of explanations by the teacher during the health and safety unit. At the end of the week, the dentist and the teachers presented a full day of activities and corners. The school took a long time to finalise and implement the activity*." (S2)

Additionally, the participants recognise that careful planning is crucial for successful implementation outcomes.

"*If the programme is planned ahead, this plan would guide the implementation process, responsibilities, and resources*." (S4)

"*I think the planning would help us to design our activity much better and look for dentists' involvement*." (S11)

Staff members in KSA special schools emphasised the importance of OHAs planning, which was lacking. Ad hoc implementation could hinder the effective implementation process. The next theme will discuss the reflection and evaluation of OHAs implementation at KSA special schools.

5.2.2.5.2 Reflecting and evaluating

This theme assesses the evaluation process for OHAs implementation in KSA special schools. According to the interviews, KSA special schools lack proper evaluation of OHAs implementation. However, some forms of evaluation exist. For example, a post-activity survey was utilised for parents and involved staff members.

"*No, do not conduct an evaluation*." (S11)

"*I do not know about their effects, as there is no evaluation.*" (S4)

"*We take parents' reactions after the activity and conduct staff and parent surveys twice yearly to determine beneficiary satisfaction*." (S2)

Additionally, the significance of OHAs evaluation was noted.

"*Naturally, getting feedback to see if anything is missing is beneficial. But unfortunately, we did not perform any evaluation*." (S4)

"*Evaluation is essential to identify what went well and what needs improvement to adjust future activities*." (S18)

Generally, KSA special schools' members recognised the importance of OHAs evaluation for effective implementation but noted its absence. The following theme explores the opinion leaders on OHAs implementation in KSA special schools and their impact.

5.2.2.5.3 Engagement

As per CFIR, this theme pertains to the factors that facilitate the involvement of stakeholders, including opinion leaders, formally appointed internal implementation leaders, and children. It examines the level of engagement of different stakeholders and the strategies employed to attract and motivate their participation in implementing the OHAs. This theme assesses the engagement of the following stakeholders.

A. Opinion leaders

According to CFIR, opinion leaders are influential persons in an organisation who can influence others' opinions during implementation and are vital in promoting the adoption of new interventions. This theme examines how KSA special schools' opinion leaders influence their colleagues' attitudes regarding implementing OHAs. It also explores their role in the implementation process.

The participants perceived a lack of OHAs implementation opinion leaders in KSA special schools.

"*I do not think there were any opinion leaders during our activity*." (S2)

However, the findings show that the special education teacher, activity leader, student counsellor, student health specialist, and school principal could be opinion leaders for implementing OHAs in KSA special schools.

"*The special education teacher, activity leader, student counsellor, student health specialist, and principal all have a role that can influence the application of the school's activities*." (S1)

"*Activity leaders are probably opinion leaders, but teachers must be part of the team*." (S3)

"*Implementing oral health activities will require the approval of the school principal, vice president, activity leader, student health officer, and student counsellor*." (S11)

Furthermore, the data indicates how opinion leaders can enhance the OHAs implementation in KSA special schools.

"*The principal could raise awareness and honour students committed to healthy food, for example. In addition, teachers can help parents deal with difficulties brushing their children's teeth, such as sensory and functional problems. Student health counsellors host a dentist or provide a dentist's disclosure card*." (S4)

"*They can create a supportive environment and culture and motivate the staff and children to engage in the activities*." (S14)

A practical method for implementing school-based OHAs in KSA special schools is to involve opinion leaders. By identifying and engaging with these individuals, their credibility and influence could promote OHAs implementation and establish a supportive culture.

The participants noted the absence of OHAs implementation opinion leaders in KSA special schools. Moreover, they emphasised the leaders' role in enhancing teachers' and children's participation in the OHAs. The following stakeholders will be the formally appointed internal implementation leaders.

B. Formally appointed internal implementation leaders

The CFIR recognises leadership's importance and includes several constructs related to leadership engagement and support during implementation. To ensure a successful implementation process, it is advisable to assign internal leaders who will provide direction, promote collaboration, and drive organisational commitment.

This theme focuses on school staff members coordinating, organising, and leading OHAs implementation in KSA special schools. It explores their characteristics, implementation roles, and capabilities.

The interviews revealed no formally appointed leaders for OHAs implementation, but school activity leaders and health counsellors could lead OHAs implementation at KSA special schools.

"*Not a formal position. There is no formal leader for our activity. We work together to develop it and apply it.*" (S4)

"*The school's activities leader or health counsellor is the most appropriate individual to lead the program*." (S12)

Furthermore, the participants highlighted the key traits of an effective OHAs implementation leader, which included creativity, efficient task allocation, and cost reduction.

"*Active, presents creative ideas, asks students and parents about their needs in activities, is loved by students, and influences them*." (S3)

"*A successful leader distributes tasks effectively, listens to novel ideas, focussing on potentials, and minimising cost*." (S16)

According to the findings, there were no formally appointed internal implementation leaders for implementing OHAs in KSA special schools. It is recommended that school activity leaders and health counsellors could lead the implementation of OHAs. The next sub theme will explore the engagement of children with disabilities attending KSA special schools in OHAs implementation as key stakeholders.

C. Key stakeholders (children attending KSA special schools)

This theme concerns the children's reported perceptions and reactions to OHAs implemented in KSA special schools. According to the interviews, children's perceptions of the activity varied according to age and degree of disability. However, there were no differences reported by gender.

"*Yeah, sure. A three-year-old child completely differs from a five- or six-year-old, taking less information and gaining fewer benefits. It is affected by the degree of disability, as some students have simple disabilities, and others are severely disabled. I do not think there is a difference between girls and boys*." (S2)

"*Some children pass by typically and do not interact, children who are attracted to games and colouring, and children who understand and interact with the teacher and apply the brushing method. Children with autism vary greatly in their abilities and interactions*." (S4)

"*Autistic children can surprise you after a while that they can apply the knowledge themselves or even share it with their parents and brothers. Especially if it were scheduled regularly as a frequent reminder*" (S5)

Moreover, the children showed great enthusiasm towards participating in the applied OHAs.

"*The children were excited to enter the corners and brush the teeth on the jaw model. The second corner involved making a healthy lunch box that gave them a sense of achievement*." (S2)

The participants believe the implemented OHE activities had limited influence on children's dietary habits.

"*Sure, it improved the knowledge, but not the dietary habits, because of the family influence, so we include them in the activity day. If forty percent of the students stay away from Nutella, sweets, and soft drinks, I consider it a success*." (S2)

"*Frankly, I do not think so because the autistic child does not know his interests or dangers. It is supposed to direct awareness and education to parents*." (S4)

On the other hand, the participants reported improvement in toothbrushing habits following the activity.

"*According to their parents, children are encouraged to brush. Still, it is better to remind them about dental hygiene during school rather than making it an annual event*." (S2).

Participants reported that children's perceptions of school-based OHAs differed based on age and degree of disability, but overall, they were positive. However, it is essential to note that this information is based on interviews with staff and not on the reflections of the children.

5.2.2.5.4 Summary

During the implementation process of the CFIR domain, the findings indicate limited planning, engaging, and evaluation of the implemented OHAs at the KSA special schools while their significance was recognised. In addition, the ideas of opinion leaders and formally appointed leaders were not applied. The children with disabilities attending special schools in KSA can participate in the OHAs to varying degrees. Figure 5.13 represents the barriers and facilitators to implementing OHAs within this domain. The following section presents study findings from semi-structured interviews with parents/carers of children in KSA special schools.

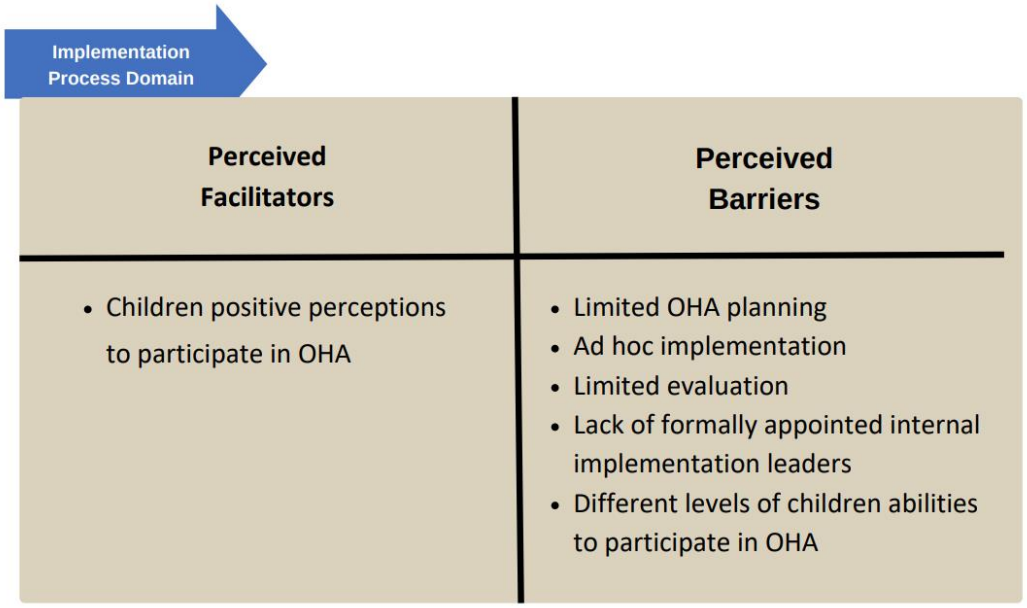

Figure 5-13 The barriers and facilitators to implementing oral health activities in KSA special schools related to the Consolidated Framework for Implementation Research- Implementation Process domain, according to staff members.

5.3 Perspectives of parents and carers towards school-based oral health activities

The previous section presented the findings of interviews with KSA special schools' staff members. This section presents findings from interviews with parents/carers of children attending these schools to identify potential OHAs implementation determinants.

This section presents findings from telephone-based semi-structured interviews with 12 parents/carers, including the identified themes and findings related to the CFIR constructs. Representative quotes have been used to illustrate the key concepts raised in the discussion. For anonymity reasons, the quotes are identified according to the interview number (e.g., P1 for the first participant), and the profile of the participants was presented earlier in Chapter Four, Table 4.9.

5.3.1 Identified themes

The identified themes during the data analysis process were grouped according to the CFIR five domains into 13 major themes with associated sub themes, as shown in Figure 5.14 below.

A- Characterestics of Individuals

- Parents' knowledge, attitude, and feelings toward oral health activities at school
- Self-efficacy

B- Intervention Characteristics

- Availability
- Adaptability
- Design and quality

C- Inner Setting

- Culture and compatibility
- Relative priority
- Leadership engagement
- Networks and communication

D- Outer Setting

- External policies and incientives

E- Implementation Process

- Planing
- Reflecting and evaluating
- Engagement

Figure 5-14 Parents or carers interviews' identified themes and subthemes, according to the Consolidated Framework for Implementation Research.

5.3.2 Factors influencing the implementation of oral health activities in KSA special schools, according to parents/carers

The findings in this section are presented under CFIR's five domains. These are the characteristics of individuals, intervention characteristics, inner setting, outer setting, and implementation process. The themes are derived from CFIR constructs as shown in Figure 5.15.

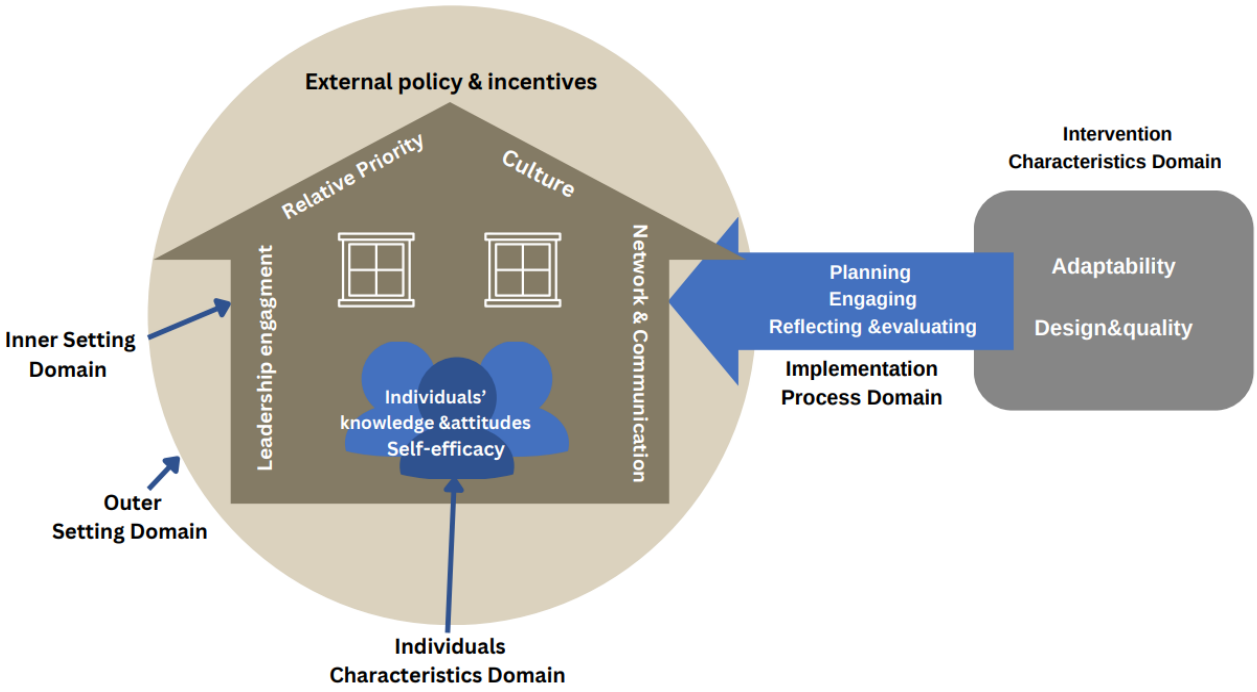

Figure 5-15 The Consolidated Framework for Implementation Research domain: intervention characteristics, individual characteristics, inner setting, outer setting, and implementation process and their underlying constructs.

5.3.2.1 Characteristics of individuals domain

This domain explored how parents'/carers' knowledge, beliefs, feelings, and self-efficacy affect the implementation of OHAs in KSA special schools. The findings are presented through two main themes and five subthemes, as illustrated in Figure 5.16.

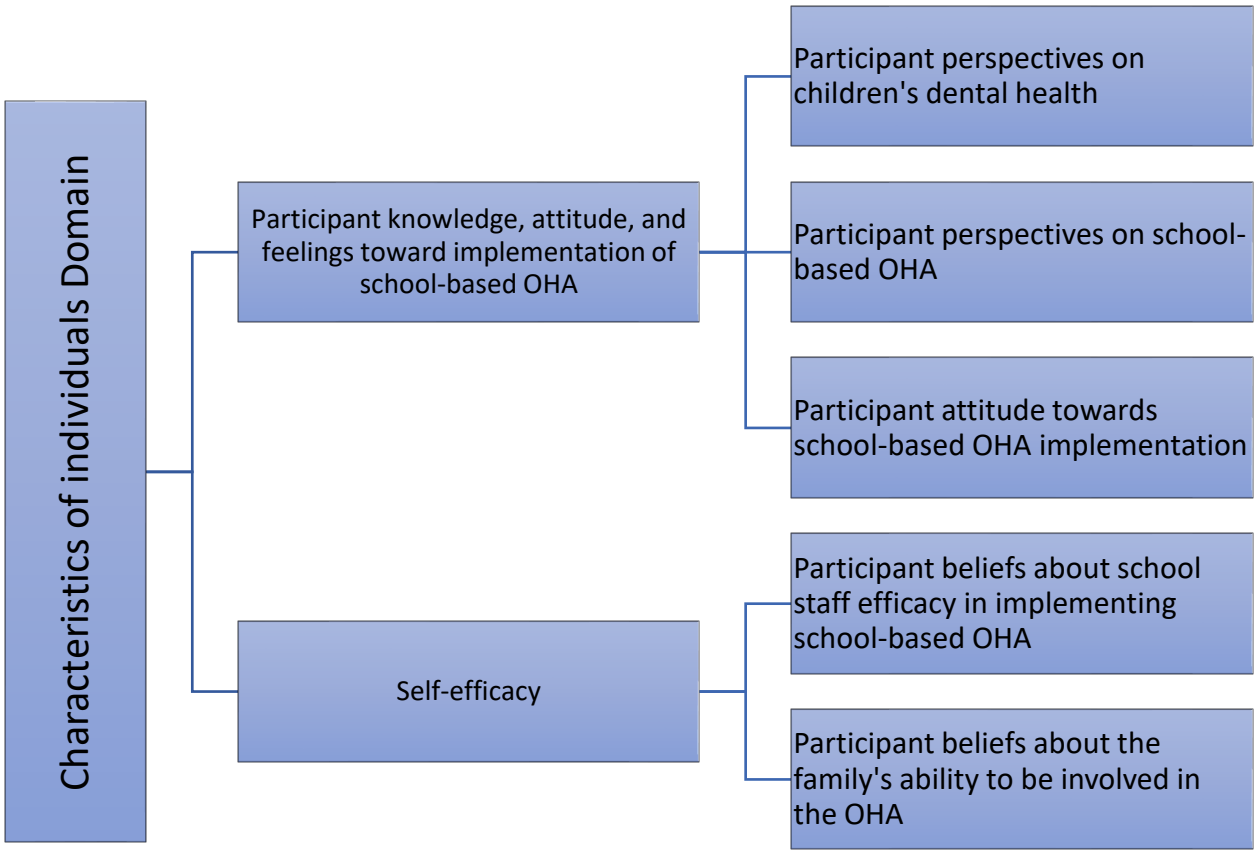

Figure 5-16 Themes and subthemes related to the Consolidated Framework for Implementation Research- Characteristics of Individuals domain, according to parents/carers interviews.

5.3.2.1.1 Participants' knowledge, attitude, and feelings toward the implementation of school-based oral health activities

This theme aimed to provide insight into participants' characteristics and how these characteristics may facilitate or hinder OHAs implementation in KSA special schools. The first subtheme discussed participants' perspectives on the dental health of children with disabilities, including dental needs, access to dental services, and daily dental care management.

The second subtheme presented participants' perspectives on school-based OHAs. Lastly, the third sub theme assessed the self-efficacy of implementing school-based OHAs in KSA special schools and how home care could complement the implementation. Figure 5.17 visually illustrates the subthemes and the underlying facets.

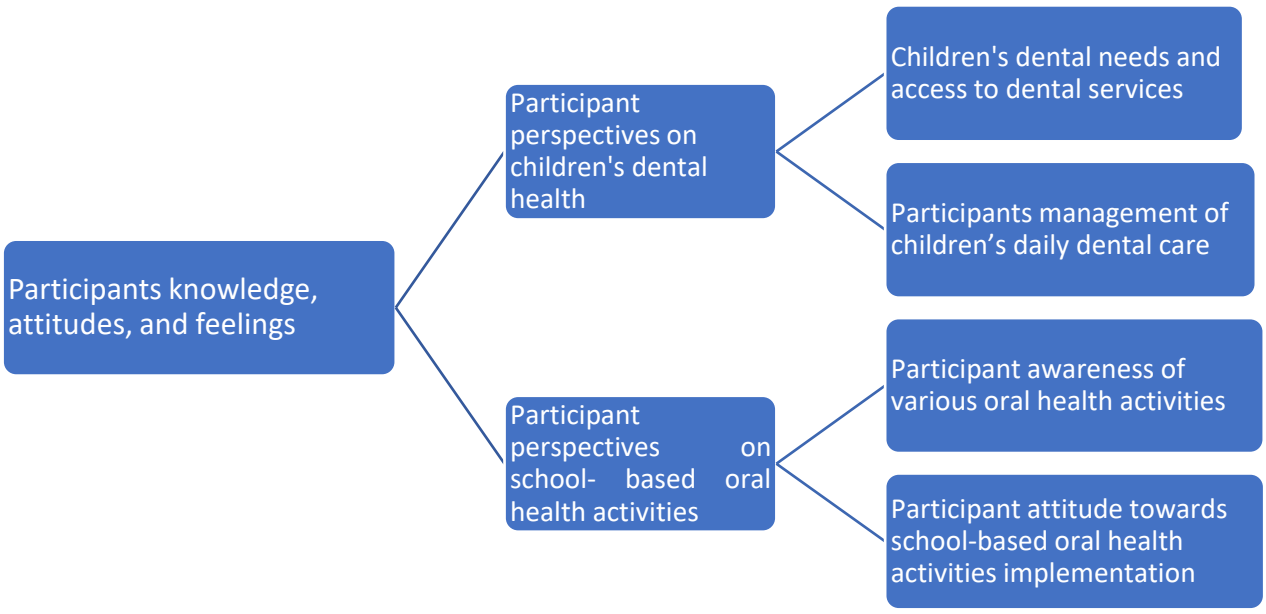

Figure 5-17 Sub themes and underlying facets within participants' knowledge, attitude, and feelings toward the implementation of school-based oral health activities theme, according to parents/carers interviews.

5. Participants' perspectives on children's dental health

This sub-theme addressed parent concerns regarding their children's dental health needs and accessibility to dental services. Further, it highlighted how parents managed their children's daily dental care. Specifically, the participants elaborated on the barriers to daily dental care for their children.

6. Children's dental needs and access to dental services

The participants recognised the dental health needs of children with disabilities in KSA. For example, parents reported dental pain, dental caries, bleeding during brushing, halitosis, and traumatic dental injuries. These dental conditions adversely affect the child's daily routine and overall well-being. Moreover, the parents acknowledged that the limited children's communication abilities might hinder recognising these conditions.

"*Yes, for sure, I can see tooth decay in my child's teeth*." (P1)

"*My daughter suffers from bad breath*." (P10)

"*Due to his vision impairment, he falls often, and sadly, he had two tooth fractures.*" (P5)

While dental health needs have been identified, participants indicated that children have limited access to dental services. The reasons for limited access to dental services can be grouped into three categories. First, only a limited number of dentists are qualified to practice special care dentistry. Fear and behaviour are the second barrier to child treatment in dentists' offices. Thirdly, the cost of general anaesthesia is prohibitive if the child requires dental treatment.

"*Not all dentists know how to deal with kids with autism spectrum disorders, including mine. This issue affects many families*." (P6)

"*When I looked for a dentist to treat my daughter, they immediately considered general anaesthesia for her case."* (P10)

Similarly, P11 was dissatisfied with her experience of trying to receive dental treatment for her daughter with severe cognitive disability; she blamed the delay in provision for worsening her daughter's dental condition.

"*Unfortunately, they put her on a waiting list for general anaesthesia while she suffers. This matter bothers me, and we are still waiting while her teeth are being destroyed*." (P11)

Additionally, most participants reported that their children had never received previous dental treatment, not even a visit to the dentist. However, some children have been treated under general anaesthesia for tooth extractions and restorations. On the contrary, none of the children received preventative treatments, such as diet counselling or topical fluoride application.

"*No, he had no previous dental treatments*." (P3)

"*He did not take a dental check-up. Recently, I was looking for a suitable dentist for her*." (P4)

"*Yes. She received dental treatment under general anaesthesia*." (P12)

b. Participants management of children's daily dental care

This facet explores participants' awareness of their role in helping children maintain proper dental hygiene and how home care can complement school-based OHA. Additionally, participants described their experiences during daily dental care, including brushing and using mouthwash for children with disabilities. Lastly, it represents sources of dental health information.

Overall, the importance of daily dental care at home in promoting child dental health was acknowledged. Parents see their role in maintaining dental hygiene for their children.

"*My child has limited cognitive ability to know the right things for his health and what harms his teeth, so I am responsible for this. I should provide him with the best care*." (P10)

According to participants, maintaining dental health starts with daily routines and yields desirable results if accompanied by school-based activities. For example, implementing a school policy for food choices provided by the school canteen was requested. Additionally, a desire was expressed to implement a tooth brushing educational session in the Life Skills subject.

"*We know that having healthy teeth requires a home routine of cleaning and brushing and limiting sugar consumption*." (P5)

"*We are trying our best at home. But, if there is a school program, it will support the child and the family by following up with them. By doing so, we can establish and sustain habits essential to dental health, such as brushing and avoiding sweets*." (P4)

"*They have a school course dealing with daily life activity skills development. It would be nice if they taught the students about dental health to help them stay healthy*." (P3)

However, the data shows participants faced difficulties with maintaining good oral health behaviours with their children with disabilities, encountering four main barriers. First, participants agreed that a child's disability can present sensory issues such as hypersensitivity to toothpaste taste or foaming sensation, or brush bristles, particularly in children with autism spectrum disorders. Also, some children lack coordination in their hands and jaw movements. Moreover, some participants expressed difficulty managing their children's challenging behaviours to enable oral health behaviours to be conducted. Finally, some participants indicated that their children required special techniques to facilitate daily oral care. According to the findings, participants felt they needed support to address their challenges when providing dental care for children with disabilities.

"*Disability is a primary barrier. Things that take two minutes for a typical child can take up to fifteen minutes for a child with a disability*." (P10)

"*My child cannot tolerate the taste of toothpaste, and even the feel of brushing stresses him out*." (P6)

"*It is not possible to floss his teeth. It is really tough to perform, but at least he can use mouthwash with my help*." (P9)

"*It is sometimes hard to deal with a child with autism when he refuses to brush his teeth*." (P12)

To overcome these issues, participants drew on their own experiences or reported using search engines and YouTube as sources of information about strategies to facilitate better daily oral care for their children.

"*Nothing special from my general knowledge or Google search for the needed information*." (P1)

"*Currently, I am learning how to brush her teeth by browsing the Internet and watching videos for children with the same condition*." (P11)

B. Participants' perspectives on school-based oral health activities

As a part of exploring the CFIR individuals, characteristics domain concerning OHAs implementation at KSA special schools, this sub theme described participants' awareness of various school-based OHAs. Additionally, it explored their attitudes and feelings about implementing school-based OHAs.

7. Participants awareness of various oral health activities

This facet assesses knowledge of different approaches for promoting oral health in schools. These include dental health education activities, food policies, and fluoride-based activities such as supervised teeth brushing and topical fluoride application.

Participants' perceptions of OHAs vary depending on their knowledge and experience. A difference has been observed between participants exposed to OHAs at their children's schools and others. Generally, there is a lack of awareness of fluoride-based activities, as demonstrated by the findings. Participants, however, tied school-based OHAs to dental health education by noting the following:

"*I do not know that much. But, according to what is done at my child's school, I can see that the school can provide presentations or demonstrations on how to protect teeth.*" (P1)

"*They can invite a dentist to speak to the children, educating them on dental health*." (P7)

"*I did not consider their role before this time*." (P6)

"*I do not know what you meant by supervised toothbrushing clubs*." (P3)

b. Participants' attitude towards the implementation of school-based oral health activities

Participants' awareness of OHAs in schools was discussed in the previous section. This section presents participants attitudes and feelings towards OHAs implementation in KSA special schools.

Overall, interviews revealed various attitudes and feelings regarding the school-based OHAs implementation. Some participants expressed positive attitudes towards implementing OHAs in KSA special schools. However, others were more concerned about these activities effectiveness and whether school staff could provide OHAs effectively. The participants indicated they wanted dental professionals to participate in the implementation process. The following theme will further elaborate on this point by examining the self-efficacy CFIR construct.

"*I will support the school's dental health activities. I like the idea.*" (P12)

"*Children will learn and build habits better if they know them from their teachers and friends*." (P2)

"*I am not entirely with it because I prefer a dentist to perform the activity*." (P11)

The participants generally have limited knowledge about different OHAs that could be conducted at schools, except for OHE. However, their attitudes and feelings towards implementing OHAs were in favour. The following theme will explore the participants' views on the ability of school staff to carry out OHAs and the willingness of families to follow OHAs instructions at home and participate in OHAs at school.

5.3.2.1.2 Self-efficacy

After exploring the participants' perspectives regarding the OHAs implementation in KSA special schools. This is the second theme under the characteristic of individuals' CFIR domain. The aim of this theme is to assess the participants confidence in the KSA special school staff ability to implement OHAs successfully. Additionally, it discusses the participants confidence in their abilities to follow on OHAs at home and to be involved in the school OHAs in two sub themes as shown in Figure 5.18 below.

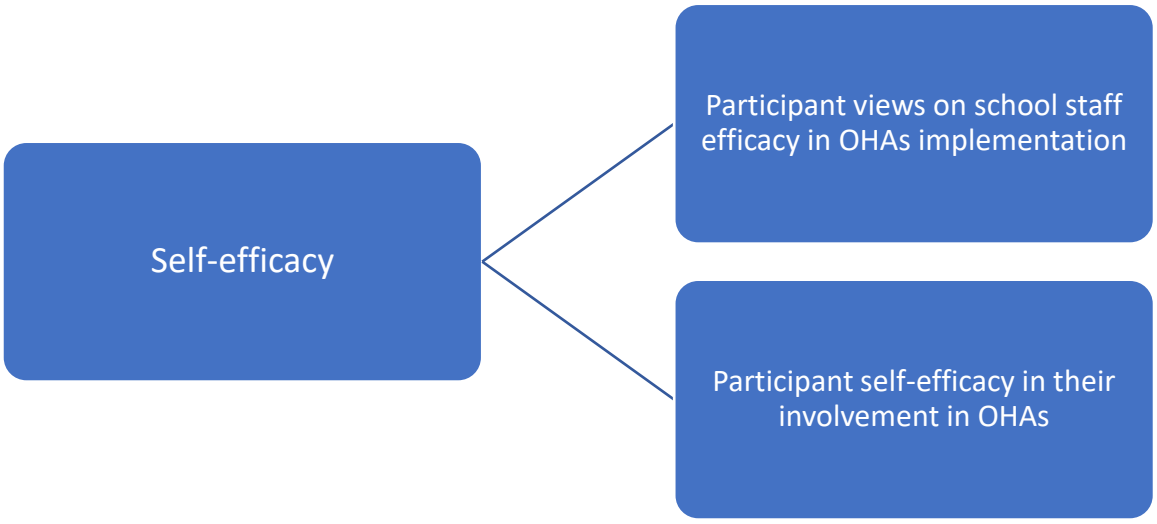

Figure 5-18 Sub themes under the self-efficacy theme of the Characteristics of Individuals domain, according to parents/carers interviews.

8. Participants' views on school staff efficacy in oral health activities implementation

This sub theme discusses the participants' confidence in the KSA special school staff as implementers of the OHAs. Participants argued that teachers might be able to implement OHAs as they are experts in educating children with disabilities. However, claims were raised concerning teachers' dental health knowledge.

To address this barrier, the need for a holistic, collaborative approach involving MoE, MoH, and children's families was highlighted. It was suggested that dental professionals could work with special schools to develop the activity. Moreover, they could develop educational resources or train school staff to implement OHAs more effectively.

"*The teachers can convey information to the children. I believe that they are qualified enough to communicate with students*." (P2)

"*I am confident that school staff can perform the activity. However, I am not sure they have proper dental health knowledge. I think they do not know more than any average person, so I recommend cooperation with the health sector*." (P3)

"*All sides should participate, including dentists, schools, and families. It cannot succeed without the support of all responsible individuals*." (P10)

B. Participants' self-efficacy in their involvement in school-based oral health activities

In this sub theme, the participants were asked to assess their ability as carers of children with disabilities to cooperate with KSA special schools in implementing OHAs. Moreover, it explores their views regarding their involvement in implementing OHAs, as it was one of the main findings from the staff interviews, as previously highlighted during the adaptability theme (Section 5.2.2.1.3).

The participants generally agreed on the importance of family involvement. However, participants presented varied perspectives on their involvement opportunities in school-based OHAs. These perspectives included attending an activity at school and practising at home.

"*We all know this group of children needs their families' support at every step. So, I believe family should be involved for broader benefits*." (P5)

For instance, participants are enthusiastic to be involved in OHAs at schools and they would appreciate simple educational resources and techniques provided by the OHAs at schools.

"*Yes, I can attend any school activity for my child*." (P7)

"*It will be an exciting opportunity to speak to others about the challenges and support on the matter. We also need educational materials, such as simple videos or leaflets.*" (P6)

Conversely, participants reported factors that might hinder their effective involvement. These factors included a lack of family willingness due to low motivation, competitive priorities, or being at work.

"*There could be a lack of interest in the activities. Some families may not want to participate. It may be due to parents' insufficient knowledge, lack of motivation, and having other responsibilities simultaneously. This may be why they do not want to be involved in dental health activities*." (P11)

To overcome such barriers, parents expressed a desire to have parent support networks via social media (e.g., WhatsApp groups) that could provide support and guidance for parents. According to them, dental professionals and school staff could facilitate these networks.

"*It would be better to create a WhatsApp group involving dentists, school staff members, and parents*." (P11)

"*We need parent groups to exchange experiences. In this case, I suggest taking advantage of online meeting platforms*." (P8)

According to this theme, parental beliefs in school staff's ability to conduct OHAs originate from the staff's ability to interact well with the children. However, concerns about the staff's level of dental health knowledge impact their self-efficacy. The participants also expressed positive views about participating in the activities while reporting some barriers.

5.3.2.1.3 Summary

This domain evaluated the participants' knowledge, attitudes, and feelings toward implementing OHAs in KSA special schools. Overall, participants acknowledged that children face barriers to daily dental care and have limited access to dental services. In addition, they were unaware of most school-based OHAs beyond dental health education. Moreover, the parents/carers had favourable attitudes towards implementing OHAs at the schools. However, they raised concerns about teacher's self-efficacy in implementing OHAs, suggesting dental professionals' involvement.

Furthermore, there was enthusiasm for following OHAs at home and participating in school activities; however, low motivation and competing priorities hindered effective family involvement in school OHAs. Figure 5.19 summarises the identified barriers and facilitators to school-based OHAs implementation within this domain.

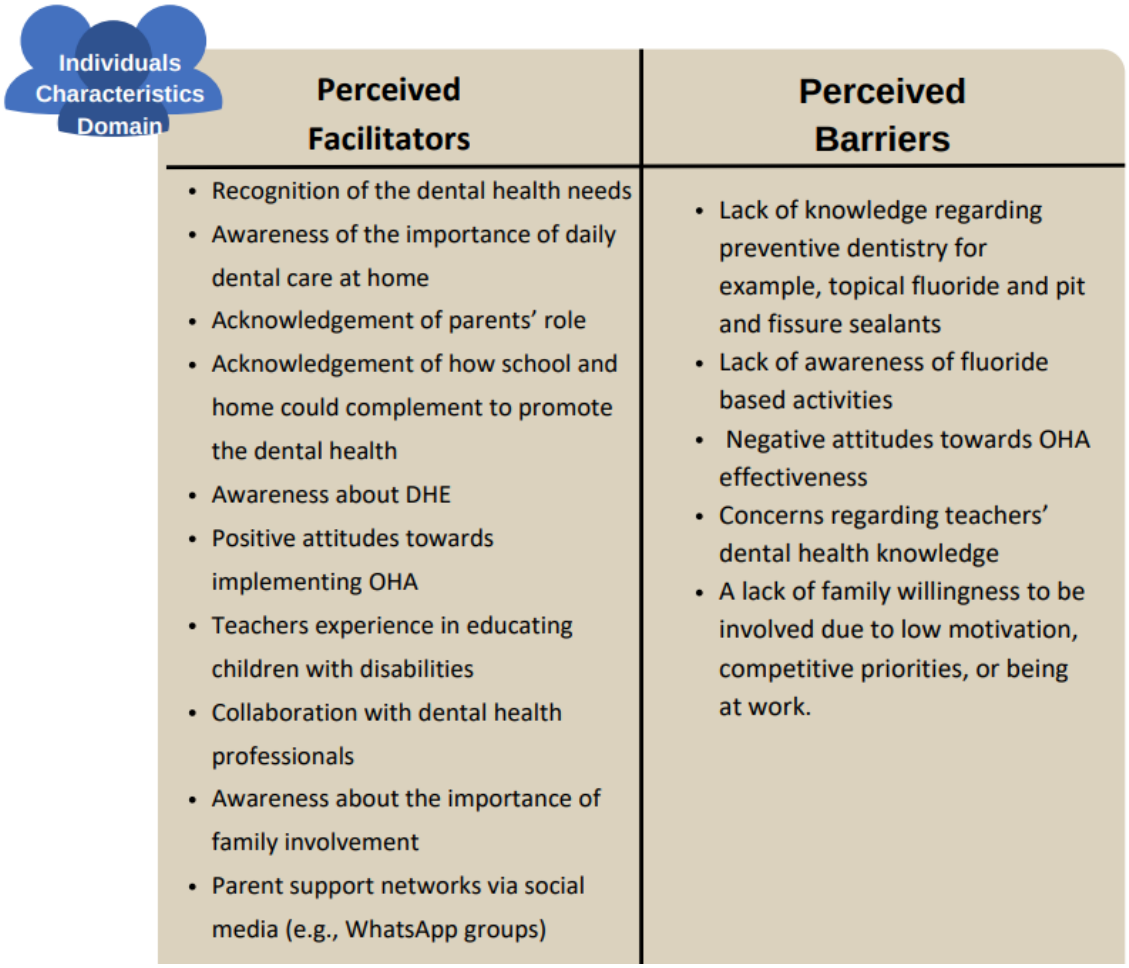

Figure 5-19 The perceived barriers and facilitators to the oral health activities implementation at KSA special schools under the Consolidated Framework for Implementation Research- Characteristics of Individuals domain, according to parents/carers.

5.3.2.2 Intervention characteristics domain

This CFIR domain covers three themes concerning the participants' views on the OHAs characteristics in KSA special schools: availability, adaptability, design and quality. Additionally, it assesses the potential impact of OHAs characteristics on the implementation process.

5.3.2.2.1 Availability and types of oral health activities

This theme focuses on the availability and types of OHAs in KSA special schools, with a range of views expressed; some participants mentioned that their child's school provided certain types of OHAs, while others criticised their child's special school for lacking OHAs.

"*There is an annual oral health awareness day at my child's school*." (P3)

"*No, they have no program or learning objective related to dental health. There is no policy regulating food choices, which is needed*." (P2)

"*I have three kids in two mainstream schools, and dental professionals visit them and arrange dental health awareness campaigns, but this is not available at my little boy's special school*." (P10)

Regarding the types of implemented OHAs in KSA special schools, the interviews revealed that the primary OHAs implemented in KSA special schools were OHE sessions, celebrations of international dental health awareness day, and dental examinations with referrals.

"*Yes, during the annual oral health awareness day, they perform activities to teach the children about brushing methods and healthy and unhealthy food options*." (P3)

"*I appreciate the excellent work of the school my child attends. They have a clinic, and periodically, they host doctors from different specialities to examine the child. They inform us about his condition and refer the child if needed*." (P11)

Furthermore, some OHE lectures were provided to parents, but no supervised tooth brushing and topical fluoride application.

"*They previously invited the mothers to a dentist's talk at school*." (P11)

Overall, some forms of OHAs are available in KSA special schools. The following theme explores how these activities are adapted to children's learning needs.

5.3.2.2.2 Adaptability

This theme explores whether school based OHAs at KSA special schools are adapted to meet children's learning needs. Also, it discusses participants' recommendations to improve OHAs adaptability.

Generally, the participants noted that the applied OHAs need to be more adapted to meet children's learning needs.

"*I believe they use generic videos from YouTube, which might be difficult for children with limited abilities*." (P11)

"I can see the dental health educational material they sent for home use. It is not specified for children with autism; it is only general information about maintaining dental health. I want sources that can provide specific assistance with the condition of my child." (P6)

The findings emphasised the importance of adaptable OHAs to achieve a successful implementation. The participants suggested that general educational resources and techniques should not be used to educate children with disabilities and that adapted resources are required.

"*If you are looking for a practical activity, it should be adjusted according to the child's ability. Otherwise, it will be a waste of time, money and effort without benefit*." (P7)

Moreover, the data shows that the OHAs implementation process should consider children's challenges in cognitive ability, communication skills, sensory hypersensitivity, and behaviours. These challenges should be addressed through adaptable OHAs following explicit instructions, breaking tasks into smaller steps, and providing visual support.

"*Any program should be tailored to each child's individual needs as they are varied in their abilities to comprehend, communicate, follow instructions, and exhibit different behaviours*." (P12)

"*They need repetition of the information given to them*." (P10)

Furthermore, the participants proposed various strategies to improve OHAs adaptability to meet children's learning needs. For instance, strategies to strengthen OHAs adaptability and implementation success include short/direct messages, tailored visual aids, sensory adapted tools, reminders, and parents should be involved in the implementation process.

"*To communicate with them, you can rely on pictures. Visuals can be used to help children understand the brushing method and steps. They can be used to reinforce the learned behaviours*." (P6)

"*I heard about non-foaming toothpaste that might help children with autism by reducing their sensitivity*." (P3)

"*As we said earlier, I believe we need family involvement*." (P5)

This theme highlights the importance of adaptable OHAs resources and techniques when implementing school-based OHAs for children with disabilities. Resources and methods which

have not been appropriately modified hinder implementation, while adaptable ones facilitate it. The theme below presents opinions regarding OHAs design and quality.

5.3.2.2.3 Design and quality

This theme assessed the design and quality of OHA provided in KSA special schools. The findings indicate that the participants were dissatisfied with the implemented OHAs.

According to the participants, the current OHAs are not providing students with resources, services, and support. The participants also identified gaps in the OHAs and offered suggestions for improvements. For example, the implemented activities were criticised for not being consistent enough to help children develop good oral health behaviours and lacking adapted educational resources.

"*It is average. It was done once without any further reinforcement*." (P11)

"*It will not work without further reinforcement, family support, and specialised educational materials*." (P3)

"*They can collaborate with dentists to provide the students with discount cards. This can enhance the services, not only education*." (P8)

"*The distribution of leaflets, booklets, toothpaste, and toothbrushes would be beneficial.*" (P4)

Moreover, participants expressed the need for a school policy to promote oral health amongst schoolchildren rather than separate activities. It was stated that the dental health sector could contribute to this effort.

"*A food policy should be established, and regular dental activity should be regulated. Collaborating with dental health professionals or at a higher level between ministries is necessary*." (P10)

Overall, participants desire improvements in the design and quality of OHA in schools by implementing policies that regulate the food canteen and toothbrushing within schools. Additionally, participants suggest that schools should provide support by distributing educational materials, toothpaste and toothbrushes. They also recommend that schools offer discount cards for dentist visits to encourage regular dental check-ups.

5.3.2.2.4 Summary

This domain aimed to evaluate opinions on the characteristics of OHAs and their impact on the implementation process in KSA special schools. Although some OHE activities were carried out in these schools, the applied activities needed to be adapted to the student's learning needs. The findings suggest a necessity to improve the OHAS by adapting the educational materials, collaborating with dentists, distributing resources, and developing appropriate policies. The identified barriers and facilitators to OHAS implementation at KSA special schools under the intervention characteristics domain are summarised in Figure 5.20.

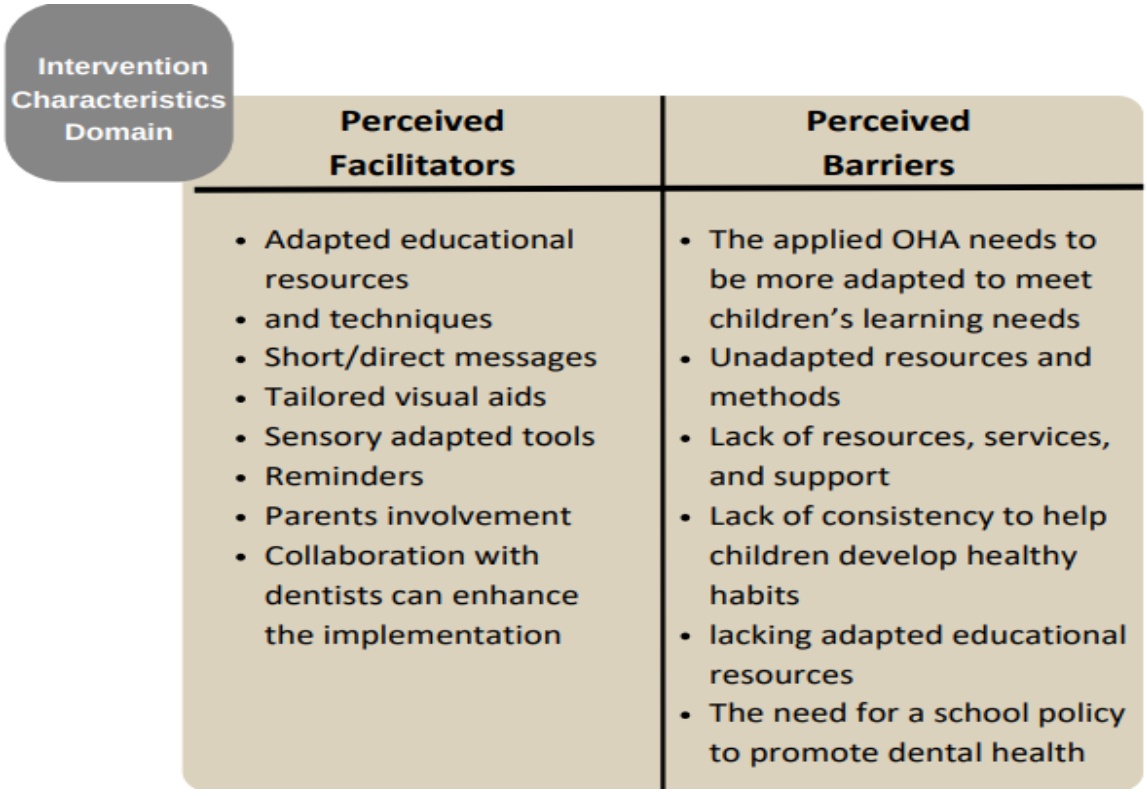

Figure 5-20 Summary of the perceived barriers and facilitators to OHA implementation in KSA special schools concerning the Intervention Characteristics Domain of the Consolidated Framework for Implementation Research, according to parents/carers.

5.3.2.3 Inner setting domain

This CFIR domain examines the impact of the inner setting (KSA special schools) on the implementation of the OHAs. Figure 5.21 illustrates four themes within this domain.

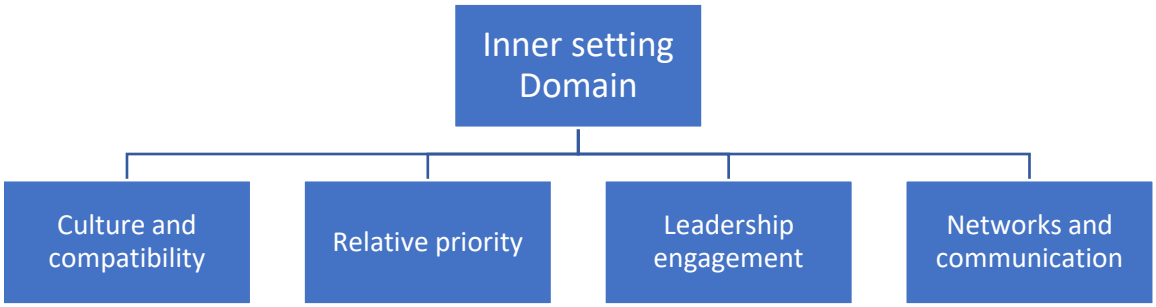

Figure 5-21 The identifies themes within the Consolidated Framework for Implementation Research – Inner Setting domain, according to parents/carers interviews.

5.3.2.3.1 Culture and compatibility

During this theme, the participants' views on KSA special schools' culture, values, and practices and their effect on implementing OHAs were explored.

Interviews show participants believed schools supported their children's learning and development. However, concerns were raised about the role of schools in OHP. They specifically noted the need for more effort in allocating time for tooth brushing and raised concerns about the food canteens.

"*Schools generally support academic achievement, self-reliance, social integration, and speech and physical development. Despite this, dental health is not supported*." (P4)

"*They are extremely helpful at caring for children's safety and learning. They provide a supportive culture, and I believe if they are asked to implement an idea, they will do it for the students' benefit*." (P7)

"*They pay attention to every detail. It is unclear to me why dental health is not a priority. Food canteens provide alarming amounts of sugar, which is concerning. Besides this, the children don't brush their teeth during the school day!*" (P6)

In addition, participants noted that the OHAs could easily be integrated with school practices without time barriers.

"*I know that they can have dental health activities within the school schedule. This will not interfere. Let us say they can use story time to talk about healthy habits for healthy teeth."*

"Curriculum-wise, they do not have much to do. Thus, time will not be a constraint." (P4)

Participants described KSA school culture as supporting children's needs through educational and social activities. Schools need to better support OHP as there is a lack of toothbrushing during the day and sugary foods are available in canteens. In the following theme, views on prioritising OHAs in KSA special schools are presented.

5.3.2.3.2 Relative priority

The second theme of CFIR's inner setting domain explores how participants perceive the priority of implementing OHAs within KSA special schools compared to other school activities.

Findings indicate that OHAs are given low priority in KSA special schools. To illustrate, the participants believed the school priorities were academic achievements, social skills, and daily life skills such as personal hygiene and eating. However, toothbrushing is among the personal hygiene practices, but it was not included. "*The school is primarily concerned with educating students and developing their social skills, not with dental health*." (P10)

"*Dental health is not a priority for them. If not, better food options and a clinic for dental emergencies would be readily available*." (P2)

They reported a limited focus on health activities, including OHAs. This lack of focus on OHAs might be due to limited resources and staffing. In addition, there might be a lack of understanding of the school's role in students' oral health.

"*They do not provide oral health activities. This might be due to limited knowledge or inadequate support*." (P10)

However, according to the participants, certain KSA special schools prioritise OHAs by conducting regular dental check-ups and referrals.

"*My child's school has a clinic, and doctors and dentists visit. Clearly, they are considering their importance in this regard*." (P11)

Nevertheless, OHAs were generally not considered a top priority among KSA special schools. The upcoming theme discusses how the engagement of KSA special school leaders in OHAs could influence their implementation.

5.3.2.3.3 Leadership engagement

This theme covered views on the role of school leaders in implementing OHAs in KSA special schools. Leadership was perceived to come from head teachers and school department leaders. Participants highlighted that school principals play a significant role in adopting and implementing all school activities, including OHAs.

"*I think school principals are the leading advocates for oral health activities in schools. They guide and support teachers and act as role models, setting healthy examples*." (P11)

There was agreement that school leaders should be actively involved in the OHAs. According to them, any plans for implementing OHAs should be directed to school leaders at the beginning since they are responsible for ensuring school access, developing policies, and coordinating activities. Further, school leaders' involvement is essential to coordinate the OHAs implementation process, which requires time, financial, and human resources.

"*School principals oversee all school activities. Nothing can be done without their approval*." (P6)

"*I believe school leaders should determine who will lead the program and how it will be funded and implemented*." (P7)

There was a consensus among participants that engagement of school leaders is essential to facilitate the implementation of OHAs in KSA special schools. The following theme discusses communicating with children's families about OHAs.

5.3.2.3.4 Networks and communication

This theme discusses school-based OHAs communication with children's families. The participants reported an inadequate level of OHAs communication. For example, they were notified after the activity through general messages to WhatsApp groups.

"*No, they did not contact us before the activity. We were informed that the event was held without providing any further details*." (P6)

According to participants, more regular communication was needed between the school and the families.

"*We needed to be informed. This will allow me to discuss it with my child and learn about his fears before the dentist examines him for a better experience*." (P11)

The participants discussed the importance of communicating with the family and providing educational resources for home use to improve implementation success.

"*Families need to be informed about the activities in detail, as some children cannot explain them to their parents.*" (P12)

"*Brochures or leaflets for home use would be helpful*." (P8)

This theme emphasised the need to communicate the applied OHAs with the families of children to facilitate implementation.

5.3.2.3.5 Summary

This domain explored the effect of culture, priorities and leadership engagement in KSA special schools on the OHAs implementation. The findings indicated that school OHAs need better communication with the families and greater prioritisation, as the current culture is unsupportive. Furthermore, school leaders should be involved in planning, implementing, and allocating resources for OHAs. The coming domain will explore the CFIR's Outer Setting domain concerning the OHAs implementation. A summary of the perceived barriers and facilitators to OHAs within this domain is presented in Figure 5.22.

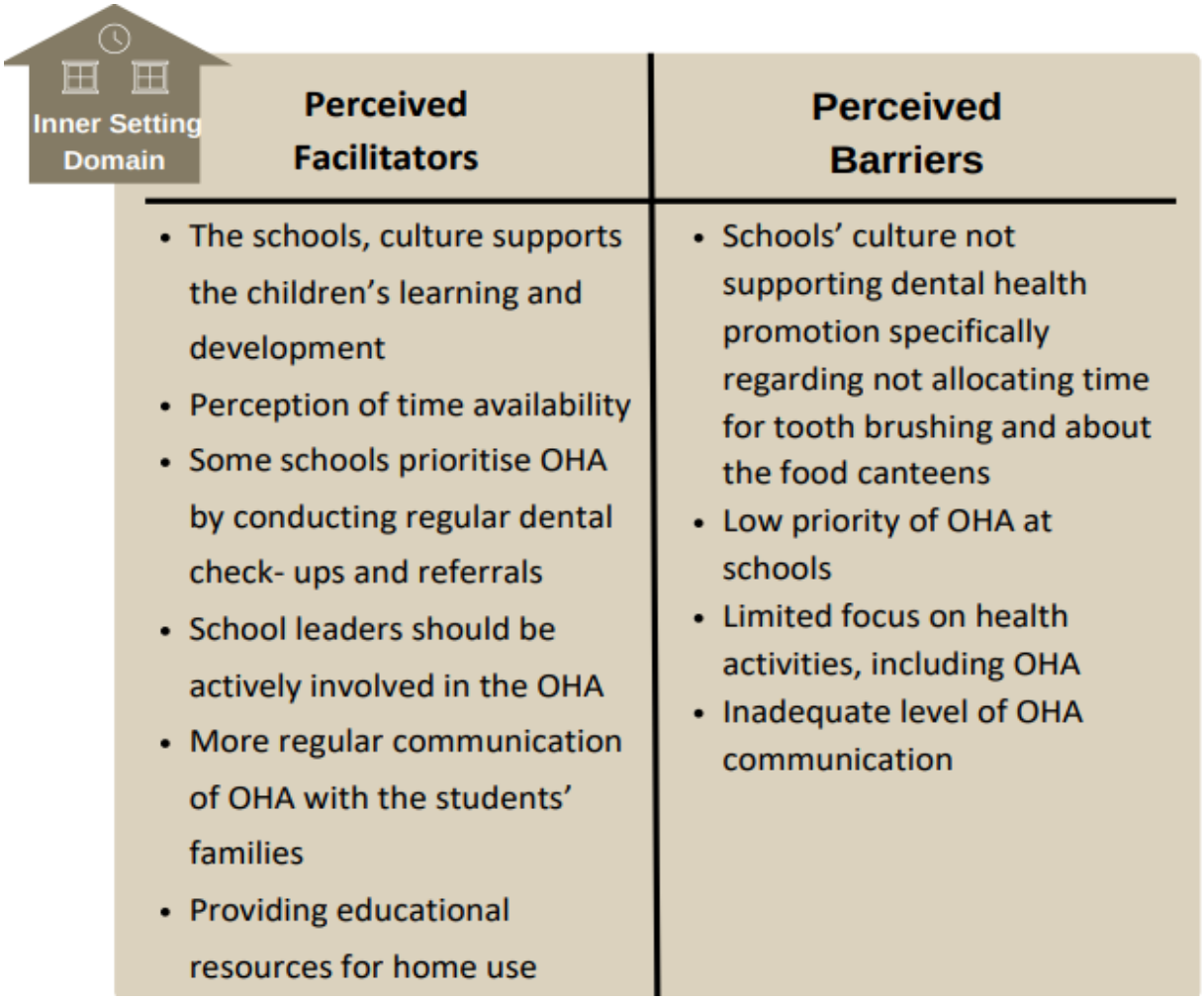

Figure 5-22 Summary of the perceived barriers and facilitators to the oral health activities implementation at KSA special schools under the Consolidated Framework for Implementation Research- Inner Setting domain, according to parents/carers.

5.3.2.4 Outer setting domain

This CFIR domain explored parent and carers perspectives on how national, regional and local policies or incentives impacted OHAs implementation in KSA special schools.

They had limited knowledge of policies regulating OHAs for children with disabilities in KSA special schools. However, the participants reported the presence of a governmental initiative to reduce dental caries prevalence among children in mainstream schools rather than in special schools. According to P11, "*I know there is a government initiative to combat dental caries in school children at the country level, but it does not cover special schools*." (P11)

Throughout the discussion, the participants shared insightful details about Aramco's incentives for schools to compete annually to run health promotion programmes in the Dammam region.

"*Aramco offers prizes to schools in the Dammam region with well-planned and integrated health programs.*" (P7)

The need to involve special schools in the national initiative to prevent dental caries among primary schoolchildren was discussed. The lack of external policy guiding the OHAs at KSA special schools could hinder their implementation. The next domain covers the OHAs implementation process at these schools.

5.3.2.5 Implementation process domain

This domain evaluates how the implementation process affected the success of OHAs implementation in KSA special schools from the perspective of parents and carers. Figure 5.23 illustrates the three themes within this domain.

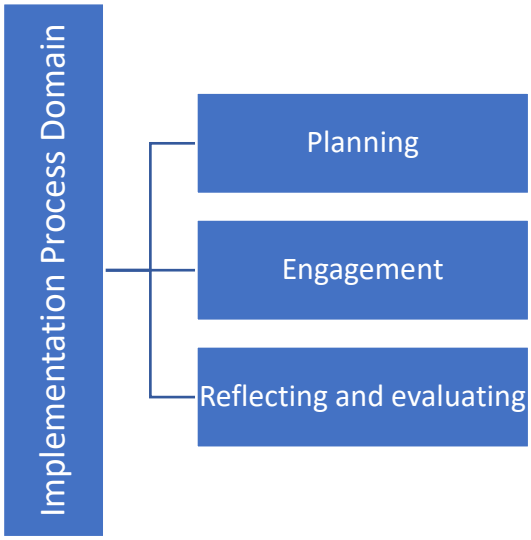

Figure 5-23 Themes related to the Consolidated Framework for Implementation Research – Implementation Process domain, according to parents/carers interviews.

5.3.2.5.1 Planning

This theme explored the school-based OHAs planning process or lack of it at KSA special schools and the degree of family involvement in this planning. For example, a participant stated that the school-based OHAs planning process left the family entirely out of the process.

"*They do not include us in the planning of their activities*." (P11)

Furthermore, the participants highlighted the need for active involvement in OHA planning to ensure that the school-based OHAs were tailored to the children's needs. They further emphasised the importance of considering their input, which would help identify the most effective strategies for approaching their children.

"*The school could plan activities around the child's needs if I communicated with them*." (P8)

"*I hope the schools consider our concerns, as we can recommend the most appropriate methods for approaching our children*." (P10)

The findings indicated that families should be given more opportunities to participate in OHAs planning and implementation. The coming theme discusses the parent/carer opinions on the engagement of children in OHAs implementation.

5.3.2.5.2 Engagement

This theme examines the views on how children's perceptions and attitudes towards school-based OHAs can affect their implementation. Although some participants positively perceived the children's attitudes towards OHAs at schools, others had a contrasting view. For example, the participants indicated that the children are eager to learn and participate in school activities.

"*Children are enthusiastic about being involved in various school activities*." (P4)

However, it was reported that children's abilities varied depending on age, disability type and degree, behaviour, and personality. They recommended that each child be approached as a unique case based on their abilities.

"*This group has a wide range of abilities. Therefore, we must consider their challenges and work towards addressing them*." (P12)

It is generally believed that children can participate in OHAs. However, children's abilities and behaviours might affect OHAs implementation in KSA special schools. Considering this point during planning, design, and implementation is crucial. The coming theme discusses parent involvement in evaluating the OHAs at KSA special schools.

5.3.2.5.3 Reflecting and evaluating

This theme focused on whether parents or carers were involved in evaluating school-based OHAs. The participants stressed the importance of evaluating activities to improve them but highlighted their lack of knowledge of any such evaluations.

"*They must evaluate the program's success and effectiveness and measure outcomes to improve future activities*." (P3)

"*I do not know about it. I do not know if they evaluate it or run the program, and that is it*." (P6)

"*I am looking for a small survey about what we want. What will work? Something like this might help*." (P11)

For instance, they suggested allowing parents to attend OHAs meetings and provide feedback to the school on the OHAs.

"*Some parents should attend and share their views if they meet to discuss the program.*" (P4)

The participants generally perceived it as crucial to involve parents in evaluating OHAs to provide their valuable insight and provide a better direction for future OHAs efforts.

5.3.2.5.4 Summary

The parents have reported that their children's abilities to participate in OHAs vary, and it is crucial to consider the variations among children when conducting the school-based OHAs. Furthermore, the participants emphasised the significance of involving families in OHAs planning and evaluation. Figure 5.24 represents the barriers and facilitators to implementing OHAs within this domain.

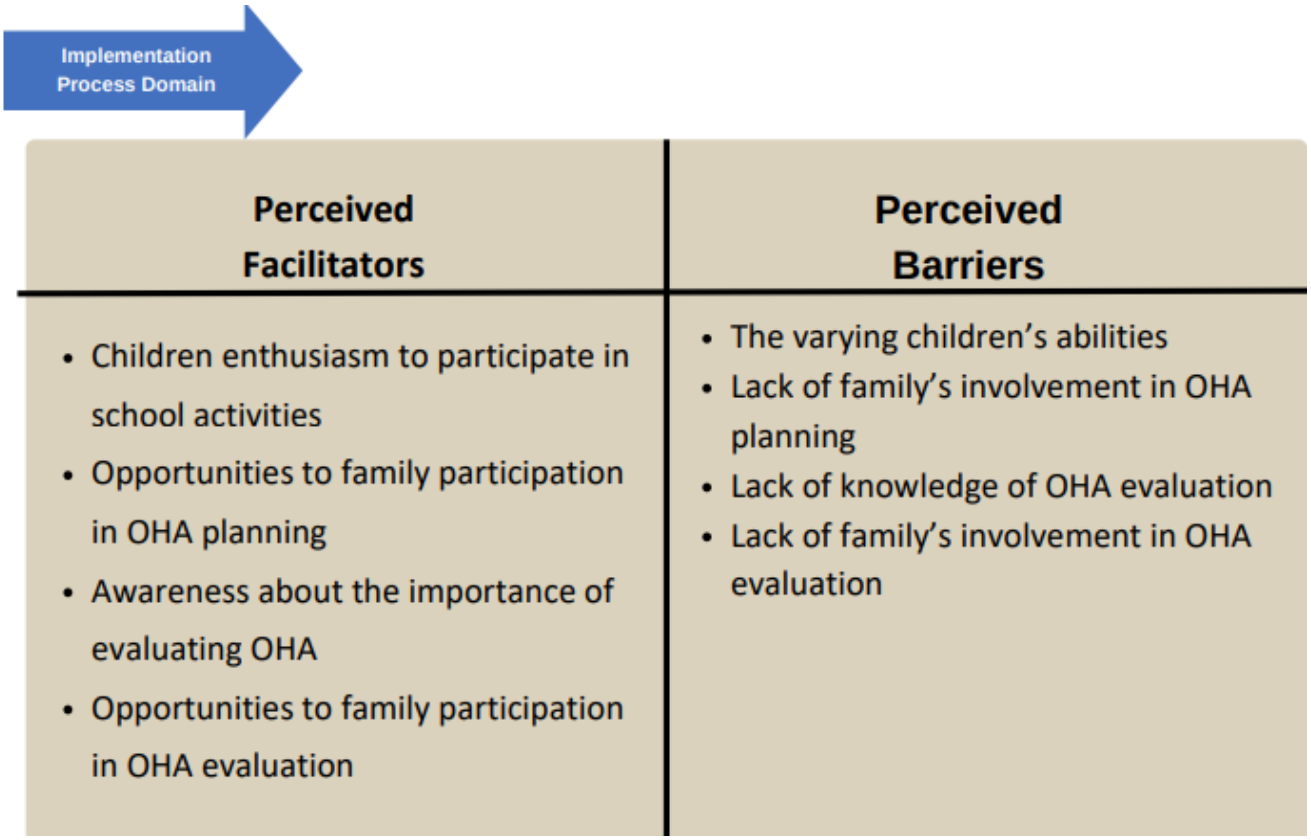

Figure 5-24 The barriers and facilitators to implementing oral health activities in KSA special schools related to the Consolidated Framework for Implementation Research- Implementation Process domain, according to parents/carers.

5.4 Summary of the findings of the qualitative study

This study has highlighted that no national OHP programmes exist at KSA special schools. School-based OHAs were not widely available at KSA special schools. The KSA special schools lack OHP, including fluoride-based activities, topical fluoride application, and supervised toothbrushing clubs. Although some OHE is provided, it is not reinforced.

In addition, the applied OHAs in these schools lacked the necessary adaptation to student learning needs. The educational materials and methods should be simplified, including visual aids and models. It is crucial to address the high-sensitivity issues. Parent and dental professionals' involvement could help design adapted OHAs for KSA special schools attending children. Furthermore, staff members in KSA special schools need to improve their oral health knowledge, attitudes, and self-efficacy towards OHAs. Conducting training sessions with dental professionals and providing oral health educational resources or toolkits/guidance documents to school staff can lead to improvements.

KSA special schools, as an inner setting, experience barriers to the effective implementation of OHAs. Integrating oral health into the school curriculum, promoting a healthy food policy, implementing supervised toothbrushing clubs, incentivising staff participation, and engaging school leaders in OHAs planning and resourcing are critical. In addition, the availability of positive peer pressure and external policies and incentives governing the OHAs implementation in KSA special schools could promote their successful implementation. Moreover, implementing OHAs effectively at KSA special schools requires careful planning,

stakeholder engagement, and continuous evaluation. This study identified key barriers to implementing school-based OHAs according to CFIR, shown in Figure 5.25.

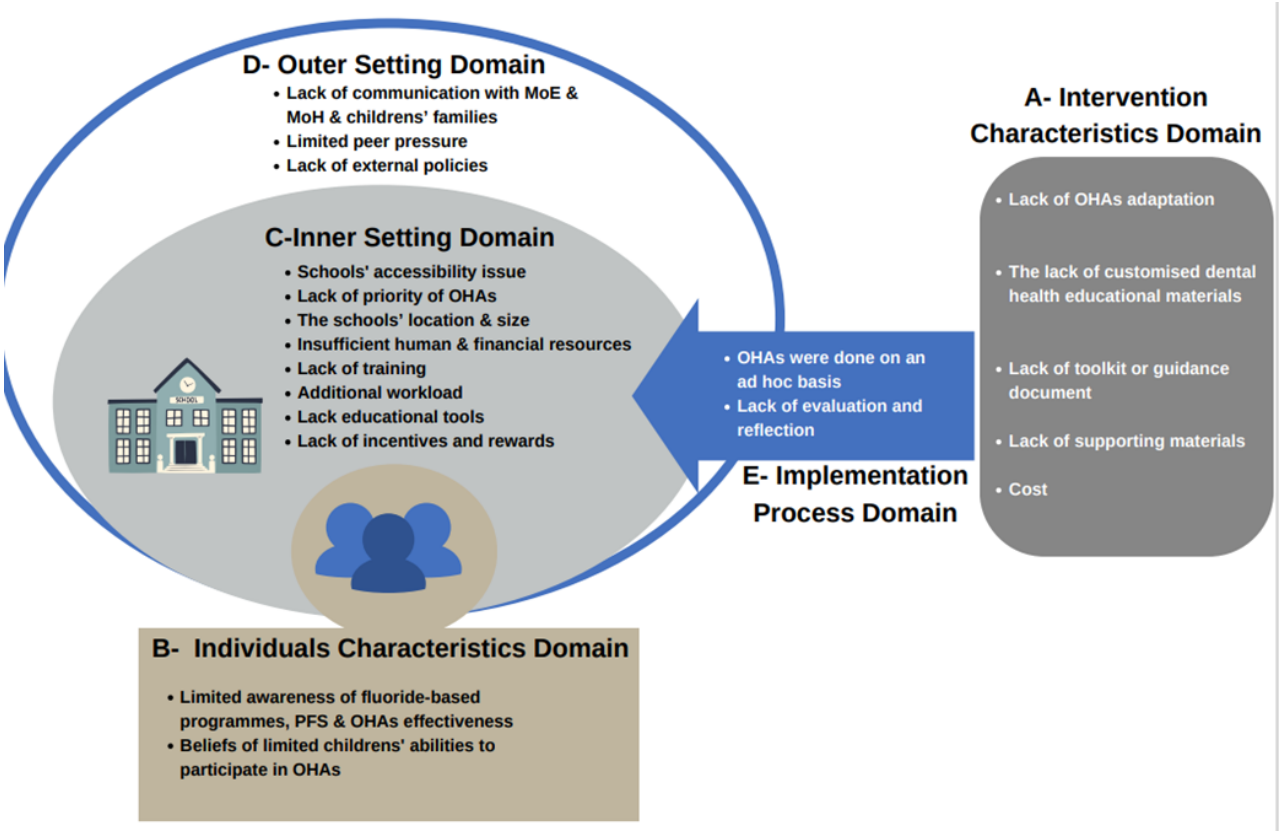

Figure 5-25 The key identified barriers to school-based oral health activities implementation at KSA special schools according to the Consolidated Framework for Implementation Research.

The findings indicate that this study could inform the development of an OHP implementation toolkit for KSA special schools. The following section presents the study recommendations for key concepts on which to base such a toolkit.

5.4.1 Key concepts to underpin an oral health promotion implementation toolkit for KSA special schools

As illustrated earlier, an OHP implementation toolkit is needed to guide the future planning, development, and implementation of effective school-based OHPAs at KSA special schools. Based on the study's key findings and the reviewed literature in Chapter Two, four main concepts considered vital to address the identified barriers and guide the development of an OHP implementation toolkit are suggested in Figure 5.26. This section outlines key concepts to underpin an OHP implementation toolkit for KSA special schools.

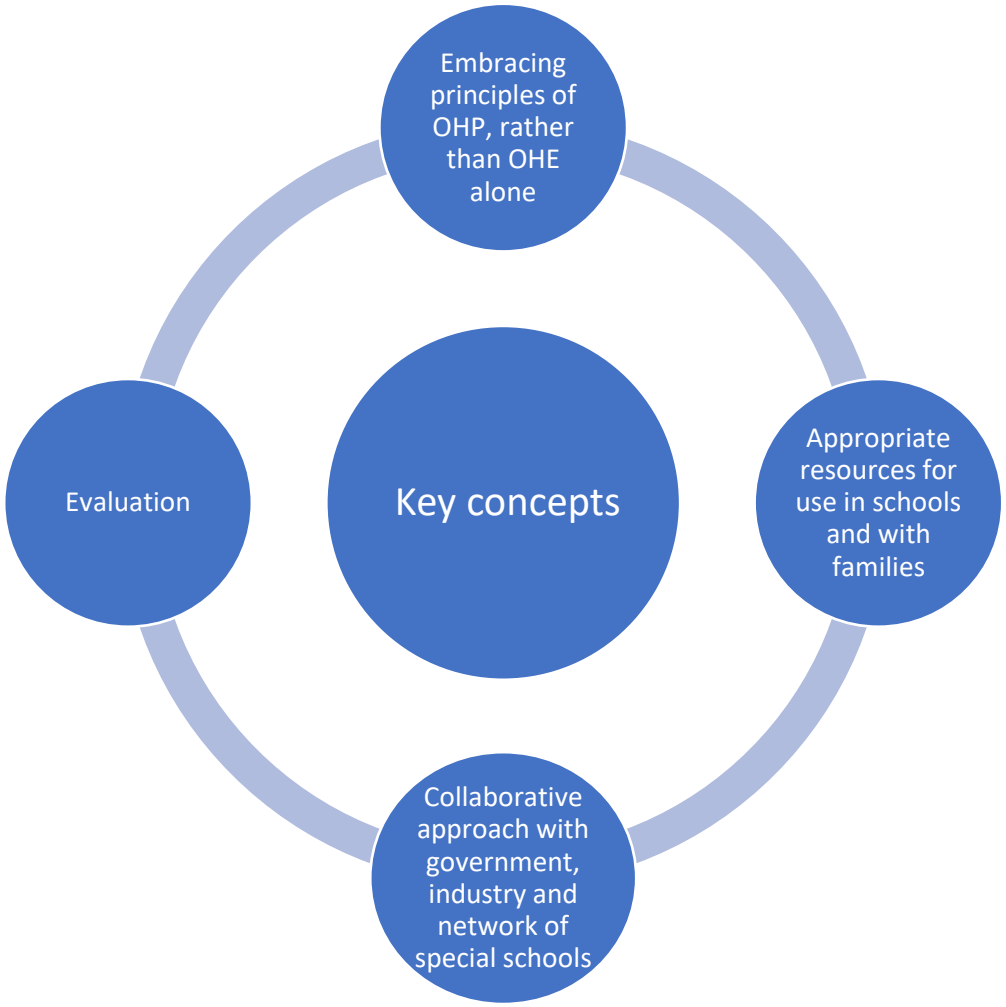

Figure 5-26 The key concepts to underpin an oral health promotion implementation toolkit for KSA special schools.

5.4.1.1 Embracing principles of oral health promotion rather than oral health education alone

An OHP implementation toolkit should be designed to ensure the implementation of activities that meet the definition of OHP rather than retaining the current focus, which is mainly on OHE. The principles of the Ottawa Charter (World Health Organization, 1986) described in (Section 2.3.3) could be applied to facilitate this:

1. Developing and enforcing oral health policies in schools

For example, a healthy eating policy could be implemented by serving only nutritious meals in the school canteen, establishing guidelines for families to pack balanced and healthy lunches, advocating for the consumption of five servings of fruits and vegetables daily, offering free fruits, vegetables, and milk at schools, and prohibiting sugary foods and drinks on school grounds.

Another oral health policy implementation example could be organising daily supervised toothbrushing clubs. The toolkit could guide the development of supervised toothbrushing clubs in KSA special schools by providing details on the definition, methods, procedures, and recommendations for this activity. It could also suggest incorporating supervised toothbrushing clubs into daily routines, such as brushing after meals or snacks, as consistency and repetition could help students develop appropriate oral hygiene habits.

Moreover, the OHP implementation toolkit could emphasise the integration of oral health into the curriculum of KSA special schools by incorporating action competencies for oral health into formal and informal curricula to enhance students' knowledge and life skills. Oral health should be incorporated into all relevant subjects in the school curriculum, focusing on developing life skills. Integrating oral health into the curriculum ensures consistency and regular exposure to the information, which is essential for children with disabilities to learn and develop new skills and behaviours.

2- Creating supportive environments by providing a safe, clean, supportive and healthy learning environment

The OHP implementation toolkit could include guidelines for KSA special schools to create safe and well-designed school buildings and playgrounds to prevent traumatic dental injuries. In addition, health-promoting school environments should prohibit the sale of unhealthy, sugary foods in the schools and surrounding areas.

3- Developing personal skills

The OHP implementation toolkit could develop the personal skills of teaching staff, parents, and children regarding proper toothbrushing techniques for children with disabilities by providing guidance on recommended oral hygiene practices. In addition, the guidance could include strategies for adapting these practices to suit different abilities and provide details on managing sensory sensitivities or behavioural challenges.

It could also provide information and recommendations on adapted dental tools or techniques that can accommodate the specific needs of children with disabilities, such as toothbrushes with modified handles or textures and non-foaming, unflavoured toothpaste. Furthermore, it could suggest incorporating strategies to assist children with sensory sensitivities in engaging in oral hygiene routines. These strategies might include offering different types of toothpaste or utilising music and visual aids to create a calming environment. Moreover, the toolkit could emphasise arranging training sessions or workshops for school staff, parents, and carers to improve their knowledge and skills in supporting oral health care for children with disabilities. Topics might include toothbrushing techniques, sugar reduction, and behaviour management strategies.

4- Strengthening community action

The toolkit could inform the KSA special schools about engaging parents, teachers, healthcare professionals, and local community members in OHP, empowering individuals to collaborate, take collective action, and provide resources to address shared barriers, foster social cohesion, and promote positive change, for instance, during the world oral health day celebration. This could be supported by forming a community advisory board or organising community meetings to gather input. In addition, workshops and seminars could be conducted to educate the community about the importance of promoting oral health for children with disabilities. Furthermore, communities could effectively promote oral health for children with disabilities by organising community events, such as awareness campaigns, and partnering with local media.

5- Facilitating access to dental health services and health promotion programmes

The OHP implementation toolkit could recommend facilitating access to dental health services and health promotion programmes for the KSA special schools, involving working with local dental health professionals to organise dental screenings and conducting workshops and training sessions for school staff and parents on the importance of oral health for children with disabilities.

This section highlighted the significance of shifting from traditional OHE conducted mainly by KSA special schools to OHP. It also recommended approaches for an OHP implementation toolkit to adopt the OHP principles defined by the Ottawa Charter (World Health Organization, 1986). The following section elaborates on the second recommended key concept to underpin the OHP implementation toolkit for KSA special schools.

5.4.1.2 Development and use of appropriate resources in schools and with families

The second key concept to underpin the OHP implementation toolkit for KSA special schools should be the development of adaptable, disability-specific, and age-appropriate educational resources that demonstrate the importance of oral health, proper toothbrushing techniques, information on healthy eating habits, and regular dental visits.

The toolkit could guide the creation of adaptable visual aids for children with disabilities, such as posters or charts, videos, social stories, and interactive tools to make learning about oral health engaging and more accessible for children with disabilities, using clear, simple language and pictures to enhance understanding. In addition, it should emphasise the significance of considering the students' communication needs and suggest using alternative communication methods, such as sign language or picture boards, to ensure clarity and engagement. Furthermore, the toolkit could provide communication tools, such as picture-based, that allow children with speech impairments to express their dental needs and concerns effectively. Furthermore, the toolkit could suggest developing social stories or visual narratives that depict proper toothbrushing techniques or the dentist visit experience in a step-by-step format to aid children in developing their understanding.

Also, the toolkit could inform the schools about the need for resources for parents and carers, such as printable handouts, web links, or online videos they could access at home to reinforce oral health practices and resources regarding their understanding of the significance of regular dental visits. Moreover, the toolkit could guide the development of online training resources for school staff and parents. This section proposed how the OHP implementation toolkit for KSA special schools could address the development and use of adaptable resources in schools and with families. The third key concept recommended to guide the development of an OHP implementation toolkit is presented in the following section.

5.4.1.3 Adopting a collaborative approach with government, industry, the network of special schools, and parents/carers

The third key concept could be collaboration with the government, industry, and the network of special schools, which is essential for promoting oral health for children with disabilities, for example, working with government health and education departments and agencies to advocate for policies and funding to support OHP for children with disabilities.

In addition, the toolkit could clarify the role of dental associations and professional organisations in raising awareness about the significance of oral health for children with disabilities and advocating for policies that promote inclusive dental care practices.

Furthermore, partnerships with local dental professionals in integrating OHP into special school programmes, such as incorporating oral health into the curriculum and organising dental screenings and preventive care services on-site, could significantly enhance efforts to promote oral health for children with disabilities.

The toolkit could also establish guidelines for collaboration between MoE and MoH on OHP initiatives. These guidelines should include information on scheduling regular dental visits, organising oral health screenings, coordinating with dental clinics that have experience working with children with disabilities, and promoting oral health in the school curriculum. In addition, it could emphasise the importance of collaboration between school staff, parents,

and children and encourage open communication and coordination. This could be achieved by engaging parents/ carers in the OHP efforts and providing them with resources, instructions, and regular updates to ensure consistent oral hygiene practices at home and in schools. This collaborative approach among government agencies, industry stakeholders, special schools, staff, and parents could make these efforts more comprehensive and sustainable. The following section highlights the significance of evaluation concept to underpin the OHP implementation toolkit for the KSA special schools.

5.4.1.4 Evaluation

An OHP implementation toolkit should provide information on the significance of regularly evaluating the implemented activities. It could include developing mechanisms to track oral health status and monitoring dental health indicators. Moreover, it could suggest methods for developing mechanisms to evaluate the effectiveness of the toolkit's implementation, involving conducting surveys and collecting feedback from children with disabilities, parents/carers, and school staff.

This chapter provided a detailed description of the qualitative study findings, which explored the OHAs in KSA special schools and identified potential determinants of OHAs implementation in these schools from the perspectives of school employees and the attending children's parents/carers. Moreover, based on the key barriers and evidence, it

described the recommendations of four key concepts needed to underpin an OHP implementation toolkit for the KSA special schools. The following chapter discusses the PhD main findings from Study One and Study Two in the context of the reviewed literature.

Chapter 6. Discussion

6.1 Introduction

This thesis's overarching aim is to explore the current provision of OHAs in special schools in KSA and the barriers and facilitators to their implementation. It is worth noting that the research focused on special education schools rather than children with disabilities in inclusive education. The differences between these schools and their attending children were covered during the review of KSA special education in Chapter One (Section 1.2.3.6.2).

Two studies were conducted for this purpose. The first study was a scoping review that aimed to map the literature on school-based OHAs for children with disabilities, identify research gaps, and provide insights to inform the second study. Study Two was a qualitative research study that involved semi-structured interviews to explore the implementation of OHAs in KSA special schools from the perspective of staff and parents/carers of children with disabilities and examine the perceived barriers to and facilitators of OHAs implementation in these schools guided by the CFIR. Furthermore, it recommended key concepts needed to underpin an OHP implementation toolkit. The studies' findings have addressed the PhD research objectives and answered the research questions.

6.1.1 Research objectives

1. To summarise the literature about school-based OHAs for children with disabilities and identify research gaps using a scoping review
2. To identify the currently conducted OHAs in KSA's special schools
3. Based on the CFIR, identify factors that influence the implementation of OHAs in these schools, including barriers and facilitators
4. To recommend key concepts on which to base an OHP implementation toolkit to improve the OHPAs in special schools in KSA

6.1.2 Research questions

1. What is known from the literature about school-based OHAs in special schools? Their types, outcomes, and factors affecting their implementation?
2. What OHAs are currently taking place in KSA's special schools?
3. What is the experience of school-based OHAs for school staff and parents/carers of children attending KSA special schools?
4. From the perspective of special school staff and parents/carers of children attending special schools in KSA, what factors hinder or facilitate the implementation of school-based OHAs?
5. What are the key concepts to guide the development of an OHP implementation toolkit for KSA's special schools?

This chapter summarises the key findings, strengths, and limitations of the scoping review (Study One), followed by a discussion of the qualitative study (Study Two). It includes the key findings to gain a comprehensive understanding, especially in the context of the broader literature, and describes their contribution to current knowledge. Furthermore, it describes methodological and ethical considerations alongside the study's strengths and limitations. Finally, it presents the research implications for policy, future research, and implementation science application for OHAs evaluation.

6.2 Scoping review of oral health activities at special schools

Chapter Three presented Study One of this PhD thesis, the first scoping review to explore the evidence on OHAs in special schools for children with disabilities. It aimed to comprehensively review school-based OHAs in special schools, identify research gaps, and inform the second study of this PhD research. It summarised the types of OHAs applied in special schools, reviewed the evidence on their measured outcomes, and identified the factors that influenced their implementation, using the Levac et al. (2010) framework. Studies in English and Arabic about school-based OHAs in special schools were searched using the Web of Science, SCOPUS, PsycINFO, Cochrane, and Medline databases from 1986 to 2021. The review comprised 11 studies, including five randomised trials, four pre- and post-design studies, a longitudinal study, and a quasi-experimental study.

The age range of the children studied was between six and 24 years old. The studies involved children with visual impairments, hearing impairments, learning disabilities, Down's Syndrome, and intellectual disabilities. Furthermore, the studies applied different types of OHAs, such as OHE (n=6), supervised toothbrushing (n=2), and a combination of both (n=3).

The findings indicate that insufficient research has been conducted on school-based OHAs for children with disabilities. The existing literature indicates that providing school-based OHAs, mainly consisting of OHE and supervised toothbrushing, might benefit children with disabilities through short-term improvements in their oral hygiene indices and oral health-related knowledge (Ganapathi et al., 2015, Hashmi et al., 2019, Pareek et al., 2015, Shah et al., 2020a, Shahabudin et al., 2016, Shyama et al., 2003). Furthermore, the review's results were consistent with Watt and Marinho (2005), who demonstrated that educational interventions effectively reduced dental plaque levels and gingival bleeding up to six months post-intervention; however, there is a lack of data to determine if such improvements are maintained in the long term.

Multiple factors affect the effectiveness of school-based OHAs, including the school schedule, teachers training and experience, access to dental health education materials, teachers' motivation, and parental compliance. However, no information is available on the contextual factors such as school structural characteristics, resources, culture, and external policies that affect the implementation of school-based OHAs in special schools despite the known impact of such factors on health promotion interventions (Poland et al., 2009).

In addition, the evidence highlighted that understanding the influence of the context in the design, implementation, and outcomes of community-based oral health programmes is vital for their success and sustainability and should be a central consideration in the planning and development of new programmes (de Silva et al., 2016b). Furthermore, the scoping review found that the duration of the OHAs and follow-ups was short, ranging from five weeks to six months. Similarly, the evidence recommends more theory-based randomised controlled trials with longer durations to improve the quality of research in this area (de Silva et al., 2016b).

Moreover, the scoping review results could not be generalised to other disabilities as most studies focused on specific populations, such as children with visual impairments. In addition, insufficient sampling could affect external validity due to small sample sizes, lack of control groups, and low response rates. Also, the studies' validity might be compromised by various factors, including social desirability bias, maturation bias, confounding variables, and subject attrition, as the studies lacked well-selected controls.

These findings informed the second study of the PhD research in exploring the implementation of school-based OHAs in the KSA's special schools and the factors influencing it. The scoping review on OHAs in special schools provided insights, identified gaps and helped plan the qualitative study. It reviewed common types, outcomes, barriers, and facilitators related to OHAs.

The scoping review findings enabled the researcher to develop well-informed, focused research questions that address gaps in the literature and helped the researcher opt for the most suitable methodology and data collection methods by reviewing existing methods. Generally, performing a scoping review before planning a qualitative study on OHAs in KSA special schools improved the researcher's understanding, built on existing knowledge, and laid the foundation for a methodologically rigorous study; more details were provided earlier in Section 3.5. The following section highlights the review's strengths and limitations.

6.2.1 Strengths and limitations

6.2.1.1 Strengths

This is the first scoping review on this important topic. The scoping review was based on a rigorous search strategy developed in conjunction with a librarian and based on the methodology of Levac et al., (2010). It aimed to include all types of OHAs in special schools and no restrictions were placed on the region or study design, which broadened the review's applicability and relevance. Moreover, this study followed the best practice guidance and reporting items for scoping review, as presented in Appendix 3.3 (Tricco et al., 2018).

6.2.1.2 Limitations

There were some limitations in this scoping review. Firstly, the review was limited to publications in English and Arabic. The search timeframe ended in October 2021, as the findings of this scoping review were used to inform the second study. There may have been further applicable studies published in the interim that may have added to the evidence which

have not been included in this study. However, the literature review in Chapter Two has been updated and no pertinent new studies were identified. Furthermore, no methodological quality assessment of the studies was made, and it is likely that the quality of the included studies is varied. As the scoping review aimed to inform the methodology for the second study it was felt that the optional step of assessing the quality of the studies was not required to meet this aim. Indeed, scoping reviews typically do not include quality assessments (Daudt et al., 2013, Levac et al., 2010, Peterson et al., 2017).

This section summarised the scoping review's key findings, strengths, and limitations. Furthermore, it explained how it guided the development of the qualitative study (Study Two), which is discussed in the following section.

6.3 Implementation of school-based oral health activities in special schools in the KSA- a qualitative Study

This study explored the school-based OHAs in the KSA special schools from the perspectives of staff and parents/carers of children with disabilities to identify the perceived barriers and facilitators to implementing school-based OHAs, according to the CFIR. The study involved semi-structured interviews with a sample of school staff and parents/carers of children (n=30) to provide a rich contextual description of the OHAs' barriers and facilitators. It employed a novel approach, little used in dental research, the CFIR, a determinant framework from implementation science. To my understanding, this study is the first to use the CFIR to explore the barriers and facilitators of implementing school-based OHAs in special schools worldwide, including KSA, highlighting the study's novelty and significance.

To that end, this study addressed three specific objectives:

1. Determined the OHAs currently being conducted in KSA special schools

2. Based on the CFIR, identified factors that influence the implementation of OHAs in these schools, including the barriers and facilitators

3. Recommended key concepts on which to base an OHP implementation toolkit to improve the OHAs in special schools in KSA

This section discussed the study's key findings, considering the evidence. It described crucial methodological and ethical considerations alongside the study's strengths and limitations. Finally, it presented the research implications.

6.3.1 Key findings of implementation of school-based oral health activities in special schools in the KSA- a qualitative Study

The key findings of the qualitative study are summarised according to the study objectives.

6.3.1.1 Determination of oral health activities provision in KSA special schools.

The study found no national oral health promotion programme in KSA special schools. The KSA special schools lacked oral health promotion, including fluoride-based activities, topical fluoride application, and supervised toothbrushing clubs. The findings revealed that OHAs were not widely available in KSA special schools and that the type of OHAs varied by school. Although some OHE was provided, it needs strengthening as most OHE activities were conducted annually to celebrate World oral health day without further reinforcement. In contrast, the role of repetition and reinforcement of OHE has been recognised (Atif et al., 2023, Bramantoro et al., 2021, Watt, 2005).

These findings support studies highlighting the gap between the ideal concepts of the health-promoting schools' framework and the situation in KSA mainstream schools. These schools were found to follow a traditional health education model with limited health promotion interventions. Moreover, healthy school policy integration, a health-promoting environment, and community involvement were lacking (AlZahrani, 2023, AlZahrani, 2022).

Special schools in KSA conduct similar OHAs to those in other developing countries. For example, a recent scoping review reveals that school-based oral health strategies in developing countries include education by teachers, peers, or parents and sometimes incorporate toothbrushing and dietary guidance (Elsadek and Baker, 2023). Furthermore, the findings of Study Two are consistent with Study One, the scoping review of OHAs for children with disabilities, as most of the conducted activities were OHE (n=6/11), as presented in Section 3.3.1 and summarised above (Section 6.2).

However, research has found that school-based OHE alone could only improve short-term oral health related knowledge and reduce dental plaque in schoolchildren. However, it had no effect on dental caries or gingivitis and could worsen oral health inequalities (Atif et al., 2023, Bramantoro et al., 2021, de Silva et al., 2016b, Kay and Locker, 1996, Stein et al., 2018, Watt, 2005, Watt and Marinho, 2005, Shen et al., 2021).

In addition, the school-based OHE activities adopted the historical approach to dental disease prevention. However, as described in Chapter Two, there has been a shift from this behavioural-focused approach (health education) to a broader approach addressing social, environmental, and political health determinants (health promotion) (Watt, 2005, Watt and Marinho, 2005, Watt, 2007, Watt and Sheiham, 2012, Watt, 2012).

Conversely, special schools in KSA lack proper OHPAs including supervised toothbrushing clubs and topical fluoride applications. This is a concern since school-based supervised

toothbrushing has been proven to be a cost-effective intervention for reducing dental caries and oral health inequalities among schoolchildren (Gray-Burrows et al., 2023, Dos Santos et al., 2018, de Silva et al., 2016a, Watt, 2005). For instance, Childsmile has been a successful initiative in Scotland that implemented supervised toothbrushing. (Anopa et al., 2015, Kidd et al., 2020, Macpherson et al., 2019b, Wright et al., 2015), as discussed in Chapter Two(Section 2.).

Childsmile includes children with learning disabilities, such as those with autism spectrum disorders. Evidence shows that implementing supervised toothbrushing in Childsmile reduced oral health inequalities. Children at higher risk of dental caries and those with learning disabilities, such as autism spectrum disorders, benefited the most (Kidd et al., 2020). However, it is essential to recognise that the level of supervision needed in special schools is different from that in mainstream schools.

Furthermore, the evidence highlights that the holistic approach with multi-component activities, including OHE, supervised toothbrushing, fluoride applications, dietary advice, a health-promoting environment and policy, should be prioritised over single-component community-based OHAs (de Silva et al., 2016b, Watt and Marinho, 2005, Watt, 2007, Watt, 2012). Nevertheless, evidence reveals that comprehensive OHP strategies that go beyond education to include policy development and social environment to support newly acquired behaviours and address the broader determinants of oral health should be prioritised to

improve outcomes in children with disabilities, one of the disadvantaged groups (Watt and Marinho, 2005, Watt, 2005, Watt, 2007, Watt, 2012).

Moreover, the KSA special schools failed to adopt the setting-based approach for OHP as it lacks the integration of oral health into the health-promoting school's framework. However, the evidence emphasises the opportunity for OHP through this approach (Elsadek and Baker, 2023, Freeman, 2020, Kwan et al., 2005, Petersen and Kwan, 2009). For example, in Brazil, including oral health in health-promoting schools has successfully improved the oral health status of mainstream schoolchildren (Moyses et al., 2003) and children attending special schools (Gaio et al., 2010). The following section presents the main barriers and facilitators to school-based OHAs implementation in KSA special schools, according to CFIR domains.

6.3.1.2 Identification of barriers and facilitators to oral health activities implementation in KSA special schools

This section presents the barriers and facilitators to implementing school-based OHAs in KSA special schools, considering relevant literature. The key findings are presented according to the CFIR domains as described in Chapter Five: Intervention Characteristics, Characteristics of Individuals, Inner Setting, Outer Setting, and Implementation Process. Furthermore, the text discusses the barriers first, followed by the facilitators.

6.3.1.2.1 Intervention characteristics domain

Exploring the characteristics of OHAs in KSA special schools reveals that the implementation is hindered by several barriers associated with the intervention source, adaptability, complexity, and design and quality constructs of the CFIR.

The OHAs were created internally and required greater participation from key stakeholders such as the MoE, MoH, dental public health professionals, researchers, experts, and parents. Conversely, Chandio et al. (2022) found that active engagement of all stakeholders is essential for implementing and sustaining toothbrushing programmes in early childhood settings and primary schools. In addition, inter-ministerial collaboration and stakeholder engagement facilitated the EU School Fruit and Vegetables Scheme implementation (Meshkovska et al., 2023a). Moreover, the evidence indicates that collaborative efforts could ensure the success and sustainability of community-based OHP initiatives (de Silva et al., 2016b, Watt and Marinho, 2005, Watt, 2005).

Also, the high cost was a potential barrier to the implementation of OHAs in KSA special schools. This aligns with a systematic review that found activity costs posed a barrier to the direct provision of fruits and vegetables in schools and kindergartens (Meshkovska et al., 2022). Likewise, Watt and Marinho (2005) suggest the high cost of OHAs depending on professional involvement. However, the Childsmile supervised toothbrushing programme has been proven to be cost-effective (Anopa et al., 2015, Wright et al., 2015).

Furthermore, the data indicate that the lack of adaptation of OHAs to children's learning needs and the absence of reliable information sources, such as toolkits, guidance documents, and support materials, have hindered their implementation in these schools. In agreement with AlZahrani (2022), there is a need for further guidance and reference sources to explain the concepts and evaluation processes of HPS, as the practical guidance for mainstream schools in KSA is lacking. While evidence indicates the significance of following evidence-based toolkits in implementing various interventions, including supervised toothbrushing in nurseries and schools (Public Health Scotland, 2023, Yamada et al., 2015).

However, the adaptability construct was crucial in identifying potential facilitators for implementing OHAs, aligning with evidence on the significance of activity flexibility and teachers' ability to adapt to local contexts (Chandio et al., 2022, Meshkovska et al., 2023a, Wang et al., 2022). Moreover, community-based OHP programmes should be tailored to the specific needs of different communities, considering factors such as socioeconomic status, culture, and existing infrastructure (de Silva et al., 2016b)

To illustrate, among the perceived facilitators of OHAs implementation in KSA special schools within the adaptability construct were adapted educational materials and suitable visual aids such as pictures, short educational videos, and sensory-engaging models. In addition, tailored approaches such as frequent reminders, modelling, social stories, and virtual reality are recommended as highly adaptable activities. Also, a personalised OHE plan was suggested to address individual differences in children's learning needs.

These findings align with research that has shown that interactive interventions, such as fun activities, games, motivational-experiential learning, and audiovisual methods, are more effective in improving oral hygiene, gingival health, and knowledge in schoolchildren compared to traditional teaching methods, such as PowerPoint lectures and leaflets or flash cards (Atif et al., 2023, Bramantoro et al., 2021, Watt, 2005). Likewise, they agree with findings of study one indicating the positive outcome of different tailored OHE approaches for children with visual and hearing impairments in a short-term statistically significant dental plaque reduction (Ganapathi et al., 2015, Hashmi et al., 2019, Mahantesha et al., 2015, Shahabudin et al., 2016, Sharififard et al., 2020).

Furthermore, the research findings proposed that parental and dentist involvement in OHAs in the KSA special schools is crucial, as evidenced by multiple studies (Bramantoro et al., 2021, Chandio et al., 2022, Meshkovska et al., 2023a, Pareek et al., 2015, Shyama et al., 2003, Watt, 2005, Atif et al., 2023). Moreover, parents strongly desired support networks via social media platforms like WhatsApp groups and suggested utilising social media and digital platforms to promote oral health to overcome the cost barrier. Social media is a potentially promising tool for promoting oral health; however, parental involvement, audiovisual content, and collaboration with oral health professionals are essential for effective promotion (Farrokhi et al., 2023). Generally, the study's findings in this domain are consistent with the existing literature, which highlights the significance of the lack of stakeholder involvement in developing OHAs, the lack of reliable sources of information such as toolkits, the activity cost, and the inadaptability of OHAs to various learning needs and settings as potential barriers to school-based OHAs implementation for children with disabilities in KSA.

The following section discusses how the knowledge, attitudes, and feelings of staff and parents of attending children affect the implementation success of OHAs in KSA special schools.

6.3.1.2.2 Characteristics of individuals domain

Barriers and facilitators at special schools' staff level

The implementation of OHAs in KSA special schools was found to be hindered by the staff's inadequate knowledge and low self-efficacy. The findings indicate that the school staff members have a restricted understanding of fluoride-based initiatives like topical fluoride applications and supervised toothbrushing clubs. Nevertheless, they conceptualised the school-based OHAs mainly as OHE. In addition, the staff members acknowledged their limited knowledge of oral health topics, which affects their self-efficacy and confidence in carrying out these activities. Collaboration with dental professionals to develop and execute the activity effectively or to train staff was suggested to overcome these barriers.

Chandio et al. (2022) also reported that teachers need more awareness regarding the importance of oral health and school-based activities to ensure the implementation of toothbrushing activities while training school staff in supervised toothbrushing promotes the implementation. Similarly, de Silva et al. (2016a) emphasised the significance of educators training in OHP to ensure the effective delivery of these programmes.

However, the staff's knowledge of OHE activities, the relationship between dental health needs and disability, the importance of OHAs to children with disabilities, and beliefs in OHAs' effectiveness in improving oral health related knowledge and reducing the fear of dentists facilitate the school-based OHAs in KSA special schools. In addition, a positive staff attitude and feelings towards school-based OHAs implementation could promote its success.

These findings further support the idea that a positive attitude and the acceptability of the activity by school staff and teachers' recognition of the importance of oral health facilitate supervised toothbrushing activities (Chandio et al., 2022). Moreover, they align with Study One, which demonstrates the teacher compliance and motivation necessity to carry out and sustain such activities (Pareek et al., 2015, Shyama et al., 2003). The coming section discusses the views and perspectives of parents/carers of children attending KSA special schools on school-based OHAs.

Barriers and facilitators at the parents'/carers' Level

This study reveals that school-based OHAs could be hindered by low awareness and motivation among the children's parents/carers. Similarly, parents' limited comprehension of teachers' role in supervising toothbrushing, challenged engagement, and lack of knowledge about oral health hindered the implementation of toothbrushing programmes at schools (Chandio et al., 2022).

Conversely, the participants' recognition of the importance of daily dental care and their children's dental health needs could facilitate the OHAs implementation at KSA special schools. For example, participants acknowledged that children face barriers to daily dental care and have limited access to dental services. This is in line with Meshkovska et al. (2023b), who demonstrated that the parents' awareness of the children's needs and beliefs in the positive influence of school-based nutritional interventions facilitated the interventions' success.

Moreover, parents' and carers' positive attitudes towards implementing OHAs at schools and their enthusiasm to follow up OHAs at home and participate in school activities are potential facilitators. Similarly, parents' acceptance of toothbrushing programmes increased children's participation in school-based toothbrushing programmes (Chandio et al., 2022). In summary, this domain indicates the influence of teachers' and children's parents/carers' perspectives on school-based OHAs implementation. The following section discusses the characteristics of KSA special schools as inner settings for OHAs implementation.

6.3.1.2.3 Inner setting domain

The Inner Setting domain was significant to the successful implementation of school-based OHAs, and several vital barriers and facilitators have been described under this domain.

The perceived barriers were a low relative priority, lack of dental health educational resources and implementation guidance, poor school structural characteristics, ineffective leadership engagement, lack of incentives, limited financial and human resources, and poor communication.

This study revealed that implementing OHAs in KSA special schools was given a low priority. This finding supports the notion that competing priorities and teachers' tendency to prioritise curriculum-related duties hinder the successful implementation of school-based direct fruit and vegetable provision interventions (Meshkovska et al., 2022). In addition, the study participants noted a need for more suitable educational resources for oral health to support OHAs at KSA special schools. However, Study One found that tailored educational approaches for children with visual and hearing impairments are available, though these materials are not in Arabic (Ganapathi et al., 2015, Hashmi et al., 2019, Shahabudin et al., 2016, Sharififard et al., 2020).

Also, it has been observed that the implementation guidance or toolkits for OHAs are not available in KSA's special schools. AlZahrani (2022) also reported a lack of guidance documents for health-promoting schools' framework at KSA mainstream schools, which was discussed earlier in this chapter under the Intervention Characteristics domain (Section 6.3.1.2.1). However, toolkits are essential resources for implementing evidence-based interventions (Yamada et al., 2015).

Among the KSA special school's structural characteristics, the school size and location, access to dentists, and lack of sufficient sinks might hinder the implementation of OHAs. However, dry toothbrushing could occur during supervised toothbrushing clubs, eliminating the need for sinks. Meshkovska et al. (2022) revealed that schools face structural challenges that hinder the implementation of nutrition interventions, including school location.

Also, ineffective leadership was an obstacle to OHAs implementation, as represented by leaders' lack of awareness about OHAs, inability to support their implementation, inability to allocate adequate resources for the activity, or inability to relieve teachers from other duties. Furthermore, the absence of proper incentives hampers staff's active participation in OHAs. According to the findings, there were also limited financial and human resources to support the implementation of OHAs in KSA special schools, indicating the essential need for volunteers from the dental sector to facilitate the implementation process. The findings indicate the need for an interdisciplinary approach involving dentists and physical, behavioural and sensory therapists. Moreover, limited OHAs communication with parents, staff, or ministries hinders OHAs implementation, as effective implementation requires the involvement of stakeholders.

These findings agree with Chandio et al. (2022), indicating that several school-related factors impede the implementation of supervised toothbrushing programmes, including inadequate oral health educational materials, lack of training for schoolteachers, lack of support from the school administration, staff workload, limited resources, and insufficient communication

between the headteacher and the school staff. Furthermore, research demonstrates that limited engagement from school administration, poor information communication, and lack of coordinated team approach impede the effective implementation of supervised toothbrushing activities in schools (Wang et al., 2022). However, supporting intervention implementers through the involvement of community volunteers and offering symbolic fees for their time and effort could facilitate the implementation process (Meshkovska et al., 2022). Moreover, the evidence emphasises that OHP interventions require a multidisciplinary approach involving a various complementary stakeholders (Watt and Marinho, 2005).

Conversely, among the potential facilitators of OHAs implementation at KSA special schools are their compatibility with the culture and practices of KSA special schools and alignment with the schools' values. Similarly, an enabler of school-based nutrition intervention was its compatibility with the workload, curriculum, and ongoing programmes (Meshkovska et al., 2023b). In addition, to enhance the implementation of OHAs in KSA special schools, integrating oral health into the MoE curriculum and adopting policies to promote healthy eating habits and toothbrushing were recommended. Healthy eating policies in schools have the ability to promote overall health and well-being, not only oral health, by aligning with the CRFA (Watt and Sheiham, 2012). This approach acknowledges that common risk factors such as diet impact on various health outcomes, including dental caries. Therefore, implementing policies that promote healthy food policy in KSA special schools could have widespread benefits beyond oral health, positively impacting students' overall well-being (Watt and Sheiham, 2012).

In addition, this aligns with Chandio et al. (2022) systematic review, which states that integrating oral health into the educational curriculum promotes the implementation of supervised toothbrushing activities. Furthermore, it proposes the feasibility of integrating oral health information into school curricula, which could positively impact OHP. However, as presented in Chapter One (Section 1.2.3.2), the curriculum in KSA is centralised through the MoE. Therefore, MoE action and collaboration are essential to integrate oral health into the curriculum.

Furthermore, when developing a strategy to promote oral health in schools, it is important to include activities covering different stages. Implementing national and local policies, such as healthy eating, are considered upstream activities. Midstream activities might focus on oral health promoting schools and community empowerment. Downstream activities involve providing school OHE and clinical prevention (Watt, 2007). Integrating these components could create a comprehensive strategy to promote oral health among schoolchildren attending KSA special schools.

Moreover, the findings revealed that effective leadership is crucial for OHAs implementation at KSA special schools, as demonstrated by school leaders' visible support, fostering of a commitment culture, and prioritising the implementation process. This agrees with evidence that emphasises the crucial role of school principals in motivating teachers and ensuring the implementation of interventions (Chandio et al., 2022, Meshkovska et al., 2022, Meshkovska et al., 2023a, Meshkovska et al., 2023b, Wang et al., 2022). In summary, multiple factors

related to schools were found to affect the implementation of OHAs in KSA special schools. Similarly, OHP in schools and its implementation evidence have long recognised these factors. The following section illustrates the relationship between the Outer Setting CFIR domain and school-based OHAs implementation for children with disabilities in KSA.

6.3.1.2.4 Outer setting domain

The Outer Setting domain revealed that the lack of external policies and incentives hindered the implementation of OHAs in KSA special schools. For example, a national initiative to prevent dental caries among primary schoolchildren is available. However, it does not include KSA special schools. However, this conflicts with the UNCRPD adopted by KSA, as special schools are not given the same opportunities as those in mainstream education. Similarly, the absence of external policies and incentives to promote healthy eating in schools were significant barriers to school-based nutritional programmes (Meshkovska et al., 2023b). Nevertheless, as a perceived facilitator, Aramco Company officially recognises the Dammam region's best school health promotion activity as an annual regional incentive. Aligning with evidence highlights the significance of policy development in improving and sustaining OHAs (Watt, 2005). To summarise, this domain highlighted the need for external policies to govern OHAs at KSA special schools. The following section presents the impact of OHAs' planning, evaluation, and children's engagement on OHAs' implementation process.

6.3.1.2.5 Implementation process domain

Inadequate planning and evaluation of OHAs, along with challenges in engaging children, were identified as significant barriers to implementing school-based OHAs at special schools in the KSA. While participants emphasised the significance of planning, proper OHAs planning was lacking, and their implementation was ad hoc. This contrasts with previous research that suggests having a planning committee, using a schedule as a visual aid, and having a backup plan as an effective implementation strategy for school-based supervised toothbrushing activities (Chandio et al., 2022).

In addition, the KSA's special schools lack proper evaluation of OHAs implementation. While some forms of evaluation exist, such as post-activity surveys, the evaluation process needs improvement. Conversely, implementation science evidence recommends incorporating formal evaluation outcomes and informal reflections into the implementation process (Chandio et al., 2022). Furthermore, this finding is consistent with evidence that suggests OHPAs are often poorly evaluated and the importance of evaluation is frequently underestimated (Watt et al., 2001, Petersen and Kwan, 2004). Moreover, the evidence indicates the need to improve the design and evaluation of community-based OHP programmes to enhance the evidence quality, inform policy, and guide the development of targeted strategies to reduce oral health inequalities (de Silva et al., 2016b, Petersen and Kwan, 2004, Watt et al., 2001, Watt and Marinho, 2005, Watt et al., 2006).

The evidence suggests integrating routine monitoring and evaluation into OHP to continuously assess and enhance their effectiveness (de Silva et al., 2016b, Watt et al., 2001, Watt, 2005). With early thorough evaluation, OHAs are likely to be more thoughtfully designed to meet the specific needs of targeted populations (Watt et al., 2001). Nevertheless, evaluating community-based OHP programmes is complex, and tailored approaches are necessary for their effectiveness and sustainability (Petersen and Kwan, 2004, Watt et al., 2006).

Moreover, the findings regarding children with disabilities' engagement in OHAs at KSA special schools indicate that the children generally had favourable perceptions of OHAs. However, some participants also noted that the children's abilities to participate in OHAs vary, and it is crucial to consider these differences when implementing school-based OHAs. This study finding confirms that children's active participation and acceptance were critical to implementing supervised toothbrushing programmes at schools, as children's positive attitudes towards the programme and perceived behaviour change significantly facilitated implementation (Chandio et al., 2022, Wang et al., 2022). In summary, school-based OHAs at KSA special schools are poorly planned and evaluated. In addition, the implementation process faces challenges in actively engaging the attending children.

6.3.1.2.6 Summary

Recognising the main perceived barriers of and facilitators to OHAs implementation at KSA special schools considering the evidence indicates the need for further guidelines, training,

and well-established and conducted OHAs. These OHAs should be comprehensive and aimed at promoting oral health holistically, addressing the underlying determinants of oral health to benefit children with disabilities in the KSA and reduce oral health inequalities. An OHP implementation toolkit could help integrate evidence-based interventions into KSA special schools. The following section discusses the key concepts recommended to underpin an OHP implementation toolkit, providing a starting point to achieve desired improvements regarding OHP in special schools in the KSA.

6.3.1.3 Recommendations of key concepts to underpin an oral health promotion implementation toolkit

The study's findings indicate a need for a toolkit or guidance document to assist in implementing OHAs in KSA schools for children with disabilities. This finding has been derived from the participants' views, which highlight their limited knowledge and experience in implementing school-based OHAs. Furthermore, it was informed by evidence supporting the effectiveness of evidence-based toolkits in guiding the implementation process (Yamada et al., 2015). The research emphasises that evidence-based toolkits could assist with implementing guidelines, informing policies, and training practitioners (Yamada et al., 2015).

Implementation science focuses on seamlessly incorporating evidence-based interventions into different settings by identifying contextual barriers that impede their implementation and sustainability into routine practice and devising strategies to overcome them (Bauer and Kirchner, 2020, Bauer et al., 2015). This study, based on implementation science, adopted an

implementation strategy focused on identifying contextual barriers to implementing OHAs. It addressed these barriers by recommending key concepts for an OHP implementation toolkit, aiming to improve the integration of evidence-based OHPAs into the KSA special schools.

Moreover, the evidence reveals that nurseries and schools are recommended to utilise toolkits to ensure the provision of high-quality supervised toothbrushing programmes (Public Health Scotland, 2023). For example, the Childsmile Toothbrushing Standards are recognised as best practice guidance for delivering such programmes (Public Health Scotland, 2023). Accordingly, the key concepts to underpin an OHP implementation toolkit for the KSA special schools was summarised in Chapter Five, Section 5.4.1. The following section discusses the four key concepts needed for the toolkit developments.

6.3.1.3.1 Key concepts to underpin an oral health promotion implementation toolkit for KSA special schools

After reviewing the identified vital barriers to OHAs implementation at KSA special schools regarding relevant literature, four essential concepts were recommended for an OHP implementation toolkit: embracing principles of OHP rather than OHE alone, an appropriate resource for use in schools and with families, a collaborative approach, and evaluation.

Embracing principles of oral health promotion rather than oral health education alone

The provided OHAs at the KSA special schools were found to be OHE. This is in agreement with recent research that demonstrates that the KSA mainstream schools follow a traditional

health education model with limited health promotion interventions. Healthy school policy integration, a health-promoting environment, and community involvement were lacking (AlZahrani, 2023, AlZahrani, 2022). To address this concern, the researcher recommended an OHP implementation toolkit to embrace the OHP principles.

Therefore, the first concept is based on the Ottawa Charter principles for OHP (World Health Organization, 1986). It highlighted the need to shift from traditional school-based OHE to OHP. It also emphasised the need to address oral health inequalities through a comprehensive approach, considering various health determinants such as lifestyle, social, economic, and environmental factors(Dahlgren and Whitehead, 2021, Sheiham et al., 2011, Watt, 2012, Watt, 2007).

This could be achieved by adopting the OHP definition criteria (World Health Organization, 1986), addressing social determinants of oral health (Dahlgren and Whitehead, 2021, Sheiham et al., 2011, Watt, 2012, Watt, 2007), considering the CRFA (Watt and Sheiham, 2012), and oral health promoting schools concepts (Elsadek and Baker, 2023, Jain et al., 2023, Jürgensen and Petersen, 2013, Kwan et al., 2005, Lee et al., 2020, Turunen et al., 2017). Furthermore, the evidence underscores the significance of a comprehensive approach with multi-component OHAs over a single component. It is crucial to develop OHP strategies that transcend education, including policy development and focusing on the social environment (de Silva et al., 2016b, Watt and Marinho, 2005, Watt, 2007, Watt, 2012).

This concept recommended enforcing oral health policies in the KSA special schools, such as a healthy eating policy, supervised toothbrushing clubs, and integrating oral health into school curricula and activities. It also emphasised the importance of creating a school environment that promotes oral health, the development of personal skills through training and education about adaptable toothbrushing recommendations for children with disabilities, community empowerment, and access to dental health services and OHP (World Health Organization, 1986).

For example, policy development and application are essential to promote oral health at the KSA special schools. A policy promoting healthy eating in the school canteen, including banning sugary foods and drinks, could lead to significant health benefits. These benefits could include reducing the risk of obesity, diabetes, and dental caries through the CRFA (Watt and Sheiham, 2012, World Health Organization, 1986).

In addition, a policy on integrating supervised toothbrushing activities into the school routine is a cost-effective approach to reducing the burden of dental caries and oral health inequalities (Anopa et al., 2015, Kirk et al., 2015, Macpherson et al., 2019b). An OHP implementation toolkit could be a valuable resource for supporting the implementation of supervised toothbrushing clubs in the KSA special schools by summarising evidence-based recommendations for implementation of supervised toothbrushing clubs for children with disabilities. This agrees with Childsmile Toothbrushing Standards, highlighting the significance

of adapting oral hygiene practices to children's needs (Public Health Scotland, 2023). It could also highlight the necessity of incorporating supervised toothbrushing activities into school routines, such as brushing after meals or snacks, as consistency and repetition help students develop good oral hygiene habits (Chandio et al., 2022, Wang et al., 2022).

Furthermore, the toolkit should prioritise integrating oral health into the curriculum of special schools in the KSA. In line with Chandio et al. (2022), evidence demonstrates the feasibility and effectiveness of incorporating oral health into the school curriculum. However, the KSA curriculum is centralised and regulated by the MoE, necessitating collaboration with the MoE to implement this recommendation.

This concept also emphasised creating an oral health-supportive environment in the KSA special schools, indicating the importance of safe and well-designed school buildings and playgrounds to prevent traumatic dental injuries as there is a positive correlation between traumatic dental traumatic injuries and hyperactivity disorder, cerebral palsy, and Down's Syndrome (Silveira et al., 2020), as reviewed in Section 2.2.5. In addition, oral health-promoting school environments should prohibit the sale of unhealthy, sugary foods in the schools and surrounding areas (Jürgensen and Petersen, 2013, Kwan et al., 2005, Petersen and Kwan, 2009, Petersen et al., 2020, Lee et al., 2020).

In addition, this concept highlighted the development of personal skills of teaching staff, parents, and children regarding proper toothbrushing techniques for children with disabilities

by providing guidance on recommended oral hygiene practices for children with disabilities. It could cover information on optimum oral hygiene practices, including toothbrushing timing, frequency, technique, toothbrush type, toothpaste type, recommended toothpaste amount, and fluoride concentrations. Furthermore, it should indicate the need to adapt oral hygiene practices to serve children's needs, such as using modified toothbrushes and unflavoured and non-foaming toothpaste. In addition, the guidance could include strategies for adapting these practices to suit different abilities and provide details on managing sensory sensitivities or behavioural challenges (Public Health Scotland, 2023). Moreover, the toolkit could emphasise arranging training sessions or workshops for school staff, parents, and carers to improve their knowledge and skills in supporting oral health care. Similarly, de Silva et al. (2016b) emphasised the significance of educators' training in oral health promotion to ensure the effective delivery of these programmes.

Furthermore, this concept recommended that an OHP implementation toolkit could inform the KSA special schools about engaging parents, teachers, dental healthcare professionals, and local community members in OHP, empowering individuals to collaborate and take collective action. Chandio et al. (2022) found that active engagement of all stakeholders is essential to ensure the effective implementation of supervised toothbrushing clubs. Also, the evidence indicates that collaborative efforts could ensure the success and sustainability of community-based OHP initiatives (de Silva et al., 2016b, Watt and Marinho, 2005, Watt, 2005).

Moreover, the OHP implementation toolkit could recommend facilitating access to dental health services and health promotion programmes for the KSA special schools, involving working with local dental health professionals to organise dental screenings and conducting workshops and training sessions for school staff and parents on the importance of oral health for children with disabilities. This recommendation helps to observe Article 25 of the UNCRPD, which argues that people with disabilities have the right to access appropriate health services and health promotion programmes (United Nations, 2006), as presented in Section 1.2.1. It also addresses the failure of the KSA National Initiative for the Prevention of Dental Cavities to include special schools.

In summary, this study's first key concept recommendation for an OHP implementation toolkit highlighted the significance of shifting from traditional OHE conducted mainly by the KSA special schools to OHP. It also indicated different approaches to adopting the OHP principles defined by the Ottawa Charter (World Health Organization, 1986). The following section elaborates on the second recommended key concept.

Appropriate resources for use in schools and with families

This concept is about the importance of effectively developing and using adaptable, disability-specific educational resources to implement OHAs in KSA special schools. Creation of adaptable visual aids, such as posters or charts, videos, social stories, and interactive tools with consideration of the student's communication needs, as evidence indicates and highlighted earlier in Section 6.3.1.2.1 (Atif et al., 2023, Bramantoro et al., 2021, Ganapathi

et al., 2015, Hashmi et al., 2019, Mahantesha et al., 2015, Shahabudin et al., 2016, Sharififard et al., 2020, Watt, 2005).

A collaborative approach

The third key concept could be collaboration with the government, industry, and the network of special schools, which is essential for promoting oral health for children with disabilities, for example, working with government health and education departments and agencies to advocate for policies and funding to support OHP for children with disabilities. This recommendation addresses the lack of external policies and incentives, which hindered the implementation of OHAs in the KSA special schools. Furthermore, this concept indicated the need for collaboration between MoE and MoH on oral health initiatives as school-based activities and curriculum are centralised. For example, inter-ministerial collaboration and stakeholder engagement facilitated the implementation of the EU School Fruit and Vegetables Scheme (Meshkovska et al., 2023a).

It also emphasised the significance of collaboration between teachers, school staff, parents, children, dental health professionals, and key stakeholders, as OHP is a multi-disciplinary. Collaborative efforts could ensure the success and sustainability of community-based OHP initiatives (de Silva et al., 2016b, Watt and Marinho, 2005, Watt, 2005). Moreover, the research findings proposed that parental and dentist involvement in OHAs in the KSA special schools is crucial, as evidenced by multiple studies (Bramantoro et al., 2021, Chandio et al., 2022, Meshkovska et al., 2023a, Pareek et al., 2015, Shyama et al., 2003, Watt, 2005, Atif et

al., 2023). The following section highlights the significance of evaluation concept to underpin an OHP implementation toolkit for the KSA special schools.

Evaluation

As OHAs in the KSA special schools need improvements in implementation and evaluation processes, this concept is about developing mechanisms to track oral health status and monitoring dental health indicators. Also, developing mechanisms to evaluate the effectiveness of the toolkit's implementation involves conducting surveys and collecting feedback from children with disabilities, parents/carers, and school staff. Similarly, the design and evaluation of community-based OHP programmes need to be improved to improve the quality of evidence, inform policy, and guide the development of targeted strategies to reduce oral health inequalities (de Silva et al., 2016b). In addition, this systematic review recommends that routine monitoring and evaluation be integrated into OHP programmes to continuously assess and improve their effectiveness (de Silva et al., 2016b).

This section discussed the recommendations for four key concepts to inform the creation of an OHP implementation toolkit for the KSA special schools. The following section elaborates on the methodological and ethical considerations.

6.3.2 Methodological considerations

This section discusses the methodological considerations, including reflexivity and ethical concerns.

6.3.2.1 Role of the researcher/reflexivity

The researcher's positionality is discussed in this section. Denzin and Lincoln (2011) state that, as the role of the researcher is paramount in analysing qualitative research, the researcher's thoughts and perspectives must be considered when interpreting the findings. The establishment of rigorous research standards on the part of the research is critical in qualitative research (Bergman and Coxon, 2005). Experts identify the risks of prejudice that can impair data collection and interpretation (Creswell and Miller, 2000). The researcher's background, position, and research processes must be carefully considered to ensure that a study is rigorous and credible. The researcher is thus required to focus their research inwards and take responsibility for their research. It is also important that ethical concerns, data collection processes, data analysis processes and research design are carefully considered by the researcher.

6.3.2.1.1 Researcher's background

The researcher has been a lecturer at the Dental Public Health Department of King Saud University in KSA since 2012. As part of community dental service, the researcher developed and participated in several school-based OHAs at both mainstream and special schools in the KSA. This equipped the researcher with a thorough understanding of the problem and gave

them a wealth of knowledge regarding the situation of school-based OHAs in the KSA. Moreover, the researcher's interest in this topic stems from being the eldest sister of a 16-year-old brother with autism spectrum disorders. Also, it is important to remember that tribes are an integral part of the KSA's society. Nonetheless, the researcher did not employ her tribal identity as leverage when interacting with research participants, even though she was aware of them. Rather than revealing her family name, which identifies the tribe she is a member of, she identified herself as Ashwag Saleh, utilising only her first and middle names.

There is a substantial amount of published work examining the insider role of the researcher (Berger, 2015, Smyth and Holian, 2008). Being an insider gave the researcher a deeper understanding of the KSA's politics, economy, healthcare, and educational systems. As an inside researcher, she learned more about the hierarchy, leadership, and operations of special schools in the KSA. Insiders typically have a better understanding of the study context than outsiders (Smyth and Holian, 2008). However, the researcher must engage in a reflective process to manage their insider status and the potential influence that this may have on the research outcomes.

There are several benefits of the researcher being an insider in the present work:

Research has shown that people are more willing to share their opinions and perspectives with researchers from the same cultural background (Chavez, 2008). For instance, the researcher, being from the KSA, eliminated any language barriers. The shared language ensured that the researcher understood the nuances in the participants' choice of words, and

the researcher could effectively interpret nonverbal and vocal indicators that may indicate a desire to share further details or not. The researcher has an additional edge when deciding whether a participant wants to continue or end the interview because they are an insider. An outsider would have to be more accurate when using these cues, which could have a negative impact on the accuracy of data collection. In addition, the researcher fully understands cultural sensitivities relating to politics, gender, ethnicity, disability, and social and cultural issues in the KSA, which would likely be unfamiliar to outsiders. In turn, this would render the data collection process more difficult for outsiders (Greene, 2014). As a female, the researcher considered the impacts of gender during the data-collection process by writing down her reflections. This made it easier to spot potential bias sources and manage the risks involved in the research process systematically. By maintaining a journal, the researcher could reduce the possibility of becoming personally involved in the research (Smyth and Holian, 2008, Greene, 2014).

Potential challenges associated with the researcher's role in this study were identified and steps were taken to improve data interpretation. During data collection and analysis, the researcher's cultural presumptions may cause them to lose their objectivity during the data collection and analysis process. The researcher can prevent this by keeping an open mind to different insights, emotions, viewpoints, and facts that might conflict with their predetermined theoretical framework. Furthermore, the researcher-maintained objectivity and tolerance for the range of perspectives on school-based OHAs. Therefore, before beginning any interview, the researcher should be aware of their own biases and limits to avoid being overly judgmental. Furthermore, the data collection process was conducted in

Arabic, but some of the data was analysed in English, which posed potential risks. The risk stemmed from the possibility of losing valid data due to translation and interpretation difficulties. The researcher implemented a quality assurance procedure to mitigate this risk. Two transcripts had to be translated back into Arabic by a qualified translator who speaks both Arabic and English fluently. After that, by listening to the recordings and reading the back-translated transcripts, the researcher evaluated the two transcripts to ensure consistency and accuracy, all possible disparities were identified and corrected. Moreover, the researcher noticed that the participants assumed she was already familiar with implementing school-based OHAs at special schools. To overcome this issue, she asked clarifying questions and reminded participants of her researcher role. These measures were taken to prevent assumptions about the participants' backgrounds and develop a comprehensive understanding of the topic.

In conclusion, although the researcher was unable to completely disregard her experiences throughout the study, the actions discussed above reduced the possibility that biases would affect the data collection and analysis (Smyth and Holian, 2008). Furthermore, the researcher's experience may have been helpful in this situation because it allowed her to objectively record profound insights from the participants as an insider. During the interview process, the researcher made significant efforts to ensure that her background and personal experiences did not inadvertently influence the research. Before conducting the interviews, the researcher asked her supervisors for guidance on effectively approaching the subjects. Furthermore, the supervisors reviewed the interview questions to ensure that her

background did not compromise the research's objectivity. The researcher also made notes and reflections in a journal to document the researcher's values, beliefs, and experiences.

6.3.2.1.2 Reflection on the interviews

The researcher's attendance in interview training and expertise have enabled them to establish good relationships with interviewees. As a result, the risk of generating "socially desirable responses" has been minimised (Braun et al., 2001). In qualitative research, researchers must actively engage with participants and establish a strong relationship. The professional background of the researcher has greatly influenced her interviewing skills.

Throughout the data collection process, my interviewing skills improved significantly. As I gained more experience and practice, I learned how to ask questions clearly and concisely that was easy for the participants to understand.

Furthermore, I was able to manage the interview sessions more effectively and control the direction of the participants' responses when they started to stray off-topic. With a better understanding of the interview guides, I also felt more confident in asking spontaneous probing questions without needing to refer to the guide. This allowed me to be more attentive to the participants and even to observe and document nonverbal cues, such as changes in voice tone. This section detailed the researcher's role, potential influence in the study, and the steps taken to minimise that influence. The following section discusses ethical considerations.

6.3.2.2 Ethical considerations

Before the research was conducted, a variety of potential ethical issues were noted and discussed with the supervisors. The researcher sought ethical approval to conduct the study from the University of Sheffield Research Ethics Committee, which provided Ethics Approval Number 048464 for the project. The study was judged to be of low ethical risk. All the participants were informed individually about the study's main objectives. Furthermore, participants received sufficient and unambiguous information about their participation in the study and how the data will be used. Before starting, they were asked to sign a consent form. The researcher made significant efforts to safeguard the participant's rights, privacy, dignity, and anonymity (Creswell and Creswell, 2017, Denzin and Lincoln, 2011). This section explains the major ethical issues, such as the purpose of the research, information for parents/carers and school staff, consent, research risks, imbalance of power, recruitment, confidentiality, data protection, dissemination, potential harm to participants, and reporting of safeguarding concerns or incidents.

The research aimed to explore the implementation of school-based OHAs at KSA special schools. The study has implications for service delivery and policy development. Participants were informed of the study's purpose. In addition, the participants were thoroughly informed about the study's purpose, procedures, anticipated uses, received detailed information about the study before deciding whether to participate. Furthermore, consent forms were supplied to parents/carers and school staff to participate in the study. Also, the researcher summarised the study's objectives at each interview, and participants could withdraw at any time and for

any reason. Parents and school staff were informed that their decision not to participate in the research would not be held against them; these consent procedures reduced the level of risk. Therefore, participants had the option of participating in research or declining, and their participation in research was entirely voluntary. The researcher also reflected on and addressed any power imbalances with participants. Power imbalances could arise in researchers' relationships with parents. For example, parents who feel obligated to participate in research might fear that refusing to participate could affect their child's access to school services. Assuring parents that their participation is entirely voluntary and that they can withdraw at any time would alleviate this issue.

Moreover, participants' anonymity and confidentiality were maintained as privacy and confidentiality in research are crucial. All audio-records were securely stored and deleted after transcription. According to the Code of Human Research Ethics (Oates et al., 2021) and the General Data Protection Regulation (Bhaimia, 2018). Specific measures were implemented to ensure the participants' privacy and confidentiality. First, participants' names were anonymised, and the anonymisation key was securely stored on an encrypted file on Google Drive. The file was only accessible to the research team. The key will be discarded promptly once the research course is completed. Second, the researcher encrypted her phone and laptop when not in use to prevent unauthorised access. Third, any data collected were moved as soon as possible to Google Drive. In addition, all sensitive personal data, such as interview records, were deleted as soon as audio was transcribed. Interviews were conducted through Zoom's synchronous calling platform and only recorded via an external digital recorder.

In addition, the study judged to be of low risk as it explored OHAs barriers and facilitators at KSA special schools. The study did not involve any interventional practices; thus, no emotional or physical discomfort was caused. In addition, participants' privacy is paramount, and their data is handled with the utmost care. Any action taken throughout the study was evaluated within a broad ethical and moral framework to ensure its acceptability. The researcher also has set up systems for reporting incidents and concerns related to safeguarding. Participants who feel they have been exploited, abused, or harmed can contact the project's Designated Safeguarding Contacts as listed in the information sheets. Moreover, the findings will be shared with the MoE and research participants in a suitable and accessible format, along with sincere gratitude for their time and involvement in the study. This section outlined the ethical concerns and methods for ensuring ethical research conduct. The section that follows highlights the study's strengths and limitations.

6.3.3 Strengths and limitations

6.3.3.1 Strengths

The present study provides the first comprehensive exploration of OHAs implementation barriers and facilitators at KSA special schools based on CFIR. The qualitative study was informed by the findings of Study One.

Furthermore, the study adopted CFIR, the most commonly cited determinant framework in implementation science, to explore contextual barriers and facilitators to OHAs' successful implementation. CFIR provides a comprehensive approach to exploring and evaluating complex interventions by considering various contextual factors influencing the implementation, promoting a holistic analysis. In addition, identifying critical CFIR constructs influencing OHAs implementation allowed the researcher to create a tailored plan for the oral health promotion implementation toolkit based on these significant constructs. Furthermore, CFIR facilitates the evidence synthesis process by providing a common language for researchers and practitioners to discuss the factors determining implementation. In the context of this study, it would be beneficial to inform both dental public health and policy in KSA. This framework also improves the applicability of the study's methods in future research.

Also, this is pragmatic qualitative research, valued for its flexibility and real-world application. It allows for adaptive methods and dynamic study design.

In addition, semi-structured interviews obtained an in-depth understanding of the experiences and perspectives of school staff members and parents/carers of children with disabilities regarding implementing OHAs. Furthermore, telephone interviews were used to establish rapport, make participants feel comfortable, maintain privacy, be culturally sensitive, and accommodate busy schedules.

Moreover, it is worth noting that the study had a well-rounded and diverse sample of school staff members and parents/carers regarding demographic characteristics, providing a better understanding. For example, the study recruited participants from various special schools in KSA with varying experience levels and qualifications. The study also involved participants from different regions, cities, and villages representing various socioeconomic statuses. The parents had children with various disabilities, ranging in age from three to 18 years, representing the age range of students attending KSA special schools. The study achieved data saturation (Francis et al., 2010), with no new themes in three consecutive interviews.

Furthermore, to ensure the study quality, the researcher implemented key strategies to enhance the research rigour, including audit trails, prolonged engagement, maintaining researcher reflexivity, and peer debriefing, as discussed in Section 4.3.4.5. In addition, this study considered different ethical considerations, including the purpose of the research, information for parents/carers and school principals, consent, research risks, imbalance of power, recruitment, confidentiality, data protection, dissemination, potential harm to participants, and reporting of safeguarding concerns or incidents as presented in Section

6.3.2.2. Moreover, a discussed during the researcher's background (Section 6.3.2.1.1), my previous experience as a dental public health personnel, working in different settings with children and their families, facilitated interaction with the interview participants.

6.3.3.2 Limitations

This study has limitations that need to be acknowledged and addressed in future studies. Firstly, the scope of this study was limited in terms of not including children, stakeholders from health, dental public health, or policy due to time constraints. Secondly, the flexibility of the pragmatic approach might introduce subjectivity, impacting data collection and analysis consistency. To address these limitations, the researcher explicitly acknowledged and discussed potential limitations and maintained methodological choice transparency, as detailed in Chapter Four. In addition, as discussed in the researcher's reflexivity section (Section 6.3.2.1), she was transparent about potential biases.

Thirdly, qualitative studies have limitations, including potential biases, subjectivity, and generalisability. However, how the researcher addressed these limitations has been clarified in Chapter Four. For example, to reduce subjectivity and interviewer bias, the researcher used an interview guide, clearly defined research objectives, recognised the researcher biases, and reflected on them as described in Section 6.3.2.1. Furthermore, the researcher acknowledged the study's focus on specific contexts (KSA special schools) and populations (school staff members and parents of children with disabilities), used purposive sampling and provided detailed descriptions to enhance transferability and address the limited generalisability.

Fourthly, regarding data collection and analysis, the researcher could not transcribe all the interviews due to time constraints. However, she was able to transcribe 40% of them. A professional transcriber was hired to conduct the remaining interviews. However, the researcher reviewed the transcriptions done by the transcriber by listening to the recordings and reading the transcripts, as explained in Section 4.3.3.2.1. In addition, translation is another critical issue affecting the process of conducting research in KSA. Translating the transcripts took much work since finding an equivalent meaning in English for some phrases in 'the Saudi dialect' took much work. However, the researcher translated only 30% of the transcripts for supervisors' revision. Then, she preferred to transcribe the remaining interviews in Arabic, and it was beneficial to preserve the original meaning, as evidence indicates (Temple and Young, 2004, Van Nes et al., 2010), as described in Section 4.3.3.2.2.

Fifthly, despite CFIR's strengths, it has some limitations. CFIR is more descriptive than prescriptive, providing a framework for understanding factors but offering limited intervention guidance. CFIR tends to focus on static factors and might not capture the dynamic nature of implementation over time. However, the evolving nature of interventions and contexts must be fully addressed. Some constructs within CFIR might overlap, leading to potential confusion in the application. However, making clear distinctions between constructs is crucial. Researchers could make better decisions in implementation research by understanding the limitations of CFIR.

In addition, it is important to note that the study did not use CFIR 2.0, the updated version of CFIR, because it was released after developing the research data collection tools and obtaining ethical approval. So, the researcher opted to proceed with the original CFIR due to time limitations. Moreover, there are no significant differences between the versions, and the CFIR original version is the most highly cited framework in implementation science. The researcher found it beneficial to apply it, as there will be evidence to compare the findings. This section presented the study's strengths and limitations. The following section discusses the research's various implications.

6.3.4 Research contribution and implications

This research is novel as this is the first exploration of OHAs in the KSA's special schools for children with disabilities. In addition, to the best of our knowledge, this is the first study to adopt CFIR in identifying implementation determinants of school-based OHAs in special schools worldwide. Moreover, identifying the barriers and facilitators to OHAs informed the recommendations for an OHP implementation toolkit for the KSA's special schools, serving as a guide for future research in developing toolkits.

The study methodology highlights the applicability of CFIR in studying and analysing the implementation determinants of school-based OHAs. Insights from the study could inform KSA policymakers in developing or refining policies to promote oral health among children with disabilities within schools. The need to engage various stakeholders for successful implementation, including students, school staff, and dental health professionals, is underscored. These implications indicate that a whole-school approach is necessary to promote oral health in the KSA's special schools. The implications are significant for the promotion of oral health among KSA children with disabilities within special school settings. The study highlights the potential of schools as a platform to promote oral health among children with disabilities.

6.3.4.1 Policy implications

Policies need to be developed or revised to establish guidelines for promoting oral health for children with disabilities in the KSA, ensuring alignment with national health objectives and the 2030 Saudi Vision. This research has several implications for the MoE. The MoE could take an overarching role in improving school-based OHAs at the KSA's special schools. The MoE could liaise with the MoH to help develop and implement a national OHP initiative. The MoE could utilise these research findings and recommendations to address the identified barriers to OHAs implementation. The MoE could integrate oral health into the school curriculum, ensuring that students receive comprehensive education on the importance of oral health and its impact on overall health. In addition, the MoE could allocate resources for adaptable oral health educational materials and support the implementation process.

The MoE could collaborate with dental professionals, MoH, and community organisations to enhance the implementation of OHAs. Furthermore, the MoE could establish mechanisms to monitor the implementation and outcomes of school-based OHAs. Furthermore, the MoE could also develop policies and guidelines to regulate school-based OHAs. Moreover, engaging parents and carers in promoting oral health could complement school-based efforts and reinforce healthy behaviours among students. By addressing these implications, the MoE could play a crucial role in improving school-based OHAs and promoting oral health and overall well-being.

In addition, policies should facilitate collaboration between the MoE, MoH, dental associations, and other relevant stakeholders to coordinate efforts and leverage resources effectively. Furthermore, policies should address inequalities in access to oral health services by prioritising underserved communities and ensuring that school-based activities reach all students, regardless of socioeconomic status or geographical location. Policies should support the long-term sustainability of school-based OHAs by integrating them into broader health promotion initiatives and providing ongoing funding and support.

By addressing these policy implications, KSA policymakers can create an enabling environment for the effective implementation of school-based OHAs, ultimately improving the oral health outcomes and overall well-being of children with disabilities. In addition, OHP policies implemented for mainstream students should also include those with disabilities, as they are at higher risk. However, the adaptation of these policies to children's learning needs is crucial. Policies to improve oral health service utilisation and quality of service provision should also address those with disabilities as they face more challenges in accessing quality services.

6.3.4.2 Future research implications

The findings identified potential barriers and facilitators to the implementation of OHAs in the KSA's special schools and provided key concepts to develop an OHP implementation toolkit tailored for the KSA's special schools. However, further work is needed to develop an OHP implementation toolkit.

In addition, further studies are needed to assess and evaluate the toolkit's acceptability, feasibility, adoption, implementation, effectiveness, cost-effectiveness and sustainability across different age groups and disabilities. Further studies should also aim to include children with disabilities, as well as other stakeholders such as dental health professionals, representatives of the MoE and MoH, and policymakers. Future research could also investigate the long-term effects of school-based OHAs on oral health outcomes, including the prevention of dental caries, periodontal diseases, oral health inequalities, and oral health-related quality of life among children with disabilities.

Also, future research should consider border impact such as self-care, and empowerment indicators, as recommended in Section 2.3.3.1.5. In addition, studies could assess the cost-effectiveness of different school-based OHAs, comparing the economic benefits of preventive interventions with the costs of treatment for oral diseases later in life. Furthermore, research could examine strategies for engaging children, parents, carers, and community members in supporting school-based OHAs. Research could also assess the implementation and impact of policies related to school-based OHAs, including barriers and facilitators to policy implementation and policies' effects on oral health inequalities.

Moreover, studies could explore effective strategies for integrating oral health into existing school curricula, including interdisciplinary approaches that incorporate oral health into subjects like science, physical education, and nutrition. By addressing these research priorities, researchers could contribute to the development of evidence-based practices and

policies that promote oral health among children with disabilities, ultimately improving overall health and well-being.

6.3.4.3 Implications for implementation science applications for oral health activities evaluation

In the field of implementation science, research on school-based OHAs could focus on several key areas to facilitate effective and sustainable implementation. Research in implementation science could investigate the most effective strategies for implementing school-based OHAs, including the identification of barriers and facilitators to implementation at the school, community, and policy levels. In addition, it could explore methods for adapting OHAs to fit the children's learning disabilities and contexts of different special schools, communities, and populations while maintaining fidelity to evidence-based practices. Furthermore, it could examine approaches for building the capacity of schools, educators, and health professionals to deliver OHAs effectively, including training, technical assistance, and ongoing support.

Research could also evaluate strategies for engaging key stakeholders, including educators, parents, policymakers, and community members, in the planning, implementation, and evaluation of school-based OHAs. Also, it could investigate factors that contribute to the long-term sustainability of school-based OHAs, including funding mechanisms, organisational support, and integration into existing systems and structures. Moreover, research could assess implementation outcomes, such as the acceptability, feasibility, fidelity, and sustainability of school-based OHAs, using standardised models and frameworks. By

addressing these implications, researchers can enhance the translation of evidence into practice and improve the effectiveness and reach of school-based OHAs, ultimately leading to better oral health outcomes for children with disabilities.

Chapter 7. Conclusions and Recommendations

7.1 Background

Disabilities in children are a pressing issue in public health, with approximately 240 million children with disabilities around the world (United Nations Children's Fund, 2021). In 2017, there were 209,574 children with disabilities in the KSA, which has a total population of 35 million (General Authority for Statistics, 2017).The literature indicates children with disabilities have a high level of untreated dental caries and are at higher risk of poor oral health with significant challenges into adulthood (Robertson et al., 2019).

According to the 2019 GBD report, the KSA has a high prevalence of common oral diseases. This indicates a higher occurrence of oral diseases compared to both the WHO's Eastern Mediterranean Region, to which it belongs, and the global estimates (Bernabe et al., 2020).A recent systematic review indicates that persons with disabilities in KSA have a high prevalence of dental caries, poor oral health status, encounter a lack of awareness about oral health, and face challenges in accessing oral health services, emphasising the need to improve oral health care services and policies to better address their needs (Asiri et al., 2022).

The WHO, schools have a unique advantage in promoting oral health (Kwan et al., 2005; Langford et al., 2014; Reddy & Singh, 2015; Watt, 2005). However, the contextual factors that influence the implementation of OHAs in the KSA's special schools have not been explored. Successful implementation requires an understanding of barriers and facilitators to OHAs.

This PhD thesis aimed to explore the current provision of OHAs in special schools in KSA and the barriers and facilitators to their implementation.

Study One: A scoping review using the Leva et al. (2010) framework provided a comprehensive summary of the literature on school-based OHAs for children with disabilities, examined their impact and the factors influencing them, identified gaps in the literature, and informed Study Two.

Study Two: A pragmatic, qualitative study conducted using telephone-based semi-structured interviews with a purposive and snowball sample of KSA special-school staff members (n=18) and parents/carers of attending children (n=12) conducted over ten months, from 13 special schools catering for children with a wide range of disabilities from all KSA geographic/administrative regions. The data collection and analysis were based on CFIR, a determinant framework from implementation science, which was utilised to inform the development of the interview guides and the identification of the theme during the framework analysis. Quirkos software was used to facilitate data visualisation and analysis.

This study aimed to explore OHAs in the KSA's special schools from the perspective of staff and parents/carers of children with disabilities, identify the perceived barriers to and facilitators to implementing school-based OHAs using CFIR, and recommend key concepts to

develop an OHP implementation toolkit for the KSA's special schools providing insights for future research. The research findings have successfully addressed the thesis objectives and provided answers to its questions.

7.2 Summary of the findings

This thesis found that insufficient research has been conducted on OHAs in special schools. Research indicates that providing school-based OHAs benefits children with disabilities, with a short-term positive impact on children's oral hygiene, oral health-related knowledge, and dental caries risk. Furthermore, it suggests involving parents and teachers in the activities to improve their impact.

Multiple factors influence school-based OHAs, including school schedules, teacher training and experience, access to dental health education materials, and parental compliance. No research is available on the contextual factors affecting the implementation of school-based OHAs in special schools, even though such factors are known to impact these activities.

Furthermore, the findings of Study Two highlighted that in KSA, no school-based OHAs met the definition of OHP; however, some OHE programmes existed. The KSA's special schools lack OHPAs, including fluoride-based activities, topical fluoride application, and supervised toothbrushing clubs.

In addition, the OHAs applied in these schools lacked the necessary adaptation to student learning needs. The educational materials and methods should be simplified, including visual aids and models. Addressing high-sensitivity issues is crucial. Parent and dental professionals could help design adapted OHAs for KSA children with disabilities. Furthermore, staff members in the KSA's special schools need to improve their dental health knowledge, attitudes, and self-efficacy toward OHAs. Conducting training sessions with dental professionals and providing dental health educational resources or toolkits/guidance documents to school staff could lead to improvements.

Also, the KSA's special schools, as an inner setting, pose barriers to implementing OHAs effectively. Integrating oral health into the school curriculum, promoting a healthy food policy, implementing supervised toothbrushing clubs, incentivising staff participation, and engaging school leaders in OHAs planning and resourcing are critical. In addition, positive peer pressure, along with external policies and incentives governing the implementation of OHAs in the KSA's special schools, is essential to promote their successful implementation. Moreover, implementing OHAs effectively in the KSA's special schools requires careful planning, stakeholder engagement, and continuous evaluation.

The findings informed the recommendations for four key concepts for developing an OHP implementation toolkit for the KSA's special schools: embracing OHP principles rather than OHE alone, developing and using appropriate resources in schools and with families, adopting a collaborative approach, and evaluation.

The first concept is based on the Ottawa Charter's principles for OHP. It recommended developing and enforcing oral health policies in the KSA's special schools, such as a healthy eating policy, supervised toothbrushing clubs, and integrating oral health into school curricula and activities. It also emphasised the importance of creating a school environment that promotes oral health, the development of personal skills through training and education about adaptable toothbrushing recommendations for children with disabilities, community empowerment, and access to dental health services and OHP. The second concept underscored the need for appropriate oral health resources for the KSA's special schools, children, and families. Furthermore, the third recommendation indicated the significance of collaboration with the government, industry, the network of special schools, and parents/carers to implement and sustain these activities. Moreover, the fourth key concept highlighted the importance of continuous evaluation. Based on the identified main barriers to the implementation of OHAs in the KSA's special schools, the researcher recommends these four crucial concepts underpin future OHP implementation toolkits.

7.3 Conclusion

No activities met the definition of oral health promotion; however, some dental health education programmes existed. Implementation of the OHAs is hindered by a lack of financial and human resources, perceptions of limited children's abilities, lack of adaptation to children's needs, lack of oral health educational materials, and lack of guidance documents

or toolkits. Effective implementation requires consideration of all CFIR domains. However, inner setting, individuals, and intervention characteristics were the key CFIR domains.

A multidisciplinary team should implement a holistic OHP approach in KSA special schools to combat the high burden of oral diseases and reduce oral health inequalities. Moreover, an evidence-based OHP implementation toolkit is essential to guide the plan, design, adoption, implementation, and sustainability of evidence-based OHPAs for children with disabilities in KSA.

While this study contributes valuable insights into OHAs in the KSA special schools and the perceived barriers and facilitators, several areas warrant further exploration. One avenue for future research is to survey the availability of the activities, their types, and implementation process to provide breadth supporting the depth of this research findings. Further research is also needed to develop and test adaptable oral health promotion resources for various disabilities among KSA children. In addition, longitudinal studies are needed to understand better the long-term implementation of OHPAs in KSA's special schools to allow a more comprehensive understanding of how these OHPAs impact children's health over time, considering the dynamic nature of the implementation process and the context.

Chapter 8. List of references

<furber-2013-framework-analysis-a-method-for-analysing-qualitative-data 1.pdf>.

<unicef-convention-rights-child-uncrc.pdf>.

ADEOYE-OLATUNDE, O. A. & OLENIK, N. L. 2021. Research and scholarly methods: Semi-structured interviews. *Journal of the american college of clinical pharmacy,* 4**,** 1358-1367.

AL-ANSARI, A. & NAZIR, M. 2020. Prevalence of dental trauma and receipt of its treatment among male school children in the Eastern Province of Saudi Arabia. *The Scientific World Journal,* 2020.

AL-FAHAM, H., DAVIS, A. M. & ERNST, R. 2019. Intersectionality: From theory to practice. *Annual Review of Law and Social Science,* 15**,** 247-265.

AL-JADID, M. S. 2013. Disability in Saudi Arabia. *Saudi medical journal,* 34**,** 453-460.

AL-JADID, M. S. 2014. Disability trends in Saudi Arabia: prevalence and causes. *Am J Phys Med Rehabil,* 93**,** S47-9.

AL-KHERAIGI, F. S. 1989. *Special education development in the Kingdom of Saudi Arabia from 1958 to 1987,* Syracuse University.

AL AGILI, D. E. 2013. A systematic review of population-based dental caries studies among children in Saudi Arabia. *Saudi Dent J,* 25**,** 3-11.

AL SAUD, T. B. A. B. 2023. Age of Majority in Saudi Laws An Epistemic Study on the Provisions of the Saudi Arabian Laws. 2024-1989 ,16 ,المجلة القانونية.

ALGHAMDI, A. S., ALMARGHLANI, A. A., ALYAFI, R. A., KAYAL, R. A. & AL-ZAHRANI, M. S. 2020. Gingival health and oral hygiene practices among high school children in Saudi Arabia. *Annals of Saudi Medicine,* 40**,** 126-135.

ALJAMEEL, A. H., GULZAR, S., GUPTA, M., ALSHEHRI, A. A., ALMALKI, S. A., ASIRI, F. Y. & CHAUDHRY, S. J. 2023. Oral Health Promotion among Individuals with Intellectual Disabilities: A Systematic Review. *European Journal of Dentistry*.

ALKAHTANI, Z. M., STARK, P. C., LOO, C. Y., WRIGHT, W. G. & MORGAN, J. P. 2014. Saudi and U.S. Dental Student Attitudes Toward Treating Individuals with Developmental Disabilities. *Journal of Dental Education,* 78**,** 1145-1153.

ALZAHRANI, S. G. 2022. Evaluation of Health Promoting Schools Programme in Saudi Arabia. *Journal of Health and Medical Sciences,* 5.

ALZAHRANI, S. G. 2023. Healthy Schools Framework in Saudi Arabia: A Narrative Review. *International Journal of Pharmaceutical Research & Allied Sciences,* 12.

ANOPA, Y., MCMAHON, A. D., CONWAY, D. I., BALL, G. E., MCINTOSH, E. & MACPHERSON, L. M. 2015. Improving child oral health: cost analysis of a national nursery toothbrushing programme. *PloS one,* 10**,** e0136211.

ARKSEY, H. & O'MALLEY, L. 2005. Scoping studies: towards a methodological framework. *International Journal of Social Research Methodology,* 8**,** 19-32.

ASIRI, F. Y. I., TENNANT, M. & KRUGER, E. 2022. Oral health status, oral health behaviors, and oral health care utilization among persons with disabilities in Saudi Arabia. *International Journal of Environmental Research and Public Health,* 19**,** 16633.

ASIRI, F. Y. I., TENNANT, M. & KRUGER, E. 2023. Oral health of individuals with cerebral palsy in Saudi Arabia: A systematic review. *Community Dentistry and Oral Epidemiology*.

ATIF, M., TEWARI, N., SAJI, S., SRIVASTAV, S. & RAHUL, M. 2023. Effectiveness of various methods of educating children and adolescents for the maintenance of oral health: A systematic review of randomized controlled trials. *International Journal of Paediatric Dentistry*.

BAIJU, R., PETER, E., VARGHESE, N. & SIVARAM, R. 2017. Oral health and quality of life: current concepts. *Journal of clinical and diagnostic research: JCDR,* 11**,** ZE21.

BAUER, M. S., DAMSCHRODER, L., HAGEDORN, H., SMITH, J. & KILBOURNE, A. M. 2015. An introduction to implementation science for the non-specialist. *BMC Psychology,* 3.

BAUER, M. S. & KIRCHNER, J. 2020. Implementation science: What is it and why should I care? *Psychiatry Res,* 283**,** 112376.

BEADLE-BROWN, J. 2022. Residential care and community living. *Textbook of Psychiatry for Intellectual Disability and Autism Spectrum Disorder*. Springer.

BEKELMAN, D. B., RABIN, B. A., NOWELS, C. T., SAHAY, A., HEIDENREICH, P. A., FISCHER, S. M. & MAIN, D. S. 2016. Barriers and facilitators to scaling up outpatient palliative care. *Journal of palliative medicine,* 19**,** 456-459.

BERGER, R. 2015. Now I see it, now I don't: Researcher's position and reflexivity in qualitative research. *Qualitative research,* 15**,** 219-234.

BERGMAN, M. M. & COXON, A. P. The quality in qualitative methods. Forum Qualitative Sozialforschung/Forum: Qualitative Social Research, 2005.

BERNABE, E., MARCENES, W., HERNANDEZ, C., BAILEY, J., ABREU, L., ALIPOUR, V., AMINI, S., ARABLOO, J. & AREFI, Z. 2020. Global, regional, and national levels and trends in burden of oral conditions from 1990 to 2017: a systematic analysis for the global burden of disease 2017 study. *Journal of dental research.*

BHADAURIA, U. S., PUROHIT, B. & PRIYA, H. 2024. Access to dental care in individuals with disability: a systematic review. *Evidence-Based Dentistry***,** 1-10.

BHAIMIA, S. 2018. The general data protection regulation: the next generation of EU data protection. *Legal Information Management,* 18**,** 21-28.

BINDAWAS, S. M. & VENNU, V. 2018. The National and Regional Prevalence Rates of Disability, Type, of Disability and Severity in Saudi Arabia-Analysis of 2016 Demographic Survey Data. *Int J Environ Res Public Health,* 15.

BRAMANTORO, T., SANTOSO, C. M. A., HARIYANI, N., SETYOWATI, D., ZULFIANA, A. A., NOR, N. A. M., NAGY, A., PRATAMAWARI, D. N. P. & IRMALIA, W. R. 2021. Effectiveness of the school-based oral health promotion programmes from preschool to high school: A systematic review. *PloS one,* 16**,** e0256007.

CARCARY, M. 2009. The research audit trial—enhancing trustworthiness in qualitative inquiry. *Electronic journal of business research methods,* 7**,** pp11-24-pp11-24.

CELESTE, R. K., EYJÓLFSDÓTTIR, H. S., LENNARTSSON, C. & FRITZELL, J. 2020. Socioeconomic life course models and oral health: a longitudinal analysis. *Journal of Dental Research,* 99**,** 257-263.

CHADWICK, D., CHAPMAN, M. & DAVIES, G. 2018. Factors affecting access to daily oral and dental care among adults with intellectual disabilities. *J Appl Res Intellect Disabil,* 31**,** 379-394.

CHALMERS, I. & GLASZIOU, P. 2009. Avoidable waste in the production and reporting of research evidence. *The Lancet,* 374**,** 86-89.

CHANDIO, N., MICHEAL, S., TADAKMADLA, S. K., SOHN, W., CARTWRIGHT, S., WHITE, R., SANAGAVARAPU, P., PARMAR, J. S. & ARORA, A. 2022. Barriers

and enablers in the implementation and sustainability of toothbrushing programs in early childhood settings and primary schools: a systematic review. *BMC Oral Health,* 22**,** 1-19.
CHAVEZ, C. 2008. Conceptualizing from the inside: Advantages, complications, and demands on insider positionality. *The qualitative report,* 13**,** 474-494.
COLQUHOUN, H. L., LEVAC, D., O'BRIEN, K. K., STRAUS, S., TRICCO, A. C., PERRIER, L., KASTNER, M. & MOHER, D. 2014. Scoping reviews: time for clarity in definition, methods, and reporting. *Journal of Clinical Epidemiology,* 67**,** 1291-1294.
COMMISSION ON SOCIAL DETERMINANTS OF HEALTH 2008. *Closing the gap in a generation: health equity through action on the social determinants of health: final report of the commission on social determinants of health,* World Health Organization.
COUTINHO, D. A., MURTHY, A. K., KHOND, M., PAWAR, P., MALBHAGE, S. & NIKAM, M. 2023. Assessing effectiveness of braille and audio-tactile performance technique in improving oral hygiene status of young adults with visual impairment. *Special Care in Dentistry,* 43**,** 656-665.
CRESWELL, J. W. 2009. Research designs: Qualitative, quantitative, and mixed methods approaches. *Callifornia: Sage*.
CRESWELL, J. W. & CRESWELL, J. D. 2017. *Research design: Qualitative, quantitative, and mixed methods approaches,* Sage publications.
CRESWELL, J. W. & MILLER, D. L. 2000. Determining validity in qualitative inquiry. *Theory into practice,* 39**,** 124-130.
CRISTINA GAIO, D., JORGE MOYSÉS, S., CÉSAR BISINELLI, J., SOTILLE FRANÇA, B. H. & TETU MOYSÉS, S. 2010. Health promoting schools and their impact on the oral health of mentally disabled people in Brazil. *Health Promotion International,* 25**,** 425-434.
DA ROSA, S. V., MOYSÉS, S. J., THEIS, L. C., SOARES, R. C., MOYSÉS, S. T., WERNECK, R. I. & ROCHA, J. S. 2020. Barriers in access to dental services hindering the treatment of people with disabilities: a systematic review. *International journal of dentistry,* 2020.
DAHLGREN, G. & WHITEHEAD, M. 2021. The Dahlgren-Whitehead model of health determinants: 30 years on and still chasing rainbows. *Public Health,* 199**,** 20-24.
DAMSCHRODER, L. J. 2020. Clarity out of chaos: Use of theory in implementation research. *Psychiatry Research,* 283**,** 112461.
DAMSCHRODER, L. J., ARON, D. C., KEITH, R. E., KIRSH, S. R., ALEXANDER, J. A. & LOWERY, J. C. 2009. Fostering implementation of health services research findings into practice: a consolidated framework for advancing implementation science. *Implementation Science,* 4**,** 50.
DAMSCHRODER, L. J. & LOWERY, J. C. 2013. Evaluation of a large-scale weight management program using the consolidated framework for implementation research (CFIR). *Implementation Science,* 8**,** 51.
DAMSCHRODER, L. J., REARDON, C. M., WIDERQUIST, M. A. O. & LOWERY, J. 2022. The updated Consolidated Framework for Implementation Research based on user feedback. *Implementation science,* 17**,** 1-16.
DAUDT, H. M., VAN MOSSEL, C. & SCOTT, S. J. 2013. Enhancing the scoping study methodology: a large, inter-professional team's experience with Arksey and O'Malley's framework. *BMC medical research methodology,* 13**,** 1-9.

DAVIES, C. & FISHER, M. 2018. Understanding research paradigms. *Journal of the Australasian Rehabilitation Nurses Association,* 21**,** 21-25.

DE SILVA, A. M., HEGDE, S., AKUDO NWAGBARA, B., CALACHE, H., GUSSY, M. G., NASSER, M., MORRICE, H. R., RIGGS, E., LEONG, P. M., MEYENN, L. K. & YOUSEFI-NOORAIE, R. 2016a. Community-based population-level interventions for promoting child oral health. *Cochrane Database Syst Rev,* 9**,** CD009837.

DE SILVA, A. M., HEGDE, S., NWAGBARA, B. A., CALACHE, H., GUSSY, M. G., NASSER, M., MORRICE, H. R., RIGGS, E., LEONG, P. M. & MEYENN, L. K. 2016b. Community-based population-level interventions for promoting child oral health. *Cochrane database of systematic reviews*.

DEJONCKHEERE, M. & VAUGHN, L. M. 2019. Semistructured interviewing in primary care research: a balance of relationship and rigour. *Family medicine and community health,* 7.

DENZIN, N. K. & LINCOLN, Y. S. 2011. *The Sage handbook of qualitative research*, sage.

DHAR, U., NAGARAJAPPA, R., SATYARUP, D., JENA, M. & MOHAPATRA, A. 2019. Oral Health Promotion Through Schools. *Indian Journal of Public Health Research & Development,* 10.

DIXON-WOODS, M. 2011. Using framework-based synthesis for conducting reviews of qualitative studies. *BMC medicine,* 9**,** 1-2.

DOLAN, T. A. 1993. Identification of appropriate outcomes for an aging population. *Special care in Dentistry,* 13**,** 35-39.

DOPSON, S. & FITZGERALD, L. 2005. *Knowledge to action?: evidence-based health care in context*, OUP Oxford.

DOS SANTOS, A. P. P., DE OLIVEIRA, B. H. & NADANOVSKY, P. 2018. A systematic review of the effects of supervised toothbrushing on caries incidence in children and adolescents. *International journal of paediatric dentistry,* 28**,** 3-11.

DYAR, O. J., HAGLUND, B. J., MELDER, C., SKILLINGTON, T., KRISTENSON, M. & SARKADI, A. 2022. Rainbows over the world's public health: determinants of health models in the past, present, and future. *Scandinavian journal of public health,* 50**,** 1047-1058.

EATON, K., YUSUF, H. & VASSALLO, P. 2023. The WHO Global Oral Health Action Plan 2023-2030. *Community Dental Health,* 40**,** 68.

ECCLES, M. P. & MITTMAN, B. S. 2006. Welcome to Implementation Science. *Implementation Science,* 1.

EL-YOUSFI, S., JONES, K., WHITE, S. & MARSHMAN, Z. 2019. A rapid review of barriers to oral healthcare for vulnerable people. *Br Dent J,* 227**,** 143-151.

ELSADEK, Y. E. & BAKER, S. R. 2023. Oral health promotion through health-promoting schools in developing countries: A scoping review. *Community Dentistry and Oral Epidemiology*.

FARROKHI, F., GHORBANI, Z., FARROKHI, F., NAMDARI, M. & SALAVATIAN, S. 2023. Social media as a tool for oral health promotion: A systematic review. *Plos one,* 18**,** e0296102.

FEILZER, M. 2010. Doing mixed methods research pragmatically: Implications for the rediscovery of pragmatism as a research paradigm. *Journal of mixed methods research,* 4**,** 6-16.

FLICK, U. 2018a. Designing qualitative research. *Designing Qualitative Research***,** 1-200.

FLICK, U. 2018b. Doing qualitative data collection–charting the routes. *The SAGE handbook of qualitative data collection***,** 1-16.

FLICK, U. 2022. An introduction to qualitative research. *An introduction to qualitative research***,** 1-100.
FRANCIS, J. J., JOHNSTON, M., ROBERTSON, C., GLIDEWELL, L., ENTWISTLE, V., ECCLES, M. P. & GRIMSHAW, J. M. 2010. What is an adequate sample size? Operationalising data saturation for theory-based interview studies. *Psychology and health,* 25**,** 1229-1245.
FREEMAN, R. 2020. Promoting Inclusion Oral Health: Social Interventions to Reduce Oral Health Inequities. *Dent J (Basel),* 8.
FRIESE, S. 2022. Role and Impact of CAQDAS Software for Designs in Qualitative Research. *The SAGE handbook of qualitative research design***,** 307-326.
FURBER, C. 2010. Framework analysis: a method for analysing qualitative data. *African Journal of Midwifery and Women's health,* 4**,** 97-100.
FUSCH , P. I. & NESS, L. R. 2015. Are we there yet? Data saturation in qualitative research.
GAIO, D. C., MOYSES, S. J., BISINELLI, J. C., FRANCA, B. H. S. & MOYSES, S. T. 2010. Health promoting schools and their impact on the oral health of mentally disabled people in Brazil. *HEALTH PROMOTION INTERNATIONAL,* 25**,** 425-434.
GALE, N. K., HEATH, G., CAMERON, E., RASHID, S. & REDWOOD, S. 2013. Using the framework method for the analysis of qualitative data in multi-disciplinary health research. *BMC Medical Research Methodology,* 13**,** 117.
GANAPATHI, A. K., NAMINENI, S., VAAKAVAAKA, P. H., VAVAMSILATHA, K., DAS, R. & DEVI, M. 2015. Effectiveness of various sensory input methods in dental health education among blind children- a comparative study. *Journal of clinical and diagnostic research,* 9**,** ZC75-ZC78.
GARCÍA-HORTA, J. B. & GUERRA-RAMOS, M. T. 2009. The use of CAQDAS in educational research: some advantages, limitations and potential risks. *International Journal of Research & Method in Education,* 32**,** 151-165.
GEERTZ, C. 1973. Geertz--Thick Description. *Pdf. The Interpretation of Cultures***,** 6.
GENERAL AUTHORITY FOR STATISTICS 2017. Disability report.
GLICK, M., WILLIAMS, D. M., KLEINMAN, D. V., VUJICIC, M., WATT, R. G. & WEYANT, R. J. 2016. A new definition for oral health developed by the FDI World Dental Federation opens the door to a universal definition of oral health. *Br Dent J,* 221**,** 792-793.
GOLDSMITH, L. 2021. Using Framework Analysis in Applied Qualitative Research. *The Qualitative Report*.
GOUGH, D., DAVIES, P., JAMTVEDT, G., LANGLOIS, E., LITTELL, J., LOTFI, T., MASSET, E., MERLIN, T., PULLIN, A. S. & RITSKES-HOITINGA, M. 2020. Evidence synthesis International (ESI): position statement. *Systematic Reviews,* 9**,** 1-9.
GOUGH, D., THOMAS, J. & OLIVER, S. 2012. Clarifying differences between review designs and methods. *Systematic reviews,* 1**,** 1-9.
GRAY-BURROWS, K. A., DAY, P. F., EL-YOUSFI, S., LLOYD, E., HUDSON, K. & MARSHMAN, Z. 2023. A national survey of supervised toothbrushing programmes in England. *British Dental Journal***,** 1-5.
GREENE, M. J. 2014. On the inside looking in: Methodological insights and challenges in conducting qualitative insider research. *The qualitative report,* 19**,** 1-13.
GUBA, E. G. 1981. Criteria for assessing the trustworthiness of naturalistic inquiries. *Ectj,* 29**,** 75-91.
GUBA, E. G. & LINCOLN, Y. S. 1994. Competing paradigms in qualitative research. *Handbook of qualitative research,* 2**,** 105.

GUEST, G., BUNCE, A. & JOHNSON, L. 2006. How many interviews are enough? An experiment with data saturation and variability. *Field methods,* 18**,** 59-82.

HARTWIG, A. D., STUERMER, V. M., DA SILVA, I. F., SCHARDOSIM, L. R. & AZEVEDO, M. S. 2017. Effectiveness of an oral health educational intervention for individuals with special health care needs from a southern Brazilian city. *Special Care in Dentistry,* 37**,** 246-252.

HASHMI, S., MOHANTY, V. R., BALAPPANAVAR, A. Y., YADAV, V., KAPOOR, S. & RIJHWANI, K. 2019. Effectiveness of dental health education on oral hygiene among hearing impaired adolescents in India: a randomized control trial. *Special care in dentistry,* 39**,** 274-280.

HEBBAL, M. & ANKOLA, A. 2012. Development of a new technique (ATP) for training visually impaired children in oral hygiene maintenance. *European Archives of Paediatric Dentistry,* 13**,** 244-247.

INSTITUTE OF HEALTH METRICS AND EVALUATION 2019. Global burden of disease 2019 (GBD 2019) results. 2020 ed.

JAIN, N., DUTT, U., RADENKOV, I. & JAIN, S. 2023. WHO's global oral health status report 2022: Actions, discussion and implementation. Wiley Online Library.

JANESICK, V. J. 2007. Peer debriefing. *The Blackwell encyclopedia of sociology*.

JAWAHAR, A. & MARAGATHAVALLI, G. 2021. Audio tactile performance technique as an effective method in improving the oral hygiene status of the visually impaired population in comparison with Braille: A systematic review. *J. Res. Med. Dent. Sci,* 9**,** 314-320.

JEAVONS, C. & CHANA, B. 2022. Global Oral Health and Inequalities. *Social Science Perspectives on Global Public Health.* Routledge.

JÜRGENSEN, N. & PETERSEN, P. 2013. Promoting oral health of children through schools–Results from a WHO global survey 2012. *Community Dent Health,* 30**,** 204-18.

KAY, E. & LOCKER, D. 1996. Is dental health education effective? A systematic review of current evidence. *Community dentistry and oral epidemiology,* 24**,** 231-235.

KIDD, J. B., MCMAHON, A. D., SHERRIFF, A., GNICH, W., MAHMOUD, A., MACPHERSON, L. M. & CONWAY, D. I. 2020. Evaluation of a national complex oral health improvement programme: a population data linkage cohort study in Scotland. *BMJ open,* 10**,** e038116.

KIRK, M. A., KELLEY, C., YANKEY, N., BIRKEN, S. A., ABADIE, B. & DAMSCHRODER, L. 2015. A systematic review of the use of the Consolidated Framework for Implementation Research. *Implementation Science,* 11.

KIRK, M. A., KELLEY, C., YANKEY, N., BIRKEN, S. A., ABADIE, B. & DAMSCHRODER, L. 2016. A systematic review of the use of the Consolidated Framework for Implementation Research. *Implement Sci,* 11**,** 72.

KLENKE, K. 2016. Qualitative research as method. *Qualitative research in the study of leadership.* Emerald Group Publishing Limited.

KOELEN, M. A. & VAN DEN BAN, A. W. 2023. *Health education and health promotion,* BRILL.

KOKKO, S., GREEN, L. W. & KANNAS, L. 2014. A review of settings-based health promotion with applications to sports clubs. *Health promotion international,* 29**,** 494-509.

KWAN, S. Y., PETERSEN, P. E., PINE, C. M. & BORUTTA, A. 2005. Health-promoting schools: an opportunity for oral health promotion. *Bulletin of the World Health organization,* 83**,** 677-685.

LAI, Y. Y. L., ZAFAR, S., LEONARD, H. M., WALSH, L. J. & DOWNS, J. A. 2020. Oral health education and promotion in special needs children: Systematic review and meta-analysis. *Oral Dis,* 28**,** 66-75.
LAI, Y. Y. L., ZAFAR, S., LEONARD, H. M., WALSH, L. J. & DOWNS, J. A. 2022. Oral health education and promotion in special needs children: Systematic review and meta-analysis. *Oral diseases,* 28**,** 66-75.
LEE, A., LO, A., LI, Q., KEUNG, V. & KWONG, A. 2020. Health Promoting Schools: An Update. *Appl Health Econ Health Policy,* 18**,** 605-623.
LEVAC, D., COLQUHOUN, H. & O'BRIEN, K. K. 2010. Scoping studies: advancing the methodology. *Implementation Science,* 5**,** 69.
LEWINS, A. & SILVER, C. 2009. Choosing a CAQDAS package.
LINCOLN, Y. S. & GUBA, E. G. 1985. *Naturalistic inquiry*, sage.
LINCOLN, Y. S. & GUBA, E. G. 2000. The only generalization is: There is no generalization. *Case study method,* 27**,** 44.
LINCOLN, Y. S., LYNHAM, S. A. & GUBA, E. G. 2011. Paradigmatic controversies, contradictions, and emerging confluences, revisited. *The Sage handbook of qualitative research,* 4**,** 97-128.
LINDLOF, T. R. & TAYLOR, B. C. 2017. *Qualitative communication research methods*, Sage publications.
MACKEY, A. & GASS, S. M. 2015. *Second language research: Methodology and design*, Routledge.
MACPHERSON, L. M., RODGERS, J. & CONWAY, D. I. 2019a. Childsmile after 10 years part 1: background, theory and principles. *Dental update,* 46**,** 113-116.
MACPHERSON, L. M., RODGERS, J. & CONWAY, D. I. 2019b. Childsmile after 10 years part 2: programme development, implementation and evaluation. *Dental update,* 46**,** 238-246.
MAHANTESHA, T., NARA, A., KUMARI, P. R., HALEMANI, P. K. N., BUDDIGA, V. & MYTHRI, S. 2015. A comparative evaluation of oral hygiene using Braille and audio instructions among institutionalized visually impaired children aged between 6 years and 20 years: A 3-monthfollow-up study. *Journal of International Society of Preventive and Community Dentistry,* 5**,** 129-132.
MARINHO, V. C., WORTHINGTON, H. V., WALSH, T. & CLARKSON, J. E. 2013. Fluoride varnishes for preventing dental caries in children and adolescents. *Cochrane Database of Systematic Reviews*.
MARMOT, M., FRIEL, S., BELL, R., HOUWELING, T. A. & TAYLOR, S. 2008. Closing the gap in a generation: health equity through action on the social determinants of health. *The lancet,* 372**,** 1661-1669.
MARSHALL, M. N. 1996. Sampling for qualitative research. *Family practice,* 13**,** 522-526.
MASON, M. Sample size and saturation in PhD studies using qualitative interviews. Forum qualitative Sozialforschung/Forum: qualitative social research, 2010.
MCCARTNEY, G., POPHAM, F., MCMASTER, R. & CUMBERS, A. 2019. Defining health and health inequalities. *Public health,* 172**,** 22-30.
MCGRATH, C., PALMGREN, P. J. & LILJEDAHL, M. 2019. Twelve tips for conducting qualitative research interviews. *Medical teacher,* 41**,** 1002-1006.
MEANS, A. R., KEMP, C. G., GWAYI-CHORE, M. C., GIMBEL, S., SOI, C., SHERR, K., WAGENAAR, B. H., WASSERHEIT, J. N. & WEINER, B. J. 2020. Evaluating and optimizing the consolidated framework for implementation research (CFIR) for use in low- and middle-income countries: a systematic review. *Implement Sci,* 15**,** 17.

MESHKOVSKA, B., FORBERGER, S., WENDT, J., SCHELLER, D. A., CASTELLARI, E., TIBOLDO, G., LUSZCZYNSKA, A., LIEN, N. & CONSORTIUM, P. 2023a. Barriers and Facilitators to Implementation of the EU School Fruit and Vegetables Scheme: Cross Country Study. *Global Implementation Research and Applications*, 1-14.

MESHKOVSKA, B., GEBREMARIAM, M. K., ATUKUNDA, P., IVERSEN, P. O., WANDEL, M. & LIEN, N. 2023b. Barriers and facilitators to implementation of nutrition-related actions in school settings in low-and middle-income countries (LMICs): a qualitative systematic review using the Consolidated Framework for Implementation Research (CFIR). *Implementation Science Communications,* 4**,** 73.

MESHKOVSKA, B., SCHELLER, D. A., WENDT, J., JILANI, H., SCHEIDMEIR, M., STRATIL, J. M., LIEN, N. & CONSORTIUM, P. 2022. Barriers and facilitators to implementation of direct fruit and vegetables provision interventions in kindergartens and schools: a qualitative systematic review applying the consolidated framework for implementation research (CFIR). *International Journal of Behavioral Nutrition and Physical Activity,* 19**,** 11.

MIDDLE, I., AL-SALLOUM, A., AL-HERBISH, A., QURACHI, M. & AL-OMAR, A. 2007. Regional variations in the prevalence of consanguinity in Saudi Arabia. *Saudi Med J,* 28**,** 1881-1884.

MITTELMARK, M. B. & BAUER, G. F. 2022. Salutogenesis as a Theory, as an Orientation and as the Sense of Coherence. *The handbook of salutogenesis*, 11-17.

MOHER, D., STEWART, L. & SHEKELLE, P. 2015. All in the family: systematic reviews, rapid reviews, scoping reviews, realist reviews, and more. *Systematic reviews,* 4**,** 1-2.

MOODLEY, J. & GRAHAM, L. 2015. The importance of intersectionality in disability and gender studies. *Agenda,* 29**,** 24-33.

MORGAN, D. L. 2014. Pragmatism as a paradigm for social research. *Qualitative inquiry,* 20**,** 1045-1053.

MOULLIN, J. C., DICKSON, K. S., STADNICK, N. A., ALBERS, B., NILSEN, P., BRODER-FINGERT, S., MUKASA, B. & AARONS, G. A. 2020. Ten recommendations for using implementation frameworks in research and practice. *Implement Sci Commun,* 1**,** 42.

MOYSES, S. T., MOYSES, S. J., WATT, R. G. & SHEIHAM, A. 2003. Associations between health promoting schools' policies and indicators of oral health in Brazil. *Health Promot Int,* 18**,** 209-18.

MUNN, Z., PETERS, M. D. J., STERN, C., TUFANARU, C., MCARTHUR, A. & AROMATARIS, E. 2018. Systematic review or scoping review? Guidance for authors when choosing between a systematic or scoping review approach. *BMC Medical Research Methodology,* 18.

MUNN, Z., POLLOCK, D., KHALIL, H., ALEXANDER, L., MCLNERNEY, P., GODFREY, C. M., PETERS, M. & TRICCO, A. C. 2022. What are scoping reviews? Providing a formal definition of scoping reviews as a type of evidence synthesis. *JBI Evidence Synthesis,* 20**,** 950-952.

NABI-BURZA, E., WINICKOFF, J. P., DREHMER, J. E., ZEEGERS, M. P. & WALTERS, B. H. 2022. A Qualitative Study of Factors Influencing Implementation of Tobacco Control in Pediatric Practices. *J Smok Cessat,* 2022**,** 4156982.

NIC IOMHAIR, A., WILSON, M. & MORGAN, M. 2020. Ten years of Designed to Smile in Wales. *Bdj Team,* 7**,** 12-15.

NICOLAU, B., THOMSON, W. M., STEELE, J. G. & ALLISON, P. J. 2007. Life-course epidemiology: concepts and theoretical models and its relevance to chronic oral conditions. *Community Dent Oral Epidemiol,* 35**,** 241-9.

NICOLAU, B. F. 2001. *The relationship between conditions in early life and along the life course and oral health status in teenagers*, University of London, University College London (United Kingdom).

NILSEN, P. 2015. Making sense of implementation theories, models and frameworks. *Implementation Science,* 10.

NILSEN, P. & BIRKEN, S. A. 2020. *Handbook on implementation science*, Edward Elgar Publishing.

NUTBEAM, D. & KICKBUSCH, I. 1998. Health promotion glossary. *Health promotion international,* 13**,** 349-364.

OATES, J., CARPENTER, D., FISHER, M., GOODSON, S., HANNAH, B., KWIATOWSKI, R., PRUTTON, K., REEVES, D. & WAINWRIGHT, T. BPS code of human research ethics. 2021. British Psychological Society.

OFFICE FOR HEALTH IMPROVEMENT AND DISPARITIES. 2021. *Delivering better oral health: an evidence-based toolkit for prevention* [Online]. Department of Health and Social Care, NHS England, and NHS Improvement. Available: tps://www.gov.uk/government/publications/delivering-better-oral-health-an-evidence-based-toolkit-for-prevention [Accessed 2024].

OFFICE OF DISEASE PREVENTION AND HEALTH PROMOTION. 2023. *Healthy People 2030* [Online]. U.S. Department of Health and Human Services. Available: https://health.gov/healthypeople/objectives-and-data/social-determinants-health [Accessed 2024].

OLIVEIRA, J. S., PRADO JUNIOR, R. R., DE SOUSA LIMA, K. R., DE OLIVEIRA AMARAL, H., MOITA NETO, J. M. & MENDES, R. F. 2013. Intellectual disability and impact on oral health: a paired study. *Spec Care Dentist,* 33**,** 262-8.

OLIVER, M. 2017. Defining impairment and disability: Issues at stake. *Disability and equality law*. Routledge.

OLIVER, M. 2018. *Understanding disability: From theory to practice*, Bloomsbury publishing.

ORGANIZATION, W. H., EDUCATIONAL, U. N., SCIENTIFIC & CULTURAL ORGANIZATION 2021. *Making every school a health-promoting school: implementation guidance*, World Health Organization.

PAREEK, S., NAGARAJ, A., YOUSUF, A., GANTA, S., ATRI, M. & SINGH, K. 2015. Effectiveness of supervised oral health maintenance in hearing impaired and mute children-A parallel randomized controlled trial. *Journal of International Society of Preventive & Community Dentistry,* 5**,** 176.

PARKER, C., SCOTT, S. & GEDDES, A. 2019. Snowball sampling. *SAGE research methods foundations*.

PENCHANSKY, R. & THOMAS, J. W. 1981. The concept of access: definition and relationship to consumer satisfaction. *Medical care,* 19**,** 127-140.

PERES, M. & HEILMANN, A. 2015. Social inequalities in oral health: from evidence to action. *London: International Center for Oral Health Inequalities Research & Policy*.

PERES, M. A., MACPHERSON, L. M., WEYANT, R. J., DALY, B., VENTURELLI, R., MATHUR, M. R., LISTL, S., CELESTE, R. K., GUARNIZO-HERREÑO, C. C. & KEARNS, C. 2019. Oral diseases: a global public health challenge. *The Lancet,* 394**,** 249-260.

PETERS, M. D., GODFREY, C., MCINERNEY, P., KHALIL, H., LARSEN, P., MARNIE, C., POLLOCK, D., TRICCO, A. C. & MUNN, Z. 2022. Best practice guidance and reporting items for the development of scoping review protocols. *JBI evidence synthesis,* 20**,** 953-968.

PETERSEN, P. E. 2009. Global policy for improvement of oral health in the 21st century--implications to oral health research of World Health Assembly 2007, World Health Organization. *Community Dent Oral Epidemiol,* 37**,** 1-8.

PETERSEN, P. E., BAEZ, R. J. & OGAWA, H. 2020. Global application of oral disease prevention and health promotion as measured 10 years after the 2007 World Health Assembly statement on oral health. *Community dentistry and oral epidemiology,* 48**,** 338-348.

PETERSEN, P. E. & KWAN, S. 2004. Evaluation of community-based oral health promotion and oral disease prevention-WHO recommendations for improved evidence in public health practice. *Community dental health,* 21**,** 319-329.

PETERSEN, P. E. & KWAN, S. 2009. World Health Organization global oral health strategies for oral health promotion and disease prevention in the twenty-first century. *Prävention und Gesundheitsförderung,* 4**,** 100-104.

PETERSEN, P. E. & OGAWA, H. 2016. Prevention of dental caries through the use of fluoride–the WHO approach. *Community dent health,* 33**,** 66-68.

PETERSON, J., PEARCE, P. F., FERGUSON, L. A. & LANGFORD, C. A. 2017. Understanding scoping reviews: Definition, purpose, and process. *Journal of the American Association of Nurse Practitioners,* 29**,** 12-16.

PETTI, S., GLENDOR, U. & ANDERSSON, L. 2018. World traumatic dental injury prevalence and incidence, a meta-analysis—One billion living people have had traumatic dental injuries. *Dental traumatology,* 34**,** 71-86.

PHAM, M. T., RAJIĆ, A., GREIG, J. D., SARGEANT, J. M., PAPADOPOULOS, A. & MCEWEN, S. A. 2014. A scoping review of scoping reviews: advancing the approach and enhancing the consistency. *Research synthesis methods,* 5**,** 371-385.

PHULKERD, S., SACKS, G., VANDEVIJVERE, S., WORSLEY, A. & LAWRENCE, M. 2017. Barriers and potential facilitators to the implementation of government policies on front-of-pack food labeling and restriction of unhealthy food advertising in Thailand. *Food Policy,* 71**,** 101-110.

PISTRANG, N. & BARKER, C. 2012. Varieties of qualitative research: A pragmatic approach to selecting methods. *APA handbook of research methods in psychology, Vol 2: Research designs: Quantitative, qualitative, neuropsychological, and biological.* Washington, DC, US: American Psychological Association.

POLAND, B., FROHLICH, K. L. & CARGO, M. 2009. Context as a fundamental dimension of health promotion program evaluation. *Health promotion evaluation practices in the Americas: Values and research***,** 299-317.

POPE, C., ZIEBLAND, S. & MAYS, N. 2000. Analysing qualitative data. *Bmj,* 320**,** 114-116.

POPPLE, B., WALL, C., FLINK, L., POWELL, K., DISCEPOLO, K., KECK, D., MADEMTZI, M., VOLKMAR, F. & SHIC, F. 2016. Brief report: Remotely delivered video modeling for improving oral hygiene in children with ASD: A pilot study. *Journal of autism and developmental disorders,* 46**,** 2791-2796.

PORTER, D. 2020. *The history of public health and the modern state,* Brill.

PUBLIC HEALTH SCOTLAND 2023. National standards for nursery and school toothbrushing programmes.

RELWANI, A. H., KIRAN, S., BHATT, R. & PATEL, M. 2016. Impact of dental health education on "specific learning needs" children. *Jaypees international journal of clinical pediatric dentistry,* 9**,** 31-34.

RIGHOLT, A., JEVDJEVIC, M., MARCENES, W. & LISTL, S. 2018. Global-, regional-, and country-level economic impacts of dental diseases in 2015. *Journal of dental research,* 97**,** 501-507.

RITCHIE, J., LEWIS, J., NICHOLLS, C. M. & ORMSTON, R. 2013. *Qualitative research practice: A guide for social science students and researchers,* sage.

RITCHIE, J. & SPENCER, L. 2002. Qualitative data analysis for applied policy research. *Analyzing qualitative data.* Routledge.

RITCHIE, J., SPENCER, L., BRYMAN, A. & BURGESS, R. G. 1994. Analysing qualitative data. Routledge, London.

RITCHIE, J., SPENCER, L. & O'CONNOR, W. 2003. Carrying out qualitative analysis. *Qualitative research practice: A guide for social science students and researchers,* 2003**,** 219-62.

ROBERTSON, M. D., SCHWENDICKE, F., DE ARAUJO, M. P., RADFORD, J. R., HARRIS, J. C., MCGREGOR, S. & INNES, N. P. T. 2019. Dental caries experience, care index and restorative index in children with learning disabilities and children without learning disabilities; a systematic review and meta-analysis. *BMC Oral Health,* 19**,** 146.

RUSLIN, R., MASHURI, S., RASAK, M. S. A., ALHABSYI, F. & SYAM, H. 2022. Semi-structured Interview: A methodological reflection on the development of a qualitative research instrument in educational studies. *IOSR Journal of Research & Method in Education (IOSR-JRME),* 12**,** 22-29.

SCHERPENZEEL, A. & SARIS, W. 1996. Causal direction in a model of life satisfaction: The top-down/bottom-up controversy. *Social Indicators Research,* 38**,** 161-180.

SCHREIER, M. 2018. Sampling and generalization. *The SAGE handbook of qualitative data collection***,** 84-97.

SCOTLAND, J. 2012. Exploring the philosophical underpinnings of research: Relating ontology and epistemology to the methodology and methods of the scientific, interpretive, and critical research paradigms. *English language teaching,* 5**,** 9-16.

SHAH, A. H., WYNE, A. H., ASIRI, F. Y., GULZAR, S., SHEEHAN, S. A., ALGHMILAS, A. S., ALOMARI, O. & ALJAMEEL, A. H. 2020a. Effectiveness of Preventive Oral Health Measures among Special Care School Children (boys) in Al-Kharj, Saudi Arabia. *Journal of Clinical and Diagnostic Research,* 14.

SHAH, A. H., WYNE, A. H., GULZAR, S., ASIRI, F. Y., SHEEHAN, S. A., ALGHMLAS, A. S., ALMADI, H. S. & ALJAMEEL, A. H. 2020b. Effectiveness of Oral Health Promotion among Teachers and Parents of Special Care School Children in Al-Kharj, Kingdom of Saudi Arabia. *World,* 11**,** 483.

SHAHABUDIN, S., HASHIM, H. & OMAR, M. 2016. The effectiveness of dental health education tools for visually impaired students in Bukit Mertajam. *Translational Craniofacial Conference 2016, (Tcc 2016),* 1791.

SHARIFIFARD, N., SARGERAN, K., GHOLAMI, M. & ZAYERI, F. 2020. A music- and game-based oral health education for visually impaired school children; multilevel analysis of a cluster randomized controlled trial. *BMC oral health,* 20**,** 144.

SHAWKY, S., ABALKHAIL, B. & SOLIMAN, N. 2002. An epidemiological study of childhood disability in Jeddah, Saudi Arabia. *Paediatr Perinat Epidemiol,* 16**,** 61-6.

SHEIHAM, A., ALEXANDER, D., COHEN, L., MARINHO, V., MOYSÉS, S., PETERSEN, P. E., SPENCER, J., WATT, R. G. & WEYANT, R. 2011. Global Oral

Health Inequalities: Task Group—Implementation and Delivery of Oral Health Strategies. *Advances in Dental Research,* 23**,** 259-267.
SHEIHAM, A. & WATT, R. G. 2000. The common risk factor approach: a rational basis for promoting oral health. *Community Dentistry and Oral Epidemiology: Commentary,* 28**,** 399-406.
SHEN, A., BERNABÉ, E. & SABBAH, W. 2021. Systematic review of intervention studies aiming at reducing inequality in dental caries among children. *International journal of environmental research and public health,* 18**,** 1300.
SHI, J., JIANG, C., TAN, D., YU, D., LU, Y., SUN, P., PAN, Y., ZHANG, H., WANG, Z. & YANG, B. 2016. Advancing Implementation of Evidence-Based Public Health in China: An Assessment of the Current Situation and Suggestions for Developing Regions. *Biomed Res Int,* 2016**,** 2694030.
SHYAMA, M., AL-MUTAWA, S. A., HONKALA, S. & HONKALA, E. 2003. Supervised toothbrushing and oral health education program in Kuwait for children and young adults with Down syndrome. *Special Care in Dentistry,* 23**,** 94-99.
SILVEIRA, A. L. N. D. M. E. S., MAGNO, M. B. & SOARES, T. R. C. 2020. The relationship between special needs and dental trauma. A systematic review and meta-analysis. *Dental traumatology,* 36**,** 218-236.
SMITH, J., BEKKER, H. & CHEATER, F. 2011. Theoretical versus pragmatic design in qualitative research. *Nurse researcher,* 18**,** 39-51.
SMULOWITZ, S. 2017. Interview Guide. *The International Encyclopedia of Communication Research Methods.*
SMYTH, A. & HOLIAN, R. 2008. Credibility issues in research from within organisations. *Researching education from the inside.* Routledge.
SNOW, S. J. 2000. John Snow MD (1813–1858). Part II: Becoming a doctor—his medical training and early years of practice. *Journal of medical biography,* 8**,** 71-77.
SOLTOFF, A. E., ISAACSON, M. J., STOLTENBERG, M., DURAN, T., LAPLANTE, L. J. R., PETEREIT, D., ARMSTRONG, K. & DAUBMAN, B. R. 2022. Utilizing the Consolidated Framework for Implementation Research to Explore Palliative Care Program Implementation for American Indian and Alaska Natives throughout the United States. *J Palliat Med,* 25**,** 643-649.
SPERBER, J. 2023. *The Age of Interconnection: A Global History of the Second Half of the Twentieth Century,* Oxford University Press.
STAHL, N. A. & KING, J. R. 2020. Expanding approaches for research: Understanding and using trustworthiness in qualitative research. *Journal of Developmental Education,* 44**,** 26-28.
STEELE, J., SHEN, J., TSAKOS, G., FULLER, E., MORRIS, S., WATT, R., GUARNIZO-HERREÑO, C. & WILDMAN, J. 2015. The interplay between socioeconomic inequalities and clinical oral health. *Journal of dental research,* 94**,** 19-26.
STEFANOVSKA, E., NAKOVA, M., RADOJKOVA-NIKOLOVSKA, V. & RISTOSKA, S. 2010. Tooth-brushing intervention programme among children with mental handicap. *Bratisl Lek Listy,* 111**,** 299-302.
STEIN, C., SANTOS, N. M. L., HILGERT, J. B. & HUGO, F. N. 2018. Effectiveness of oral health education on oral hygiene and dental caries in schoolchildren: Systematic review and meta-analysis. *Community dentistry and oral epidemiology,* 46**,** 30-37.
STUCKI, G., CIEZA, A., EWERT, T., KOSTANJSEK, N., CHATTERJI, S. & ÜSTÜN, T. B. 2002. Application of the International Classification of Functioning, Disability and Health (ICF) in clinical practice. *Disability and rehabilitation,* 24**,** 281-282.

SWALLOW, V., NEWTON, J. & VAN LOTTUM, C. 2003. How to manage and display qualitative data using 'Framework'and Microsoft® Excel. *Journal of Clinical Nursing,* 12**,** 610-612.
TEMPLE, B. & YOUNG, A. 2004. Qualitative research and translation dilemmas. *Qualitative research,* 4**,** 161-178.
THE CONSOLIDATED FRAMEWORK FOR IMPLEMENTATION RESEARCH. 2009. *The Consolidated Framework for Implementation Science* [Online]. Available: https://cfirguide.org/guide/app/#/ [Accessed 11-11-2023].
THOMAS, K. B. 1968. John Snow, 1813-1858. *The Journal of the Royal College of General Practitioners,* 16**,** 85.
TOBIN, G. A. & BEGLEY, C. M. 2004. Methodological rigour within a qualitative framework. *Journal of advanced nursing,* 48**,** 388-396.
TONES, B. K. 1986. Health education and the ideology of health promotion: a review of alternative approaches. *Health Education Research,* 1**,** 3-12.
TONG, A., SAINSBURY, P. & CRAIG, J. 2007. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. *International journal for quality in health care,* 19**,** 349-357.
TONGCO, M. D. C. 2007. Purposive sampling as a tool for informant selection. *Ethnobotany Research and applications,* 5**,** 147-158.
TRICCO, A. C., LILLIE, E., ZARIN, W., O'BRIEN, K. K., COLQUHOUN, H., LEVAC, D., MOHER, D., PETERS, M. D., HORSLEY, T. & WEEKS, L. 2018. PRISMA extension for scoping reviews (PRISMA-ScR): checklist and explanation. *Annals of internal medicine,* 169**,** 467-473.
TULCHINSKY, T. H. & VARAVIKOVA, E. A. 2014. *The new public health,* Academic Press.
TURNER, B. S. 2001. The history of the changing concepts of health and illness: Outline of a general model of illness categories. *Social studies in health and medicine***,** 9-22.
TURNER, D. 2013. *Simple qualitative data analysis software, Quirkos.* [Online]. Available: https://www.quirkos.com/ [Accessed 16 November 2023].
TURUNEN, H., SORMUNEN, M., JOURDAN, D., VON SEELEN, J. & BUIJS, G. 2017. Health promoting schools—a complex approach and a major means to health improvement. Oxford University Press.
UNITED NATIONS 1989. Convention on the Rights of the Child
UNITED NATIONS 2006. Convention on the Rights of Persons with Disabilities.
UNITED NATIONS CHILDREN'S FUND 2021. Seen, Counted, Included: Using data to shed light on the well-being of children with disabilities. *New York, NY: UNICEF.*
VAN NES, F., ABMA, T., JONSSON, H. & DEEG, D. 2010. Language differences in qualitative research: is meaning lost in translation? *European journal of ageing,* 7**,** 313-316.
VARSI, C., EKSTEDT, M., GAMMON, D. & RULAND, C. M. 2015. Using the consolidated framework for implementation research to identify barriers and facilitators for the implementation of an internet-based patient-provider communication service in five settings: a qualitative study. *Journal of medical Internet research,* 17**,** e5091.
VASILEIOU, K., BARNETT, J., THORPE, S. & YOUNG, T. 2018. Characterising and justifying sample size sufficiency in interview-based studies: systematic analysis of qualitative health research over a 15-year period. *BMC medical research methodology,* 18**,** 1-18.

VOS, T., LIM, S. S., ABBAFATI, C., ABBAS, K., ABBASI, M., ABBASIFARD, M., ABBASI-KANGEVARI, M., ABBASTABAR, H., ABD-ALLAH, F., ABDELALIM, A., ABDOLLAHI, M., ABDOLLAHPOUR, I., ABOLHASSANI, H., ABOYANS, V., ABRAMS, E. M., ABREU, L. G., ABRIGO, M. R. M., ABU-RADDAD, L. J., ABUSHOUK, A. I., ACEBEDO, A., ACKERMAN, I. N., ADABI, M., ADAMU, A. A., ADEBAYO, O., ADEKANMBI, V., ADELSON, J. D., ADETOKUNBOH, O. O., ADHAM, D., AFSHARI, M., AFSHIN, A., AGARDH, E., AGARWAL, G., AGESA, K. M., AGHAALI, M., AGHAMIR, S. M. K., AGRAWAL, A., AHMAD, T., AHMADI, A., AHMADI, M., AHMADIEH, H., AHMADPOUR, E., AKALU, T. Y., AKINYEMI, R., AKINYEMIJU, T., AKOMBI, B. J., AL-ALY, Z., ALAM, K., ALAM, N., ALAM, S., ALAM, T., ALANZI, T., ALBERTSON, S. B., ALCALDE-RABANAL, J. E., ALEMA, N. M., ALI, M., ALI, S., ALICANDRO, G., ALIJANZADEH, M., ALINIA, C., ALIPOUR, V., ALJUNID, S. M., ALLA, F., ALLEBECK, P., ALMASI-HASHIANI, A., ALONSO, J., AL-RADDADI, R., ALTIRKAWI, K. A., ALVIS-GUZMAN, N., ALVIS-ZAKZUK, N. J., AMINI, S., RARANI, M. A., AMINORROAYA, A., AMIRI, F. N., AMIT, A. M. L., AMUGSI, D. A., AMUL, G. G. H., ANDERLINI, D., ANDREI, C. L., ANDREI, T., ANJOMSHOA, M., ANSARI, F., ANSARI, I., ANSARI-MOGHADDAM, A., ANTONIO, C. A. T., ANTONY, C. M., ANTRIYANDARTI, E., ANVARI, D., ANWER, R., ARABLOO, J., ARAB-ZOZANI, M., ARAVKIN, A. Y., ARIANI, F., ÄRNLÖV, J., ARYAL, K. K., ARZANI, A., ASADI-ALIABADI, M., ASADI-POOYA, A. A., ASGHARI, B., ASHBAUGH, C., ATNAFU, D. D., et al. 2020a. Global Burden of 369 Diseases and Injuries in 204 Countries and Territories, 1990–2019: A Systematic Analysis for the Global Burden of Disease Study 2019. *The Lancet*.

VOS, T., LIM, S. S., ABBAFATI, C., ABBAS, K. M., ABBASI, M., ABBASIFARD, M., ABBASI-KANGEVARI, M., ABBASTABAR, H., ABD-ALLAH, F., ABDELALIM, A., ABDOLLAHI, M., ABDOLLAHPOUR, I., ABOLHASSANI, H., ABOYANS, V., ABRAMS, E. M., ABREU, L. G., ABRIGO, M. R. M., ABU-RADDAD, L. J., ABUSHOUK, A. I., ACEBEDO, A., ACKERMAN, I. N., ADABI, M., ADAMU, A. A., ADEBAYO, O. M., ADEKANMBI, V., ADELSON, J. D., ADETOKUNBOH, O. O., ADHAM, D., AFSHARI, M., AFSHIN, A., AGARDH, E. E., AGARWAL, G., AGESA, K. M., AGHAALI, M., AGHAMIR, S. M. K., AGRAWAL, A., AHMAD, T., AHMADI, A., AHMADI, M., AHMADIEH, H., AHMADPOUR, E., AKALU, T. Y., AKINYEMI, R. O., AKINYEMIJU, T., AKOMBI, B., AL-ALY, Z., ALAM, K., ALAM, N., ALAM, S., ALAM, T., ALANZI, T. M., ALBERTSON, S. B., ALCALDE-RABANAL, J. E., ALEMA, N. M., ALI, M., ALI, S., ALICANDRO, G., ALIJANZADEH, M., ALINIA, C., ALIPOUR, V., ALJUNID, S. M., ALLA, F., ALLEBECK, P., ALMASI-HASHIANI, A., ALONSO, J., AL-RADDADI, R. M., ALTIRKAWI, K. A., ALVIS-GUZMAN, N., ALVIS-ZAKZUK, N. J., AMINI, S., AMINI-RARANI, M., AMINORROAYA, A., AMIRI, F., AMIT, A. M. L., AMUGSI, D. A., AMUL, G. G. H., ANDERLINI, D., ANDREI, C. L., ANDREI, T., ANJOMSHOA, M., ANSARI, F., ANSARI, I., ANSARI-MOGHADDAM, A., ANTONIO, C. A. T., ANTONY, C. M., ANTRIYANDARTI, E., ANVARI, D., ANWER, R., ARABLOO, J., ARAB-ZOZANI, M., ARAVKIN, A. Y., ARIANI, F., ÄRNLÖV, J., ARYAL, K. K., ARZANI, A., ASADI-ALIABADI, M., ASADI-POOYA, A. A., ASGHARI, B., ASHBAUGH, C., ATNAFU, D. D., et al. 2020b. Global burden of

369 diseases and injuries in 204 countries and territories, 1990–2019: a systematic analysis for the Global Burden of Disease Study 2019. *The Lancet,* 396**,** 1204-1222.
WALDRON, C., MACGIOLLA PHADRAIG, C., COMISKEY, C. & NUNN, J. 2016. Oral health interventions for children and adolescents with disabilities; a scoping review. *J Disabil Oral Health,* 17**,** 144-149.
WANG, M.-C., MARSHMAN, Z., CHEN, W.-H. & SHIH, W.-Y. 2022. A qualitative study of barriers and facilitators to the implementation of a pilot school-based, toothbrushing programme. *BMC Oral Health,* 22**,** 1-10.
WARD, D. J., FURBER, C., TIERNEY, S. & SWALLOW, V. 2013. Using Framework Analysis in nursing research: a worked example. *J Adv Nurs,* 69**,** 2423-31.
WARNER, G., LAWSON, B., SAMPALLI, T., BURGE, F., GIBSON, R. & WOOD, S. 2018. Applying the consolidated framework for implementation research to identify barriers affecting implementation of an online frailty tool into primary health care: a qualitative study. *BMC Health Serv Res,* 18**,** 395.
WATT, R., FULLER, S., HARNETT, R., TREASURE, E. & STILLMAN-LOWE, C. 2001. Oral health promotion evaluation–time for development. *Community Dentistry and Oral Epidemiology: Commentary,* 29**,** 161-166.
WATT, R. G. 2005. Strategies and approaches in oral disease prevention and health promotion. *Bulletin of the World Health Organization,* 83**,** 711-718.
WATT, R. G. 2007. From victim blaming to upstream action: tackling the social determinants of oral health inequalities. *Community dentistry and oral epidemiology,* 35**,** 1-11.
WATT, R. G. 2012. Social determinants of oral health inequalities: implications for action. *Community Dent Oral Epidemiol,* 40 Suppl 2**,** 44-8.
WATT, R. G., HARNETT, R., DALY, B., FULLER, S. S., KAY, E., MORGAN, A., MUNDAY, P., NOWJACK-RAYMER, R. & TREASURE, E. T. 2006. Evaluating oral health promotion: need for quality outcome measures. *Community dentistry and oral epidemiology,* 34**,** 11-17.
WATT, R. G. & MARINHO, V. C. 2005. Does oral health promotion improve oral hygiene and gingival health? *Periodontology 2000,* 37**,** 35-47.
WATT, R. G. & SHEIHAM, A. 2012. Integrating the common risk factor approach into a social determinants framework. *Community Dent Oral Epidemiol,* 40**,** 289-96.
WHITEHEAD, M. & DAHLGREN, G. 2021. Concepts and principles for tackling social inequities in health.
WICKHAM, M. & WOODS, M. 2005. Reflecting on the strategic use of CAQDAS to manage and report on the qualitative research process.
WILLS, J. 2022. *Foundations for Health Promotion-E-Book: Foundations for Health Promotion-E-Book*, Elsevier Health Sciences.
WILSON, N. J., LIN, Z., VILLAROSA, A., LEWIS, P., PHILIP, P., SUMAR, B. & GEORGE, A. 2019. Countering the poor oral health of people with intellectual and developmental disability: a scoping literature review. *BMC Public Health,* 19.
WINKELMANN, J., LISTL, S., VAN GINNEKEN, E., VASSALLO, P. & BENZIAN, H. 2023. Universal health coverage cannot be universal without oral health. *The Lancet Public Health,* 8**,** e8-e10.
WORLD HEALTH ORGANIZATION 1948. Definition of health. *http://www. who. int/suggestions/faq/zh/index. html*.
WORLD HEALTH ORGANIZATION 1986. Ottawa charter for health promotion, 1986. World Health Organization. Regional Office for Europe.

WORLD HEALTH ORGANIZATION 1996. Regional guidelines: development of health-promoting schools-a framework for action.

WORLD HEALTH ORGANIZATION 2022. Action plan for oral health in South-East Asia 2022–2030: towards universal health coverage for oral health.

WRIGHT, W., TURNER, S., ANOPA, Y., MCINTOSH, E., WU, O., CONWAY, D. I., MACPHERSON, L. M. & MCMAHON, A. D. 2015. Comparison of the caries-protective effect of fluoride varnish with treatment as usual in nursery school attendees receiving preventive oral health support through the Childsmile oral health improvement programme—the Protecting Teeth@ 3 Study: a randomised controlled trial. *BMC Oral Health,* 15**,** 1-15.

YAMADA, J., SHORKEY, A., BARWICK, M., WIDGER, K. & STEVENS, B. J. 2015. The effectiveness of toolkits as knowledge translation strategies for integrating evidence into clinical care: a systematic review. *BMJ open,* 5**,** e006808.

YESUDIAN, G., HALL, M., OWENS, J., RODD, H., MARSHMAN, Z. & AL-SHEHRI, S. 2012. The oral health experiences of children with learning disabilities in special schools in Sheffield. *Journal of Disability and Oral Health,* 13**,** 45.

YOUNAS, A., FÀBREGUES, S., DURANTE, A. & ALI, P. 2022. Providing English and native language quotes in qualitative research: a call to action. *Nursing Open,* 9**,** 168-174.

ZHOU, N., WONG, H. M., WEN, Y. F. & MCGRATH, C. 2019. Efficacy of caries and gingivitis prevention strategies among children and adolescents with intellectual disabilities: a systematic review and meta-analysis. *J Intellect Disabil Res,* 63**,** 507-518.

Chapter 9. Appendices

Appendix 3.1: Levac et al., 2010 scoping review methodological framework.

Arksey andO'Malley FrameworkStage	Critique of Arksey and O'Malley Framework	Recommendations for clarificationor additional steps
#1 Identifyingthe research question	Scoping study questions are broad.	Clearly articulate the research question that will guide the scope of inquiry. Consider the concept, target population, and health outcomes of interest to clarify the focus of the scoping study and establish an effectivesearch strategy.
	Establishing scoping study purpose isnot associated with a framework stage.	Mutually consider the purpose of the scoping study with the research question. Envision the intended outcome (e.g., framework, list of recommendations) to help determinethe purpose of the study.
	The four purposes of scoping studies lackclarity	Consider the rationale for conductingthe scoping study to help clarify the purpose.
#2 Identifying relevant studies	1. Balancing the breadth and comprehensiveness of the scoping study with the feasibility of resources can be challenging.	1a. Research question and purposeshould guide decision-making around the scope of the study.
		1b. Assemble a suitable team withcontent and methodological expertise to ensure the study's successful completion.
		1c. When limiting scope is unavoidable, justify decisions and acknowledge the potential limitations of the study.

#3 Studyselection	The linearity ofthis stage is misleading. The process of decision-making forstudy selection is unclear.	1. This stage should be considered an iterative processinvolving searching the literature, refining the search strategy, and reviewing articles for study inclusion. 2a. At the beginning of the process, the team should meetto discuss decisions surrounding study inclusion and exclusion. At least two reviewers should independently review abstracts for inclusion. 2b. Reviewers should meet at the beginning, midpoint and final stages of the abstract reviewprocess to discuss challenges and uncertainties related to study selection andto go back and refine the search strategy if needed. 2c. Two researchers should independently review fullarticles for inclusion. 2d. When disagreements on study inclusion occur, a thirdreviewer can determine final inclusion.
#4 Chartingthe data	The nature andextent of data to extract from the includedstudies is unclear. The 'descriptive-analytical method' of charting data ispoorly defined.	1a. The research team should collectively develop the datacharting form and determine which variables to extract to answer the research question. 1b. Charting should be considered an iterative process in which researchers continually extract data and update thedata charting form. 1c. Two authors should independently extract data from the first five to ten included studies using the data-charting form and meet to determine whether their approach to data extraction is consistent with the research question and purpose. 2. Process-oriented data may require extra planning foranalysis. A qualitative content analysis approach is suggested.

#5 Collating, summarising, and reportingthe results	1. Little detail is provided, and multiple steps are summarised as one framework stage.	Researchers should break this stage into three distinctsteps: 1a. Analysis (including descriptive numerical summaryanalysis and qualitative thematic analysis) 1b. Reporting the results and producing the outcome thatrefers to the overall purpose or research question. 1c. Consider the meaning of the findings as they relate tothe overall study purpose; discuss implications for futureresearch, practice, and policy.
#6 Consultation	This stage is optional Lack of clarity exists about when,how and why	1. Consultation should be an essential component of study methodology. 2a. Clearly establish a purpose for the consultation.

Appendix 3.2: Study one search term according to population, concept, and context.

Population	Issue/Intervention	Context	Outcome
Child*	Oral Health	Settings-based	Oral Health
Young people	Caries reduction	School-based	Dental fitness
Adolescent*	Oral Health Promotion	Health promoting school*	Oral hygiene
Disabled child*	Oral Health Education	School* initiative	OHRQoL
learning difficulties	Fluorid*	Healthy Schools	Dental Health
learning disabilities	Fissure sealants		Dental Health-related Knowledge
Autism*	Oral health intervention		Dental Health Attitude
Cerebral palsy	toothbrushing		Dental Health Perception
Down Syndrome	Dental Health		Dental Health behaviour
Mental disability	Dental Health Education		Dental Health view
	Dental Health Promotion		
	Dental Status		

Appendix 3.3: Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) Checklist

SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
TITLE			
Title	1	Identify the report as a scoping review.	Click here to enter text.
ABSTRACT			
Structured summary	2	Provide a structured summary that includes (as applicable) the background, objectives, eligibility criteria, sources of evidence, charting methods, results, and conclusions related to the review questions and objectives.	Click here to enter text.
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known. Explain why the review questions/objectives lend themselves to a scoping review approach.	Click here to enter text.
Objectives	4	Provide an explicit statement of the questions and objectives being addressed with reference to their key elements (e.g., population or participants, concepts, and context) or other relevant key elements used to conceptualize the review questions and/or objectives.	Click here to enter text.
METHODS			
Protocol and registration	5	Indicate whether a review protocol exists; state if and where it can be accessed (e.g., a Web address); and if available, provide registration information, including the registration number.	Click here to enter text.
Eligibility criteria	6	Specify characteristics of the sources of evidence used as eligibility criteria (e.g., years considered, language, and publication status), and provide a rationale.	Click here to enter text.
Information sources*	7	Describe all information sources in the search (e.g., databases with dates of coverage and contact with authors to identify additional sources), as well as the date the most recent search was executed.	Click here to enter text.
Search	8	Present the full electronic search strategy for at least 1 database, including any limits used, such that it could be repeated.	Click here to enter text.

SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
Selection of sources of evidence†	9	State the process for selecting sources of evidence (i.e., screening and eligibility) included in the scoping review.	Click here to enter text.
Data charting process‡	10	Describe the methods of charting data from the included sources of evidence (e.g., calibrated forms or forms that have been tested by the team before their use, and whether data charting was done independently or in duplicate) and any processes for obtaining and confirming data from investigators.	Click here to enter text.
Data items	11	List and define all variables for which data were sought and any assumptions and simplifications made.	Click here to enter text.
Critical appraisal of individual sources of evidence§	12	If done, provide a rationale for conducting a critical appraisal of included sources of evidence; describe the methods used and how this information was used in any data synthesis (if appropriate).	Click here to enter text.
Synthesis of results	13	Describe the methods of handling and summarizing the data that were charted.	Click here to enter text.
RESULTS			
Selection of sources of evidence	14	Give numbers of sources of evidence screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally using a flow diagram.	Click here to enter text.
Characteristics of sources of evidence	15	For each source of evidence, present characteristics for which data were charted and provide the citations.	Click here to enter text.
Critical appraisal within sources of evidence	16	If done, present data on critical appraisal of included sources of evidence (see item 12).	Click here to enter text.
Results of individual sources of evidence	17	For each included source of evidence, present the relevant data that were charted that relate to the review questions and objectives.	Click here to enter text.
Synthesis of results	18	Summarize and/or present the charting results as they relate to the review questions and objectives.	Click here to enter text.
DISCUSSION			
Summary of evidence	19	Summarize the main results (including an overview of concepts, themes, and types of evidence available), link to the review questions and objectives, and consider the relevance to key groups.	Click here to enter text.
Limitations	20	Discuss the limitations of the scoping review process.	Click here to enter text.

SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
Conclusions	21	Provide a general interpretation of the results regarding the review questions and objectives, as well as potential implications and/or next steps.	Click here to enter text.
FUNDING			
Funding	22	Describe the sources of funding for the included sources of evidence and the scoping review. Also, describe the role of the scoping review funders.	Click here to enter text.

JBI = Joanna Briggs Institute; PRISMA-ScR = Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews.

From: Tricco AC, Lillie E, Zarin W, O'Brien KK, Colquhoun H, Levac D, et al. PRISMA Extension for Scoping Reviews (PRISMAScR): Checklist and Explanation. Ann Intern Med. 2018;169:467–473. doi: 10.7326/M18-0850.

Appendix 4.1: Consolidated framework for implementation research constructs definitions.

Consolidated Framework for Implementation Research Constructs		
CFIR Website		
Construct		Short Description
I. INTERVENTION CHARACTERISTICS		
A	Intervention Source	Perception of key stakeholders about whether the intervention is externally or internally developed.
B	Evidence Strength & Quality	Stakeholders' perceptions of the quality and validity of evidence supporting the belief that the intervention will have desired outcomes.
C	Relative Advantage	Stakeholders' perception of the advantage of implementing the intervention versus an alternative solution.
D	Adaptability	The degree to which an intervention can be adapted, tailored, refined, or reinvented to meet local needs.

E	Trialability	The ability to test the intervention on a small scale in the organization, and to be able to reverse course (undo implementation) if warranted.
F	Complexity	Perceived difficulty of implementation, reflected by duration, scope, radicalness, disruptiveness, centrality, and intricacy and number of steps required to implement.
G	Design Quality & Packaging	Perceived excellence in how the intervention is bundled, presented, and assembled.
H	Cost	Costs of the intervention and costs associated with implementing the intervention including investment, supply, and opportunity costs.
II. OUTER SETTING		
A	Patient Needs & Resources	The extent to which patient needs, as well as barriers and facilitators to meet those needs, are accurately known and prioritized by the organization.
B	Cosmopolitanism	The degree to which an organization is networked with other external organizations.
C	Peer Pressure	Mimetic or competitive pressure to implement an intervention; typically because most or other key peer or competing organizations have already implemented or are in a bid for a competitive edge.
D	External Policy & Incentives	A broad construct that includes external strategies to spread interventions, including policy and regulations (governmental or other central entity), external mandates, recommendations and guidelines, pay-for-performance, collaboratives, and public or benchmark reporting.
III. INNER SETTING		
A	Structural Characteristics	The social architecture, age, maturity, and size of an organization.
B	Networks & Communications	The nature and quality of webs of social networks and the nature and quality of formal and informal communications within an organization.
C	Culture	Norms, values, and basic assumptions of a given organization.
D	Implementation Climate	The absorptive capacity for change, shared receptivity of involved individuals to an intervention, and the extent to which use of that intervention will be rewarded, supported, and expected within their organization.
1	Tension for Change	The degree to which stakeholders perceive the current situation as intolerable or needing change.
2	Compatibility	The degree of tangible fit between meaning and values attached to the intervention by involved individuals, how those align with individuals' own norms, values, and perceived risks and needs, and how the intervention fits with existing workflows and systems.

3	Relative Priority	Individuals' shared perception of the importance of the implementation within the organization.
4	Organizational Incentives & Rewards	Extrinsic incentives such as goal-sharing awards, performance reviews, promotions, and raises in salary, and less tangible incentives such as increased stature or respect.
5	Goals and Feedback	The degree to which goals are clearly communicated, acted upon, and fed back to staff, and alignment of that feedback with goals.
6	Learning Climate	A climate in which: a) leaders express their own fallibility and need for team members' assistance and input; b) team members feel that they are essential, valued, and knowledgeable partners in the change process; c) individuals feel psychologically safe to try new methods; and d) there is sufficient time and space for reflective thinking and evaluation.
E	Readiness for Implementation	Tangible and immediate indicators of organizational commitment to its decision to implement an intervention.
1	Leadership Engagement	Commitment, involvement, and accountability of leaders and managers with the implementation.
2	Available Resources	The level of resources dedicated for implementation and on-going operations, including money, training, education, physical space, and time.
3	Access to Knowledge & Information	Ease of access to digestible information and knowledge about the intervention and how to incorporate it into work tasks.
IV. CHARACTERISTICS OF INDIVIDUALS		
A	Knowledge & Beliefs about the Intervention	Individuals' attitudes toward and value placed on the intervention as well as familiarity with facts, truths, and principles related to the intervention.
B	Self-efficacy	Individual belief in their own capabilities to execute courses of action to achieve implementation goals.
C	Individual Stage of Change	Characterization of the phase an individual is in, as he or she progresses toward skilled, enthusiastic, and sustained use of the intervention.
D	Individual Identification with Organization	A broad construct related to how individuals perceive the organization, and their relationship and degree of commitment with that organization.
E	Other Personal Attributes	A broad construct to include other personal traits such as tolerance of ambiguity, intellectual ability, motivation, values, competence, capacity, and learning style.
V. PROCESS		

A	Planning	The degree to which a scheme or method of behavior and tasks for implementing an intervention are developed in advance, and the quality of those schemes or methods.
B	Engaging	Attracting and involving appropriate individuals in the implementation and use of the intervention through a combined strategy of social marketing, education, role modelling, training, and other similar activities.
1	Opinion Leaders	Individuals in an organization who have formal or informal influence on the attitudes and beliefs of their colleagues with respect to implementing the intervention.
2	Formally Appointed Internal Implementation Leaders	Individuals from within the organization who have been formally appointed with responsibility for implementing an intervention as coordinator, project manager, team leader, or other similar role.
3	External Change Agents	Individuals who are affiliated with an outside entity who formally influence or facilitate intervention decisions in a desirable direction.
4	Executing	Carrying out or accomplishing the implementation according to plan.
C	Reflecting & Evaluating	Quantitative and qualitative feedback about the progress and quality of implementation accompanied with regular personal and team debriefing about progress and experience.

Appendix 4.3: King Saud University approval letter.

جامعة الملك سعود (034)
المملكة العربية السعودية
هاتف +966 467 74 28
ص.ب 60169 الرياض 11545
فاكس +966 467 85 48
www.ksu.edu.sa

جامعة الملك سعود
King Saud University

كلية طب الأسنان

السلام عليكم ورحمة الله وبركاته

تحيه طيبه و بعد

إلى من يهمه الأمر

نفيدكم أن المبتعثه أشواق صالح العتيبي - معيد - كليه طب الأسنان - جامعه الملك سعود.

مبتعثه إلى جامعه شفيلد- المملكة المتحدة للحصول على درجه الدكتوراه في طب أسنان المجتمع. تقوم بعمل بحث يهدف إلى انشاء أداه تثقيفيه للبرامج المدرسية لتعزيز صحه الفم و الأسنان في مدارس و مراكز الأطفال ذوي الاعاقة في المملكة العربية السعودية.

ترغب في توزيع رابط الكتروني للدعوة للمشاركة في البحث حيث أن الفئه المستهدفة هي موظفي المدارس و المعاهد الخاصة بذوي الاعاقة و أولياء أمور الطلاب و الطالبات الملتحقين بها. و أداه البحث هي مقابله عن بُعد عن طريق تطبيق زووم أو اجتماعات قوقل.

مرفق رابط الدعوة للبحث يحتوي على معلومات البحث و نموذج الاقرار بالمشاركة

https://forms.gle/3VBkthbJZ1jzHm6E7
نموذج أولياء الأمور

https://forms.gle/8j8o7iEYXRy3FPjW7
نموذج موظفي المدارس

شاكرين لكم كريم تعاونكم وحسن استجابتكم.

تقبلوا خالص الشكر والتقدير.

للتواصل

الباحثة : أشواق صالح العتيبي

جوال رقم : +966555473708

البريد الالكتروني: alotaibi-ashwag@hotmail.com

الرقم _____

التاريخ _____

المرفقات _____

Appendix 4.4: Informed consent for potential participants (Special schools staff members).

Title of the project: Special Schools' Staff in the Kingdom of Saudi Arabia perspectives concerning activities to improve the children's oral Health.

I, the undersigned, confirm that (please initial box as appropriate):

	Agree	Disagree
1. I have read and understood the information about the project, as provided in the Information Sheet		
2. I can consider the information, ask questions, and have had these answered satisfactorily.		
3. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason, without any effect.		
4. I agree to provide information to the researchers under the conditions of anonymity set out on the information		
5. I understand that my information will be anonymised and only the researcher will know who I am.		
6. I understand the anonymised data may be used for publication and no-one will know who I am		
7. I agree with the interview recording		
8. I agree to take part in the above project		

Name of Participant: ----------

Signature: ----------

Date: ----------

Appendix 4.5: Informed consent for potential participants (parents/carers version).

Title of the project: Parents' and caregivers' perspectives concerning activities in the Kingdom of Saudi Arabia special schools to improve children's oral health.

I, the undersigned, confirm that (please initial box as appropriate):

	Agree	Disagree
1. I have read and understood the information about the project, as provided in the Information Sheet		
2. I can consider the information, ask questions, and have had answered satisfactorily.		
3. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason, without any effect.		
4. I agree to provide information to the researchers under the conditions of anonymity set out on the information		
5. I understand that my information will be anonymised and only the researcher will know who I am.		
6. I understand the anonymised data may be used for publication and no-one will know who I am		
7. I agree with the interview recording		
8. I agree to take part in the above project		

Name of Participant: ----------

Signature: ----------

Date: ----------

Appendix 4.6: Information sheet to potential participants (special schools staff members version)

School's staff information sheet

KSA special school staff perspectives concerning school-based activities to improve the children's oral health.

Researchers want you to take part in a project. Before you make a choice, you should know why the project is being done and what it will involve. Please take the time to read the information below carefully, and if you want to, talk about it with other people. Ask us if you don't understand something or like more information. Take your time to decide if you want to join in.

What is the purpose of the study?

I want to find out how staff who work with children with disabilities feel about school-based activities to improve the children's oral health. I also want to learn more about what the staff think and how they feel about activities conducted at special schools that promote the children's oral health. The staff of special schools may be able to help find good practices and areas for improvement.

Do I have to take part?

You can decide for yourself whether to join. If you decide to do so, you will be asked for your permission to take part in the project. This information sheet is yours to keep. You can quit the project anytime, for any reason, without detriment to your employment.

What will happen to me if I take part?

If you decide to participate, the project will be explained and discussed further, and you will have the opportunity to ask questions before you consent to participate. The interview will happen either via phone and may take up to an hour.

What do I have to do?

Taking part in this project will not pose any restrictions to your lifestyle. The only change you will have to make will be to find a convenient time to be interviewed.

Will I be recorded, and how will the recorded media be used?

The interviews you take part in will be recorded. The interview recordings will be turned into written text, and this information will be analysed. The recordings will be deleted as soon as I write them down. After the data is analysed, it will be written up for publication, but no one will know who you are because the data will be anonymised.

What are the possible disadvantages and risks of taking part?

There are no known risks. However, if you feel uncomfortable discussing any specific topic during the interview, you are under no obligation to continue with it.

What are the possible benefits of taking part?

There are no direct or immediate benefits to you. Nevertheless, this project will help us understand the school staff's perspectives on activities in special schools that can improve children's oral health in Saudi Arabia.

Will everything I say be kept private?

All the information you give will be kept secret. Only the research team will retain and use all the information. The names of the participants and the people you mention will be changed so that you cannot be found. Any other information that could be used to find you will also be taken out. All the data will be kept on a computer

that has a password. In agreement with the people who took part, the recordings will be deleted as soon as the researcher is done with them.

What will happen to the results of the research study?

Upon completing the project, we will write to you, giving you a summary of our findings (and details of how you can obtain a full copy of the report). We will also produce publications based on the results of the study.

Who is organising and funding the research?

The project is part of Ashwag Saleh's PhD project at the School of Clinical Dentistry, University of Sheffield. Professor Zoe Marshman and Dr Fiona Gilchrist from the Academic Unit of Oral Health, Dentistry and Society within the School of Clinical Dentistry in Sheffield, UK, supervise the project. The Saudi government funds the project.

Who has reviewed the study?

The University of Sheffield Research Ethics Committee reviewed and approved the project's protocol. Permission has been granted by the Ministry of Education, Riyadh, Kingdom of Saudi Arabia.

Who can I contact for further information?

Further information about the study is available from Ashwag Saleh, School of Clinical Dentistry, University of Sheffield, Sheffield, S10 2TA. If there is anything that is not clear or that you would like more information about, please contact me (Ashwag Saleh) directly by email address (asalotaibi2@sheffield.ac.uk) or phone number (0555473708). Please note that asking further questions will not require you to participate in the study. Alternatively, you can contact Professor Zoe Marshman (z.marshman@sheffield.ac.uk). Academic Unit of Oral Health, Dentistry and Society, School of Clinical Dentistry, University of Sheffield, Sheffield, S10 2TA.

Thank you for taking the time to read this information sheet.

Best regards, Ashwag Saleh

Appendix 4.7: Information sheet to potential participants (parents/carers version)

Parents/Carers Information Sheet

Parents' and carers' perspectives concerning activities in KSA special schools to improve children's oral health.

Researchers want you to participate in a project. Before you decide, you should know why the project is being done and what it will entail. Please take the time to read the information below carefully, and if you want to, talk about it with other people. Ask us if you don't understand something or would like more information. Take your time to decide if you want to join in.

What is the purpose of the study?

I want to learn from Saudi Arabian parents whose children have disabilities what they think of what happens at school to improve their children's oral health.

Do I have to take part?

You can decide for yourself whether to join. If you decide to do so, you will be asked for your permission to take part in the project. You can still quit the project at any time without giving a reason. Your refusal to participate will not affect your child's care.

What will happen to me if I take part?

If you choose to take part, you will be told about the project and given a chance to ask questions. If you still want to participate, I will ask for your permission before I interview you. The interview will happen over the phone. They could take as long as an hour.

What do I have to do?

Taking part in this project will not pose any restrictions to your lifestyle. The only change you will have to make will be to find a convenient time to be interviewed.

Will I be recorded, and how will the recorded media be used?

The interview will be recorded. The interview recordings will be turned into written text, and this information will be analysed. The recordings will be deleted as soon as they are written down. After the data is analysed, it will be written up for publication, but no one will know who you are because the data will be anonymised.

What are the possible disadvantages and risks of taking part?

There are no known risks. However, if you feel uncomfortable discussing specific topics during the interview, you don't have to.

What are the possible benefits of taking part?

You might not get any immediate or direct benefits. Still, this project will help us understand how Saudi Arabian parents feel about school-based activities to improve the oral health of children with disabilities

Will everything I say be kept private?

All the information you provide will be kept secret. Only the research team will retain and use it. The names of the participants and the people you talk about will be changed so that you cannot be identified. Any information that could be used to find you will also be removed. All the data will be kept on a computer with a password. In agreement with the people who took part, the recordings will be deleted as soon as the researcher is done with them.

What will happen to the results of the research study?

Upon completion of the project, we will write you a summary of our findings (and details of how you can obtain a full copy of the report). We will also produce publications based on the results of the study.

Who is organising and funding the research?

The project is part of Ashwag Saleh's PhD project, which is based at the School of Clinical Dentistry, University of Sheffield. Professor Zoe Marshman and Dr Fiona Gilchrist from the Academic Unit of Oral Health, Dentistry and Society within the School of Clinical Dentistry in Sheffield, UK, supervise the project. The Saudi government is funding the project.

Who has reviewed the study?

The University of Sheffield Research Ethics Committee reviewed and approved the project's protocol. The Ministry of Education, Riyadh, Kingdom of Saudi Arabia, has granted permission.

Who can I contact for further information?

Further information about the study is available from Ashwag Saleh, School of Clinical Dentistry, University of Sheffield, Sheffield, S10 2TA. If there is anything that is not clear or that you would like more information about, please contact me (Ashwag Saleh) directly by email address (asalotaibi2@sheffield.ac.uk) or phone number (0555473708). Alternatively, you can contact Professor Zoe Marshman at (z.marshman@sheffield.ac.uk)

Thank you for taking the time to read this information sheet.

Best regards,

Ashwag Saleh

Appendix 4.8: Interview guide (special schools staff members version)

Interview guide: (School staff)

Introduce self

Hello, my name is Ashwag Saleh. I'm a PhD student at the University of Sheffield, UK, and a lecturer at the College of Dentistry at King Saud University. I'm doing a research project to find out what school staff think about activities at special schools to improve the oral health of children with disabilities.

Introduce the topic

During this project, the interviewer will use this topic guide. This will enable her to explore special school staff perspectives on activities at special schools to improve the oral health of children with disabilities in the Kingdom of Saudi Arabia.

Explain the purpose of the interview

Your interview will help us better understand the barriers and facilitators of school activities to improve oral health among the attending students. To gain various perspectives, we will interview multiple people at your school. Therefore, we would appreciate it if you could tell us more about your experience with these activities.

Describe the audio recording and how we will assure confidentiality and answer any questions

This study has ethical approval from the Ethics Committee at the University of Sheffield. Our interview will be recorded so we have a detailed record of what you say. Nobody except the research team will have access to your responses or be able to identify you. The recording will be deleted as soon as the transcript is verified and analysed by researcher. There is no information about you on the transcripts. We'll keep your transcript and records confidential.

Please let me know if you feel any of the questions are too sensitive, and I'll turn off the recorder. If you don't want to answer any questions, you can skip them.

Do you have any questions for me? [Answer any questions]

Are you ready to begin? I'm going to start voice recording now.

Introduction

I will now move on to the introduction part of the interview, where my questions will be open-ended. Don't hesitate to share anything you think might relate to any of these topics. Now, I would like to ask you a few questions to provide general information about you and your school.

General information about school staff members

Could you tell me what your job title is?

What is your major degree?

Which age group do you work with?

What type of disabilities do you usually see in children?

What does disability and oral health mean to you?

General information about the school

Type of the school

The school location

Attending student age range

Type of disabilities

Types oral health promotion activity running in the school, if any.

Main interview section

Now I would like to ask you if your school has school activities that aim to improve the attending student's oral health.

Does the school do oral health activities?

Such as:

Dental health education

Teeth brushing clubs

Diet counselling

Dental examination and referral

Topical fluoride application

Dentist visiting the school

Distribution of dental education material such as booklets, brochures

If no, did they do any oral health activities before? If so, when? Can you tell me what it was?

The interviewer will move to sections C and D if the school doesn't have an oral health activity. However, the interviewer will move to sections E and F if the school has an oral health activity.

Interview guide for schools without oral health activities

Since your school does not have oral health activities, I would like to hear your views and expectations about introducing oral health activities at the school to improve the students' dental health.

Characteristics of individuals

Knowledge & Beliefs about the Intervention

What do you know about the oral health activity and its implementation?

What do you know about topical fluoride applications, teeth brushing clubs, and dental health education?

In your opinion, should schools develop oral health activities?

Do you know how important oral health activities are for children with disabilities?

How will you feel about the plan to introduce oral health activities at your school?

Will you have any feelings of anticipation? Stress? Enthusiasm? Why?

How do you think the oral health activity will work in your school?

Self-efficacy

Do you feel confident that you can successfully implement the oral health activity?

What gives you that confidence level (or lack of confidence)?

Do you think the children can successfully participate in the oral health activity?

Inner setting domain

Structural characteristics

What impact will your school's infrastructure have on the oral health activity implementation?

How will the infrastructure help or hinder oral health activity implementation?

What are you going to do about the structural challenges?

What kind of infrastructure changes will be needed? Changes in the scope of practice? Policy changes? Curriculum changes? Timetable? Other?

What kind of approvals will be needed? Who will need to be involved?

Can you describe the process needed to make these changes?

Culture

Should any values or norms be considered when planning and developing oral health activities?

Can you tell me how much your school embraces new ideas? Is there an example you can give me?

Compatibility

What are your school's values, and how will the oral health activity fit in?

How will you integrate oral health activity into your current practices?

How will it interact or conflict with current practices?

Relative Priority

Could oral health activity take a back seat to other high-priority activities?

How important do you think oral health is among other priorities?

Organisational Incentives & Rewards

What incentives will help to ensure the oral health activity goes well?

What will motivate you to assist in the oral health activity?

Leadership Engagement

In your opinion, how can school leaders help make this activity successful? Can you provide specific examples?

What types of barriers might they create?

Available Resources

Do you expect sufficient resources to implement the oral health activity?

[If Yes] What resources are you counting on?

Would you like any other resources?

What resources will be easy to get?

What will not be available?

What will be your plan for getting the resources?

Who can help with locating resources?

What challenges do you expect to encounter?

What information and materials will your school need about the oral health activity? Or preferred?

Copies of materials?

Personal contact?

Internal information sharing, e.g., staff meetings?

Will training go to prepare you for the responsibilities you will have? Can you explain?

What kind of training will be suitable for you?

Intervention characteristics domain

Evidence strength and quality

Do you have information from your search about the effectiveness of implementing a school's oral health activity?

How can we convince the school of the activity's effectiveness?

Adaptability

Are there any ways we can customise the upcoming activity to fit your school?

Complexity

In your opinion, what difficulties might hinder the implementation and sustainability of the proposed oral health activity in your school?

What barriers might you face if you want to participate in the oral health activity implementation?

How can we overcome these difficulties in planning the upcoming oral health activity?

What costs will be incurred to implement the oral health activity? How to reduce it?

What are the alternatives to be considered?

Design and quality

What are you looking for in the design of the oral health activity?

What will be your expectation of the quality of the oral health activity's supporting materials? Why?

Outer setting domain

Peer pressure

In your opinion, will the oral health activity give your school an advantage over other schools in your area?

Implementation process domain

Opinion leaders

Who will be the key influencers for implementing oral health activities?

How much will they influence others' use of the activity?

How much will they affect implementation success?

Formally Appointed Internal Implementation Leaders

Who will lead the implementation of the oral health activity?

What attributes or qualities does this person have that make them an effective leader of this implementation?

Who else will be involved in implementing oral health activities?

Reflecting and evaluating

What information will you plan to collect when you implement the oral health activity?

Which measures will you track? How will you follow them?

Will you receive feedback on the implementation?

Conclusion

Generally speaking.

If you had the option, would you recommend introducing oral health activity at your school? Why or not?

Lastly, I'd like to know what changes you think will improve the oral health activities in KSA's special schools for children with disabilities.

Your answers will help us publish scientific papers on school-based activities to improve the oral health of children with disabilities in KSA. Hopefully, this will lead to more studies and policies.

It's been a pleasure speaking with you.

Thank you for your participation

E. Interview guide for schools conducting oral health activities

Characteristics of Individuals domain

Knowledge & Beliefs about the Intervention

What do you know about your school's oral health activity and its implementation?

What do you know about topical fluoride applications, teeth brushing clubs, and dental health education?

In your opinion, should schools implement oral health activities?

How important is school oral health activity for children's oral health, and what are the benefits?

What do you know about your school oral health activity?

In your school, do you believe the oral health activity is effective? Could you tell me why or why not?

Can you tell me how you feel about the applied oral health activity?

To the best of your knowledge, do you think children's perceptions of the activity were influenced by their age?

To the best of your knowledge, do you think children's perceptions of the activity were influenced by their gender?

To the best of your knowledge, do you think children's perceptions of the activity were influenced by the child's disability type?

Self-efficacy

How confident are you that you can successfully implement the oral health activity?

What gives you that level of confidence (or lack of confidence)?

In your opinion, is the school staff capable of implementing the activity with confidence?

Do you think the students can successfully participate in this oral health activity?

Inner Setting domain

Culture

What do you think about the school's culture (general beliefs, values, assumptions) and how they affected the oral health activity? Can you describe an example that highlights this?

Compatibility

Does the oral health activity align with the school's values and norms? Can you elaborate?

Can you tell me if you got any support or resources to help you implement this activity?

Relative Priority

Could you tell me which school activities you consider the most important?

How important is school-based oral health activity compared to other activities?

Could oral health activity take a back seat to other high-priority activities?

Do you think this oral health activity is needed? Why or why not?

How do others (school staff or children's parents) feel about the oral health activity?

What changes are needed to this oral health activity to fill the current gaps?

Leadership engagement

In your opinion, how can school leaders help make this activity successful? Can you provide specific examples?

types of barriers might they create?

Examples

Were there any technical issues? Did they get resolved? How do you report workload? Is it credible?

Available Resources

Could you describe the physical space configuration used for the activity? Available Resources…Complexity… Structural characteristics

Probes

Was the activity implemented in a specific space? What is it?

What is the day-to-day effort and time required to provide the intervention? Complexity

Probes

Was there extra work or time involved in getting everything implemented? E.g., IT support.

To sustain the intervention over the long run, what resources would be needed?

What kind of external support did you receive? During Implementation?

Probes

Talk about support in terms of mentoring, problem-solving, training

Specific examples.

Did you have adequate communication with the activity staff? Externally? Internally?

Can you tell me what kind of them are? support? Money?

Is there relief from other school duties?

Is there anything you didn't get that would have helped you implement the activity?

Was there any funding constraint when implementing the activity?

Probes

Inadequate staffing?

Inadequate time?

Competing priorities?

Inadequate training?

Leadership engagement

How involved are school leaders in the activity implementation?

Probes

Could you tell me what kind of support they gave you? Specific example.

What are their roles in the implementation of the activity?

Networks and communications

Do you have a team of disciplines or services helping implement the activity?

Probes

Teaching staff only? Health staff? Dentists? Dental hygienists? Dental assistants? Dental students? Others?

Explain how they are involved

How does the school and family communicate the oral health activity?

Intervention Characteristics domain

Intervention Source

Let me know how the oral health activity started at your school.

Probes

How was the oral health activity developed?

Who decided to organise the oral health activity?

Do you have any involvement with this activity? What's your role?

Are you voluntarily involved?

Complexity

On a scale of 0-10, where zero is very easy and ten is nearly impossible, how difficult was it to implement the activity? What's the reason?

Probes

What barriers did you face when implementing the activity?

What were the facilitators of the activity implementation?

Adaptability (“Soft periphery”)

Were you able to modify the activity to make it work in the way that worked best for your school? Could you tell me why or why not?

Probes

Is there any way to make the activity more flexible?

What can be done to make the activity better suited to your school?

Design and quality

What is your perception of the quality of the applied oral health activity?

Do you have any support materials, like a toolkit, booklet, or brochure to help you implement the oral health activity? What do you think about them?

Outer setting domain

Implementation process domain

Planning

Can you describe the planning you did to get the activity implemented?

Probes

Is there a way to track what needs to get done? What's the progress? What's the status?

Key stakeholders

What steps have been taken to encourage you to commit to your involvement in the activity?

What information was given to you?

How frequently and how the school communicate with you about the activity?

Conclusion

On a scale of 0-10, how successful do you think *the activity* is at your school? Why? Note: We are interested in the "perception" of success; the interviewee can define success in any way.

If you had the option, would you recommend continuing the activity at your school? Why or not?

Probes

Is there anything you can do to keep your school's activity going?

How would you justify keeping this activity going over the long-term?

Have you got any suggestions for other schools who haven't started promoting oral health yet?

If you could improve the activity, how would you do it? Why?

Lastly, I would like to know what changes you think will improve oral health promotion activities in KSA's for children with disabilities.

Your answers will help us publish scientific papers on school-based activities to improve oral health of children with disabilities in KSA. Hopefully, this will lead to more studies and policies.

It has been a pleasure speaking with you.

Thank you for your participation.

Appendix 4.9: Interview guide (parents/cares version)

Introduce self

Hello, my name is Ashwag Saleh. I'm a Ph.D. student at the University of Sheffield, UK, and a lecturer at the College of Dentistry at King Saud University. I'm conducting research to find out what parents think about activities at special schools that improve the oral health of children with disabilities.

Introduce the topic

During this project, the interviewer will use this topic guide. This will enable her to explore parents' perspectives on activities at special schools to improve the oral health of children with disabilities in the Kingdom of Saudi Arabia.

Explain the purpose of the interview

Your interview will help us better understand the barriers and facilitators of school activities to improve oral health among children with disabilities. To gain various perspectives, we will interview multiple people. Therefore, we would appreciate your telling us more about your experience with these activities.

Describe the audio recording and how we will assure confidentiality and answer any questions

This study has ethical approval from the Ethics Committee at the University of Sheffield. Our interview will be digitally recorded using a digital voice recorder, so we have a detailed record of what you say. The recording will be deleted as soon as the transcript is verified and analysed by the researcher. Nobody except the research team will have access to your responses or be able to identify you. There is no information about you on the transcripts. We'll keep your transcript and records confidential.

Please let me know if you feel any questions are too sensitive, and I'll turn off the recorder. If you don't want to answer any questions, you can skip them.

Do you have any questions for me? [Answer any questions]

Are you ready to begin? I'm going to start the voice recording now.

Introduction

I will turn to the introduction of this interview, where our questions will be open-ended. I want to hear your thoughts, so please do not hesitate to share whatever you believe might be related to any of the topics.

I would like to ask you a few questions to provide general information about you and your child.

General information about the child

Child's age

Type of disability

Type of school, location

Family structure, number of children:

Number of children in the family, family living arrangements; extended or nuclear

Managing child's oral health; support or barriers

About oral health

Where do you get your children's oral health information? Was it easy to obtain and understand?

Are you able to spot dental diseases in your child? (Breath smells bad, gums that are bleeding and puffy, plaque build-up, teeth cavities)?

Did your child have previous dental treatment? What it was? How was the experience?

Main interview section

Now, I would like to move to the main part of this interview by asking you about your child's school activities, which aim to improve the attending student's oral health.

Does the school do any kind of oral health activities?

Such as:

Dental health education

Teeth brushing clubs

Diet counselling

Dental examination and referral

Topical fluoride application

Dentist visiting the school

Distribution of dental education material such as booklets, brochures

If no, did they do any oral health activities before? If so, when? Can you tell me more about it?

The interviewer will move to sections C and D if the school doesn't have an oral health activity. However, the interviewer will move to sections E and F if the school has an oral health activity.

Topic guide for schools without oral health promotion activities

Since your child's school does not have oral health activities, I would like to hear your views and expectations about introducing oral health activities at the school where your child attends to improve the students' dental health.

Characteristics of individuals domain

Knowledge & Beliefs about the Intervention

What do you know about oral health activities and their implementation?

What do you know about topical fluoride applications, teeth brushing clubs, and dental health education?

In your opinion, should schools develop oral health activities?

Do you know how important oral health activities are for children with disabilities?

How will you feel about the plan to introduce oral health activities at your child's school?

Will you have any feelings of anticipation? Stress? Enthusiasm? Why?

How will the oral health activity work in your child's school?

Do you think this oral health activity is needed? Why or why not?

How do others (school staff or children's parents) feel about the oral health activity?

What changes are needed to this oral health activity to fill the current gaps?

Self-efficacy

Can your child successfully participate in the oral health activity?

Do you feel confident you can successfully follow the oral health activity at home?

What gives you that confidence level (or lack of confidence)?

In your opinion, will the school staff be capable of implementing the activity with confidence?

Inner setting domain

Culture

In your view, are there any values or norms to be considered when planning and developing oral health activities?

Can you tell me how much your child's school embraces new ideas? Is there an example you can give me?

Relative Priority

Could oral health activity take a back seat to other high-priority activities?

How important do you think oral health is among other priorities?

In your opinion, what is your child's need for oral health activity?

Is oral health a priority at the school?

Leadership Engagement

In your opinion, how can school leaders help make this activity successful? Can you provide specific examples?

What types of barriers might they create?

Intervention characteristics domain

1- Adaptability

Are there any ways we can customise the upcoming activity to fit your child's needs?

2- Complexity

In your opinion, what difficulties might hinder the implementation and sustainability of the oral health activity in your child's school?

What barriers will your child face if he or she wants to participate in the oral health activity?

How can we overcome these difficulties in planning the upcoming oral health activity?

3- Design and quality

What are you looking for in the design of the oral health activity?

What will be your expectation of the quality of the oral health activity's supporting materials? Why?

Conclusion

Generally speaking.

If you had the option, would you recommend introducing oral health activity at your child's school? Why or not?

2- Lastly, I would like to know what changes you think will improve the oral health activities in KSA's special schools for children with disabilities.

Your answers will help us publish scientific papers on school-based activities to improve the oral health of children with disabilities in KSA. Hopefully, this will lead to more studies and policies.

It's been a pleasure speaking with you.

Thank you for your participation.

Topic guide for schools conducting oral health promotion activity guided by CFIR

Characteristics of Individual domain

Knowledge & Beliefs about the intervention

What do you know about your child's school's oral health activity and its implementation?

What do you know about topical fluoride applications, teeth brushing clubs, and dental health education?

In your opinion, should schools implement oral health activities?

How important is school oral health activity for children's oral health, and what are the benefits?

do you believe their oral health activity is effective in your child's school? Could you tell me why or why not?

How do you feel about the applied oral health activity?

Self-efficacy

Do you think your child can successfully participate in this oral health activity?

Is this an oral health activity you can confidently follow at home?

What makes you feel confident (or not confident)?

In your opinion, is the school staff capable of implementing the activity with confidence?

Inner setting domain

Culture

What do you think about the school's culture (general beliefs, values, assumptions) and how they affected the oral health activity? Can you describe an example that highlights this?

Compatibility

Does the oral health activity align with your values and norms? Can you elaborate?

Relative Priority

Could you tell me which school activities you and your child consider the most important?

How important is school-based oral health activity compared to other activities?

Could oral health activity take a back seat to other high-priority activities?

Leadership Engagement

`1- In your opinion, did school leaders help make this activity successful? Can you provide specific examples?

What types of barriers did they create?

Networks & Communications

How do the school and family communicate the oral health activity?

Intervention Characteristics domain

Adaptability

Would you say the applied oral health activity is a good fit for your child?

How is the oral health activity adapted for special school students?

Complexity

On a scale of 0-10, where zero is very easy and ten is nearly impossible, how difficult was it for your child to participate in the oral health activity? What's the reason?

Did your child face any barriers to participating in the oral health activity?

On a scale of 0-10, where zero is very easy and ten is nearly impossible, how difficult was it for you to follow the oral health activity at home? What's the reason?

In your opinion, what are the difficulties that hinder the implementation and sustainability of the applied oral health activity in your child's school?

Design and quality

What is your perception of the quality of the applied oral health activity?

Do you have any support materials, like a toolkit, booklet, or brochure, to help you apply the oral health activity at home? What do you think about them?

Outer setting domain

External policy and incentives

Is there any external policy regulating the special schools' oral health activities?

Implementation process domain

Planning

Have you and your child been involved in planning this activity?

Can you describe how you participated in the planning of the activity?

Key Stakeholders

What steps have been taken to encourage you and your child to commit to using the activity at home?

What information was given to you?

How do you see your child's ability to participate in oral health activities?

How does your child feel about participating in oral health activities?

Conclusion

Generally speaking.

On a scale of 0-10, how successful do you think the activity is at your child's school? Why? Note: We are interested in the "perception" of success; the interviewee can define success in any way.

If you had the option, would you recommend continuing the activity at your child's school? Why or not?

Are you satisfied with the applied oral health activity?

If not, what are you not satisfied with?

Lastly, I'd like to know what changes you think will improve the oral health activities in KSA's special schools for children with disabilities.

Your answers will help us publish scientific papers on school-based activities to improve the oral health of children with disabilities in KSA. Hopefully, this will lead to more studies and policies.

It's been a pleasure speaking with you.

Thank you for your participation.

Appendix 4.10: An example of the interview's transcript.

Staff number 2 interview transcript, 20-11-2022, 03:00 P.m., 48 minutes

Me: Alsalam alikum, how are you doing?

P: I'm doing well, Alhamdulillah; how are you?

Me: Alhamdulillah, thank you.

Me: First, I would like to welcome you to this interview and thank you for participating in this project.

P: Thank you.

Me: As I said at the beginning, and you have seen and agreed on the onset form with the invitation link, I am Ashwag. I am a PhD student at the University of Sheffield, UK. My research project aims at improving oral health promotion activities in KSA special schools for children with disabilities. This interview will be voice-recorded. This may stress you a little bit. However, I assure you that no one can access what you say except me. And this recording will be deleted as soon as I finish writing them down.

P: it is OK.

Me: Do you have any questions?

P: No.

Me: Are you ready to start? I will start recording now.

P: Yes.

Me: Now, I would like to ask you a few questions to provide general information about you and your school.

ME: What is your job title?

P: School Agent, I'm also supervising the Autism Disorder Program.

Me: What is your major?

P: Master's degree in special education, Autism track.

Me: Which age group do you work with?

P: Children aged 3 to 6 years

Me: What type of disability do you deal with?

P: Autism.

Me: If I asked you, what do disability and oral health mean to you?

P: If the child doesn't take care of his or her dental health in all areas of cleaning, care, and food type, this will lead to many diseases in the body. A child's disability may also hinder his parents' attention to his teeth and make it more difficult to manage.

Me: What is your school type?

P: Private sector

Me: The school location

P: Jeddah / rehab district /Dallah street.

Me: Attending student age range

P: 3 to 7 years old.

Me: Types of disabilities

P: Autism and behavioural disorders.

Me: Are there any oral health promotion activities run in the school?

P: We take a health and safety unit every year; during this unit, we conduct dental hygiene activities, having a volunteer dentist who is a mum of a child at our school. We plan and collaborate to do this activity. This activity discusses how to care for dental health and how dessert can harm the teeth. I have worked at the school for eight years and perform this activity annually.

Me: Great, OK, I will mention some types of the activity please tell me if they are conducted at your school.

Me: Dental health education, such as lectures or presentations or in the curriculum

P: It is in the plan for every child; there is a specialised plan to raise the child's awareness of dental health in proportion to the child's situation. Children are even encouraged to clean their teeth as part of their goals.

Me: Teeth brushing club at school

P: We've been before Corona, and today's goal is to promote the idea that the child should clean his/her teeth after eating their school dinner.

Me: Dietary advice

P: During the health and safety unit nutritionist spoke about the daily lunch box.

Me: Dental examination and referral

P: No, until now

Me: Topical fluoride application

P: No

Distribution of dental education materials such as booklets and brochures

Yes, the dentist gave them toothbrushes and toothpaste, and brochures for their families

Me: OK, as you have said, there is oral health activity at your school. So, I'd like to hear more about this oral health activity and your opinion and knowledge about it.

Me: What do you know about your school's oral health activity?

P: Every year, during the health and safety unit, there is a mother-speaking session, where the teacher and the mothers are invited. She talks about the importance of teeth and how to care for them very simply, as we aim to learn through play.

Me: I want to ask you what you know about topical fluoride applications.

P: (.) Honestly, I don't have information about topical fluoride, but I've heard about it

Also, there is no awareness about it.

Me: Me: OK. What do you know about teeth-brushing clubs at schools?

P: Brushing after the school meal with help and assistance.

Me: What is dental health education?

P: Presentations or talks about dental health.

Me: In your opinion, should schools develop oral health activities?

P: It is essential. It is possible to have a 40 per cent benefit, but by using tangible measures; we can improve the benefit of children with disabilities.

Me: Excuse me. Can you elaborate more?

P: As they are young and have learning difficulties, I expect a partial comprehension of the information. Having simple instructions in routine practice will benefit them more than just one activity annually.

Me: Do you know how important oral health activities are for children with disabilities?

P: Of course, they are because it shows the child the importance of this part of his body and how to keep it. As there are limited activities for them regarding their dental health.

Me: Do you believe oral health activity is effective in your school?

P: Of course, we only do something at school once we know how it's working and the school's convinced it's working. At least, it raises awareness, as I said.

Me: Can you tell me how you feel about the applied oral health activity?

P: We are excited about all the school's activities because we know the outcomes will be positive. When he is working on activities, the child works independently and applies the information practically. We were satisfied with the results and with the satisfaction and desire of the teacher and parents.

Me: To the best of your knowledge, do you think children's perceptions of the activity were influenced by their age?

P: Yeah, sure. A three-year-old child is completely different from five and six years possible, taking little information and less benefit.

Me: Do you think children's perceptions of the activity were influenced by their gender?

P: I don't think there's a difference between girls and boys.

Me: Do you think the child's disability type influences children's perceptions of the activity?

P: Yes, it is affected by the disability degree, as some students have simple disabilities, and others are severely disabled.

Me: How confident are you that you can successfully implement the oral health activity?

P: Obviously, we can execute, but I think if there is a dentist involved, it will be more effective. Although I can gather and provide information, a specialist can answer any questions students might ask, rather than me saying what I think we should look for later.

Me: Do you think students can successfully participate in this oral health activity?

P: Yes inshallah, but we have disparities between children and their abilities. Some children don't differ from normal healthy children, which makes us feel impressed.

Me: If I ask you, do you see a need for this type of activity? Why or why not?

P: Absolutely, we need it so that parents and children know how to maintain healthy teeth and prevent dental diseases that could affect all organs, including the heart.

Me: OK. How did this activity meet the needs of the students? Was it able to meet that need?

P: I agree, but autistic children can surprise you after a while that they can apply the knowledge themselves or even share it with their parents and brothers. However, if it were scheduled regularly as a reminder, it would be more beneficial.

Me: How do you think the school's culture affects activities?

P: The school is a leader in applying values, whether religious, social or health values, and everyone wants to apply these values. As part of the school's health values, this activity is supported. These values surely affect the practices of workers and students. The school culture is respected and followed by everyone.

Me: How do others (school staff or children's parents) feel about the oral health activity? Have you heard anything?

P: We take parents' reactions after the activity, and conduct staff and parents surveys twice a year to determine the beneficiary's satisfaction.

Me: Okay, do you have any information about their satisfaction?

P: Yes, of course. We are receiving positive feedback, and everyone is happy with the current situation. Children are becoming more aware of dental health and healthy practices, and their parents are thanking us for what we're doing.

Me: What changes are needed to this oral health activity to fill the current gaps?

P: It can be connected to health in general, not as an independent topic, with its effect on the blood, heart, and stomach. Furthermore, I would like it to be expanded more, such as through a partnership with King Abdulaziz University Dental School. I am now inspired by you.

Me: Does the oral health activity align with the school's values and norms?

P: Yeah, of course, it is compatible with the goal of the school's vision and values. It is one of the child's rights and interests. Health is an important value to us.

Me: Could you tell me which school activities you consider the most significant?

P: Priority based on the study units coming from the Ministry of Education at the beginning of the academic year.

Me: In your opinion, how can school leaders help make this activity successful?

P: UM(..) I'm a school leader trying to find ways to apply the activity. We have a school committee of 13 mothers volunteering. I meet with them, take their ideas, motivate them, and support them. Our interest lies in the outcomes. I don't know if I answered properly.

Me: What types of barriers might they create?

P: Maybe it's not the school leader. It might be the school owners. It can be the financial side only, although there is a budget for each department and activity. However, sometimes ambitions exceed the budget, and teachers and mothers may contribute financially. In general, the financial aspect makes us rethink our activities twenty times.

Me: Could you describe the physical space used for the activity?

P: We have a large indoor hall where all school activities are held.

Me: What is the effort and time required to provide the activity?

P: Previous activities took about two to three weeks to plan and prepare, followed by a week of explanations by the teacher during the health and safety unit. By the end of the week, the dentist and the teachers will present a full day of activities and games.

Me: What resources would be needed to sustain the activity over the long run?

P: Generally, we need financial support and human resources because I cannot release teachers from curriculum work to deliver other activities. Volunteers are critical to activities as well as financial support.

Me: What kind of external support did you get when you implemented the activity?

P: Provision of tools, materials and educational means from the teacher and the visiting mother (dentist), but there is no external support.

Me: How involved are school leaders in the activity implementation? Could you tell me what kind of support they gave you?

P: Leaders such as the department head are part of the activity. They provide motivation, encouragement and certificates for participating mothers and teachers. A sense of motivation, admiration for the activity, and a desire to repeat it.

Me: How did the children and parents feel about the activity?

P: The children were excited to be able to enter the corners and brush the teeth on the jaw model. The second corner involved making a healthy lunch box that would give them a sense of achievement.

Me: How did the parents feel about the activity?

P: Also, the parents were happy to participate and provide this activity for their children and were excited.

Me: In your opinion, did the children become more motivated to improve their diet or eating habits?

P: Yeah, sure, but not too much. I can't tell you about the results because children with disabilities need repetition and continuous motivation. Additionally, family dietary habits can affect them, which is why we include them in the activity day. If 40% of the students manage to stay away from Nutella, sweets, and soft drinks, I consider it a success.

Me: How did the activity affect the children's brushing habits?

P: According to their parents, children are encouraged by a simple percentage. Still, it's better to remind them about dental hygiene during school days rather than only having an annual event.

Me: Did they become more motivated to visit the dentist?

P: Really? I don't know.

Me: In what ways did the school struggle to achieve its goals?

P: The difficulty we have encountered is the labour force. I don't have a special committee of four to five people for activities.

Me: Do you have any support or resources to help you implement this activity?

P: No, we don't have.

Me: Is there relief from other school duties for the participating teacher?

P: Sure, I gave the class an alternative to the teacher.

Me: Let me know how your school's oral health activity started. In other words, how did the oral health activity come about?

P: The administration decides to act based on the study units established by the Ministry and then discusses it with the school committee (composed of 13 volunteering mothers).

Me: Is there any information you saw that showed the oral health activity would work?

P: Yes, studies have proven the importance of school activities for children with disabilities, and I have outputs from our activities that illustrate that.

Me: Okay, how could you convince the school staff of the effectiveness of the activity?

P: Motivation. Education for them first. Give them certificates and thank them. We have created a thank you video for them.

Me: On a scale of 0-10, where zero is very easy, and ten is nearly impossible, how difficult was it to implement the activity? And why?

P: I could say four because the only difficulty is human resources.

Me: What barriers did you face when implementing the activity?

P: There are no human resources.

Me: What were the facilitators of the activity?

P: Our belief in the importance of this activity and that it must be implemented, support from the principal of the school, the cooperation of the providing mother (Dentist), and the provision of some scientific tools at the school.

Me: Were you able to modify the activity to make it work in the way that worked best for your school? Could you tell me why or why not?

P: We plan it and tailor it to fit them from the beginning. We activated the five senses. But in talking with you, I discovered many things I will do in the next activity, and I'll let you know about them.

Me: What can be done to make the activity better suited to your school?

P: It would be possible if there was a collaboration with health centres and universities.

Me: What is your perception of the quality of this oral health activity?

P: This activity was excellent, even better than excellent, because the mother (Dentist) put a lot of effort into it. Brochures, toothbrushes, and toothpaste were distributed. Teachers also taught each student individually.

Me: Do you have any support materials, like a toolkit or booklet to help you implement the oral health activity?

P: No. We don't.

Me: Do you have a team of disciplines or services helping implement the activity?

P: No, only the maintenance and technical support officer, and the health guide (nurse) whose role is to provide guidance and suggestions.

Me: How does the school and family communicate about the activity?

P: At the start of the unit, we send the unit announcement to the families and remind them of the learning objectives and activities. Furthermore, we send them family-related tasks.

Me: What steps have been taken to encourage you to commit to your involvement in the activity?

P: Motivation, thanks and appreciation in general.

Me: On a scale of 0-10, how successful do you think the activity is at your school? Why?

P: As a program that worked, I consider it very successful, and I know this success from the feedback questionnaires, which were very encouraging. As a program, it ended up being very successful, even though we had difficulties locating human resources and spent our own funds. I can say nine out of ten.

Me: Would you recommend continuing the activity at your school if you had the option? Why?

P: Sure, I will. Because it's a goal of the school to promote child health, and one of our most significant values is 'my health is my right'. We need to raise awareness of dental health and spread the culture of caring for it.

Me: Is there anything you can do to keep your school's activity going?

P: First of all, we need to convince the educational community of the importance of activity, and that the child learns through sensory and motor activities. The belief we have can be spread to them.Me: If you could improve the activity, how would you do it? Why?

P: Contact the college of dentistry at King Abdullaziz University for collaboration.

In order to activate and involve the community, I will contact the district.

I think this activity will be beneficial at the neighbourhood level

I do an exhibition and presentations on oral and dental health topics to the whole neighbourhood, rather than only the child and mother in school

Me: Such great ideas.

Me: Lastly, I would like to know what changes you think will improve oral health promotion activities in KSA’s for children with disabilities.

P: Work collectively. Being a part of the children's educational plans. Instead of focusing on the curriculum, we need to teach students life skills as well. From the beginning of the school year, be part of the plan.

Me: Your answers will help us publish scientific papers on school-based activities to improve the oral health of children with disabilities in KSA. Hopefully, this will lead to more studies and policies.It has been a pleasure speaking with you. Thank you for your participation.

Appendix 4.11: An example of the first stage of theme identification.

Staff number 3 Interview transcript, 30-12-2023, 04:00 P.m., 55 minutes

Participant response	Code	Related CFIR construct	
Me: First, would you like to tell me your job title? **P: Special education teacher** Me: The degree you hold? **P: Bachelor of Special Education** Me: What age group of students do you teach? **P: 15-18 years old.** Me: Type of disabilities among the students? **P: Mild intellectual disability, and there are some cases with accompanying disabilities such as hearing impairment (weakness) or physical disability**	Staff information Job Major Age of the students Type of disabilities		
Me: Tell me about your school. **P: The 16th Intermediate School in Eastern Province, Al Khaldiah neighbourhood. Governmental school for girls. Students' age range is 13-18 years old.**	School information Type of school The school location Attending student age range Disabilities type		
Me: Are there activities to promote oral and dental health? **P: Oh, I wish. Especially since I see many cases of front teeth decay and lack of hygiene, most families are of low income.**	Are there any activities that promote oral health at school?		
Me: What do you personally know about the dental health activities that can be held in the school? P: It is possible to distribute brushes and toothpaste, do lectures, get dentists to check up on teeth and direct parents to health centres for dental treatment their children need. (M:10) Me: What do you know about topical fluoride application? P: I heard about it as a gel placed on the teeth. This is just my information.	Staff knowledge and beliefs of school based OHPAs Staff knowledge of topical fluoride applications	Characteristics of individuals Knowledge & Beliefs about the Intervention	

Me: In your opinion, should schools develop dental health activities? P: I hope so, considering the causes that lead to poor dental health and caries, for example, healthy eating habits. I wish the school try to put in place policies to prevent sweets and soft drinks inside the school because the school canteen currently serves Nutella with crepe and other candies, and I cannot imagine the girls will not brush after these sweets. (M:16) Me: How important are dental health activities for children with disabilities? P: It is essential for them. As I told you, I see cases where even the front teeth have fractures and are levelled to the point where I think about how a girl can eat. Also, children with disabilities have a low self-level because they feel that they are less than others. If the teeth are also not clean or aligned, the low self-level increases. And, because normal children know their interests, or at least they understand right and wrong. As for children with disabilities, we must be with them step by step. They also have short-term memory, which needs reinforcement and constant and continuous reminders. Also, children with intellectual disabilities are more exposed to poor dental health because most of them depend on others to take care of them. Honestly, in all aspects, they face more problems than normal students. Me: It is true that they face barriers and need help to overcome them.	Staff knowledge regarding the need to develop OHPAs at school. Staff beliefs in the importance of school based OHPAs for children with disabilities Cases of anterior teeth caries and fractures Effect on self esteem Dependence on parents or carers		
(M:19) Me: If we want to implement dental health activities in schools for children with disabilities, and it requires the participation of the school staff in implementing the activity, for example, they teach students the correct way to clean their teeth. Do you feel confident in implementing it successfully? P: Yes, and I hope so. We may need information or help from dentists, but awareness and educational messages can be provided through us. We also	Self confidence in the implementation of OHPAs by staff Effect of mother's level of education Effect of socioeconomic status Need for parents cooperation.	Self-efficacy	

need parents' cooperation. In most cases, we have a mother divorced, or the father imprisoned, or the standard of living is very low, and most mothers are uneducated and do not care about teeth these all will affect them. If there is no cooperation from the parents, we will be unable to achieve anything because the students are not fully aware. Me: Ok, for the students, do you think they can participate in the activity successfully? P: Ummm, mostly yes, but as I told you before, they have less ability to learn and perceive than normal children, and they also suffer from short memory. What you learn and apply at school can be forgotten at home. It is difficult for them to generalise the behaviour. Me: Ok, since you specialise in dealing with them, I would like to know how we can help them acquire knowledge and apply behaviours. P: Continuous reminders. I print her a schedule for brushing her teeth, for instance, and hang it in her book. When the student brushes her teeth every day, I put a star sticker up, and at the end of the week, I give gifts to the students who brush their teeth because they love gifts so much. Me: Wonderful.	A staff's opinion on whether the children can participate successfully in OHPAs. Less ability to perceive. Short memory Difficulty to generalise behaviours. A staff belief on how to help the students to apply the knowledge. Continuous reminders. I print her a schedule for brushing her teeth, for instance, and hang it in her book.		
Me: Is oral health a priority in school? P: Unfortunately, the proof is that there is no activity and that harmful foods are prepared in the school canteen. Me: How will you and your colleagues respond to participating in the activity? P: The teachers are proactive, and they present ideas to the administration and arrange some activities in the classrooms, for example, an activity on personal hygiene, and we distributed personal hygiene kits to the students with our own money. I think we will find cooperation from them.	Priority of OHPAs within the school Staff expectation of her colleague's response to the activity	Inner Setting Patient needs and resources. And relative priority	

Me: Ok, what are the obstacles that might hinder your participation? **P: Controlling the students and their behaviours; for example, here, after the third lesson, the students become hyperactive and distracted, and some students exhibit refusal and stubborn behaviours. We may need the administrators to help us control the students. The activity's success may also be hindered by the parent's lack of cooperation. Such programs need the cooperation of all aspects of the school, administration, teachers, parents, and students. There are also financial obstacles, but I think we can implement the activity at a low cost. The budget for the school is 2000 riyals, so it isn't easy to find the budget for other activities, and we, the teachers, often do activities from our own accounts.**	Barriers to staff participation in the OHPAs Students' behaviours Parents' cooperation Financial constrains	Patient needs and resources.	
(M:38) Me: Do you have information about the effectiveness of oral and dental health activities in schools? P: Frankly, as scientific information, no, but I see its importance and I believe that if it was applied correctly and with everyone's cooperation, it will be effective in educating parents and children, improving dental health and not being afraid of visiting the dentist, and it will lead to improving students' pronunciation and self-confidence because The shape and cleanliness of the teeth play a significant role in confidence. One of my students suffers from Selective Mutism only because the students once laughed at the shape of her teeth since most of them are missing.	Staff knowledge of the effectiveness of implementing a school's OHPAs	Intervention characteristics Evidence strength and quality	

(M:40) M: Are there ways we can customise to fit this category better? P: This group cannot receive a lot of information. Lectures, lessons, and PowerPoint presentations aren't beneficial for them. These methods do not work for them. Pictures and videos and tactile sensory things are helpful for them, like brushing teeth on the jaw model. I apply and let the students apply it.	Staff view on methods to adapt the OHPAs to students' special needs. Pictures Short video Tactile and sensory methods e.g., models	Adaptability	
Me: Okay, what do you look for in an activity's quality? P: Targeting parents is the most critical point, even if we do educational lectures for mothers. For the children, we present information in a very simplified way in pictures and short videos, using educational aids such as jaw models.	Staff expectation of the OHPA quality and design Targeting the parents	Design quality and packaging	
Me: In your opinion, will the activity give your school an advantage over other schools in the area? P: Yes, of course, especially since it will boost the school's reputation as parents can talk about health activities occurring at the school.	Staff opinion regarding whether the OHPA will give the school an advantage over others	Outer setting Peer pressure	
Me: Who will lead the activity? P: Often the school's activity leader. Me: What qualities should this person have? P: She is active, presents new ideas, asks students and parents about their needs in activities, is loved by students, and influences them. Me: Who will participate in the implementation of the activity? P: The teacher who is the class leader, and we can involve a dentist.	Staff perspective on Potential leaders and their attributes Persons to be involved in the OHPAs implementation	D- Process Formally Appointed Internal Implementation Leaders	
Me: What information do you plan to collect during the activity? P: Unless I am measuring knowledge, there doesn't seem to be any specific information showing me the effectiveness of the activity. However, I care about results, whether the student improved her dental health.	Data needed to be collected during the activity for evaluation	Reflecting and evaluating	
Me: Finally, if you had the choice, would you recommend introducing dental health activities at your school? Why? P: Yes, because it limits a phenomenon that is widely spread among us in Saudi Arabia which is dental caries and because	Staff recommendation regarding the introduction of OHPAs in schools		

it raises the level of self-confidence among students.			
Me: Lastly, I would like to know what changes you think will improve oral health promotion activities in KSA's for children with disabilities. P: Cooperation with all parties, a healthy food policy in the school, dental cleaning after the meal, and ideally a clinic set up in each school for emergencies and toothaches and the necessary referral work. This will be an opportunity for unemployed dentists.	Changes needed to improve OHPAs in KSA's special schools for children with disabilities		
Me: Your answers will help us publish scientific papers on school-based activities to improve the oral health of children with disabilities in KSA. Hopefully, this will lead to more studies and policies. It has been a pleasure speaking with you. Thank you for your participation. Any additions? P: It's great to talk to you and I hope to see your positive work in our schools soon.	Ending		

Topic	Item No.	Guide Questions/Description	Reported on Page No.
Domain 1: Research team and reflexivity			
Personal characteristics			
Interviewer/facilitator	1	Which author/s conducted the interview or focus group?	
Credentials	2	What were the researcher's credentials? E.g., PhD, MD	
Occupation	3	What was their occupation at the time of the study?	
Gender	4	Was the researcher male or female?	
Experience and training	5	What experience or training did the researcher have?	
Relationship with participants			
Relationship established	6	Was a relationship established prior to study commencement?	
Participant knowledge of the interviewer	7	What did the participants know about the researcher? e.g., personal goals, reasons for doing the research	
Interviewer characteristics	8	What characteristics were reported about the inter viewer/facilitator? e.g., Bias, assumptions, reasons, and interests in the research topic	
Domain 2: Study design			
Theoretical framework			
Methodological orientation and Theory	9	What methodological orientation was stated to underpin the study? e.g.,grounded theory, discourse analysis, ethnography, phenomenology, content analysis	
Participant selection			
Sampling	10	How were participants selected? e.g., purposive, convenience, consecutive, snowball	
Method of approach	11	How were participants approached? e.g., face-to-face, telephone, mail, email	
Sample size	12	How many participants were in the study?	

Non-participation	13	How many people refused to participate or dropped out? Reasons?	
Setting			
Setting of data collection	14	Where was the data collected? e.g., home, clinic, workplace	
Presence of non-participants	15	Was anyone else present besides the participants and researchers?	
Description of sample	16	What are the important characteristics of the sample? e.g., demographic data, date	
Data collection			
Interview guide	17	Were questions, prompts, guides provided by the authors? Was it pilot? tested?	
Repeat interviews	18	Were repeat inter views carried out? If yes, how many?	
Audio/visual recording	19	Did the research use audio or visual recording to collect the data?	
Field notes	20	Were field notes made during and/or after the interview or focus group?	
Duration	21	What was the duration of the inter views or focus group?	
Data saturation	22	Was data saturation discussed?	
Transcripts returned	23	Were transcripts returned to participants for comment and/or	

Topic	Item No.	Guide Questions/Description	Reported on Page No.
		correction?	
Domain 3: analysis and findings			
Data analysis			
Number of data coders	24	How many data coders coded the data?	
Description of the coding tree	25	Did authors provide a description of the coding tree?	
Derivation of themes	26	Were themes identified in advance or derived from the data?	
Software	27	What software, if applicable, was used to manage the data?	
Participant checking	28	Did participants provide feedback on the findings?	
Reporting			
Quotations presented	29	Were participant quotations presented to illustrate the themes/findings? Was each quotation identified? e.g., participant number	
Data and findings consistent	30	Was there consistency between the data presented and the findings?	
Clarity of major themes	31	Were major themes clearly presented in the findings?	
Clarity of minor themes	32	Is there a description of diverse cases or discussion of minor themes?	

Developed from: Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. *International Journal for Quality in Health Care*. 2007. Volume 19, Number 6: pp. 349 – 357

Once you have completed this checklist, please save a copy, and upload it as part of your submission. DO NOT include this checklist as part of the main manuscript document. It must be uploaded as a separate file.