

Evaluation of a Long Standing School-based Oral Health Program: A Sequential-explanatory
Mixed-method Approach

by

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Abstract

Background: In 1983, the Kuwait Ministry of Health established the School-based Oral Health Program (SOHP) in the Capital region and, in 1995, extended it to all Kuwaiti regions. The program provides education activities, prevention procedures, and treatment care. The service is delivered through a system of center- and school-based clinics and preventive mobile teams that deliver preventive services to children in schools without permanent dental clinics.

Objectives: The overall goals of this evaluation study are to evaluate the impact of the prevention program through measuring children's oral health and Oral Health-Related Quality of Life (OHRQoL) as well as mothers' oral health awareness and OHRQoL (Phase I), and to explore the impact of the contextual factors on program performance and maintenance (Phase II).

Method: A mixed-method was employed based on sequential explanatory design to evaluate the prevention component of SOHP in the Kuwait Capital region. A framework developed based on the Ecological Health Model and RE-AIM (Reach, Effectiveness, Adoption, Implementation, Maintenance) guided this evaluation research. Five sources of data were collected via questionnaires and oral examinations, interviews, archival records, and field notes. The study consisted of two phases. In Phase I, we conducted a cross-sectional quantitative project to explore children's oral health status and OHRQoL, as well as mothers' oral health Knowledge, Attitude, and Practice (KAP) and OHRQoL. In Phase II, we conducted a qualitative project using a focused ethnography approach. An interview guide inspired by the RE-AIM model directed the interviews and focus groups. The quantitative and qualitative data were then compared and contrasted to enhance the validity of our results.

Results: The quantitative results revealed that of 440 children-mother pairs in the 11-to-12 year age group participating in the current study (of which 49.3% were male), there was an almost equal distribution of participants classified into two groups: SOHP and non-SOHP. The results showed that mean decay level (SD) DT/dt was 1.41 (1.66) and 2.61 (2.63) for SOHP-enrolled and non-SOHP, respectively ($p<0.05$). SOHP children also had a higher number of sealed and restored teeth. No significant differences were found in Child Perception Questionnaire (11-14) scores or subscale scores between the two groups. SOHP mothers had significantly better OHRQoL compared to non-SOHP mothers ($p<0.05$), with significant differences in their OH knowledge but not in attitude and practices ($p=0.019, 0.077, 0.12$, respectively).

The qualitative data included 30 service providers, key informants, and decision-makers in four focus groups and four in-depth interviews. The interview data analysis showed two and three main categories of influencers affecting implementation and maintenance, respectively. For implementation dimension, from the participants' viewpoints, the two categories that hindered the successful implementation of the program in school settings were: 1) elements related to program structure and strategies, and 2) factors related to school settings and oral health behaviors of schoolchildren and stakeholders. It was discovered that the program went through major modifications in order to be maintained over the last three decades. Multiple factors were related to three chronological phases, including leadership, evidence-based dentistry and decision-making, development change, and proactive sustainability plan. Meanwhile, vision and sustainable funding were found to be the key elements for long-standing maintenance.

Conclusion: For Kuwaiti schoolchildren, preventive treatment had a positive impact on their emotional well-being, restorative treatments improved their oral function, and an increase in the

number of carious teeth was associated with a limitation in oral functions. Mothers' oral hygiene practices were associated with their children's dental disease level and oral hygiene as well as their children's OHRQoL. Schoolchildren who were enrolled in the SOHP had lower dental caries and a higher number of sealed teeth, but no correlation was found between enrollment in SOHP and OHRQoL. Additionally, implementation barriers relating to organization capacity and unsupportive settings because of poor intersectoral relationships affected the fidelity of service delivery and the sustainability of some program components, but not the maintenance of the program. Therefore, revisiting the program's statement of mission, assessing program theory, and embracing community-based participatory principles may enhance the program's outcomes. The outcomes of this study provide insights for decision- and policy-makers to consider in action towards improved capacity for school-based oral health interventions.

Preface

This thesis is an original work by Aishah Alsumait. The research projects, of which this thesis is a part, received research ethics approval from the University of Alberta Research Ethics Board, my quantitative projects name “Oral Health Related Quality of Life (CPQ11-14) Among Kuwaiti Public School Children”, “Association Between Mothers’ KAP and Children Caries Experience and OHR-QoL”, No. Pro00037434, 04/06/2013. And my qualitative project name “Implementation & Maintenance Evaluation of the Capital School Oral Health Program in Kuwait” No. Pro00051240, 11/03/2014.

Chapter 2 of this thesis has been published as Alsumait, A., ElSalhy, M., Raine, K., Cor, K., Gokiart, R., Al-Mutawa, S., & Amin, M. (2015). Impact of dental health on children’s oral health-related quality of life: A cross-sectional study. *Health and Quality of Life Outcomes*, 13, 98. I was responsible for the data collection and analysis as well as the manuscript composition. Elsalhy, M assisted as second author and second reviewer and contributed to manuscript edits. M., Raine, K., Cor, K., Gokiart, R., Al-Mutawa, S., & Amin, M were the supervisory authors and were involved with concept formation and manuscript composition.

Dedication

This thesis is dedicated to the souls I've lost during my Ph.D.

journey my mom, sister Khawlah, and brother Anwar

&

To my sister Lamya who walks the journey with me

A.A

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I am deeply appreciative of the support I have received by friends, family, colleagues, supervisors, and researchers in the health promotion and public health field. This dissertation could not have been completed without them.

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Table of Contents

Abstract.....	ii
Preface.....	v
Dedication	vi
Acknowledgements	vii
List of Tables	xvii
List of Figures.....	xix
List of Abbreviations	xx
Chapter One	1
Introduction.....	1
1.1 Background.....	1
1.1.1 Oral health of school children	1
1.1.2 Oral health promotion programs	2
1.1.2.1 School oral health programs.....	2
1.1.2.2 Oral health education programs	3
1.1.2.3 Fluoride varnish programs.....	4
1.1.2.4 Dental sealants program	5
1.2 Evaluation of Oral Health Programs.....	6
1.2.1 Evaluation types	7
1.2.2 Evaluation methods	9
1.2.3 Evaluation of school oral health programs	10

1.3	Kuwait School Oral Health Program Model.....	12
1.3.1	Program goals.....	13
1.3.2	Program initiation and structure	13
1.3.3	Target population	14
1.3.4	Program objectives.....	15
1.3.5	Program services and activities	15
1.3.6	Program logic model	16
1.3.7	Program stakeholders	18
1.3.8	Program evaluation	19
1.4	Problem Statement	20
1.4.1	Objectives.....	21
1.4.2	Research questions	22
1.5	Evaluation Plan.....	22
1.5.1	Outcome and implementation evaluation.....	22
1.5.2	Program evaluation indicators.....	23
1.5.2.1	Caries rate and oral health status	24
1.5.2.2	Child Perception Questionnaire (CPQ ₁₁₋₁₄).....	25
1.5.2.3	Mothers' oral health Knowledge, Attitude, and Practices (KAP)	25
1.5.2.4	Reach, adoption, implementation of the program in the schools: context and maintenance of SOHP	26
1.6	Conceptual Framework	27
1.6.1	Ecological Health Model (EHM)	27
1.6.2	Reach, Effectiveness - Adoption, Implementation, and Maintenance (RE-AIM) Framework	28
1.6.3	Evaluation method	29

1.6.3.1	The Mixed-method design.....	30
1.6.3.2	Cross-sectional study.....	32
1.6.3.3	Focused Ethnography.....	32
1.7	Summary	33
1.8	References	35
Chapter Two.....		54
Impact of Dental Health on Children's Oral Health-Related Quality of Life: A Cross-Sectional Study		54
2.1	Abstract	54
2.2	Introduction	55
2.3	Methods	57
2.3.1	Study design.....	57
2.3.2	Study setting and participants	58
2.3.3	Procedure.....	58
2.3.4	Measures	58
2.3.4.1	Clinical examination	59
2.3.4.2	CPQ ₁₁₋₁₄ Questionnaire.....	59
2.3.5	Data analysis	62
2.4	Results.....	62
2.4.1	Dental health status	63
2.4.2	Oral health-related quality of life	65
2.4.3	DHS and OHRQoL	66
2.4.4	Predictors of OHRQoL	67
2.5	Discussion	71
2.6	Conclusions	75

2.7	References	76
Chapter Three		81
Do Mothers' Oral Health Knowledge, Practices, and Quality of Life Affect Their Children's Dental Health Status and Oral Health-Related Quality of Life? A Cross-Sectional Study		81
3.1	Abstract	81
3.2	Introduction	83
3.3	Methods	85
3.3.1	Ethical consideration	85
3.3.2	Study design and sample	85
3.3.3	Procedure.....	86
3.3.4	Measures	86
3.3.4.1	Child's clinical dental parameters	86
3.3.4.2	Child OHRQoL questionnaire.....	87
3.3.4.3	Psychometric properties of the CPQ ₁₁₋₁₄	88
3.3.4.4	Mothers' oral health knowledge (OHK), practice, and OHRQoL <i>questionnaire</i>	89
3.3.5	Data analysis	90
3.4	Results.....	91
3.4.1	Children's dental health status and OHRQoL	91
3.4.2	Mothers' oral health knowledge, practices and OHRQoL	93
3.4.2.1	Knowledge	93
3.4.2.2	Practices.	94
3.4.2.3	OHRQoL	95
3.4.3	Predictors of dental health status in children (DHS).....	96
3.4.4	Predictors of OHRQoL in children	99

3.5	Discussion	101
3.6	Conclusions	104
3.7	References	105
Chapter Four		111
Impact Evaluation of a School-Based Oral Health Program: Kuwait National Program		111
4.1	Abstract	111
4.2	Introduction	112
4.3	Methods	115
4.3.1	Study design.....	115
4.3.2	Participants and setting.....	116
4.3.3	Procedure.....	116
4.3.4	Outcome measures	117
4.3.4.1	Children’s dental examinations	117
4.3.4.2	Children’s OHRQoL	118
4.3.4.3	Mothers’ knowledge, practice, and OHRQoL.....	120
4.3.5	Data analysis	121
4.4	Results.....	122
4.4.1	Characteristics of studied population	122
4.4.2	Participants’ OH indicators	123
4.4.3	Children’s oral health-related quality of life	125
4.4.4	Mothers’ KAP and OHRQoL.....	126
4.5	Discussion	127
4.6	References	130

Chapter Five	135
Implementation and Maintenance Evaluation of the School Oral Health Program in Kuwait.....	135
5.1 Abstract	135
5.2 Program Description	137
5.3 Objectives	139
5.4 Methods	140
5.4.1 Study design.....	140
5.4.2 Participants and recruitment.....	141
5.4.3 Data collection	142
5.4.4 Data analysis	143
5.5 Findings	145
5.5.1 Implementation	147
5.5.1.1 Internal context.....	147
5.5.1.1.1 Protocol	148
5.5.1.1.2 Resources.....	150
5.5.1.2 External context.....	153
5.5.1.2.1 School engagement.....	153
5.5.1.2.2 Oral health behavior of stakeholders	156
5.5.2 Maintenance	157
5.5.2.1 Initiation phase (1982-1984)	158
5.5.2.1.1 Gatekeepers	159
5.5.2.1.2 Leadership	160
5.5.2.1.3 Intervention planning.....	161
5.5.2.2 Expansion phase (1984-1998).....	163

5.5.2.2.1	Developmental Changes (Initial expansion).....	163
5.5.2.2.2	Remedial change (Complete expansion)	165
5.5.2.3	Sustainability phase (1999-2014).....	167
5.5.2.3.1	Central administration’s organization-wide change of the programs	168
5.5.2.3.2	Policy development	169
5.5.2.3.3	Power dynamics.....	171
5.5.2.3.4	Funding.....	172
5.6	Discussion	174
5.6.1	Implementation	174
5.6.1.1	Internal context.....	175
5.6.1.2	External context.....	175
5.6.2	Maintenance	178
5.6.2.1	Factors related to the program initiation phase	178
5.6.2.2	Factors related to the organization-change phase.....	180
5.6.2.3	Factors Related to the Sustainability Phase.....	180
5.7	Limitations	183
5.8	Recommendations for Research and Practice	184
5.9	References	185
Chapter Six.....		194
Discussion and Conclusions		194
6.1	Summary of Evaluation Outcomes	194
6.2	Sequential Explanatory Mixed-Method Design.....	196
6.2.1	Quantitative results.....	198
6.2.2	Qualitative results.....	199
6.2.3	Integration of quantitative and qualitative results	200

6.3	Ecological Health Model	202
6.3.1	Individual level.....	203
6.3.2	Family level.....	204
6.3.3	Community and organizational level	205
6.4	RE-AIM Evaluation Model.....	206
6.4.1	Reach.....	206
6.4.2	Effectiveness	209
6.4.3	Adoption.....	211
6.4.4	Implementation	213
6.4.5	Maintenance	216
6.5	Limitations	218
6.6	Conclusions and Future Considerations.....	219
6.6.1	Recommendations and future considerations for research and policy implications.....	221
6.6.1.1	Research recommendation	221
6.6.1.2	Policy implications	221
6.7	References	223
References		194
Appendices		272
Appendix 1.		272
Oral Examination Sheet		272
Capital Program Oral Health Examination Form		273
Appendix 2.		277
Child Perception Questionnaire (CPQ₁₁₋₁₄)		277
Appendix 3		282

Mothers’ Questionnaire 282

Appendix 4.286

Interview Guide286

List of Tables

Table 1.1. School Oral Health Program Logic Model.....	17
Table 1.2. Identifying program outcomes.....	24
Table 2.1. Basic demographics of participants.....	63
Table 2.2. Demographics and DHS measures.....	64
Table 2.3. Correlations between different components of CPQ ₁₁₋₁₄	65
Table 2.4. Demographics and CPQ ₁₁₋₁₄ scores.....	66
Table 2.5. DHS and CPQ ₁₁₋₁₄ scores.....	67
Table 2.6. Odds ratio (95% CI) for negative impact on OHRQoL from multivariate logistic regression analysis final model*	69
Table 2.7. Odds ratio (95% CI) for negative impact on different OHRQoL domains from multivariate logistic regression analysis final model*.....	70
Table 3.1. Basic demographics of participants.....	92
Table 3.2. Percentages of mothers responded correctly to knowledge questions.....	93
Table 3.3. Mothers' oral health practices.....	95
Table 3.4. Mothers' OHRQoL responses.....	96

Table 3.5. Multiple linear regression analysis final models predicting children DHS indicators.....	98
Table 3.6. Odds ratio (95% CI) for negative impact on different OHRQoL domains from multivariate logistic regression analysis final model.....	100
Table 4.1. School prevention and education logic model.....	115
Table 4.2. Basic demographics of participants according to SOHP enrolment...	123
Table 4.3. Children's mean (SD) OH measures and OHRQoL scores according to SOHP enrolment.....	124
Table 4.4. Multiple linear regression analysis final models predicting children OH indicators significantly associated with SOHP enrolments.....	125
Table 4.5. Mothers' mean (SD) OH knowledge, attitude, practices, OHRQoL scores according to SOHP enrolment.....	126

List of Figures

Figure 1.1. Program structure.....	14
Figure 1.2. Evaluation Plan.....	30
Flow chart 5.1. Reach and Adoption.....	139
Figure 5.1. Implementation conceptual map.....	146
Figure 5.2. Maintenance conceptual map.....	159
Figure 6.1. Evaluation Model.....	196
Figure 6.2. Visual Evaluation Model Plan.....	202

List of Abbreviations

CPQ₁₁₋₁₄: Child Perception Questionnaire among 11- to 14 year-old

DHS: Dental Health Status

dmf: decayed, missing, or filled primary teeth

DMF: decayed, missing, or filled permanent teeth

DMF/T: decayed, missing, or filled teeth index

DMF/S: decayed, missing, or filled surfaces index

EHM: Ecological Health Model

Fl. V: fluoride varnish

FS: Fissure sealants

ICDAS: International Caries Detection and Assessment System

KAP: Knowledge, Attitude, and Practices

OH: Oral Health

OHK: Oral Health Knowledge

STROBE guidelines: STrengthening the Reporting of OBservational studies in Epidemiology

OHRQoL: Oral Health-Related Quality of Life

PI: plaque index

PUFA: Pulp, Ulcer, Fistula, Abscess index

RE-AIM: Reach, Effectiveness, Adoption, Implementation, Maintenance)

SOHP: School-based Oral Health Program

WHO: World Health Organization

Chapter One

Introduction

In this chapter, first, I briefly describe oral health of schoolchildren, and different approaches to prevention of dental diseases in general, and school-based interventions, in particular. I then discuss different evaluation methods, types, and recommendations available in the public and oral health evaluation literature. Next, I present the Kuwait comprehensive long-standing model of School Oral Health Program as a case study. I then follow with a description of the problem statement, including my research questions and objectives. At the end, I outline the evaluation plan that I selected for my study based on the literature review and evidenced-based criteria, followed by my conceptual framework.

1.1 Background

1.1.1 Oral health of schoolchildren

Worldwide, dental decay affects most adults and up to 90% of schoolchildren (Jürgensen & Petersen, 2013). Compounding this problem is that oral disease is the fourth most expensive illness to treat (Glick et al., 2012). Dental caries are one of the most common chronic preventable childhood infectious diseases (Selwitz, Ismail, & Pitts, 2007). Dental decay is a multifactorial condition initiated by microbial shifts within the biofilm of individuals, and is affected by salivary nature, fluoride exposure, consumption of sugary diets, and individual oral hygiene behavior (Fejerskov, 2004). In addition to high treatment cost, dental caries are the primary reason for oral pain and tooth loss, consequently compromising quality of life (Kidd &

Fejerskov, 2004). However, the disease is preventable and can even be reversed at different stages of formation (Pitts, 2001).

1.1.2 Oral health promotion programs

In dentistry, the notable improvements in dental health over the past decades reflect the sound science of the community-based prevention field (Ismail & Bader, 2004). Successful interventions range from simple strategies that utilize one preventive approach to more comprehensive strategies that involve multiple interventions. Some examples of community-based intervention include oral health education and community water fluoridation, which are the cornerstones of caries prevention in the United States (Beltran-Aguilar et al., 2005). Other interventions include school mouth-rinse, provision of fluoride gel or varnish, and school dental sealant programs (Al-Jundi, Hammad, & Alwaeli, 2006; Anneli Ahovuo-Saloranta, Hiiri, Nordblad, Makela, & Worthington, 2008; Gold, 2013) .

1.1.2.1 School oral health programs

School settings can offer substantial access to a large proportion of the targeted population, and can also be instrumental in shaping children's health-related beliefs, attitudes, values and behaviors (Hubley & Zumbo, 2013). Additionally, evidence suggests that oral health services in childhood can influence a healthy lifestyle into adulthood (Alsumait et al., 2015b; Brownson, Haire-Joshu, & Luke, 2006). A World Health Organization (WHO) report in 2003 supported the implementation of school-based oral health promotion programs (Petersen, 2003a), because schools can potentially play a crucial role in establishing the foundations for healthy patterns of behavior (Aunger, 2007; Honkala, 2014; Licence, 2004). These commonly used programs offer

oral health education, dental screenings, and preventive services directly to the students at their schools and mainly target the communities most in need of dental services.

School-based prevention program compositions and strategies implemented worldwide depend on the nature of the services needed, as well as the available budget and infrastructure (Jürgensen & Petersen, 2013). The economic benefits of various school-based interventions have been examined in several studies and proven to be cost-effective (Klein et al., 1985; Morris, Gillespie, Al Za'abi, Al Rashed, & Al Mahmeed, 2008; Sakuma, Yoshihara, Miyazaki, & Kobayashi, 2010; Werner, Pereira, & Eklund, 2000).

1.1.2.2 Oral health education programs

Oral health education programs implemented in the school settings use various approaches and techniques to improve children's oral health (Petersen et al., 2015). Teachers, parents, and dental professionals, including dentists and dental hygienists or dental and dental hygiene students, are often the providers of these educational services in the school facilities. Diet and oral hygiene practices and their impact on dental health are the most reported topics covered in school-based oral health education programs (Honkala, 2014; Jürgensen & Petersen, 2013). These initiatives primarily target schoolchildren, but in many cases, they involve parents and teachers as well, since these two groups have significant influence on children's oral health beliefs, attitudes, and behaviors (Kowash, Pinfield, Smith, & Curzon, 2000; Rajab, Petersen, Bakaeen, & Hamdan, 2002). Oral health education per se may have a limited impact on oral health behaviors (Kay & Locker, 1998; Nakre & Harikiran, 2013), but combining education activities with other interventions have resulted in better oral health outcomes (Adair, Burnside, & Pine, 2013;

Arevalo, Chattopadhyay, & Tomar, 2008; Vanobbergen, Declerck, Mwalili, & Martens, 2004).

Mothers' oral health education has been another target for oral health promotion programs (Petersen et al., 1990; Sujlana & Pannu, 2015). Despite differences in maternal roles in different cultures (Fisher-Owens et al., 2007), mothers still play a prominent role in children's oral health-related lifestyle (Poutanen, Lahti, Tolvanen, & Hausen, 2006). Moreover, the adoption of childhood habits takes place at home, with parents – especially mothers – being the primary model for home oral health behaviors (Poland, Krupa, & McCall, 2009). Therefore, mothers' oral health knowledge and practices may determine the dental health status of their children.

Generally, there is limited evidence for the effectiveness of education interventions targeting oral health behavioral change on plaque outcomes, and children's oral health knowledge acquisition (Petersen 2003; Watt et al. 2001; Vanobbergen et al. 2004). However, as reported by the Cochrane collaboration, the international evidence on school-based education interventions has shown that a lack of theoretical foundation and poor evaluation design can influence the review's inconclusive results in relation to the effectiveness of primary school-based behavioral interventions on oral health outcomes (Cooper et al., 2013).

1.1.2.3 Fluoride varnish programs

A World Health Organization (WHO) Global Survey on oral health in schools indicated that around 30% of school-based fluoride programs used fluoride varnish as part of their oral health prevention strategy (Jürgensen & Petersen, 2013). Fluoride varnish has replaced fluoride gel and

is broadly used in school-based interventions. High content of fluoride concentration improved the potency of fluoride varnish, it contains five times more fluoride content than fluoride gel (Gold, 2013; Marinho, Higgins, Logan, & Sheiham, 2003; Seppä, 2004).

Fluoride varnish approach is considered a simple and safe caries-preventive modality that can be utilized as a public health intervention. Reports showed that fluoride varnish school-based intervention is well adapted worldwide throughout Europe and North America, benefits in caries reduction among schoolchildren with minimal risk and acceptable service coverage were achieved (Bercström, Sköld, Birkhed, & Lepp, 2012; Dohnke-Hohrmann & Zimmer, 2004; Evans, Pearson, & Simons, 2013).

Fluoride varnish treatments reduce dental decay by 45% in permanent teeth and 33% in deciduous teeth (Arruda, Senthamarai Kannan, Inglehart, Rezende, & Sohn, 2012; Dohnke-Hohrmann & Zimmer, 2004; Marinho, Higgins, Logan, & Sheiham, 2002). According to a Cochrane systematic review, it is recommended that fluoride varnish be applied semi-annually, and some researchers recommend applying it up to four times a year to reduce dental caries in children (Marinho, 2009). Azarpazhooh and Main in a systematic review reported that fluoride varnish is a straightforward material that can prevent dental caries, but also reverse the action of early caries lesions among children and adolescence (2008).

1.1.2.4 Dental sealants program

School-based sealant program improved access to dental care among under-served populations (Devlin & Henshaw, 2011). First developed in the late 1960s, dental sealants are a thin layer of plastic material that is applied to the pits and fissures of the occlusal (chewing) surfaces of

posterior (back) teeth in order to prevent the development of dental caries. Sealants act as a physical barrier, preventing decay-causing bacteria from entering the difficult-to-clean deep grooves, or pits and fissures, where 90% of all dental caries in school-aged children occurs (Ahovuo-Saloranta, Hiiiri, Nordblad, Makela, & Worthington, 2008; Beauchamp et al., 2008).

Despite being a safe and effective preventive intervention (Beauchamp et al., 2008; Francis, Mascarenhas, Soparkar, & Al-Mutawaa, 2008; Gooch et al., 2009), dental sealants are used in less than 9% of community-based oral health programs worldwide due mainly to economic, leadership, and intersectoral factors (Petersen, 2003b; World Health Organization-WHO, 2013).

Simonsen (2002) in a systematic review reported that 70% caries reduction was detected among children with dental sealants over one year, and around 64% reduction after two years. This result is consistent with the systematic review conducted by Ahovuo-Saloranta et al (2008) that reported 27% reduction in dental caries after nine years of dental sealants placement (Simonsen 2002; Ahovuo-Saloranta et al. 2008). A similar result was reported after 5-year dental sealants' retention in Kuwait School Oral Health Program (SOHP) population (Francis et al. 2016). However, to be successful, sealant placements must be applied by a skillful operator, as sealant placement requires meticulous attention to technique and proper diagnosis of eligible teeth (San-Martin, Ogunbodede, & Kalenderian, 2013).

1.2 Evaluation of Oral Health Programs

Evaluation of oral health interventions improves the quality of the initiatives by providing systematic evidence-based information about oral health intervention strategies in a realistic

setting. Evaluation is broadly defined as the process of learning about how a program is implemented, as well as its short- and long-term impacts (Harris 2010). The oral health literature has demonstrated poorly-designed evaluation studies, due to both the lack of systematic processes to identify outcomes, and lack of expertise to carry it out (Murray et al., 2010; Petersen et al., 1990).

Evaluation is often neglected in the oral health field, and many programs have not been subjected to adequate evaluation (Tomar 2008; Watt et al. 2001). Published reports about oral health interventions have primarily focused on individual aspects of oral health programs, such as education, screening, referrals and dental sealants, rather than on combined or comprehensive efforts (Jürgensen & Petersen, 2013; Kwan, Petersen, Pine, & Borutta, 2005). An emphasis on evaluation usually occurs in a climate where there is increasing pressure to ensure that public funds are being used appropriately (Raphael, 2000) and, to a lesser extent, for management and development, learning and capacity building, and ethical obligations (Green & Tones, 1999).

1.2.1 Evaluation types

The main evaluation frameworks used most often in the public health field are formative and summative evaluations. A formative evaluation provides information for guiding program improvement mainly by examining the program delivery, with process and implementation being the most common types of this form of evaluation (Centers for Disease Control and Prevention [CDC], 1999). A summative evaluation determines whether a program is beneficial and expectations are met by assessing whether the intervention caused the outcome, determining the

overall impact of the causal factor beyond the immediate target outcomes, and using outcome and impact as the main measure of evaluation.

The formative evaluation includes (a) needs assessment that determines who needs the program, the extent of the need, and how it may change (Rossi, et al. 2004), (b) evaluability assessment that determines whether an evaluation is feasible and how stakeholders can help shape its usefulness, (c) evaluation of program theory measuring the appropriateness of conceptualization and assumptions core to the intervention (Watt et al. 2001), (d) implementation that monitors the fidelity of the program, and (e) process evaluation, which investigates the process of delivering the program.

The summative evaluation includes (a) outcome evaluation, which investigates whether the program or technology caused demonstrable effects on specifically defined target outcomes, (b) impact evaluation to assesses the overall or net effects – intended or unintended – of the program as a whole, and (c) cost-effectiveness and cost-benefit analysis to address questions of efficiency by standardizing outcomes in terms of their dollar costs and values (Alkin, 2011). Evaluations that include needs assessment, utilization assessment, and economic are less used in the public health field (Habicht, Victora, & Vaughan, 1999; Rychetnik, Frommer, Hawe, & Shiell, 2006).

Complex intervention is usually hard to evaluate because multiple components within a dynamic environment do not interact in a linear manner (Campbell et al., 2007). A phased approach design to the development and evaluation of complex interventions is recommended to help researchers clearly define what they are assessing, and where they are in the evaluation

research process. A considerable body of literature suggests the use of qualitative and quantitative evidence (Koorts & Gillison, 2015; Kwan et al., 2005), which is discussed in the next section.

1.2.2 Evaluation method

Epidemiological oral health surveys are the criteria most commonly used by WHO to record dental caries and enable a rough comparison of disease prevalence between countries (Petersen & Kwan, 2004). Nonetheless, oral health field services and interventions have been developed from a biomedical research paradigm. Evidenced-based dentistry embraces experimental methodologies, particularly Randomized Clinical Trials (RCTs) as the “gold standard” approach for distinct clinical therapy evaluation, and quasi-experimental for intervention evaluation to determine causality relationships (Petersen, 2003; Victora et al. 2004). Due to feasibility and cost limitations of experimental design, in recent years the qualitative evaluation approach has emerged to explore social phenomena that influence health behavior and social determinants of health (Glanz & Bishop, 2010). A pluralistic approach has also recently been acknowledged as a beneficial alternative for the evaluation of public health interventions (Watt 2005; Watt et al. 2001). The rationale for the pluralistic approach is augmenting traditional methods for assessing and exploring the impact of a program, using complementary methods. The weaknesses in one method is supported by the strength of the other, “mixing” two different data types in a single study provides magnitude of the problem and an insight into the studied phenomena (Bamberger, 2012; Caracelli & Greene, 1997). Also a pluralistic approach provides a deeper understanding and the ability to explore underlying issues that influence the performance of complex interventions (Green & Tones, 1999; Patton, 1990).

There are numerous designs using the mixed-method approach. Among those, Creswell et al. (2003) recognized six most commonly used designs, which include three sequential and three concurrent designs. Each type depends on the sequence/stage of quantitative and qualitative data collection, analysis, and integration of results (Ivankova, 2006). Design decision depends on the research questions and intervention characteristics to be evaluated (Creswell, 2014).

1.2.3 Evaluation of school oral health programs

Evaluation design structures are based on three main issues: the questions the evaluation is to answer, the method or procedures the evaluator uses to answer the research question, and the evaluator-stakeholder relationship, which may reveal a type of collaboration and evaluation type (Rossi et al. 2004; Petersen & Kwan 2004). Every school-based program has different and unique characteristics, so evaluation design should be customized based on sound systematic evidence based practice for robust outcomes (Patton, 2008; Petersen & Lennon, 2004).

Despite the fact that there is a growing interest in exploring multi-level oral health determinants and outcomes (Fisher-Owens et al., 2007), published evaluations have primarily focused upon discrete aspects of school-based oral health programs, such as dental sealants, fluoride applications, education, and screening and referral, rather than combined or comprehensive efforts.

Multiple methods were used to evaluate school-based dental sealant programs, such as sealant retention, progress of dental caries, cost-effectiveness, and population coverage.

Evaluating the coverage of program services was to compare the oral health of students enrolled in sealant programs to students not enrolled in such programs. These types of evaluations allow

assessment of program productivity and progress toward meeting the set goals and objectives of the health organizations (Gooch et al., 2009).

Fluoride varnish school-based programs were demonstrated to be an effective intervention (Seppä, 1991). In addition, Azarpazhooh and Main (2008) provided an effective clinical protocol for the application of fluoride varnish, which recommended varnish application every six months, and the use of single dose products for young children.

Oral health education was shown to improve oral health related behaviors and oral hygiene status for school students. Moreover, continuous rounds of education sessions among mothers of young children were effective in reducing dental caries among children (Plutzer & Spencer, 2008). However, the education evaluated was provided during a single school year. No evaluation of repeated annual oral health education has been published (Kay & Locker, 1996; Shenoy & Sequeira, 2010).

Further, a considerable body of literature suggests to combining a couple of prevention modalities in school-based intervention for better oral health, such as fluoride varnish programs complemented by sealant application, tooth brushing programs, oral hygiene instruction and nutrition counseling (Jürgensen & Petersen, 2013; Petersen, Peng, Tai, Bian, & Fan, 2004).

A review of the literature reveals that an evaluation model of various prevention efforts in combination with a comprehensive oral health promotion program, such as the Kuwait SOHP, does not exist. Hence, there is a clear need to develop a dental evaluation model that could capture the outcomes of a comprehensive program with a wide variety of intervention modalities in a specific environment such as a school-based program. The suggested evaluation designs

should include: (a) sound outcomes and indicators that are clearly identified and defined (Watt et al. 2001), (b) mixed methods to capture multiple dimensions of the intervention (Barker & Pistrang, 2005), and (c) mechanism of actions and validity of tools that can be clearly demonstrated (Poland et al., 2009). An evaluation design that included these criteria could be used for a broader range of oral health evaluations in similar communities so that a better utilization of resources can be achieved and more children served.

1.3 Kuwait School Oral Health Program Model

For several decades, oral health has been a focus of government interest in Kuwait. In 1982 the division of oral health in the Kuwaiti Ministry of Health conducted the first national children's oral health survey (Al-Mutawa, Shyama, Al-Duwairi, & Soparkar, 2006). The reports showed that the prevalence of dental caries among schoolchildren exceeded 80 %. Since schools have a great capacity to support programs involving health promotion and preventive interventions, including oral health (Ariga, Al-Mutawa, & Nazar, 2014; Jürgensen & Petersen, 2013), the Kuwaiti government established the School-based Oral Health Program (SOHP) in the Capital region in 1983 as a pilot project. The program was a joint venture between the Ministry of Health and the Forsyth Institute, Cambridge, MA, U.S.A.

The Kuwaiti SOHP began as a pilot project in the capital region in 1983. Based on its initial success, the program was extended to the Al-Ahmadi governorate in 1986. Then, in 1993-94, the Ministry of Health decided to extend the program to the remaining governorates of Al-Farwaniya, Hawally, and Al-Jahra. The University of Kentucky, Lexington, KY, U.S.A.; the University of Copenhagen, Copenhagen, Denmark; and the Forsyth Institute, Cambridge, MA,

U.S.A., were given the responsibility of managing the program in each governorate. In 2000, the SOHPs in all the governorates came under the management of the Ministry of Health, Kuwait, and the Forsyth Institute. In 2004, another branch was started at the new governorate of Mubarak Al-Kabeer. The SOHP is now present in all six governorates of Kuwait (Morris et al., 2008).

1.3.1 Program goals

The high prevalence of dental decay among schoolchildren prompted the government of Kuwait to establish the School Oral Health Program (Petersen et al., 1990). A wide range of goals were set to promote the oral health of Kuwaiti schoolchildren, including (a) raising dental health awareness, (b) improving oral hygiene, and (c) reducing the prevalence of dental decay (Morris, Al Za'abi, Behbehani, Gillespie, & Al Mahmeed, 2004).

1.3.2 Program initiation and structure

Kuwait is divided into six regions. The Ministry of Health is responsible for delivering health services to all regions, therefore, there is one SOHP in each region. All six programs have the same internal structure, which consists of center-based and school-based clinics for treatment and prevention procedures, and mobile clinics for prevention procedures only (Figure 1.1).

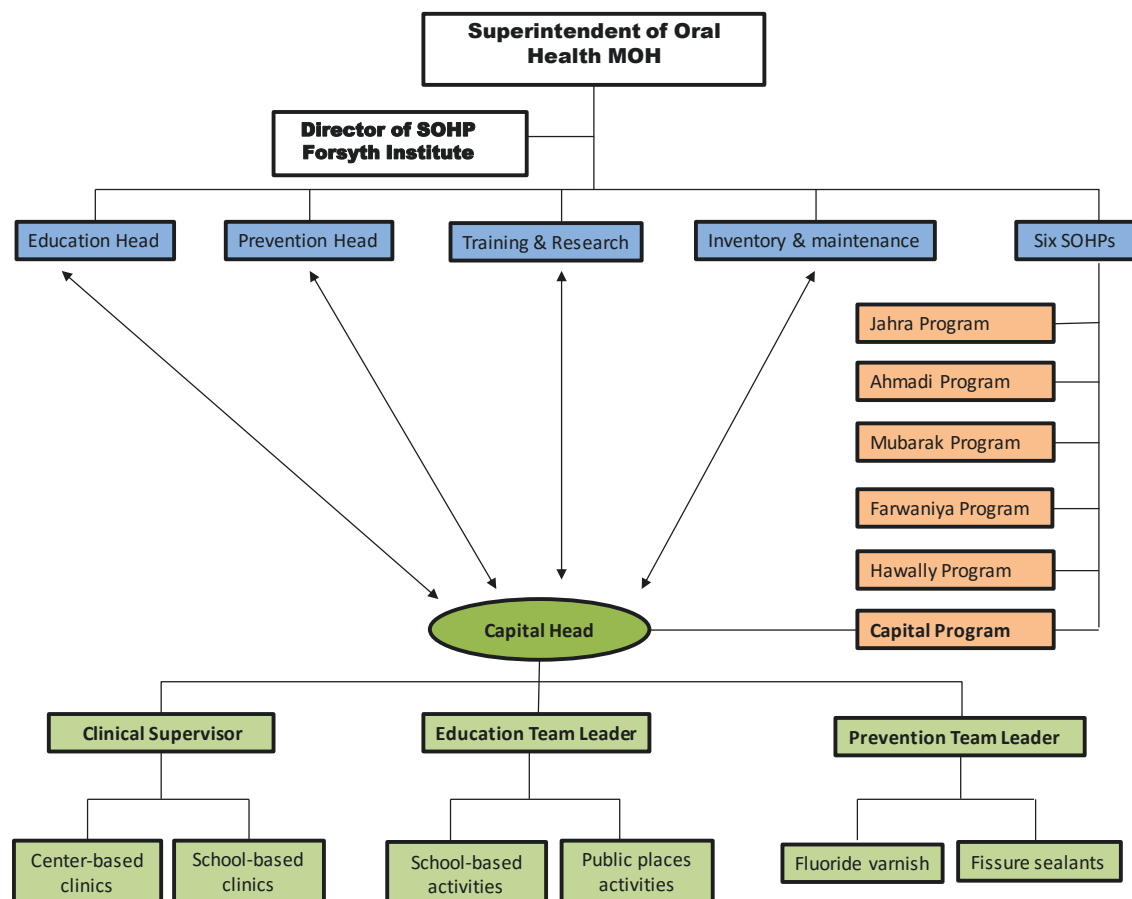


Figure 1.1. Program structure

1.3.3 Target population

Schoolchildren between 5 and 16 years of age are entitled to receive oral health care through school oral health clinics. More than 280,000 children are eligible for these services.

Participation in the program is voluntary and only requires a written consent from the parents (Ariga et al., 2014).

1.3.4 Program objectives

In order to achieve the goals of the program and to improve schoolchildren's oral health quality of life, the following objectives were defined in 2004 (Morris et al., 2008):

1. To increase the number of children participating in the program every year.
2. To enhance awareness about the importance of oral health among schoolchildren, parents, and teachers.
3. To increase the number of caries-free children both in primary and permanent teeth.
4. To reduce the number of children with unmet dental needs.

1.3.5 Program services and activities

In 2004, the Forsyth Institute standardized their education, prevention and treatment protocols at both school- and center-based clinics. The SOHPs offered routine restorative care in addition to root canal therapy. The SOHPs also offer prevention services such as fluoride varnishes, fissure sealants, and tooth brushing education sessions (Ariga et al., 2014). In the school years 2011-2012 and 2012-2013, about 80% of the 280,000 eligible children had two applications of fluoride varnish and 48% had fissure sealants (National Oral Health Annual report, 2013). A total of 4,000 hours were spent on education each year, and special sessions were conducted in the schools for children, parents, and teachers (Ariga et al., 2014). As well, continuing education sessions were provided each year to improve staff's capacity to encourage oral health-related interest.

The SOHP education activity planners use the Knowledge, Attitude, and Practice model (KAP) as a basis for their educational initiatives (Vigild, Petersen, & Hadi, 1999). KAP is based

on two premises. The first premise is that if people are given “the facts,” they will behave accordingly. Thus, health education campaigns have been conducted under the premise that if parents were aware of, for example, the importance of maintaining good oral hygiene, they would adhere to preventative oral health measures. KAP’s second premise regarding health promotion is that if people can be convinced to hold favorable or unfavorable “attitudes” about any oral health practice, they will change their oral health behaviors to fit the favorable attitudes. The model’s three components of knowledge, attitude and practice have a circular relationship, with knowledge being the main controlling construct (Poutanen et al., 2006).





1.3.6 Program logic model

In order to understand the program, it is important to demonstrate a clear and logical relationship among the goals, objectives, and activities in the program. The logic model is described as the rationale of the intervention in condensed, graphical sequence formatting (Harris., 2010). It outlines the program’s resources, activities, outputs, and expected client outcomes, and also incorporates a plausible theory to explain the association between the interventions and the anticipated outcomes (Alkin, 2011).

Dr. Alsumait developed the program logic model for the purpose of this doctoral research (Table 1.1). Previously, the logic model was discussed and refined with the director of the SOHPs, the prevention coordinator, the education coordinator, the capital program head, and two team leaders.

Table 1.1.

School Oral Health Program Logic Model

Inputs	Activities	Outputs	Short-term outcomes	Intermediate outcomes	Long-term outcomes
Prevention: Prevention Head Prevention team leader Prevention teams: <ul style="list-style-type: none"> Dentists Hygienists Dental Assists. Location: schools	Provide fluoride varnish (FL), Fissure sealants (FS)	Children with FL and FS protection	1. Increase proportion of the child population is protected with FL and FS	Lower incidence of OH related disease	Lower incidence of OH disease Improve OHRQoL among children
Education: Education head Education team leaders Education teams: <ul style="list-style-type: none"> Dentists Hygienists Dental Assists. Locations: Schools Primary care centers & hospitals Public events Laptops & projectors	Education sessions at schools, (children, mothers, teachers). Participate in school activities	knowledgeable teachers, parents and children	1. Increase number of schools in the program 2. Increase number of enrolled children in the program 3. Increased OH knowledge in children, teachers, and parents	Improved OH behavior of children, teachers, and parents	Lower incidence of OH related disease Improved OHRQoL
Treatment: walk in clinics Clinical supervisor <ul style="list-style-type: none"> Dentists Hygienists Dental Assists. 	Restorative dental treatments Referral to specialty clinics Provides emergency treatment on holidays Train new dentists.	Improve access to dental care	1. Increase proportion of children accessing and receiving oral care 2. Increase ratio of restorative care among children	Lower untreated dental disease Improved children oral health	Improve dental care need Improved children oral health
Training and Research: Training principal Researchers Computer lap Auditorium	Training new dentists Continuous education Guest Speakers Research	OH Educators OH Practitioners	1. Improved quality of OH education 2. Improving quality of care. 3. Employ evidence based-dentistry	Improve capacity building among OH providers	Prevention  Education  Treatment  Training and Research 

The outcomes addressed in the logic model are important and relevant to different aspects of program activities (Rossi et al. 2004). Some outcomes have a direct effect on children's oral health, such as dental decay level and mother's attitudes toward oral health and SOHP. Others have an indirect effect on children's oral health, such as the continuing education program conducted for program staff. Some outcomes need different measures to be assessed and these measures should be reliable, valid, and sensitive in order to detect any changes in outcome levels.

1.3.7 Program stakeholders

Given the school-based nature of the intervention and its wide-reaching impact, multiple groups are involved and have a shared interest in this program. These stakeholders include policy- and decision-makers (Kuwait Dental Department and the Forsyth Institute), beneficiaries (schoolchildren, mothers, and other community constituents), service providers (program heads and staff), contextual stakeholders (Ministry of Education, school staff), and academia. The director and program heads are the link between policy-makers and program staff and providers. Their chief concern is the effectiveness of the program in promoting oral health among schoolchildren.

Published reports about previous oral health surveys are difficult to compare to each other due to the absence of standardized examination methods and examiners, and the inability to differentiate between children enrolled in the SOHP and those who were not enrolled in a school-based prevention program. While these oral health surveys may suggest that the program is ineffective, a more systematic evaluation was needed to focus on a broader set of program

outcomes and provide a wider view of program performance (Jürgensen & Petersen, 2013; Kwan et al., 2005).

1.3.8 Program evaluation

Few studies have been published evaluating different aspects of Kuwait SOHP include; oral health surveys, needs assessment, and assessments of dental sealants and fluoride application protocols (Francis et al., 2008; Francis et al., 2016; Nazar et al., 2012). The oral health survey was the main tool used to measure dental diseases among schoolchildren attending public schools in Kuwait. Dental disease prevalence has mainly been evaluated through four national oral health surveys conducted by SOHP in 1982, 1985, 1993, and 2001, with the aim of determining the oral health status of children aged 5 and 15 years (Behbehani & Scheutz, 2004; Morris et al., 2008). The main outcome measures of children's oral health were level of dental plaque and caries prevalence, neither of which demonstrated any improvements over time.

In addition, two clinical studies have been published about evaluating dental sealants retention, and effectiveness of mixing fluoride applications and dental sealants in preventing dental caries that revealed the effectiveness of using multiple dental prevention modalities (Francis et al., 2008; Nazar et al., 2012).

Further, needs assessments studies have been published measuring knowledge, attitude, and practices among children, teachers, and mothers at early stages of program initiation, which showed the need for oral health education, and which were used as a baseline data for planning the current program activities (Petersen et al., 1990; Vigild et al., 1999).

1.4 Problem Statement

The program's services, which are provided through school- and center-based clinics, include oral health education, prevention, and restorative treatments. The initial budget allocation of 10 million USD over successive 3-year periods was intended to service the needs of around 150,000 schoolchildren (Morris et al., 2008); this was recently increased to 65 million USD to cover 280,000 schoolchildren (<http://www.ctc.gov.kw>).

The School Oral Health Program (SOHP) started in various regions at different times, and was developed and implemented by numerous consultant universities with a variety of working strategies. As a result, the evaluation of the program has become extremely complicated. The first major change occurred in 1999, when all programs in the six regions came under the umbrella of the Ministry of Health and the Forsyth Institute, USA, with standardized working protocols. In 2005, the second major change occurred when SOHP instituted an intensive prevention policy. Despite these aggressive changes, an increased incidence of dental decay has been consistently reported among Kuwaiti children. This finding has prevented the program from reaching its main goal, which is bringing the increase in dental decay to a halt.

Another complication is the lack of baseline data to evaluate the performance of SOHP. A comprehensive evaluation model is required to explore the impact of the program on the well-being of the schoolchildren, in order to justify the money and effort that have been invested in this program, the missing class hours that students experience, and the use of school spaces and resources that could be used for other purposes.

Given the extensive and diverse set of interventions offered within SOHP, a systematic evaluation model capable of identifying what the program is designed to influence was developed. A project like this not only helps to determine the effectiveness of SOHP, but also serves as a model for other oral health evaluators on how to carry out evaluations that are broader and deeper, and thus more useful for future improvement.

1.4.1 Objectives

The objectives of this dissertation were:

1. To evaluate the impact of dental sealants and fluoride varnish on the prevention of caries prevalence.
2. To explore the impact of oral health education and tooth brushing sessions on children's oral hygiene status.
3. To assess the normative needs of children with respect to oral health.
4. To determine the long-term effects of SOHP on children's Oral Health Related Quality of Life (OHRQoL).
5. To assess oral health knowledge, attitudes and practices of mothers who are involved in SOHP activities and events, compared to mothers who are not involved.
6. To explore factors influencing program implementation and performance as perceived by service providers and receivers (using prevention teams and school employees as key informants).
7. To identify the factors influencing SOHP policy changes and policy-making that facilitated the maintenance of the program.

1.4.2 Research questions

1. Do children registered in SOHP have a lower prevalence of caries and better oral hygiene than those not registered?
2. Do children registered in SOHP have a better perception about their oral health and Oral Health Related Quality of Life (OHRQoL) than those not registered?
3. Do mothers who participate in SOHP activities have better oral health knowledge, attitudes and practices than those who do not participate?
4. What factors support or impede the implementation of the Capital SOHP?
5. What factors assist the maintenance and sustainability of the SOHP?

1.5 Evaluation Plan

1.5.1 Outcome and implementation evaluation

This evaluation research included two types of evaluation: an outcome evaluation and an implementation evaluation. An outcome-based evaluation is an assessment of the effect, at the population level, of multiple initiatives (Alkin, 2011). I used an outcome-based evaluation to measure the effect of Kuwait SOHP on the program's beneficiaries and their environment, in order to validate the money and effort invested in this program. The outcome evaluation also aims to justify to parents and school administrators the missed class hours of their children, and the ongoing use of school physical spaces and resources.

Further, an implementation evaluation is also used to assess the extent to which an intervention is implemented as proposed. Program maintenance refers to the extent to which the program is sustained over time and the procedures institutionalized (Glasgow et al., 2001).

Because SOHP working strategies have been subjected to changes that have never been assessed, it is advisable to utilize implementation type of evaluation approach. The literature showed that the complexity and diversity of the interventions were inversely related to the level of implementation and sustainability (Gaglio et al., 2013), which is a valid concern in Kuwait model. In order to conduct an outcome and implementation evaluation, primary outcomes were identified using the program's logic model.

1.5.2 Program evaluation indicators

The evaluation indicator of an intervention is broadly defined as “a specific, observable, and measurable characteristic that can be used to show changes or progress a program is making toward achieving a specific outcome” (Parrish 2010, p.5) Similarly, studying the context of school-based setting explores the underpinning issues that stemmed the program outcomes. Therefore, the following indicators were used to measure and explore the SOHP program context and impacts (Table 1.2):

1. Oral health assessment indices.
2. A perception questionnaire instrument designed to measure oral health-related quality of life among children aged 11-14 years.
3. A questionnaire assessing oral health KAP among mothers.
4. Reach, adoption, implementation of the program in the schools' context and maintenance of SOHP.

1.5.2.1 Caries rate and oral health status

Most studies, focused on dental health status have used the mean number of decayed, missing, or filled surfaces/teeth (DMF) index, which has been in use for dental caries assessment research for almost 65 years to describe the dental caries experience. Despite its long history of use in oral health epidemiological assessments, there are some limitations to this index, such as its lack of assessing severity of decay and soft tissue condition (Broadbent & Thomson, 2005). Thus, children's oral hygiene was evaluated using the Silness-Löe plaque index (Löe, 1967), and the clinical consequences of untreated dental caries (severity of the disease) were evaluated using the Pulp, Ulcer, Fistula, Abscess (PUFA) index (Monse, Heinrich-Weltzien, Benzian, Holmgren, & Van Palenstein Helderman, 2010). In addition, a restorative care (RI) index was also used, reflecting received dental care among schoolchildren (Tagelsir, Cauwels, van Aken, Vanobbergen, & Martens, 2011), these measures were used for comprehensive oral health examination purposes.

Table 1.2.
Identifying program outcomes

Outcomes	Questions	Data	Assessment tools
Improve general health and quality of life	What is the impact of SOHP on children's quality of life?	Quantitative data	CPQ ¹¹⁻¹⁴ OHRQoL survey
Decrease prevalence of oral diseases	What are the prevalence of dental decay / severity of the disease?	Quantitative data	DMF Index, RI index, oral hygiene index PI, Decay severity index
Improve oral health awareness among mothers	What is the effect of oral health education on mothers?	Quantitative data	KAP and OHRQoL survey
Changes on working policies including: prevention and education protocol	What factors influence program implementation?	Qualitative data	In-depth and focus groups interview, personal journals & program records.

1.5.2.2 Child Perception Questionnaire (CPQ 11-14)

Oral health has been defined as the standard of health for oral and related tissues that enable individuals to eat, speak, and socialize without active disease, discomfort, or embarrassment (Brown & Al-Khayal, 2006; Foster Page, Thomson, Jokovic, & Locker, 2005). Contemporary concepts of health emphasize the importance of subjective well-being measures.

Among a number of Oral Health-Related Quality of Life (OHRQoL) measures developed to describe the impact of oral diseases on an individual's life, five instruments have been specifically designed for children, including the Child Perception Questionnaire (CPQ₁₁₋₁₄) developed in Toronto (Jokovic, Locker, & Guyatt, 2005, 2006), which is thus far the only self-administered OHRQoL questionnaire designed for this specific age-group of children.

Although nearly all OHRQoL tools have been developed in North America and Europe, Brown and Al-Khayal translated and validated an Arabic version of CPQ₁₁₋₁₄ in Saudi Arabia (Brown & Al-Khayal, 2006). In spite of the acceptable validity and reliability of the Arabic questionnaire, some children had problems with the self-report questions. In order to overcome this limitation in the current study, a trained hygienist explained the questionnaire to the participants by referring to pictures of oral diseases, and also answered the children's questions.

1.5.2.3 Mothers' oral health Knowledge, Attitude, and Practices (KAP)

In the literature, there is strong consensus that oral health knowledge and the attitude of mothers can influence children's oral health behavior. Moreover, the adoption of consistent behavioral

habits in childhood that takes place at home, primarily with parents (especially mothers), can become a lifetime behavioral model (Poutanen et al., 2006).

Patterson et al. (1990), in a previous study conducted in Kuwait, also reported that mothers and teachers were aware of the need for dental services for children, and supported the SOHP initiative in Kuwait (Petersen et al., 1990). In the present evaluation, mothers' awareness of oral health issues, their attitudes towards oral health and SOHP, their personal oral hygiene practices, and the impact of their oral health on their quality of life were assessed.

1.5.2.4 Reach, adoption, implementation of the program in the schools: context and maintenance of SOHP

A considerable body of literature shows the effectiveness of utilizing a multi-dimensional approach to identifying barriers and facilitators of public health programs (Lee & Stewart, 2013; McLeroy, Bibeau, Steckler, & Glanz, 1988; Richard, Gauvin, & Raine, 2011). The local school-SOHP setting was assessed in conjunction with local data as an indicator of the SOHP environmental characteristics (Brownson et al., 2006; Campbell et al., 2007). Program records and reports were used to explore program coverage, characteristics of participants. Dental public health system were explored to address proportion rates around the adoption of the program. Qualitative interviews were used to explore key informants' perceptions toward SOHP activities as well as opportunities around decision-making/policy-changing and how decisions were made (Brownson et al., 2006; Gregson et al., 2001; Hanney, Gonzalez-Block, Buxton, & Kogan, 2003; Sorensen et al., 2003). The extent to which the program activities have been implemented and become institutionalized were addressed.

In the study, annual dental department reports, SOHP records and policy-tracking were reviewed. In addition, qualitative approach such as focus groups and semi-structured interviews were used to explore the enabling factors that impact program performance among multi-level stakeholders.

1.6 Conceptual Framework

In the past, researchers tended to focus mainly on the biological etiology of dental decay. In recent years, however, there has been a notable shift in interest towards exploring children's oral health outcomes using a broader and deeper framework that incorporates multiple determinants such as environmental, psychological, and biological measures at different levels (Murray et al., 2010).

It is incorrect to assume that lifestyle is solely an individual's choice. A non-deterministic view of human behavior explains behavior as a consequence of multiple complex person-environment interactions over time, rather than a single event (Fisher-Owens et al., 2007). Therefore, the Ecological Health Model (EHM) and the Reach, Effectiveness-Adoption, Implementation and Maintenance (RE-AIM) framework were found to be the most appropriate models for guiding this evaluation (Glasgow, Vogt, & Boles, 1999).

1.6.1 Ecological Health Model (EHM)

The EHM is the overarching model utilized in this evaluation to assess changes at individual, family, community, and system levels (Fisher-Owens et al., 2007; Richard et al., 2011; Stokols, 1996). It provides guidance for this comprehensive approach to SOHP evaluation across multiple domains, as follows. On the individual level, because oral health is influenced by dental decay,

the effects of the physiological, psychological, and family situation status level of the children on their oral health was investigated (McLeroy et al., 1988). On the interpersonal level, the impact of family, cultural norms, and mothers' knowledge and awareness on oral health was studied. At the community level, including SOHP system characteristics and school environment characteristics, a number of factors were explored, including how enhanced support for oral health education can create a more positive environment for behavior change opportunity, and how partnerships between SOHP and school administration can enhance positive outcomes (Gregson et al., 2001; Sorensen et al., 2003). Finally, at the system and policy level, policy-making and indications for regulations' development of dental public health were addressed as domains that recognize the effect of multiple ecological factors on SOHP performance (Murray et al., 2010). Hence, I have explored how and why the existing regulations were established, and why some of the regulations were modified.

1.6.2 Reach, Effectiveness - Adoption, Implementation, and Maintenance (RE-AIM)

Framework

The RE-AIM framework was developed for the planning and evaluation of chronic diseases' public health programs (Glasgow et al., 1999). It uses five constructs (Reach, Efficacy, Adoption, Implementation and Maintenance) to advance the effectiveness of translating research into practice and enabling a better understanding of the impact of public health interventions. The five constructs at the individual and organizational levels are generally defined as follows. Reach indicates the true proportion of participants involved in a certain program. Effectiveness is the impact of an intervention on specific outcomes. Adoption refers to the proportion and representativeness of the settings hosting the program services. Implementation is the extent to

which the intervention is implemented as proposed. The last construct, maintenance, refers to the extent to which the program is sustained over time, and the procedures institutionalized.

According to the RE-AIM literature researches a successful initiative would have a broad reach and an effective intervention, widely adopted by providers and organizations, appropriately implemented, and maintained over time (Hanney et al., 2003).

Adopting the above mention models in a systematic evaluation that assesses the impact of multiple interventions offered on individual, community, and organization level, acknowledges multiple dimensions in evaluation research in dental public health. The proposed model provided an insight into expensive dental-based interventions.

1.6.3 Evaluation method

As noted above, a logic model for the SOHP was developed, program outcomes were identified, and indicators for primary outcomes were assessed. The outcome measures were used to explore the impact of the Kuwait Capital SOHP, utilizing a multi-layer sequential explanatory mixed-method design. The mixed-method sequential design consists of two distinct phases:

quantitative, followed by qualitative phase. This process is diagrammed in Figure 1.2.

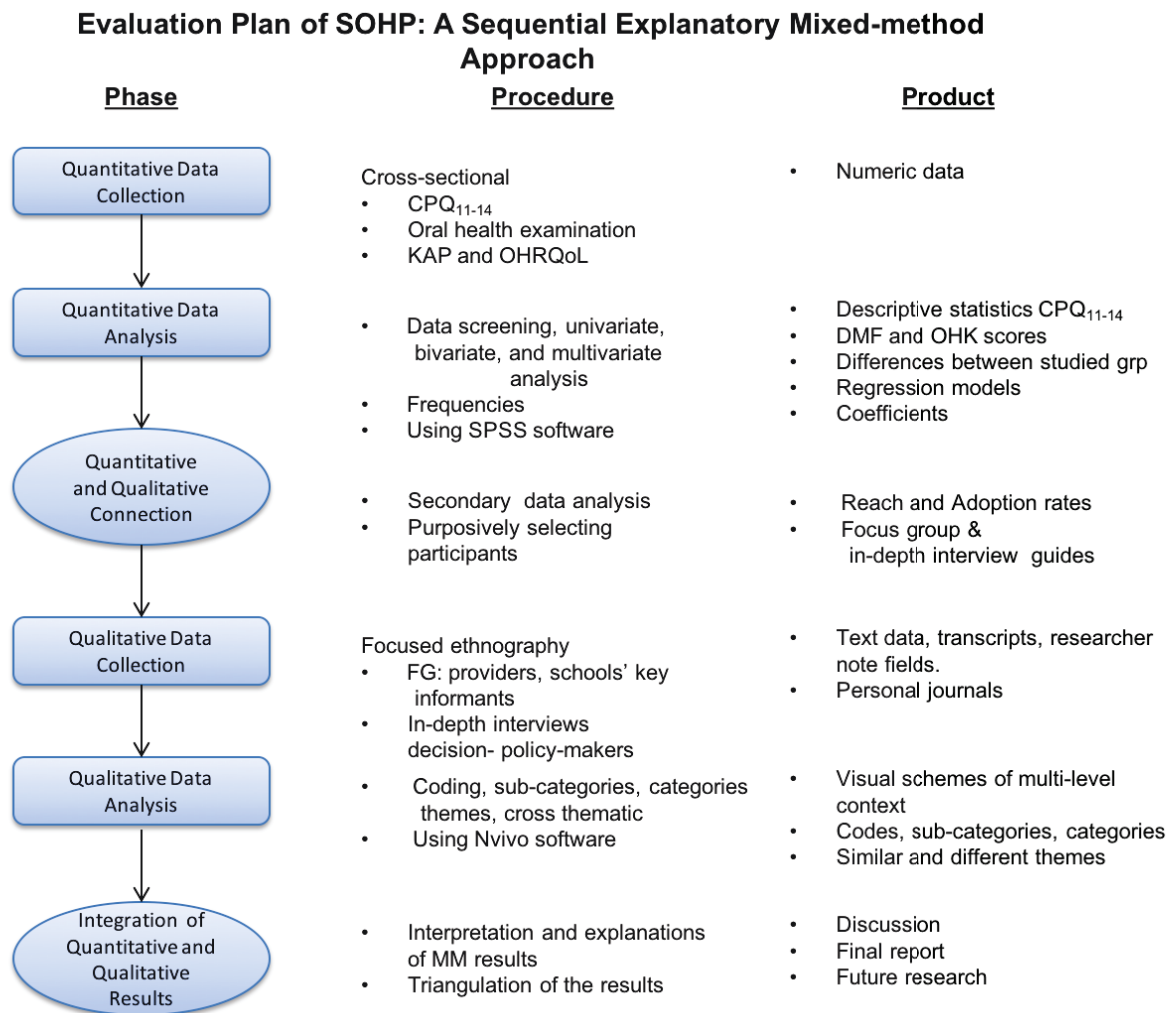


Figure 1.2. Evaluation Plan

1.6.3.1 The mixed-method design

By definition, a mixed-method design indicates the use of a pluralistic approach (quantitative and qualitative), and involves integrating quantitative and qualitative data at some stage of the

process to enhance understanding of the program outcomes, particularly in the case of unexpected outcomes and unmet needs (Mays, Pope, & Popay, 2005; Tashakkori & Teddlie, 1998). A sequential explanatory mixed-method implies collecting and analyzing quantitative data such as cross-sectional surveys or clinical examinations, followed by a qualitative method of inquiry (Ivankova, 2006). The implementation of each stage, the equal priority of the selected methods, and the integration of data are coherent with the research question and the objectives of the evaluation (Teddlie & Yu, 2007).

For this evaluation study, I used the mixed-method sequential explanatory approach because of the complexity of the program, multi-level stakeholders involved, and assessment of disease prevalence among a relatively large population of schoolchildren. The quantitative data provided information about the extent of the dental problem and the level of coverage of the program services, while the qualitative data explained the underlying issues. In this evaluation, the phases proceeded in a sequential manner, with both phases having the same priority. Data integration was initially performed in the intermediate stage as well as at the end in order to formulate the final report.

The evaluation was conducted in two phases. The first phase assessed the magnitude of dental diseases by measuring the prevalence rates and impact of program activities. The records for measuring the coverage rates were also analyzed. In the second phase, factors related to service delivery at school settings that affect the fidelity of delivering program activities, and key elements of long term program maintenance were explored. A quantitative method was used in Phase I and a qualitative method in Phase II. Phase I was made up of two projects. The first project focused on children's oral health status and OHRQoL (objectives 1-4), and the second

explored mothers' oral health knowledge, attitudes, and practices (KAP) (objective 5). These two quantitative projects examined the impact of SOHP on the primary target populations (children and mothers). The integration of quantitative and qualitative methods began at this stage. Data analysis and the interpretation and review of program reports and records were used to enhance the interview guide for Phase II.

1.6.3.2 Cross-sectional study

In Phase I, a cross-sectional study was conducted to estimate the level of dental diseases and oral hygiene status, OHRQoL among children, and oral health KAP and OHRQoL of mothers (objectives 1-4). This type of research design is widely used in dental public health to estimate the prevalence of a dental condition, and to report the current health situation of a certain population. This research design is also used in the oral health epidemiological literature to detect the trend of disease among specific populations (Petersen & Kwan, 2004; WHO, 2013).

1.6.3.3 Focused Ethnography

In Phase II, a focused ethnographic approach was used to gain detailed insight into factors influencing program performance from SOHP stakeholders' perceptions, by interviewing oral health providers, school staff, and decision-makers (objectives 5 and 6). Ethnography has traditionally sought to explore cultures or communities on the basis of researchers' observations over a long period of time (Knoblauch 2005). A focused-ethnographical approach, compared to traditional ethnography, is a time-limited method to obtain the meaning for a specific topic among a specific group of people rather than an entire community (Alcock, Camic, Barker, Haridi, & Raven, 2011; Cruz & Higginbottom, 2013). Moreover, focused ethnographic research often uses small sample sizes as its aim is to explore participants' perceptions and practices,

viewing them within the context in which they actually occur (Cruz & Higginbottom, 2013). The focused ethnography results have provided meaningful and valuable applications in community and health care interventions (Knoblauch, 2005). This technique is highly compatible with the goals of process evaluation, as the key advantage of its holistic approach is to understand behavior in context.

1.7 Summary

The literature reviewed in this chapter has shown that despite widespread public health interventions, dental decay is still a public health issue affecting schoolchildren. School-based preventive programs are one of the community-based interventions recommended by WHO (Petersen 2003b). The Kuwait school-based oral health program that comprises a series of education, prevention, and treatments services to schoolchildren via school- and center-based clinics has been introduced as a case study.

Despite the benefit of school-based programs, researchers complain that published evaluation reports are poorly designed. Furthermore, the implementation and evidence-based practice of school-based intervention is underdeveloped (Watt, 2008). Limitations about improper outcome indicators, lack of theoretical frameworks, and using a single data collection method are suggested as the main drawbacks to capture multi-factorial dental disease prevalence (Cooper et al., 2013; Watt, 2005), i.e., SOHP provides clinical prevention to children, and education activities to children, parents and teachers in a schools' dynamic environment needs a comprehensive approach in accordance with the nature and characteristics of its' environment (Sheiham & Watt, 2000; Watt, 2005). These studies have shown that multiple criteria should be employed in the evaluation of oral health research such as using multiple tools to assess disease

level, impact of the disease on quality of life, and contextual factors affecting the delivery of the services.

In this dissertation, Chapter 2 discusses the impact of dental health on children's oral health-related quality of life. Chapter 3, a cross-sectional study, discusses whether mothers' oral health knowledge, practices, and quality of life affect their children's dental health status and oral health-related quality of life. Chapter 4, a cross-sectional study, assesses the impact of Kuwait school oral health program. Chapter 5 discusses the implementation and maintenance of the school oral health program in Kuwait. Chapter 6 presents the discussion and conclusions.

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Chapter Two

Impact of Dental Health on Children's Oral Health-Related Quality of Life: A Cross-Sectional Study

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2.1 Abstract

Objective: To assess the impact of children's dental health status (DHS) on their oral health-related quality of life (OHRQoL).

Methods: Participants were 11- and 12-year-old children attending public schools in the Kuwait Capital Region. Children's DHS was evaluated by clinical examinations and presented using decayed, missed, filled teeth/surface (DMFT/dmft, DMFS/dmfs); restorative care (RI), plaque (PI); and pulp, ulcers, fistula, abscess (PUFA) indices. Children's OHRQoL was assessed using the Child's Perception Questionnaire 11-14 (CPQ₁₁₋₁₄). Means (SD) and frequencies were used for data description. Different factors were analyzed as predictors of OHRQoL by logistic regression analysis.

Results: A total of 440 children aged 11-12 years (50.7% females) participated in this cross-sectional study. Mean (SD) DMFT/dmft, RI, PI, and PUFA scores were 2.91(2.75), 0.21 (0.34), 3.59 (1.63), 0.31 (0.85), respectively. The mean total CPQ₁₁₋₁₄ was 20.72 (16.81). Mean scores of oral-symptoms, functional-limitations, emotional and social well-being were 4.26 (3.32), 5.40 (4.92), 5.48 (6.15) and 5.33 (6.05), respectively. Children with more than four fillings were 95% less likely to have had oral symptoms than those with no fillings. Children with a DMFT/dmft of 2-3 were 2.8 times more likely to have functional limitations than those with a DMFT/dmft of 0, while children with a DMFT/dmft of more than 4 were 4.4 times more likely to experience limitations. Having two or three non-cavitated lesions reduced the odds of having functional-limitations by 58%. Children with more than four missing teeth were 45% more likely to experience emotional stress. Having more than four fissure sealants reduced the odds of having emotional stress by 46%.

Conclusions: The increase in the number of carious teeth was associated with a limitation in oral functions. Preventive treatment had a positive impact on children's emotional well-being and restorative treatments improved their oral function.

Keywords: Quality of life, Caries, Oral Health, Restorative index, Children, Oral Symptoms

2.2 Introduction

Worldwide, dental decay remains one of the most widespread chronic diseases, and oral diseases are the fourth most costly to treat (Glick et al., 2012). Oral health is a standard of health of oral and oral-related tissues that contributes to general well-being and enables an individual to eat, speak and socialize without active disease, discomfort or embarrassment (Kay & Locker, 1998;

Yewe-Dyer, 1993). Objective evaluation of oral health status (OHS) includes measures of caries, fluorosis, malocclusion, hypodontia, periodontal diseases and orofacial deformities (Mohlin, Pilley, & Shaw, 1991). Oral health-related quality of life (OHRQoL) measures are subjective indicators based on information provided by individuals about their oral health status and its impact on various aspects of their life (Gherunpong, Tsakos, & Sheiham, 2006). Measures of OHRQoL provide essential information when assessing the treatment needs of individuals and populations, as well as when making clinical decisions and evaluating interventions, services and public health programs (Jokovic et al., 2002; Kramer et al., 2013; Krisdapong & Sheiham, 2014; Palencia, Espelt, Cornejo-Ovalle, & Borrell, 2014).

Four domains are used to measure OHRQoL: oral symptoms, functional limitations, social well-being, and emotional well-being. The domains are interconnected and influence one another as it has been documented in relationships between children's and adults' psychological status and functioning (Eccleston & Malleson, 2003; Mohlin et al., 1991). Dental health status (DHS) is, similarly, thought to have a direct impact on overall children's OHRQoL (Barbosa & Gaviao, 2008).

The relationships between malocclusion and orofacial deformities (abnormalities in the oral cavity and jaws) and overall OHRQoL, especially in relation to emotional and social well-being domains, are already well-documented (Broder & Wilson-Genderson, 2007; Foster Page, Thomson, Jokovic, & Locker, 2005; Gherunpong, Tsakos, & Sheiham, 2004). Dental caries was also reported to be associated with all components of OHRQoL in a low caries community, where DMFT (decayed, missing, and filled teeth) scores were 1 or less among 12-year-old children (Robinson, Nalweyiso, Busingye, & Whitworth, 2005). However, in a high caries

population, the association was only detected with the oral symptom and functional subscales (Brown & Al-Khayal, 2006). Social and emotional well-being subscales were less affected by caries in young children because they attach less importance to their social interactions (Gherunpong et al., 2004). Yet, it is not clear which component of the caries, oral hygiene, caries severity indices have an impact on OHRQoL or has a better predictive value in a population with a high level of dental caries.

In this study, we hypothesized that poor DHS, measured by caries/ caries consequences, dental treatments, and hygiene level, is associated with low measures of OHRQoL in all four domains. Therefore, the specific objectives were to: (i) measure DHS by direct examination; (ii) measure OHRQoL by a self-administered questionnaire; and (iii) evaluate the association between DHS and children's OHRQoL, and to determine factors that may predict this relationship for schoolchildren 11–12 years old.

2.3 Methods

2.3.1 Study design

This was a cross-sectional study using an OHRQoL survey along with the oral examination of participating children. The study protocol was approved by the University of Alberta Research Ethics Board (Protocol no. 00037434) and the Joint Committee for the Protection of Human Subjects in Research, Kuwait. Informed consent from parents/guardians of every participating child was collected. The study was conducted in accordance with the Helsinki Declaration and was presented following the STROBE guidelines (Vandenbroucke et al., 2007).

2.3.2 Study setting and participants

The study was conducted in the Capital Education/Health Region in Kuwait, where more than 85% of Kuwaiti children attend public schools, and the research procedures were carried out for 6 months during the 2013 academic year. Participants were 11- and 12-year-old children attending public schools in the Kuwait Capital Region. Seven schools were randomly selected from a list provided by the Ministry of Education Research Department (West & Galecki, 2012). A letter of information was sent to the selected schools, coupled with an additional information letter to be sent to the parents. All 11-12 year-old children at these schools were approached for participation. The sample size was calculated based on a total of 16,361 students, with a type one error of 0.05, 95% confidence intervals, and the proportion of 0.5 was estimated to be 375. A 75% positive response rate was expected; therefore, a total of 500 consents were distributed.

2.3.3 Procedure

A hygienist gave a 5-minute presentation to children about the study and sent an information letter along with a consent form home for their parents to sign. Child's assent was obtained prior to administering the questionnaire and performing the dental examination. Clinical examinations were performed at the capital public school clinics using fully equipped mobile dental chairs and sterile WHO probes and mirrors.

2.3.4 Measures

The following measures were used to assess children's DHS and OHRQoL:

2.3.4.1 Clinical examination

All clinical examinations were conducted at the school clinic using a mobile dental chair, an artificial LED light, and a dental unit. Using the WHO oral health examination criteria, the clinical examinations were conducted by one calibrated examiner. The examiner had training and experience in the use of WHO criteria for the Kuwait National School Oral Health Survey 2013–2014. The examining dentist showed high intra- and inter-examination consistency ($\kappa = 0.91\text{--}0.83$). Differences between cavitated and non-cavitated lesions were evaluated according to the International Caries Detection and Assessment System (ICDAS) guideline criteria (<https://www.icdas.org>). The children's oral hygiene was evaluated using the Silness-Löe plaque index (Silness & Loe, 1964), and the clinical consequences of untreated dental caries were evaluated using the PUFA index (Monse, Heinrich-Weltzien, Benzian, Holmgren, & van Palenstein Helderman, 2010).

The following indices were recorded as part of the examination: decayed teeth (DT/dt), missing due to decay (MT/mt), filled teeth (FT/ft), DMF teeth (DMFT/dmft), DMF surfaces (DMFS/dmfs), number of sealed teeth, number of non-cavitated teeth, restorative care index (RI) (Jackson, 1973), plaque index (PI), and PUFA index for comprehensive oral health examination purposes (Appendix 1).

2.3.4.2 CPQ₁₁₋₁₄ Questionnaire

The Child Perceptions Questionnaire (CPQ₁₁₋₁₄), developed in Toronto, Canada by Jokovic et al. (Jokovic et al., 2002) was used to assess each child's oral impacts on function, life-style activities, general sense of well-being, and relationship with others (Barbosa & Gaviao, 2008).

The CPQ₁₁₋₁₄ includes the four domain subscales of oral symptoms (e.g. pain), functional limitations (e.g. difficulty eating/drinking), emotional well-being (e.g. avoiding smiling or laughing around other children), and social well-being (e.g. being asked questions / experiencing comments from other children about his/her mouth). The Arabic version of this questionnaire was translated and validated by Brown and Al-Khayal (Brown & Al-Khayal, 2006) and provides good psychometric properties (e.g., internal consistency, test-retest reliability). The CPQ₁₁₋₁₄ instrument can be self-administered or interviewer-administered, with only slight differences in the score results (Jokovic et al., 2002). For this study, we introduced the questionnaire to the children and used the CPQ₁₁₋₁₄ self-administered form (Appendix 2).

The CPQ₁₁₋₁₄ questionnaire uses Likert-type scales with response options of “Never” = 0, “Once or twice” = 1, “Sometimes” = 2, “Often” = 3, and “Every day or almost every day” = 4 within a recall period of 3 months. Items are grouped into four domains: oral symptoms (6 questions), functional limitations (9 questions), emotional well-being (9 questions), and social well-being (12 questions). Domain and overall OHRQoL scores of the CPQ₁₁₋₁₄ were calculated by summing all of the responses to items either in the domains or on the whole questionnaire. Lower scores indicated a better OHRQoL.

The questionnaire also contained two global self-rating questions on perceived oral health (with Likert-type scale), with responses ranging from “Excellent”= 0, “Very good”= 1, “Good”=2, “Acceptable”=3, to “Poor”=4, and one question about the impact of oral health on overall well-being with responses ranging from “Not at all”=0, “Very little”=1, “Somewhat”=2, “A lot”=3 to “Very much”=4. The latter question was used as a dependent variable in the analysis as a further indicator of OHRQoL.

The Arabic version questionnaire was pre-tested with a group of students, and unclear words were replaced with alternatives that were easier to understand. One hundred and eighteen questionnaires were administered twice, with a two-week gap between attempts; kappa scores for the test/retest questionnaires were 0.87–1.0.

Internal consistency was quantified using Cronbach's alpha for the CPQ₁₁₋₁₄ questionnaire as well as each subscale. The intra-class correlation coefficient of repeated questionnaires was used to measure agreement. The item response rate was 100 %, and the results suggested high levels of internal consistency for the overall questionnaire. Reliability, tested by Cronbach's alpha for the overall CPQ₁₁₋₁₄ in the sample, was 0.91. The alpha coefficients for emotional and social well-being subscales were 0.83 and 0.81, respectively, which is excellent. The alpha coefficient for the functional limitation subscale (0.7) was acceptable; however, it was only moderate for the oral symptoms subscale (0.58). The intra-class correlation coefficient on repeated applications of the measure was 0.89 (95% CI = 0.76–0.97), suggesting excellent agreement.

As an index of construct validity, Spearman's correlation was significant for both global indicators for the total scale ($r = 0.23$ and 0.335), oral symptoms ($r = 0.27$ and 0.32), functional limitations ($r = 0.184$ and 0.32), emotional well-being ($r = 0.19$ and 0.29), and social well-being ($r = 0.14$ and 0.22). In addition, all of the constructs of the questionnaire were significantly positively correlated with each other (Table 2.3).

2.3.5 Data analysis

Data were managed and analyzed using SPSS 21.0 software (SPSS Inc., Chicago, IL, USA).

Data normality was tested using Kolmogorov-Smirnov test. The CPQ₁₁₋₁₄ responses were used to calculate mean domain scores and overall CPQ₁₁₋₁₄ scores as well as global self-rating. Indicators of OHRQoL were compared between children grouped by different demographic or DHS variables. Mean differences (i.e., ANOVA) of the DMF and CPQ₁₁₋₁₄ scores according to different independent variables were evaluated. The correlation between subscales, and global health and oral health questions were evaluated using Spearman's correlation test.

A new dependent variable was created, to conduct a multivariate logistic regression analysis of OHRQoL, Children were categorized into “negatively affected” (if they recorded the impact on any subscale question as “Often” and/or “Every day or Almost every day”) and “not affected”. Oral health status indicators were included as independent variables in multivariate logistic models for OHRQoL together with other controlling socioeconomic indicators, such as gender, number of siblings, mother's education and mother's age. Logistic regression models were generated for overall CPQ₁₁₋₁₄ as well as for every subscale. The level of significance was set at 0.05.

2.4 Results

The response rate was 88% as 449 children returned the parent authorizations. Nine participants were excluded due to the presence of a systemic disorder as reported by parents or child's uncooperative behavior for the clinical examination or completion of the questionnaire.

The final sample was composed of 440 participants, of which 50.7% were female.

Almost 46.4% of the children were from families with 2–4 children, while 34 (7.7%) of them had no siblings. Almost half of the children’s mothers had a college degree and were younger than 40 years of age. The participants’ demographics are summarized in Table 2.1.

Table 2.1.
Basic demographics of participants

Variable	Number (%)
Gender	
Male	217 (49.3)
Female	223 (50.7)
Mother’s education	
High school or less	94 (21.4)
More than high school	106 (24.1)
College	204 (46.4)
Post-college	27 (6.1)
Number of children in the family	
Only child	34 (7.7)
2–4	204 (46.4)
More than 4	202 (45.9)
Mother’s age	
Under 40	227 (53.0)
40 and over	201 (47.0)

2.4.1 Dental health status

Mean (SD) DT/dt, DMFT/dmft and DMFS/dmfs were 1.96 (2.24), 2.91(2.75), and 5.71 (6.94), respectively. Although 23.9% of the children had DMFT/dmft = 0. Per child, the mean number of non-cavitated carious teeth was 2.34 (2.17) and mean sealed teeth 1.78 (2.56), while the mean RI was 0.21 (0.34). The mean plaque index was 3.59 (1.63) and the mean PUFA index was 0.31 (0.85). DHS and separate components of DMF/dmf can be reviewed in Table 2.2.

Table 2.2.
Demographics and DHS measures

Variable	DT/dt	MT/mt	FT/ft	DMFT/dmft	DMFS/dmfs	No. of sealed teeth	No. of non-cavitated teeth	RI	Plaque index	PUFA score
Gender										
Male	2.0 (2.2)	0.4 (1.0)	0.7 (1.2)	3.1 (2.8)	6.4 (8.0) ^a	1.9 (2.5)	2.3 (2.2)	0.2 (0.3)	0.9 (0.4)	0.4 (0.9)
Female	1.9 (2.3)	0.2 (0.6)	0.6 (1.2)	2.7 (2.6)	4.9 (5.8) ^b	1.7 (2.6)	2.4 (2.3)	0.2 (0.3)	0.9 (0.4)	0.3 (0.7)
Mother's education										
High school or less	2.9 (2.8) ^a	0.3 (0.9)	0.6 (.9) ^a	3.8 (3.1) ^a	7.6 (7.9) ^a	1.5 (2.4)	3.0 (2.4) ^a	0.2 (0.3) ^a	1.0 (0.4)	0.5 (1.2)
More than high school	1.7 (2.0) ^b	0.3 (0.8)	0.6 (.9) ^a	2.5 (2.6) ^b	5.3 (6.8) ^b	1.9 (2.6)	2.3 (2.1) ^b	0.2 (0.3) ^a	0.9 (0.4)	0.3 (0.8)
College	1.7 (2.0) ^b	0.3 (0.9)	0.7 (1.2) ^a	2.7 (2.6) ^a	5.0 (6.5) ^b	1.8 (2.6)	2.1 (2.1) ^b	0.2 (0.4) ^a	0.9 (0.4)	0.3 (0.7)
Post-college	1.0 (1.3) ^b	0.1 (0.4)	2.1 (2.4) ^b	3.3 (3.4) ^{a,b}	4.9 (5.1) ^b	1.7 (1.9)	0.7 (1.1) ^b	0.5 (0.4) ^b	0.8 (0.3)	0.2 (0.5)
Number of children in the family										
Only child	2.7 (3.1) ^b	0.0	0.0	2.7 (3.1) ^a	3.7 (4.7)	0.0	1.3 (0.6)	0.2 (0.3)	0.8 (1.0) ^a	
2–4	1.6 (2.1) ^a	0.3 (0.8)	0.7 (1.2)	2.5 (2.6) ^a	4.8 (6.4)	1.9 (2.7)	2.4 (2.2)	0.2 (0.4)	0.8 (0.4) ^a	0.3 (0.7)
More than 4	2.7 (2.4) ^b	0.3 (0.9)	0.6 (1.1)	3.2 (2.8) ^b	6.6 (7.5)	1.6 (2.4)	2.4 (2.2)	0.2 (0.3)	1.0 (0.4) ^b	0.4 (1.0)
Mother age										
Under 40	2.0 (2.2)	0.3 (0.8)	0.6 (1.1)	2.9 (2.7)	5.5 (6.55)	1.7 (2.3)	2.5 (2.2)	0.2 (0.3)	0.9 (0.3)	0.3 (0.8)
40 and over	1.9 (2.2)	0.3 (0.9)	0.7 (1.2)	2.9 (2.8)	5.8 (7.41)	1.9 (2.8)	2.2 (2.2)	0.2 (0.4)	0.9 (0.4)	0.3 (0.9)

Within columns, means followed by different superscript letters represent statistical differences among groups by t-test or ANOVA (with LSD post-hoc analysis). D/d=decayed; F/f=filled; M/m=missing; S/s=surface; T=permanent teeth; t=primary teeth; RI=Restorative index; PUFA=Pulp, Ulcer, Fistula, Abscess

Male children had significantly higher DMFS/dmfs than female children (Table 2.2).

Children without siblings and those from families with more than four children had a significantly higher level of dental decay and worse oral hygiene (DT/dt and plaque index) than children from families with 2–4 children. Children from families of more than four children had a significantly higher DMFT/dmft than children from smaller families. Furthermore, those whose mothers had less than a high school education had significantly higher DT/dt, DMFT/dmft, DMFS/dmfs and non-cavitated carious teeth than those whose mothers had a higher education. Children of mothers with a college education had higher FT/ft and RI. There was no significant correlation between mothers' age and caries, RI, plaque or PUFA indices. The DHS variables according to demographics are summarized in Table 2.2.

2.4.2 Oral health-related quality of life

A total of 74.2% of children reported at least one negative impact on their quality of life by responding with “Often” and/or “Every day or almost every day” in the questionnaire. In the oral symptoms domain, 29.9% responded to at least one question with “Often” and/or “Every day or almost every day”, while 38.7% did so in the functional limitations domain, 35.5% in the emotional well-being domain, and 29.7% in the social well-being domain.

Table 2.3.

Correlations between different components of CPQ₁₁₋₁₄

	OH self-evaluation	Overall well-being	Oral symptoms	Functional limitations	Emotional well-being	Social well-being	Total CPQ
OH self-evaluation	1						
Degree oral condition affects overall life	0.003	1					
Oral symptoms	0.272*	0.324*	1				
Functional limitations	0.184*	0.316*	0.524*	1			
Emotional well-being	0.188*	0.290*	0.474*	0.556*	1		
Social well-being	0.144*	0.222*	0.417*	0.530*	0.615*	1	
Total CPQ	0.230*	0.355*	0.691*	0.805*	0.862*	0.839*	1

* Spearman's correlation is significant at the 0.01 level (2-tailed).

The mean (SD) total CPQ₁₁₋₁₄ score was 20.72 (16.81). Mean scores for subscales were 4.26 (3.32) for oral symptoms, 5.40 (4.92) for functional limitations, 5.48 (6.15) for emotional well-being, and 5.33 (6.05) for social well-being. Almost 78% of the participating children evaluated their oral health as excellent or very good, while only 5% evaluated it as fair or poor. The mean overall self-evaluation of the effect of OH on their life was 0.69 (0.95), with 82.6% reporting “not at all or very little” and 5% reporting that it affects their life “a lot or very much”.

The study's male children had significantly better emotional well-being than the female children, with no significant differences between genders in overall self-evaluation, total CPQ₁₁₋₁₄ scores, or the other subscales (Table 2.4). Children whose mothers had a high school or post-

college education had higher total CPQ₁₁₋₁₄ scores, emotional well-being and social well-being than those whose mothers had lower than high school or post-college education. Children whose mothers were older than 40 years had a better self-evaluation of their OH.

Table 2.4.
Demographics and CPQ₁₁₋₁₄ scores

Variables	Overall OH self-evaluation (0–4)	Degree oral condition affects overall life (0–4)	Total CPQ (0–144)	Oral symptoms (0–24)	Functional limitations (0–36)	Emotional well-being (0–36)	Social well-being (0–48)
Gender							
Male	0.69 (0.98)	0.65 (0.96)	20.45 (16.21)	4.51 (3.52)	5.45 (4.59)	4.90 (5.67) ^a	5.59 (6.44)
Female	0.71 (0.90)	0.71 (0.90)	21.26 (17.74)	4.11 (3.26)	5.46 (5.27)	6.26 (6.79) ^b	5.43 (5.99)
Mother's education							
High school or less	0.88 (1.05)	0.82 (1.02)	24.33 (18.15) ^a	4.60 (3.86)	5.59 (5.14)	7.35 (6.94) ^a	6.8 (7.35) ^a
More than high school	0.64 (0.90)	0.65 (0.90)	21.54 (17.61) ^b	4.43 (3.40)	5.59 (5.08)	5.82 (6.55) ^b	5.70 (5.82) ^b
College	0.64 (0.88)	0.63 (0.88)	18.44 (15.08) ^b	4.02 (3.05)	5.18 (4.50)	4.55 (5.44) ^b	4.69 (5.55) ^b
Post-college	1.17 (1.47)	1.0 (1.41)	35.0 (30.61) ^a	6.50 (5.47)	9.33 (10.60)	9.83 (10.83) ^a	9.33 (10.86) ^a
Number of children in the family							
Only child	1.50 (0.71)	0.81 (0.63)	35.50 (16.26)	8.00 (4.24)	7.50 (2.12)	7.50 (0.71)	12.50 (9.19)
2–4	0.75 (0.94)	0.74 (0.94)	21.11 (17.28)	4.26 (3.30)	5.69 (5.01)	5.61 (6.41)	5.55 (6.48)
More than 4	0.63 (0.93)	0.61 (0.83)	20.44 (16.70)	4.32 (3.48)	5.15 (4.90)	5.58 (6.24)	5.39 (5.82)
Mother's age							
Under 40	0.78 (0.97) ^a	0.78 (0.97) ^a	21.43 (17.75)	4.21 (3.41)	5.67(5.13)	5.71 (6.45)	5.84 (6.75)
40 and over	0.60 (0.89) ^b	0.57 (0.86) ^b	20.21 (16.11)	4.41 (3.36)	5.20 (4.73)	5.49 (6.15)	5.12 (5.47)

Within columns, means followed by different superscript letters represent statistical differences among groups by t-test or ANOVA (with LSD post-hoc analysis).

D/d=decayed; F/f=filled; M/m=missing; S/s=surface; T=permanent teeth; t=primary teeth; RI=Restorative index; PUFA=Pulp, Ulcer, Fistula, Abscess

2.4.3 DHS and OHRQoL

Children with DMFT/dmft and DMFS/dmfs of less than 4 and those with less than two carious teeth ($DT/dt < 2$) had a significantly better self-evaluation of the impact of their dental health on their overall life compared with their counterparts (Table 2.5). Children with two or more carious teeth suffered from significantly higher oral symptoms and functional limitation compared with those with less than two carious teeth. Children with a PI score of more than two had significantly higher total CPQ₁₁₋₁₄, oral symptoms and functional limitation scores. The total CPQ₁₁₋₁₄ scores and subscales are summarized in Table 2.5.

Table 2.5.
DHS and CPQ₁₁₋₁₄ scores

CPQ components	OH self-evaluation		Overall well-being		Total CPQ		Oral symptoms		Functional limitations		Emotional well-being		Social well-being	
DHS indices	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
DMFT/dmft														
0	0.92	0.90	0.52	0.78	20.09	15.57	4.216	3.17	4.80	4.08	5.58	5.79	5.05	5.88
1	0.80	0.93	0.59	0.80	18.26	13.00	3.66	2.80	5.04	4.85	4.92	4.66	4.40	4.61
2 or 3	0.84	0.90	0.63	0.87	20.64	15.15	4.13	3.16	5.56	4.34	5.36	5.34	5.72	6.42
More than 4	0.91	0.95	0.92*	1.13	22.34	20.27	4.68	3.74	5.84	5.90	5.78	7.56	5.59	6.38
DMFS/dmfs														
0	0.92	0.90	0.52	0.78	20.09	15.57	4.22	3.17	4.80	4.08	5.58	5.79	5.05	5.88
1	0.71	0.90	0.74	0.86	17.34	11.40	3.55	2.94	5.00	4.69	4.87	4.55	3.47	3.46
2 or 3	0.92	0.98	0.51	0.85	18.94	13.33	3.79	2.71	5.16	3.99	4.81	4.67	5.51	5.36
More than 4	0.88	0.91	0.83*	1.04	22.17	18.92	4.56	3.61	5.83	5.53	5.77	6.95	5.73	6.64
DT/dt														
0	0.88	0.88	0.58	0.82	19.70	14.83	4.12	3.01	5.07	4.10	5.25	5.76	4.87	5.69
1	0.89	0.94	0.60	0.87	17.70	13.62	3.32	2.60	4.56	4.45	5.14	5.23	4.86	5.19
2 or 3	0.85	0.89	0.82*	1.06	23.43	17.48	4.78*	3.43	6.27*	5.36	6.13	6.33	6.19	6.62
More than 4	0.91	1.02	0.80*	1.04	21.32	20.99	4.64*	4.07	5.48*	5.82	5.31	7.32	5.41	6.55
MT/mt														
0	0.87	0.92	0.67	0.91	20.37	16.46	4.14	3.20	5.22	4.77	5.55	6.14	5.22	5.95
1	1.03	0.85	0.72	1.00	21.85	16.03	5.34	3.37	5.80	4.83	4.69	5.34	5.53	6.29
2 or 3	0.65	0.83	1.00	1.23	24.18	23.24	4.57	4.87	7.43	7.15	5.55	7.22	6.52	7.48
More than 4	1.13	1.36	1.00	1.41	22.63	17.33	4.50	3.25	5.88	3.64	6.13	8.08	6.13	6.13
FT/ft														
0	0.92	0.93	0.61	0.88	21.03	16.33	4.22	3.35	5.35	4.71	5.64	5.87	5.38	5.89
1	0.87	1.00	0.80	0.95	19.72	17.19	4.68	3.68	5.11	4.81	4.73	5.75	5.40	6.54
2 or 3	0.71	0.73	0.96	1.20	21.47	19.52	4.16	2.89	6.42	6.23	6.14	7.69	5.06	6.20
More than 4	0.85	0.81	0.75	1.12	18.94	15.47	3.32	2.14	4.67	4.52	4.79	7.51	5.20	6.26
RI														
0- < 0.2	0.89	0.93	0.73	0.97	21.10	16.93	4.24	3.47	5.55	5.05	5.73	6.14	5.58	5.96
0.2-0.5	0.91	1.04	1.02	1.05	24.91	20.52	5.66*	4.11	6.46	5.83	6.15	6.84	6.68	8.28
0.5 and more	0.76	0.84	0.73	1.04	18.38	16.10	3.45	2.41	5.39	5.19	4.77	6.74	4.77	5.32
Plaque index														
0- < 1	0.92	0.94	0.68	0.97	20.62	15.09	4.27	3.07	5.34	4.57	5.53	5.81	5.17	5.76
1- < 2	0.83	0.88	0.70	0.92	20.57	19.35	4.12	3.66	5.41	5.40	5.39	6.72	5.57	6.51
2-3	0.50	0.84	1.33	1.03	35.25*	14.24	8.00*	2.61	8.40*	6.39	6.40	5.18	6.33	6.83
PUFA score														
0	0.86	0.88	0.68	0.94	20.62	15.52	4.18	3.15	5.39	4.63	5.47	5.78	5.34	5.93
1	1.04	1.15	0.81	0.96	22.40	21.92	4.79	3.64	5.85	5.90	6.30	8.41	5.44	6.57
More than 1	0.87	0.97	0.70	1.02	19.56	23.33	4.43	4.69	4.79	6.52	4.40	6.41	5.07	6.99

Within columns, means followed with different superscript letters represent statistical differences among groups by t-test or ANOVA (with LSD post-hoc analysis)(p < 0.05).

2.4.4 Predictors of OHRQoL

Factors associated with a negative impact on OHRQoL were identified as predictors of OHRQoL using logistic regression analysis (Table 2.6). Having adjusted for a potential confounding effect in the logistic regression analysis, it was found that participating children with a DMFT of 2 or 3

were 3.8 times more likely to have their quality of life affected than those with a DMFT of 0 (OR = 3.80, 95% CI: 1.13–12.87), while having a DMFT of more than 4 increased the odds to 11.5 times (OR = 11.46, 95% CI = 1.80–73.02). Children with more than 4 carious teeth were two times more likely to be affected in the 3 months preceding the study than those who were caries-free (OR = 2.21, 95% CI: 1.04–2.01). Having 2 or 3 filled teeth decreased the odds of having an impact on quality of life by 62%, while having more than 4 fillings reduced it by 81%. For children with a PUFA score of more than 1, it was 33% more likely that their life was affected in the 3 months prior to the study (Table 2.6). The only predictor of oral symptoms was number of filled teeth (Table 2.7). Children with more than four fillings were 95% less likely to have had oral symptoms in the previous 3 months than those with no fillings (OR = 0.05, 95% CI: 0.01–0.59).

Table 2.6.

*Odds ratio (95% CI) for negative impact on OHRQoL from multivariate logistic regression analysis final model**

Variables	P-value.	Odds ratio	95% CI	
			Lower limit	Upper limit
DMFT/dmft				
0	-	Reference		
1	0.128	2.758	0.746	10.191
2 or 3	0.032	3.804	1.125	12.867
More than 4	0.010	11.459	1.798	73.021
DT/dt				
0	-	Reference		
1	0.085	0.475	0.204	1.107
2 or 3	0.184	0.480	0.162	1.417
More than 4	0.042	2.205	1.041	3.014
FT/ft				
0	-	Reference		
1	0.076	0.545	0.279	1.065
2 or 3	0.048	0.377	0.143	0.993
More than 4	0.043	0.187	0.032	0.997
PUFA score				
0	-	Reference		
1	0.582	0.812	0.386	1.705
More than 1	0.027	1.327	1.021	2.883
*Only significant variables (p < 0.05) were kept in the final model. Odds ratios were adjusted for other variables in the model. D/d=decayed; F/f=filled; M/m=missing; T=permanent teeth; t=primary teeth; PUFA=Pulp, Ulcer, Fistula, Abscess				

Children with a DMFT/dmft of 2 or 3 were 2.8 times more likely to have limitations in their oral function than those with a DMFT/dmft of 0, while children with a DMFT/dmft of more than 4 were 4.4 times more likely to experience limitations (Table 2.7). Having two or three non-cavitated lesions reduced the odds of having functional limitations by 58%. Children whose mothers had at least one college degree were 53% less likely to have functional limitations than those whose mothers had only a high school education or less.

Table 2.7.

*Odds ratio (95% CI) for negative impact on different OHRQoL domains from multivariate logistic regression analysis final model**

Variables	P-value	Odds ratio	95% CI	
			Lower limit	Upper limit
Oral symptoms				
FT/ft				
0	-	Reference		
1	0.220	0.383	0.083	1.776
2 or 3	0.056	0.169	0.027	1.049
More than 4	0.017	0.053	0.005	0.587
Oral functions				
DMFT/dmft				
0	-	Reference		
1	0.436	1.676	0.457	6.155
2 or 3	0.036	2.785	1.166	8.957
More than 4	0.028	4.428	1.261	25.785
Non-cavitated lesions				
0	-	Reference		
1	0.713	0.864	0.396	1.886
2 or 3	0.018	0.421	0.205	0.864
More than 4	0.072	0.509	0.244	1.063
Mother's education				
High school or less	-	Reference		
More than high school	0.445	0.764	0.383	1.524
College	0.020	0.471	0.249	0.889
Post-college	0.832	0.789	0.088	7.060
Emotional well-being				
MT/mt				
0	-	Reference		
1	0.346	0.651	0.266	1.591
2 or 3	0.034	1.234	0.061	0.897
More than 4	0.025	1.446	1.072	2.759
Fissure sealants				
0	-	Reference		
1	0.254	1.450	0.766	2.745
2 or 3	0.133	1.649	0.859	3.168
More than 4	0.049	0.538	0.276	0.949
Mother's education				
High school or less	-	Reference		
More than high school	0.018	0.466	0.248	0.878
College	0.001	0.286	0.158	0.518
Post-college	0.549	0.597	0.110	3.224
Social well-being				
Mother's education				
High school or less	-	Reference		
More than high school	0.927	1.029	0.553	1.917
College	0.003	0.398	0.217	0.731
Post-college	0.787	1.259	0.237	6.689

*Only significant variables ($p < 0.05$) were kept in the final model. Odds ratios were adjusted for other variables in the model. D/d=decayed; F/f=filled; M/m=missing; T=permanent teeth; t=primary teeth; PUFA=Pulp, Ulcer, Fistula, Abscess

Children with two or three missing teeth were 23% more likely to face emotional stress, while those with more than four missing teeth were 45% more likely to experience emotional stress. Having more than four fissure sealants reduced the chances of having emotional stress by 46%. Children whose mothers had a high school or college education were 53% and 71% less likely, respectively, to face emotional stress due to their teeth than those whose mothers had less than a high school diploma. None of the studied factors showed an association with OH self-evaluation and/or the overall well-being global rating.

2.5 Discussion

This study was conducted to evaluate the association between DHS and OHRQoL and to determine which components of dental health may have an impact on OHRQoL. In the study population, the prevalence of caries experienced by the children (76%) was very close to the percentage of children experiencing oral impacts (74.2%) in the 3 months preceding the study. The overall mean of children's CPQ₁₁₋₁₄ was generally better than that in a study undertaken previously in the region (Brown & Al-Khayal, 2006) and very similar to studies undertaken in other countries (Foster Page et al., 2005). The improved OHRQoL may be due to the presence of a school-based program that provides treatment, education, and prevention services in the region.

In the study population, the mean CPQ₁₁₋₁₄ score was relatively high; however, it was consistent with high DMFT level. Male children had a higher DMFS than female children; they also reported better emotional well-being. A gender difference was observed only in the emotional well-being subscale in our study, and this is consistent with the results reported previously by Foster Page et al. (2005). This observation can perhaps be explained by the

assumption that females are more concerned about their health and appearance than males (Foster Page et al., 2005) and are also more susceptible to emotional stress than males as noted in previous studies (Landgraf, Abetz, Denardo, & Tucker, 1995).

Mothers' education has been found as one of the major determinants of children's OHRQoL in previous reports (Gomes et al., 2014; Ramos-Jorge, Pordeus, Ramos-Jorge, Marques, & Paiva, 2013). In our study, mothers' education was also one of the major determinants of children's DH status and RI. However, children of uneducated and well-educated mothers had lower overall OHRQoL and, among the four components, emotional and social well-being subscales were affected the most. This may indicate that mothers' education level may not be a predictor of the OHRQoL in Kuwaiti children. For example, children of mothers' with a college education had better OHRQoL than children's of mothers' with a post-college education. In addition, children of mothers with less than a high school education had a high number of carious teeth, while children of mothers with a post-college education had a high number of filled teeth. In other words, while the experience of caries was the same in both groups, the level of untreated caries was higher in children with uneducated mothers. Nonetheless, the overall OHRQoL was lower in both groups, which may suggest that both untreated and treated caries can negatively affect children's emotional and social well-being. One possible reason is because children's DH status may upset their mothers, and mothers may transfer this stress to the child emotionally (Goettems, Ardenghi, Demarco, Romano, & Torriani, 2012; Gomes et al., 2014; Ramos-Jorge et al., 2013). In contrary to a previous study (Gomes et al., 2014) reporting no association between mothers' age and child's OHRQoL, in our study, children with older mothers, had a better self-evaluation of their OHS and overall well-being.

Similar to previous reports (Broder & Wilson-Genderson, 2007; Brown & Al-Khayal, 2006; Foster Page et al., 2005; Kramer et al., 2013; Locker, 2007; Martins-Junior et al., 2013; Scarpelli et al., 2013), the results of our study also suggest that OHS is associated with children's OHRQoL. While DMFT, DMFS and DT scores greater than 4 were significantly associated with children's overall well-being, only DMFT and DT were predictors of negative overall OHRQoL. In previous studies with the same age group, Foster Page et al. (Foster Page et al., 2005) found that a DMFS score of 4 or more was associated with a negative impact on overall OHRQoL through oral symptoms and social well-being, while Brown and Al-Khayal (2006) found that the DMFT was only significantly correlated with oral symptoms. In our study, the number of carious teeth was significantly associated with oral symptoms and functional limitation, while DMFT was a major predictor of a lower quality of life. All of these studies support the concept that caries experience has a negative impact on quality of life, so the discrepancy is mainly due to how the data are analyzed. Foster Page et al. (Foster Page et al., 2005) categorized DMFS scores into four categories (similar to our study), whereas Brown and Al-Khayal (2006) evaluated the correlation between the CPQ₁₁₋₁₄ scores and DMFT. As caries severity can be reflected on the PUFA index, children with a PUFA score of more than 1 were 33% more likely to be negatively affected. The present study is the only one thus far to investigate the PUFA index and OHRQoL.

In addition to caries, the number of filled teeth could be associated with OHRQoL. Children who had two or more filled teeth ($FT \geq 2$) were less likely to face negative experiences on overall OHRQoL and especially less likely to develop oral symptoms. Although not a predictor of better quality of life, RI was associated with better quality of life in the oral symptoms domain. Fissure sealants were also predictors of better emotional well-being. There

are currently no studies evaluating the effect of fillings or fissure sealants on OHRQoL with which to compare our findings. This indicates that any preventive dental services, such as fissure sealants, may have an effect on the children's emotional well-being domain of oral health quality of life. Hypodontia has also proven to negatively affect OHRQoL (Wong, McMillan, & McGrath, 2006). Similarly, in our study, the number of missing teeth was a predictor of the emotional distress component of OHRQoL. Interestingly, PI scores were associated with more effects on overall OHRQoL, especially the oral symptoms and functional limitations subscales. Such findings reinforce the fact that healthy oral hygiene practices can have a positive impact on OHRQoL.

This study has inherent limitations due to its cross-sectional design and the use of questionnaires that may have been subject to information bias. Self-administered questionnaires have limitations in identifying cause-effect relationships, but can still show useful associations. Nonetheless, self-reports of oral health-related behaviors and OHRQoL can provide accurate information (Desai, Durham, Wassell, & Preshaw, 2014). Using validated questionnaire and a representative sample may diminish the effects of these limitations. An additional limitation is that malocclusion and dental traumatic injuries were not included in the present study as they may have an impact on children's OHRQoL. However, caries and plaque level were the main focus of the present study. The number of recruited participants was larger than the calculated sample size as the response rate was higher than the response rate reported previously (Alsumait et al., 2015a). All children with positive consents were included to benefit from the clinical examination and the customized oral health advice provided in the study.

2.6 Conclusions

In conclusion, our results show that despite the fact that Kuwaiti schoolchildren are considered a high caries population, their oral health quality of life was comparable to published reports that evaluated children with lower level of caries. Children's oral hygiene (plaque level) could be related to overall OHRQoL. Dental caries level, non-cavitated lesions (early lesions), and severe carious lesions may impact oral health symptoms domain; however, RI reflects the treatment received, the higher the RI, the lower the functional limitation subscale scores. Missing and filled teeth were also correlated with the emotional well-being component. Surprisingly, fissure sealants as a dental decay preventive measure positively associated with emotional and well-being component. Further qualitative studies are recommended to evaluate how oral health preventive measures are associated with the emotional and social well-being components of CPQ₁₁₋₁₄.

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Chapter Three

Do Mothers' Oral Health Knowledge, Practices, and Quality of Life Affect Their Children's Dental Health Status and Oral Health-Related Quality of Life? A Cross-Sectional Study

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3.1 Abstract

Objective: To investigate the impact of mothers' knowledge, practice, and oral health-related quality of life (OHRQoL) on children's dental health status (DHS) and their OHRQoL.

Methods: Participants were 11- and 12-year-old children-mother pairs attending public schools in Kuwait Capital Region. Mothers' knowledge, practices, and OHRQoL were evaluated by a self-administered questionnaire. Children's DHS was evaluated by clinical examinations and presented using decayed, missed, filled teeth/surface (DMFT/dmft, DMFS/dmfs); restorative care (RI), plaque (PI); and pulp, ulcers, fistula, abscess (PUFA) indices. Children's OHRQoL was assessed using the Child's Perception Questionnaire.

Different factors were analyzed as predictors of DHS and OHRQoL by multiple linear and logistic regression analyses.

Results: An increase in mothers' education and frequency of drinking fluoridated water were associated with reductions in DMFT/dmft and DMFS/dmfs. Mothers' habits of regular dental visits, drinking bottled water, and using dental floss were a positive predictor for children's PI. Mothers' overall OHRQoL and drinking bottled water were the only predictors for children's PUFA scores. Children of mothers aware of the importance of dental visits twice a year were 76.6% more likely to evaluate their OH positively. Children whose mothers' consumed soft drinks daily were eighteen times more likely to have their OH negatively affect their overall health. Children were 30% more likely to be affected emotionally if their mothers' self-esteem was affected.

Conclusions: Mothers' oral hygiene practices were associated with their children's dental caries, plaque, restorative care levels as well as children's OHRQoL. Mothers' self-esteem had an impact on their children's OH-related emotional well-being.

Keywords: Mothers, Children, Caries, Dental Health, Quality of life, Oral Symptoms

3.2 Introduction

According to the World Health Organization (WHO) report, dental caries also known as tooth decay, affect 60-90% of schoolchildren worldwide, and people are susceptible to the disease throughout their life time (Selwitz, Ismail & Pitts, 2007; WHO, 2002). Despite the consistent decline in the incidence of dental disease in developed countries (WHO 2002), they are still a growing problem in developing countries, which is exacerbated by the fact that oral disease is the fourth most expensive disease to treat (Glick et al., 2012; Jurgensen & Petersen, 2013).

In the past, research has primarily focused on the biological and medical risk factors of caries. However, in the last decade a holistic view of oral health determinants has been offered with risk of dental caries including physical, biological, environmental, and behaviors of individuals (Fisher-Owens et al., 2007; Glick et al., 2012). Children are exposed to caries risk factors that are modifiable throughout their life related to individual behavior and life style. These factors include oral hygiene behaviors, dietary habits, and regular dental visits (Sujlana & Pannu 2015). At the family level, parents' socioeconomic status (SES) and health perceptions, as well as family composition and culture have been described in the literature as factors affecting children's oral health (Fisher-Owens et al., 2007). Acquired oral health habits early in life also continue to shape children's oral health behaviors later in adulthood. More specifically, parents' oral health knowledge, attitude, and practices have been cited as key factors influencing children's oral health-related behaviors and caries status (Poutanen et al., 2006; Van den Branden, Van den Broucke, Leroy, Declerck & Hoppenbrouwers, 2013). In a recent systematic review, lack of adequate parental oral health knowledge was identified as a risk factor for dental caries among children aged 0 to 6 years (Hooley, Skouteris, Boganin, Satur & Kilpatrick, 2012).

In addition, children of parents with negative attitudes toward dental hygiene, diet, and dental attendance have also had higher rates of dental caries (Poutanen, Lahti, Tolvanen & Hausen, 2006).

Despite changes in maternal roles in different cultures (Rossow, 1992), mothers still play a prominent role in children's oral health-related lifestyle (Okada, Kawamura & Miura, 2001; Poutanen et al., 2006; Saied-Moallemi, Murtomaa, Tehrani & Virtanen, 2007). Moreover, the adoption of childhood habits takes place at home, with parents – especially mothers – being the primary model for home oral health behaviors (Okada et al., 2002). Therefore, exploring mothers' oral health knowledge and practice may determine dental health status of their children.

Several studies have investigated the role of mothers' oral health practices in children's oral health status by focusing on the presence of caries and oral hygiene status (Petersen, Danila & Samoila, 1995; Poutanen et al., 2006). In a recent systematic review, Badri, Saltaji, Flores-Mir and Amin (2014) suggested that mothers' dental attendance and home oral care habits were significantly associated with a child's caries experience. Many studies concluded that mothers' oral health status is a strong predictor of their children's oral health status (de Silva-Sanigorski et al., 2013; Dye, Vargas, Lee, Magder & Tinanoff, 2011; Fisher-Owens et al., 2007).

Oral health-related quality of life (OHRQoL) of an individual is an indicator of the impact of oral health on individual's well-being (Wilson & Cleary 1995). Although many predictors of children's oral health have been investigated, the relationship between mothers' OHRQoL and the OHRQoL of their children has not been investigated. Information about mothers' oral health knowledge, practice, and quality of life is an area worth considering when an oral health promotion is designed to improve and promote children's oral health behaviors.

Therefore, the objectives of the present study were to investigate the level of mothers' knowledge, practice, and OHRQoL and how these influence children's dental health status and their OHRQoL.

3.3 Methods

3.3.1 Ethical consideration

This study was conducted in accordance with the Helsinki Declaration. The study protocol was approved by the University of Alberta Research Ethics Board (Protocol no. 00037434), and the Joint Committee for the Protection of Human Subjects in Research, Kuwait. Assent and informed consent were collected from the participants/guardians in this study.

3.3.2 Study design and sample

This cross-sectional study was conducted in the Capital Education/Health Region in Kuwait. Mother-child pairs from randomly selected public schools in Kuwait Capital area were recruited. The study was subjected to Strengthening the Reporting of the Observational studies in Epidemiology (STROBE) guidelines (von Elm et al., 2007). The schools were randomly selected from a list provided by the Ministry of Education Research Department. Extra schools were also chosen within the same geographical area, in case the anticipated number of children was not recruited in the designated schools. Information letters were sent to the selected schools and to the parents. The oral health examination, child's oral health perception, and mother's oral health knowledge, practice and quality of life assessments were carried out for six months during the 2013-2014 academic years.

The sample size was calculated based on a total population of 16,361 students. Considering a type-one error of 0.05, confidence interval (CIs) of 95%, and the proportion of 0.5, the sample size was estimated to be 375. However, a total of 500 consent forms were distributed to an equal number of girls and boys aged 11- and 12-years-old, to accommodate the possible 25% non-return rate (Petersen et al., 1990).

3.3.3 Procedure

A trained hygienist presented a five-minute talk to the children and gave each an information letter and consent form to take home. The hygienist called the mothers who approved their children's participation and scheduled clinical examinations. The children's assent was obtained prior to administering the questionnaire and performing the dental examination. Of the two dentists who were experienced in the use of WHO criteria for the Kuwait National School Oral Health Survey 2013-2014, the one with higher intra- and inter-examination consistency ($\kappa = 0.83-0.91$) was assigned to perform the dental examinations. The mothers who attended their children's dental examination completed the mothers' knowledge and practice questionnaires, along with a three-item OHRQoL instrument. Questionnaires were sent home with the children whose mothers did not attend their dental examination for completion.

3.3.4 Measures

3.3.4.1 Child's clinical dental parameters

One trained dentist, using fully equipped mobile dental chairs and sterile WHO probes and mirrors, performed clinical examinations at the Capital public school clinics. All clinical examinations followed the WHO dental examination criteria.

Caries was assessed using Decay, Missing, and Filled Teeth (DMFT). The following indices were recorded during the examination: decayed teeth (DT/dt), missing due to decay (MT/mt), filled teeth (FT/ft), DMF teeth (DMFT/dmft), DMF surfaces (DMFS/dmfs), number of sealed teeth, and number of non-cavitated teeth. Differences between cavitated and non-cavitated lesions were evaluated according to the International Caries Detection and Assessment System (ICDAS) guideline criteria (<https://www.icdas.org>).

Children's oral hygiene was evaluated using the Silness-Löe plaque index (Silness and Loe 1964). Plaque index (PI) was used to assess oral hygiene status coded as: 1- no plaque, 2- film of plaque, 3- moderate accumulation, or 4- abundant accumulation.

The clinical consequences of untreated dental caries were evaluated using the Pulp, Ulcer, Fistula, and Abscess (PUFA) index (Monse, Heinrich-Weltzien, Benzian, Holmgren & van Palenstein Helderman, 2010), for comprehensive oral health examination purposes. Finally, the restorative caries index (RI) (Jackson, 1973) was used to assess the restorative care received.

3.3.4.2 Child OHRQoL questionnaire

The Arabic version of the Child Perceptions Questionnaire (CPQ₁₁₋₁₄) (Jokovic et al., 2002) was used to assess children's oral health impacts on their function, life-style activities, general sense of well-being, and relationship with others (Barbosa & Gaviao 2008). The Arabic version of the questionnaire was translated and validated by Brown and Al-Khayal (2006) and possesses good psychometric properties. The CPQ₁₁₋₁₄ instrument can be self-administered or interviewer-administered, with only slight differences in score results (Jokovic et al., 2002).

The Arabic CPQ₁₁₋₁₄ scale consists of 38 questions that assess the OHRQoL of children. The questionnaire includes two questions on demographics, and two global self-rating questions on perceived oral health that were used as independent variables. Also, there are four domain subscales: six questions of oral symptoms (e.g., pain), nine questions of functional limitations (e.g., difficulty eating/drinking), nine questions of emotional well-being (e.g., avoiding smiling/laughing around other children), and twelve questions of social well-being (e.g., being asked questions/experiencing comments from other children about his/her mouth).

The frequency and severity of impacts were scored on a 5-point Likert scale, with response options coded 0-4 (0= Never, 1= Once or twice, 2= Sometimes, 3= Often, 4= Every day or almost every day) within a recall period of three months. The severity and frequency of the impacts scores range from 0 to 144; lower scores indicate a better OHRQoL. The questionnaire also contained two global self-rating questions on perceived oral health. The responses to the perceived overall health/oral health rating were (0= Excellent, 1= Very good, 2= Good, 3= Acceptable, 4= Poor). The latter question was used as a dependent variable in the analysis as a further indicator of OHRQoL.

3.3.4.3 Psychometric properties of the CPQ₁₁₋₁₄

The Arabic CPQ was pre- and post-tested (with a two-week gap between tests) with a sample of 118 students aged 11 to 12. Unclear words were replaced with alternatives. The kappa score for test/retest reliability was 0.87-1.0.

Internal consistency was quantified using Cronbach's alpha for the CPQ₁₁₋₁₄ questionnaire as well as each subscale. The intra-class correlation coefficient of repeated

questionnaires was used to measure agreement. The item response rate was 100%, and the results suggested high levels of internal consistency for the overall questionnaire. Reliability, tested by Cronbach's alpha for the overall CPQ₁₁₋₁₄ in the sample, was 0.91. The alpha coefficients for emotional and social well-being subscales were excellent, at 0.83 and 0.81, respectively. The alpha coefficient for the functional limitation subscale (0.7) was acceptable, but the oral symptoms subscale (0.58) was moderate. The intra-class correlation coefficient on repeated applications of the measure was 0.89 (95% CI = 0.76–0.97), suggesting excellent agreement.

As an index of construct validity, Spearman's correlation coefficient was significant for both global indicators for the total scale ($r = 0.23$ and 0.34 , oral symptoms ($r = 0.27$ and 0.32), functional limitations ($r = 0.184$ and 0.32), emotional well-being ($r = 0.19$ and 0.29), and social well-being ($r = 0.14$ and 0.22). In addition, all of the constructs of the questionnaire were significantly and positively correlated with each other.

3.3.4.4 Mothers' oral health knowledge (OHK), practice, and OHRQoL *questionnaire*

A questionnaire for oral health knowledge, practice, and quality of life was used in this study. The questionnaire was initially prepared in English, translated into Arabic, and then translated back into English by two independent translators to check for the correctness of the message conveyed. Questions included in the questionnaire were taken from previously published studies among Kuwaitis' population (Al-Ansari, Honkala & Honkala, 2003; Alsumait, ElSalhy & Amin, 2015a; Kassak, Dagher & Doughan, 2001).

The questionnaire consisted of four sections. Demographics included age, sex, education, and number of children. In the second section, fourteen questions assessed participants' oral hygiene knowledge. Questions measured the association between oral bacteria and systemic and caries, frequency of brushing and flossing, type of toothbrush and replacement frequency, dental check-up frequency, and use of fluoridated toothpaste. Participants' oral health-related behaviors (e.g., last dental visit, brushing and flossing frequency, use of fluoridated toothpaste, etc.) were explored in the third section (Appendix 3).

The final section of the questionnaire asked about participants' OHRQoL across three domains: physical, social, and psychological (self-esteem) impairments. The questions measured how often oral health problems affected participants' daily/social activities, and whether the appearance of their teeth caused them to avoid conversation.

3.3.5 Data analysis

Data were managed and analyzed using SPSS 21.0 software (IBM Corp., Armonk, N.Y., USA), and data normality was tested using the Kolmogorov-Smirnov test. The CPQ₁₁₋₁₄ child responses were used to calculate mean domain scores and overall CPQ₁₁₋₁₄ scores as well as global self-rating. Correlation coefficients were used to examine the association between subscales and global health and oral health questions using Spearman's correlation coefficient. To study the impact of mothers' knowledge, practice, and OHRQoL on different OHS indices, multiple linear regression analysis was used.

For OHRQoL analysis, a new dependent variable was created. Children were categorized as "negatively affected" and "not affected." Children were considered negatively affected if they

recorded the impact on any subscale question as “often” and/or “every day or almost every day”; otherwise, they were not considered negatively affected. Mothers’ KAP and OHRQoL factors were used as independent variables in multivariate logistic models for OHRQoL. Logistic regression models were generated for overall OHRQoL as well as for every subscale. The level of significance was set at 0.05.

3.4 Results

Four hundred and forty-nine consent forms were returned with parent authorizations. Nine participants were excluded due to systemic disorder (that may act as a confounder of presence of dental disease) as reported by parents, and/or non-cooperation (i.e., refused to complete the questionnaire and/or undergo the dental examination).

A total of 440 mother-child pairs participated in the present study. Among the children studied, the gender was equally distributed, and 46.4% had 1-3 siblings. The majority of mothers were under 40 years old, and 45.5% had no formal education beyond high school. Demographics are summarized in Table 3.1.

3.4.1 Children’s dental health status and OHRQoL

The experience of dental caries among the children was as follows: Mean (SD) DT/dt 1.96 (2.24), DMFT/dmft 2.91(2.75), and DMFS/dmfs 5.71 (6.94), with 23.9% of the children being caries-free (DMFT/dmft = 0). Per child, the mean number of non-cavitated carious teeth was 2.34 (2.17) and the mean for sealed teeth was 1.78 (2.56), while the mean RI was 0.21 (0.34). The mean plaque index was 3.59 (1.63) and the mean PUFA index was 0.31 (0.85). Children’s

DHS according to different demographic variables were previously described and published (Alsumait et al. 2015b).

About 74% of children reported at least one negative impact on their quality of life by responding with “Often” and/or “Every day or almost every day” on the questionnaire. In the oral symptoms domain, 29.9% responded to at least one question with “Often” and/or “Every day or almost every day,” while 38.7% of studied children had an oral functional limitation, 35.5% in the emotional well-being domain and 29.7% in the social well-being domain, respectively. Children’s OHRQoL according to different demographic variables were previously described and published (Alsumait et al., 2015b).

Table 3.1.
Basic demographics of participants

Variable	Number (%)
Children gender	
Male	217 (49.3)
Female	223 (50.7)
Mother education	
High school or less	94 (21.4)
More than High school	106 (24.1)
College	204 (46.4)
Post-College	27 (6.1)
Number of children in the family	
Only child	34 (7.7)
2-4	204 (46.4)
More than 4	202 (45.9)
Mother age	
Less than 40	227 (53.0)
40 and more	201(47.0)

3.4.2 Mothers' oral health knowledge, practices and OHRQoL

3.4.2.1 Knowledge

Total oral health knowledge scores ranged from 28.6% to 92.9%, the higher the score the better oral health knowledge, with a mean (95% CI) score of 71.7% (70.6-72.8). On average, most of the included mothers possessed good knowledge. The majority (91.8%) of the participants scored above 50%. The best-known facts (more than 85% correct) were that caries is the most common dental disease among children, tooth brushing should be done twice a day with fluoridated toothpaste, sticky sugary foods have a cariogenic effect, soft drinks can damage teeth, and improper brushing can cause gum bleeding. The least-known facts (less than 50%) were about toothbrush replacement frequency and knowledge regarding fluoridated bottled water. Mothers' responses to OH knowledge questions are shown in Table 3.2.

Table 3.2.

Percentages of mothers responded correctly to knowledge questions

No	Questions	N	%
1	Dentists recommend use of soft bristled tooth brush.	368	83.6
2	One should replace a tooth brush once in 3 months	124	28.2
3	Fluoride containing tooth paste should be regularly used	396	90.0
4	Caries is the most common dental disease among children.	421	95.7
5	Fluoride helps in prevention of caries	362	82.3
6	Sticky sugar is the most common cause for caries	400	90.9
7	Improper tooth brushing causes gum bleeding	385	87.5
8	Oral bacteria can cause systemic diseases	361	82.0
9	Soft drinks can cause wearing down of teeth	421	95.7
10	Oral bacteria can be transmitted from parent to child	225	51.1
11	One should brush teeth at least 2 times/day	405	92.0
12	Dental check-up should be done twice a year	313	71.1
13	Dental floss is used to clean the teeth	301	68.4
14	Bottled water in Kuwait contains fluoride	200	45.5

3.4.2.2 Practices.

Sixty-seven percent of mothers had their last dental visit in the year prior to the data collection. Emergency/pain was the main reason for 38.4% of the visits, and preventive care was the reason for 24.4%. Ninety-seven percent of mothers' brushed their teeth daily, 51.4% used a medium-bristled brush, and 43.1% used a soft brush. Fluoridated toothpaste was used by 88.2% of mothers, and 57.4% reported using dental floss. About 8.3% reported drinking sugary, carbonated beverages daily. Almost 17% consumed an excessive amount of sugar most of the time. Table 3.3 summarizes the mothers' OH practices.

Table 3.3.
Mothers' oral health practices

OH Behavior	N	(%)	OH Behavior	N	(%)
Last dental visit			Use of dental floss		
Less than a year ago	296	67.4	Yes	253	57.4
One year ago	70	16.0	No	187	42.6
Two years ago	73	16.7	Flossing frequency		
Never	0	0	Once a day	138	31.4
Reason for last visit			Once a week	101	23.0
Emergency/ Pain	169	38.4	More than once a week	54	12.3
Follow up treatment	132	29.9	Never	147	33.3
Regular check	107	24.4	Daily use of soft drinks		
Other reasons	32	7.3	None of the time	148	33.6
Daily Brushing			A little of the time	228	51.9
Yes	430	97.7	Some of the time	28	6.3
No	10	2.3	Most of the time	17	3.9
Last time brushed your teeth			All the time	19	4.4
Today morning	385	87.5	Use of excessive sugar in diet		
Yesterday morning	1	.2	None of the time	94	21.3
Yesterday night	49	11.1	A little of the time	202	45.8
Do not remember	5	1.2	Some of the time	70	16.0
Use of Fluoridated toothpaste			Most of the time	39	8.8
Yes	388	88.2	All the time	36	8.1
No	13	3.0	Drinking bottled water		
Don't Know	39	8.8	None of the time	26	6.0
Type of toothbrush			A little of the time	198	44.9
Soft	190	51.4	Some of the time	63	14.4
Medium	226	43.1	Most of the time	57	13.0
Hard	19	4.4	All the time	96	21.8
Don't know	5	1.2			

3.4.2.3 OHRQoL

Scores ranged from 0 to 12 for the three-item quality of life instrument, with the mean among the total study population being 0.95 ± 1.8 points. More than three-quarters of mothers had no teeth and/or gum problems affecting their daily activities, social life, or self-esteem in the three months prior to the study. The mothers' OHRQoL responses are shown in Table 3.4.

Table 3.4.
Mothers' OHRQoL responses

During the past three months, how often have problems with your teeth or gums ...	N	%
Affected your daily activities?		
• All of the time	5	1.2
• Most of the time	11	2.6
• Some of the time	19	4.4
• A little of the time	60	13.7
• None of the time	344	78.2
Affected your social activities?		
• All of the time	4	0.9
• Most of the time	18	4.0
• Some of the time	18	4.2
• A little of the time	59	13.3
• None of the time	342	77.7
Caused avoidance of conversations?		
• All of the time	8	1.9
• Most of the time	5	1.2
• Some of the time	7	1.6
• A little of the time	44	10.0
• None of the time	376	85.4

3.4.3 Predictors of dental health status in children (DHS)

Having adjusted for potential confounding factors in the multiple regression analyses (Table 3.5), multiple components of mothers' knowledge, practice, and OHRQoL predicted children's DHS using different measures. An increase in mothers' education and frequency of drinking fluoridated bottled water were associated with reductions in DMFT/dmft, DMFS/dmfs, and DT/dt in children. Every unit increase in the frequency of daily soft drink consumption for mothers was associated with a 2.6 increase in the DMFS/dmfs and 0.2 increases in DT/dt in children. When mothers used fluoridated toothpaste, 0.2 reduced the number of filled teeth in children. Dental compliance among mothers was the only predictor of the number of children's fissure sealants. This means that children of mothers who visited the dentist during the past year

had 0.4 more sealants. Mothers' habits of regular dental visits, drinking bottled water, and using dental floss were a positive predictor for children's plaque index. Mothers' overall OHRQoL and drinking bottled water were the only positive predictors for the PUFA score. Mothers' habit of drinking soft drinks daily was associated with a decrease in the children's RI, while the habit of using dental floss was associated with improved RI in children. Table 3.5 summarizes the multiple linear regression final models for every OHS index.

Table 3.5.

Multiple linear regression analysis final models predicting children DHS indicators

Variables	Coefficient	SE	P-value.	95% CI	
				Lower limit	Upper limit
DMFT					
Constant	4.944	0.457	<0.001	4.046	5.843
Do you drink bottled water?	-0.421	0.102	<0.001	-0.622	-0.219
Mother's qualification	-0.328	0.162	0.044	-0.646	-0.010
DMFS					
Constant	11.268	1.907	<0.001	7.519	15.017
Do you drink bottled water?	-0.994	0.258	<0.001	-1.501	-0.486
Mother's qualification	-1.066	0.409	0.010	-1.870	-0.261
Do you drink soft drinks every day?	2.655	1.270	0.013	0.158	5.152
Gender (female/male)	-1.681	0.660	0.011	-2.979	-0.383
DT/dt					
Constant	3.063	0.447	<0.001	2.185	3.941
Do you drink bottled water?	-0.319	0.082	<0.001	-0.481	-0.157
Mother's qualification	-0.373	0.131	0.005	-0.631	-0.115
One should replace a tooth brush once in 6 months	0.647	0.231	0.005	0.193	1.101
Do you drink soft drinks every day?	0.276	0.110	0.013	0.060	0.492
MT/mt					
Constant	0.484	0.102	<0.001	0.284	0.685
Do you drink bottled water?	-0.068	0.031	0.031	-0.130	-0.006
FT/ft					
Constant	0.976	0.140	<0.001	0.700	1.252
Use fluoride containing tooth paste?	-0.237	0.105	0.025	-0.444	-0.030
Number of sealant					
Constant	1.762	0.408	<0.001	0.959	2.565
Last time you visited a dentist?	0.416	0.179	0.021	0.064	0.768
PI					
Constant	0.554	0.087	<0.001	0.383	0.725
Last time you visited a dentist?	-0.118	0.043	0.006	-0.202	-0.033
Do you drink bottled water?	-0.043	0.016	0.009	-0.074	-0.011
Do you use dental floss?	-0.086	0.043	0.047	-0.171	-0.001
PUFA					
Constant	0.049	0.121	0.687	-0.190	0.287
Mother overall OHRQoL	0.068	0.026	0.009	0.017	0.118
Do you drink bottled water?	-0.075	0.036	0.028	-0.137	-0.008
RI					
Constant	0.204	0.125	0.104	-0.042	0.451
Do you drink soft drinks every day?	0.051	0.024	0.034	0.004	0.099
Do you use dental floss?	-0.091	0.044	0.040	-0.178	-0.004

3.4.4 Predictors of OHRQoL in children

Multiple components of mothers' knowledge, practice, and OHRQoL predicted children's OHRQoL self-evaluation and subscales. Children of mothers who were aware that they should visit the dentist twice a year were 76.6% more likely to evaluate their OH status as excellent or very good. Children whose parents consumed soft drinks daily were eighteen times more likely to state that their oral health condition negatively affected their overall health while those whose mothers drank bottled water were 93% less likely to be negatively affected (Table 3.6).

Children of mothers with post-college education were eight times more likely to be affected by oral symptoms and received more dental services. Children of mothers who used fluoridated toothpaste, and were aware that fluoride prevents caries and sugar is the common cause of caries, were less likely to have oral symptoms. Children of mothers who were aware that flossing is important for cleaning teeth were 49% less likely to be affected by functional limitations.

Children of mothers who had pursued a degree beyond high school and had college degrees were less likely to have their emotional well-being affected as a result of oral health problems than children of mothers with less than a high school education. Children were 30% more likely to be affected emotionally if their mothers' self-esteem was affected by their oral health conditions. Children of mothers who were aware that bottled water contains fluoride were 59% less likely to have their social well-being affected by oral conditions than children of mothers who were unaware.

Table 3.6.

Odds ratio (95% CI) for negative impact on different OHRQoL domains from multivariate logistic regression analysis final model

Variables	P-value.	Odds Ratio	95% CI	
			Lower limit	Upper limit
Overall OH self-evaluation				
Aware that the dental visit should be twice a year				
No	-	Reference	-	-
Yes	0.023	0.234	0.067	0.815
Degree oral condition affect overall life				
Daily use of soft drinks				
None of the time	-	Reference	-	-
A little of the time	0.251	2.182	0.576	8.262
Some of the time	0.641	1.847	0.140	24.362
Most of the time	0.998	0.000	0.000	.
All the time	0.010	18.383	2.003	168.706
Drinking bottled water				
None of the time	-	Reference	-	-
A little of the time	0.003	0.032	0.003	0.310
Some of the time	0.053	0.109	0.011	1.030
Most of the time	0.106	0.172	0.020	1.458
All the time	0.017	0.063	0.007	0.608
Oral symptoms				
Mother education				
High school or less	-	Reference	-	-
More than High school	0.950	1.023	0.503	2.081
College	0.130	0.590	0.298	1.169
Post-College	0.042	8.226	1.083	62.479
Aware that fluoride helps in prevention of caries				
No	-	Reference	-	-
Yes	0.006	0.392	0.199	0.769
Aware that sticky sugar is the common cause for caries				
No	-	Reference	-	-
Yes	0.047	0.371	0.138	0.899
Use fluoridated toothpaste				
No	-	Reference	-	-
Yes	0.039	0.408	0.174	0.955
Oral functions				
Aware that dental floss is important to clean the teeth				
No	-	Reference	-	-
Yes	0.013	0.512	0.302	0.869
Emotional well-being				
Mother education				
High school or less	-	Reference	-	-
More than High school	0.038	0.485	0.245	0.962
College	<0.001	0.270	0.138	0.527
Post-College	0.750	0.743	0.119	4.642
Mother's self-esteem during last 3 months?				
Not affected	-	Reference	-	-
Affected	0.046	1.298	1.010	1.462
Social well-being				
Aware that bottled water contains fluoride				
No	-	Reference	-	-
Yes	0.001	0.414	0.244	0.703

3.5 Discussion

This study evaluated associations between the oral health knowledge, practice, and OHRQoL of Kuwaiti mothers and their school-aged children's Dental Health Status (DHS) and OHRQoL. Results indicate that participating mothers had good oral health knowledge and OHRQoL. It was also found that the dietary habits, oral hygiene behaviors, and the self-esteem of mothers' OHRQoL were significantly associated with their children's DHS and OHRQoL.

More than 50% of the mothers who participated in this study had proper OHK and practices. The findings suggest a substantial improvement in oral health behaviors among Kuwaiti mothers, such as the use of fluoride toothpaste and dental adherence, compared to a previous study conducted by Petersen et al. (1990). An example of such knowledge is that 95% of mothers in the current study were aware of the cariogenic effect of sweet and sugary drinks compared to less than 50% found earlier (Petersen et al., 1990). This trend may be related to the implementation of the Kuwaiti national oral health program, the availability of fluoridated toothpaste (Okada et al., 2002), and the wide exposure of individuals to educational media resources that are now widely available to individuals in Kuwait (e.g., television, internet, social media). Nonetheless, mothers need to be better informed about some oral hygiene practice recommendations, such as toothbrush replacement and dental floss use. In our study, overall knowledge level was comparable to other studies among different populations; however, the caries level among the children in our study was considered elevated compared to the other published reports (Petersen & Baehni, 2012).

With respect to mothers' OH practices, our findings support the importance of emphasizing mothers' self-care strategies of hygiene practices and dental adherence (Poutanen et

al., 2006). Although the percentage of mothers who were drinking fluoridated bottled water was low, among those, drinking bottled water was a significant predictor of lower caries levels, severity of dental caries, and better oral hygiene (plaque level) in their children. This finding supports the decision of resuming water fluoridation as a community preventive measure of dental caries that is under consideration by the decision-makers in Kuwait. Water Fluoridation was suspended in the early 1980s because of technical problems (Morris, Gillespie, Al Za'abi, Al Rashed, & Al Mahmeed, 2008). Consistent with our dental attendance findings, Badri et al. (2014) reported that mothers' dental adherence was a very strong predictor of improved children's oral hygiene and caries level. Our results suggest that dental adherence has a direct association with fissure sealants received through preventive care. These results support Okada et al. (2002) findings that children of mothers who adhered to preventive measures, such as regular flossing, had less dental caries as well as better oral hygiene and dental care levels. Also, our results complement Nurelhuda, Ahmed, Trovik and Astrom (2010) regarding the harmful effects of sugary drinks, showing that mothers' consumption of soft drinks had a significant effect on children's caries.

In accordance with Social Learning Theory (Bandura), oral health habits are largely acquired through observational learning and modeling (Mattila, Rautava, Sillanpaa & Paunio, 2000). Our study identified a positive significant association between two specific practices, mother's adherence to regular dental visits and drinking fluoridated bottled water and children's overall OHRQoL. In other words, children of mothers with proper oral health behaviors (e.g., flossing) and adequate oral health information (e.g., benefits of fluoride, harmful effects of

sugar) were less likely to report suffering from oral functional limitations and oral symptoms. Healthy dietary habits among mothers played a significant role in children's health perception; a negative perception of general health was 18 times more likely to be reported among children of mothers who had an unhealthy lifestyle as defined by high consumption of soft drinks. This finding supports the previous reports that children's oral health behavior is usually molded by parents' values and norms (de Silva-Sanigorski et al., 2013; Poutanen et al., 2006).

However, our finding differs from that of the other studies evaluating the impact of oral health on quality of life of mothers' and their children. Interestingly, while more than three quarters of mothers reported that their OHRQoL was not affected by dental problems, around 75% of children believed that their OHRQoL was negatively affected by their dental problems. Mothers' self-esteem construct was the only predictor of the emotional and well-being domain of OHRQoL among studied children. While challenging to draw a conclusion from this finding, it may suggest that mothers' psychological construct of OHRQoL may intersect with children's emotional construct of OHRQoL (Conger, McCarty, Yang, Lahey, & Kropp, 1984). This is a promising area for further research in the OHRQoL and oral health promotion fields. Another interesting finding warranting further investigation is that mother's oral health practices were mainly predictors of children's normative oral health needs while children's perceived oral health needs were mainly associated with mothers' OHK.

Although this study identified the significant predictive associations between mothers' oral health knowledge and OHRQoL and children dental health status and OHRQoL, the cross-sectional study design prevents identifying casual inference regarding the effect of mothers'

knowledge and children's oral health status and quality of life. Moreover, one of the limitations of the mothers' questionnaire was socio-economic status; mothers' level of education was the only variable used to identify their socio-economic status, which needs further exploration. Also, more information is needed about whether mothers were the primary caregiver of the child or were helped by others, such as nannies and grandparents. Finally, the main source of mothers' OHK was not reported, which may help to explain knowledge-practice correlations.

3.6 Conclusions

In conclusion, our study identified a significant impact of oral health practices of mothers on children's oral health status. Lack of oral hygiene behaviors such as dental floss, dental attendance, and drinking fluoridated bottled water, as well as incredibly high consumption of soda drinks and sugar, had significant associations with dental caries, plaque, restorative care levels and children's OHRQoL. Finally, mothers' self-esteem in relation to OHRQoL was related to the children's emotional well-being domain of OHRQoL. The predictors discussed above could be used to develop more effective oral health promotion strategies, which could help foster positive dental health habits for both children and parents.

3.7 References

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Chapter Four

Impact Evaluation of a School-Based Oral Health Program: Kuwait National Program

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4.1 Abstract

Objective: To evaluate the impact of Kuwait school-based oral health prevention program (SOHP) on children's caries experience and oral health-related quality of life (OHRQoL), and their mothers' oral health (OH) knowledge, attitude, practice, and OHRQoL.

Methods: This cross-sectional study, in the Kuwait Capital, included 440 primary school children aged 11 to 12 years and their mothers. Participants were classified into two groups: SOHP and non-SOHP. The SOHP group had been enrolled in the prevention program for at least three years: children had two/yearly applications of fluoride varnish and fissure sealants if needed; mothers had, at least, one oral health education session. The non-SOHP group were not enrolled in the SOHP and had not been exposed to the prevention program activities. Dental examinations were performed at schools using portable dental units. Caries experience was

determined using the decayed (D/d), missing (M/m), and filled (F/f) teeth (T/t)/surface (S/s) indices. Children's OHRQoL was assessed using the self-administered validated Child Perceptions Questionnaire 11-14 (CPQ₁₁₋₁₄). Mothers' OH knowledge, attitude, practice, and OHRQoL were also assessed. After Bonferroni correction, a p value of less than 0.005 was considered statistically significant for caries experience measures while p value of less than 0.013 was considered statistically significant for OHRQoL subscales and Mothers' OH knowledge, attitude, practice and OHRQoL.

Results: Mean (SD) DT/dt, DMFT/dmft and DMFS/dmfs were 1.41 (1.66), 2.35 (2.33), and 4.41 (5.86) for SOHP children, respectively. For non-SOHP children the means were 2.61 (2.63), 3.56 (3.05), and 7.24 (7.78), respectively. The difference between the SOHP and non-SOHP was statistically significant ($p < 0.001$). SOHP children also had a higher number of sealed and restored teeth. No significant differences were found in CPQ₁₁₋₁₄ scores or subscale scores between the two groups. SOHP mothers had significantly better OHRQoL compared to the non-SOHP mothers ($p = 0.027$, respectively), with no significant difference in their OH knowledge, attitude and practices ($p = 0.019, 0.077, 0.12$, respectively).

Conclusions: The SOHP prevention services had a positive impact on children's caries level.

Keywords: Evaluation, School, Program, Oral Health, Children

4.2 Introduction

Worldwide, dental professionals struggle to improve public oral health. School-based programs have been established to provide prevention services, including oral health, for school-aged children (Centers for Disease & Prevention, 2001; Cooper et al., 2013). These programs can

benefit a wide group of children at minimum cost, especially those who are less likely to receive dental care due to economic limitations, limited exposure to fluoride, or low perceived value of oral health because of culture norms (Centers for Disease & Prevention, 2001). In fact, using the school as a setting for oral health promotion interventions was recommended in 2002 by the World Health Organization (WHO). Activities in school programs have included oral health education/promotion, supervised tooth brushing, fluoride and fissure sealant application, and/or various treatments. Although school-based oral health education has been found to be effective in promoting oral hygiene and improving oral health knowledge and practices (Tai, Du, Peng, Fan, & Bian, 2001; Worthington, Hill, Mooney, Hamilton, & Blinkhorn, 2001), there is limited literature on the impact of multi-approach preventive programs (Cooper et al., 2013).

In 1983, the Kuwaiti government established the School Oral Health Program (SOHP) in the capital region. The program is a partnership between the Kuwaiti Ministry of Health and the Forsyth Institute, Cambridge, U.S.A., in reaction to the 80% caries rate found in the 1982 national survey (Ariga, Al-Mutawa, & Nazar, 2014). The SOHP was established to provide dental education, prevention, and treatment for children between the ages of 6 and 14 years. These prevention services are offered through mobile clinics at the schools, preventive services, and center-based clinics (See Table 4.1 for the logic model associated with SOHP). The program provides dental care for approximately 280,000 school children, with approximately 60-70% of these children receiving preventive (general oral health education, tooth brushing education services, fluoride varnish, fissure sealants) or therapeutic dental care-treatment in 2004 (Ariga et al., 2014).

The Kuwaiti School Oral Health Program has the following broad goals: (1) reduce the prevalence of dental caries among school children by increasing the proportion of caries-free children; (2) reduce the severity of dental caries; and (3) improve the oral health status among this population through oral health education involving parents, teachers and children (Ariga et al., 2014). Most of the children enrolled in the program receive fluoride varnish applications and about half of them have at least one sealed tooth. Around 4,000 hours are spent annually on education, including special sessions conducted for children, parents, and teachers in the schools (Ariga et al., 2014).

Four national oral health surveys were conducted by SOHP in 1982, 1985, 1993 and 2001 to determine the dental health status of children aged 5-15 years. The surveys showed no improvement in dental caries incidence in the population (Al-Mutawa, Shyama, Al-Duwairi, & Soparkar, 2006, 2010). As these surveys do not differentiate between SOHP enrolled and non-enrolled children, they cannot reflect the effectiveness of the program. The impacts of the SOHP components had not been fully evaluated.

Therefore, this study was designed to evaluate the impact of the school-based preventive and educational activities of the SOHP's in the Kuwait Capital area by assessing: (1) children's dental health status and Oral Health-Related Quality of Life (OHRQoL), and (2) mothers' oral health knowledge, attitude, practice, and OHRQoL.

Table 4.1.
School prevention and education logic model

Inputs	Activities	Outputs	Short-term outcomes	Intermediate outcomes	Long-term outcomes
Prevention: Prevention team leader Prevention teams: <ul style="list-style-type: none"> • Dentists • Hygienists • Dental Assists. Location: schools	Provide fluoride varnish (FL), Fissure sealants (FS)	Children with FL and FS protection	1. Increase proportion of the child population is protected with FL and FS	Lower incidence of decay	Lower incidence of OH related disease Improve OHR-QoL among children
Education: Education team leader Education teams: <ul style="list-style-type: none"> • Dentists • Hygienists Location: Schools	Education sessions at schools, (children, mothers, teachers). Participate in school activities	Knowledgeable teachers, parents and children	1. Increase number of schools in the program 2. Increase number of enrolled children in the program 3. Increased OHK in children, teachers, and parents	Improve OH behavior of children, teachers, and parents	Lower incidence of OH related disease Improved OHR-QoL among mothers' and children

4.3 Methods

4.3.1 Study design

This is a cross-sectional study of mother-child pairs, randomly selected from Kuwait Capital area public schools. The University of Alberta Research Ethics Board (Protocol no. 00037434), together with the Joint Committee for the Protection of Human Subjects in Research of Kuwait, approved the study protocol. Furthermore, the research was conducted in adherence to the Helsinki

Declaration and the STROBE guidelines, and the parents/guardians of each participating child granted their informed consent.

4.3.2 Participants and setting

The research was conducted for six months during the 2013-2014 academic year in the Capital Education/Health Region in Kuwait. Approximately 85% of children residing in Kuwait attend public schools. Seven schools were randomly selected from a list provided by the Ministry of Education Research Department. Within these seven schools, children in the 11-to-12 year age group (and their mothers) were selected to participate. Participants were classified into two group; SOHP and non-SOHP. SOHP participants had been enrolled in the prevention program of the SOHP for at least three years. These children received, at least, one oral health education session, two applications of fluoride varnish, and (if eligible) fissure sealants. Non-SOHP participants had negative consents and were not enrolled in the school-based preventive oral health activities.

An information letter was sent to the selected schools, and an additional information letter was sent to the parents. Required sample size of 370 participants was calculated based on the number of children in the capital region (16,361 children) using type I error of 0.05, sampling error of 0.05, and estimated the proportion of 0.5. A 75% positive response rate was expected, so a total of 500 consent forms were distributed.

4.3.3 Procedure

Trained field assistants gave a 5-minute presentation to the children about the study and an information letter and consent form was sent for their parents to sign. Once consent was

obtained, field assistants administered structured questionnaires. Clinical examinations were performed at school clinics using fully equipped mobile dental chairs and sterile WHO probes and mirrors.

4.3.4 Outcome measures

4.3.4.1 Children's dental examinations

clinical examinations were conducted at the school clinics to assess the normative needs of the children. The examinations were carried out in adherence to the oral health criteria recommended by the WHO by one calibrated examiner. The examiner had already used the WHO criteria during the Kuwait National School Oral Health Survey (2013-2014).

The primary equipment comprised a mobile dental chair, artificial LED light, and a dental unit. High intra-examination and inter-examination (Compared to a gold standard examiner) consistency of kappa = 0.91, 0.83, respectively, was shown by the examiner. Evaluations of differences between cavitated and non-cavitated lesions followed criteria outlined in the guidelines of the International Caries Detection and Assessment System (ICDAS) (<https://www.icdas.org>). Additionally, the Silness-Löe plaque index (Silness & Loe, 1964) was used to make evaluations of the oral hygiene of participating children, while the PUFA index (Monse, Heinrich-Weltzien, Benzian, Holmgren, & van Palenstein Helderman, 2010) measured the clinical consequences of the participants' untreated dental caries.

Decayed teeth (DT/dt), missing teeth due to caries (MT/mt), filled/restored teeth (FT/ft), DMF teeth (DMFT/dmft), and DMF surfaces (DMFS/dmfs) indices were used during the examination. Additional indices applied during the examinations included the number of sealed

teeth, the number of non-cavitated teeth, the restorative care index (RI) (Jackson, 1973) and the plaque index (PI). The PUFA index (for comprehensive oral health examination purposes) was also used.

4.3.4.2 Children's OHRQoL

To assess each participating child's oral health impacts on function, life-style activities, a general sense of well-being, and relationship with others, the Child Perceptions Questionnaire (CPQ₁₁₋₁₄), developed in Toronto, Canada, by Jokovic et al. (Jokovic et al., 2002), was used. The questionnaire highlights the following four domain subscales: 1) oral symptoms, which are mainly pain-related; 2) functional limitations, such as difficulties encountered while eating and drinking; 3) emotional well-being, such as avoiding smiling or laughing around other people; and (4) social well-being, which involves, peer related comments about his/her mouth. Overall, the questionnaire offers sound psychometric properties, including good internal consistency and test-retest reliability. The questionnaire can be administered either by an interviewer or self-administered by the participant, giving only minor differences in results (Jokovic et al., 2002). In the present study, the participating children were given the CPQ₁₁₋₁₄ self-administered form. The CPQ₁₁₋₁₄ was translated from the original English version into Arabic, and the translation was validated by Brown and Al-Khayal (Brown & Al-Khayal, 2006).

In the questionnaire, the participants are asked to give their oral health a global rating and to describe the impact of their oral health status on their general well-being. The following information was framed as a dependent variable in the analysis as a further indicator of OHRQoL. Across the two questions, the response options are: "Excellent" = 0, "Very good" = 1,

“Good” = 2, “Acceptable” = 3 to “Poor” = 4; and “Not at all” = 0, “Very little” = 1, “Somewhat” = 2, “A lot” = 3 to “Very much” = 4.

Questions related to perceptions around the impacts of oral health are grouped into the following four domains: oral symptoms included 6 questions, functional limitations included 9 questions, emotional well-being included 9 questions, and social well-being included 12 questions. Participants were given five possible response options. The options were Never (0), Once or twice (1), Sometimes (2), Often (3), and Every day or almost every day (4) to be applied within a recall period of 3 months. From these responses, domains and overall OHRQoL scores on the questionnaire were calculated by adding up the responses of the items in the domains or the whole questionnaire. Low scores indicated a better OHRQoL.

Prior to administering the questionnaire for research purposes, the Arabic-version questionnaire was given to a small group of participants as a ‘pre-test’. Based on participant responses, terms and phrases that were unclear were reworded to make them easier for the children to understand. A total of 118 questionnaires were administered twice (for a grand total of 236), with a 14-day gap between the administration of the initial pre-test and the repeat of the modified pre-test. The kappa scores for the pre-test/pre-retest questionnaires were 0.87–1.0.

For the CPQ₁₁₋₁₄ questionnaire and each subscale, Cronbach’s alpha was used to quantify internal consistency, while the agreement was measured using the intra-class correlation coefficient of repeated questionnaires. The item response rate was 100%, with the results suggesting high levels of internal consistency for the questionnaire. As tested by Cronbach’s alpha for the overall CPQ₁₁₋₁₄ in the sample, reliability was 0.91. The alpha coefficients for emotional and social well-being subscales were excellent, measuring 0.83 and 0.81, respectively.

However, the alpha coefficient for the functional limitation subscale was acceptable (0.7) but only moderate (0.58) for the oral symptoms subscale. The intra-class correlation coefficient for repeated applications of the measure was 0.89 (95% CI = 0.76–0.97), which is excellent agreement.

4.3.4.3 Mothers' knowledge, practice, and OHRQoL

Mothers were the second target population for the SOHP. According to a previously published report among the Kuwaiti population, mothers were the main caregiver and had a high influence on children's oral health status (Ashkanani & Al-Sane, 2013). A questionnaire on the mothers' oral health knowledge, attitude, practice and quality of life was used in this study. It was initially prepared in English and translated into Arabic. Then it was translated back into English by two independent translators to check for the correctness of the messages conveyed. Questions included in the questionnaire have been used in previously published studies (Al-Ansari, Honkala, & Honkala, 2003; Kressin, Reisine, Spiro, & Jones, 2001).

In addition to a section on demographics (i.e., age, educational attainment, and number of children), the questionnaire consisted of four sections. The first section included 14 questions that assessed the participants' oral hygiene knowledge. Questions were about the association between oral bacteria and systemic diseases, transmission of bacteria from parent to child, soft drinks and tooth wear, sugar intake, caries, frequency of brushing and flossing, type of toothbrush and replacement frequency, dental check-up frequency, and use of fluoridated toothpaste. The second section consisted of six questions about attitudes toward OH including the importance of OH for overall health, the relationship between healthy diet and healthy teeth, the exclusion of unhealthy foods from school premises, the inclusion of oral health topics in the

school curriculum, and mothers as oral health educators and role models for their children and students in general. The participants' oral health-related practices (e.g., last dental visit, brushing and flossing frequency, use of fluoridated toothpaste, etc.) were explored in the third section.

The final section of the questionnaire asked about the participants' OHRQoL in three domains: physical, social, and psychological (self-esteem) impairments. The questions asked participants how often oral health problems affected their daily/social activities, and whether the appearance of their teeth caused them to avoid conversation.

4.3.5 Data analysis

The data were managed and analyzed using SPSS 21.0 software (IBM Corp., Armonk, NY, USA), and data normality was tested using the Kolmogorov-Smirnov test. The children's DH measures and CPQ₁₁₋₁₄ scores and the mothers' Knowledge, Attitude, and Practice (KAP) and OHRQoL mean scores were calculated and compared between children grouped by SOHP enrollment. Mean differences according to SOHP enrollment were evaluated by t-test. SOHP and non-SOHP outcomes that were significantly different were further evaluated using multiple linear regression models that controlled for socioeconomic indicators, such as gender, the number of siblings, mother's education and mother's age. The significance level was 0.05. To accommodate for multiple comparisons, the Bonferroni correction was used for every family of variables as follows. A p value of less than 0.005 was considered statistically significant for oral health indicators while a p value of less than 0.013 was considered statistically significant for OHRQoL subscales and Mothers' KAP and OHRQoL.

4.4 Results

4.4.1 Characteristics of studied population

Signed consent forms with respective parent authorizations were returned by 449 participating children, giving a response rate of 88%. Of these 449, nine participants were excluded due to the presence of a systemic disorder which may affect oral health status (as reported by the parents), or due to the child's uncooperative behavior either during the clinical examination or the administration of the questionnaire.

Four hundred and forty children comprised the final sample, of which 49.3% were male. Approximately half (46.4%) of the children were from families with 2-4 children while less than a tenth (7.7%) of the participants had no siblings. Nearly half of the mothers had earned a post-secondary degree and were 39 years of age or younger. Table 4.2 presents a demographics summary of the participants.

Table 4.2.

Basic demographics of participants according to SOHP enrolment

Variable	Number (%)	SOHP N=237	None-SOHP N=203	P-value**
Child gender				
Male	217 (49.3)	114	103	0.581
Female	223 (50.7)	123	100	
Mother education				
High school or less	94 (21.4)	31	63	<0.001
More than High school	106 (24.1)	59	57	
College	203 (46.4)	134	69	
Post-College	27 (6.1)	13	14	
Number of children in the family				
Only child	34 (7.7)	20	14	0.01
2-4	204 (46.4)	124	80	
More than 4	202 (45.9)	93	109	
Mother age*				
Less than 40	227 (53.0)	122	105	0.92
40 and more	201(47.0)	109	92	
*Total less than 440 due to missing information				
** Chi-Square test. Significant at the level p < 0.05				
SOHP= School Oral Health Program				

4.4.2 Participants' OH indicators

Mean (SD) DT/dt, DMFT/dmft and DMFS/dmfs indices were 1.96 (2.24), 2.91 (2.75), and 5.71 (6.94), respectively. About 23.9% of the children had a DMFT/dmft of zero. The mean number of non-cavitated carious teeth per child was 2.34 (2.17) while the mean sealed teeth was 1.78 (2.56). The mean restorative index was 0.21 (0.34), the plaque index was 3.59 (1.63), and the PUFA index was 0.31 (0.85). Children's dental health status according to the demographics was reported in a previous paper (Alsumait et al., 2015).

The children enrolled in the SOHP had significantly lower DMFT/dmft ($P < 0.001$), DMFS/dmfs ($P < 0.001$), dt/Dt ($P < 0.001$) scores than non-enrolled children. In addition, they

had a higher number of teeth with fissure sealants. The children's DHS according to their SOHP enrollment is summarized in Table 4.3.

Table 4.3.

Children's mean (SD) OH measures and OHRQoL scores according to SOHP enrolment

Variable	Total	SOHP N=237	None-SOHP N=203	P-value*
Oral Health measures				
dmft/DMFT	2.91 (2.75)	2.35 (2.33)	3.56 (3.05)	<0.001
dmfs/DMFS	5.71 (6.94)	4.41 (5.86)	7.24 (7.78)	<0.001
dt/DT	1.96 (2.24)	1.41 (1.66)	2.61 (2.63)	<0.001
mt/MT	0.28 (0.83)	0.25 (0.80)	0.32 (0.85)	0.391
ft/FT	0.67 (1.19)	0.69 (1.16)	0.64 (1.24)	0.641
Non-cavitated lesions	2.34 (2.17)	2.35 (2.19)	2.32 (2.14)	0.875
Fissure Sealants	1.78 (2.56)	2.36 (2.79)	1.10 (2.05)	<0.001
Plaque Index	0.89 (0.41)	0.86 (0.40)	0.95 (0.41)	0.019
PUFA	0.31 (0.85)	0.18 (0.51)	0.47 (1.11)	0.01
Restorative Index	0.28 (0.36)	0.33 (0.38)	0.22 (0.34)	0.008
OHRQoL				
Total CPQ	20.72 (16.81)	19.82 (15.46)	21.74 (18.22)	0.253
Oral symptoms	4.26 (3.32)	4.24 (3.03)	4.29 (3.64)	0.862
Functional limitations	5.41 (4.92)	5.23 (4.44)	5.59 (5.43)	0.457
Emotional well-being	5.48 (6.15)	5.15 (5.95)	5.87 (6.37)	0.228
Social well-being	5.33 (6.05)	5.06 (5.97)	5.64 (6.14)	0.321

* t-test with Bonferroni correction. Significant at the level $P < 0.005$
* t-test with Bonferroni correction. Significant at the level $P < 0.001$
SOHP= School Oral Health Program; D/d=decayed; F/f=filled; M/m=missing; S/s=surface;
T=permanent teeth; t=primary teeth; PUFA=Pulp, Ulcer, Fistula, Abscess; CPQ= Children perception Questionnaire

Having adjusted for potential confounding factors (i.e., gender, number of children, mother's age, and mothers' OH knowledge, attitude, practice, and OHRQoL) in the multiple linear regression analyses, we have found that enrolment in the SOHP and mothers' level of education were the only predictors for DMFT/dmft and DT/dt, while only enrollment in the SOHP was a predictor for DMFS/dmfs (Table 4.4).

Table 4.4.

Multiple linear regression analysis final models predicting children OH indicators significantly associated with SOHP enrolments

Variables	Coefficient t	SE	P-value	95% CI	
				Lower limit	Upper limit
DMFT					
Constant	1.021	1.146	0.374	-1.232	3.274
Enrolment in the SOHP (No/Yes)	-0.913	0.268	0.001	-1.440	-.387
Mother's education (High school or less/ More than High school/ College/ Post-College)	-0.380	0.127	0.003	-0.628	-0.131
DMFS					
Constant	1.602	2.953	0.588	-4.204	7.408
Enrolment in the SOHP (No/Yes)	-2.090	0.690	0.003	-3.446	-0.734
DT/dt					
Constant	0.582	0.932	0.533	-1.250	2.414
Enrolment in the SOHP (No/Yes)	-0.965	0.218	<0.001	-1.392	-0.536
Mother's education (High school or less/ More than High school/ College/ Post-College)	-0.321	0.103	.002	-0.523	-0.118
Number of sealants					
Constant	1.531	1.089	0.161	-0.611	3.672
Enrolment in the SOHP (No/Yes)	1.296	0.254	< 0.001	0.796	1.796
SOHP= School Oral Health Program; D/d=decayed; F/f=filled; M/m=missing; S/s=surface; T=permanent teeth; t=primary teeth					

4.4.3 Children's oral health-related quality of life

The average (SD) total CPQ₁₁₋₁₄ score was 20.72 (16.81). The oral symptoms subscale score was 4.26 (3.32); functional limitations score was 5.40 (4.92), emotional well-being score was 5.48 (6.15), and social well-being score was 5.33 (6.05). Nearly 78% of the participating children

evaluated their oral health as being excellent or very good, and 5% evaluated it as being fair or poor. The mean overall self-evaluation of the effect of OH on their life was 0.69 (0.95), More than 80% of children reported that their OHRQoL was “Not at all or very little” affected, and 5% reporting that it affects their life “A lot or very much.” Children’s OHRQoL according to demographics was previously reported (Alsumait et al., 2015).

There was no significant difference between SOHP-enrolled and -non-enrolled children in their total CPQ₁₁₋₁₄ score or subscales ($P > 0.013$) (Table 4.3).

4.4.4 Mothers’ KAP and OHRQoL

No significant difference in mothers’ OH knowledge, attitude, practices or OHRQoL was found ($P > 0.013$). The mothers’ mean KAP and OHRQoL scores, according to SOHP, are summarized in Table 4.5

Table 4.5.
Mothers’ mean (SD) OH knowledge, attitude, practices, OHRQoL scores according to SOHP enrolment

Variable	Total	SOHP N=237	None- SOHP N=203	P-value*
OH Knowledge score	10.04 (1.57)	10.21 (1.46)	9.84 (1.67)	0.019
OH Attitude score	11.63 (0.53)	5.86 (0.39)	5.77 (0.62)	0.077
OH Practices score	13.81 (2.42)	13.97 (2.45)	13.61 (2.37)	0.120
OHRQoL score	0.95 (1.80)	0.78 (1.64)	1.16 (1.96)	0.027

* t-test with Bonferroni correction. Significant at the level $P < 0.013$

OH=Oral Health; OHRQoL=Oral Health Related Quality of Life; SOHP= School Oral Health Program

4.5 Discussion

School oral health programs were recommended by the WHO to be a cost-effective approach to reach and promote oral health in school-aged children and to eliminate inequalities in oral health. In the present research, we investigated the effects of oral health education and preventive interventions on the dental health of school-aged children. To assess the effectiveness (impact evaluation), we chose simple variables to measure dental caries, oral hygiene, and quality of life. Overall, children enrolled in the program had better dental health (fewer caries lesion), and enrollment in the program was the main predictor of children's caries level.

The preventive interventions provided by the SOHP were evidenced-based and recommended by WHO (Petersen & Kwan, 2004). Fluoride has been acknowledged in caries prevention over the past 40 years, and fluoride varnish has been the core of numerous oral health interventions in school children (Paige & Shahid, 2014; Rolnick, Jackson, DeFor, & Flottemesch, 2015). Fissure sealant has also been recognized as an effective method for prevention of caries on occlusal surfaces in some studies (Griffin et al., 2008). In accordance with existing evidence, our results showed that twice-a-year fluoride varnish and fissure sealant as part of the school-based prevention activities were effective in reducing dental caries in children.

In Kuwait, all children in the public schools are encouraged to enroll in the SOHP. Our data indicate that enrollment in school-based prevention activities is associated with better dental health. Being enrolled in the SOHP influenced children's level of dental caries, the severity of the disease, and oral hygiene status. However, the program had no impact on children's OHRQoL. We also found that the level of dental caries showed no impact on children's OHRQoL (Alsumait et al., 2015), a result that was inconsistent with Castro Rde et al. (Castro

Rde, Portela, Leao, & de Vasconcellos, 2011). This inconsistency could be explained by under reporting due to a lack of oral health literacy among Kuwaiti children, an area which needs more research exploration. Further investigation is required regarding the psycho-social impact of dental diseases among the Kuwaiti population.

The second target of the SOHP was the mothers. An appropriate level of oral hygiene practices is often the ultimate outcome of any oral health education/promotion program (Morris, Gillespie, Al Za'abi, Al Rashed, & Al Mahmeed, 2008). Therefore, the intention of Kuwait SOHP for mothers was also improving their oral health practices through enhancing their knowledge and attitude using the KAP model. Although mothers of children enrolled in the program had better but not significant oral health knowledge, this was not reflected in their practices. This finding aligns with prior research that suggests knowledge alone does not necessarily lead to changes in behaviors (Watt & Marinho, 2005). Accordingly, SOHP policy-makers may consider adopting behavior-change models for education protocols if a change in behavior is a target.

Published reports have showed that the outcome of preventive care provided through different programs varied based on the local context, and more complex interventions tend to have a lower implementation rate (Glasgow, McKay, Piette, & Reynolds, 2001). Many countries provide an extensive preventive regimen, including fluoride varnish, fissure sealant, and oral health education (Ariga et al., 2014; Sagheri, Hahn, & Hellwig, 2007) that targets only high-risk populations, and thus evaluating a public health program is a context-sensitive process. It is a challenge to capture such a program's outcomes in a quantitative study (Protheroe, 2003), because beyond quantitative measure, the context of the program goals, objectives and resources

should also be considered. This could be complemented by a process evaluation (i.e., document review) and qualitative data.

The limitations of this study were twofold: the study design and the evaluation variables. Because this was a cross-sectional study, the causal link between intervention activities and dental health indicators cannot be assessed. For instance, we cannot offer conclusive evidence that fissure sealants reduced the incidence of dental caries. Moreover, the SOHP is the main proxy for free-of-charge dental services in Kuwait, and 90% of children receive mainly therapeutic services in the program's dental center. Also, children in Kuwait are not exposed to community preventive measure of dental caries that was suspended early in the 1980s (Behbehani & Scheutz, 2004). However, a significant association was detected between enrollment in the school-based prevention intervention and dental health status.

In conclusion, the Kuwait school oral health program is a comprehensive multicomponent program that has had a positive impact on children's dental health. The prevention services have positive effects on children's dental health. Children enrolled in the program had lower caries levels and better dental health status. However, no association was detected between the program enrollment and OHRQoL among children, and mothers' level of oral health knowledge and practices. Using a mixed-methods approach, a better understanding of the program's internal- and external-context might be achieved. Further, monitoring of program delivery for quality assurance, examining the delivery of a proper dose of intervention, and targeting most needed population may provide better insight of program performance.

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Chapter Five

Implementation and Maintenance Evaluation of the School Oral Health Program in Kuwait

5.1 Abstract

Objectives: The purpose of this study was to explore (a) factors affecting the implementation of Kuwait School Oral Health Program (SOHP) procedures, and (b) identify factors influencing program maintenance over the past three decades.

Methods: A qualitative focused ethnography approach was employed. An interview guide inspired by the ecological health framework and RE-AIM evaluation model directed our data collection through in-depth and focus group interviews with dental care providers, key informants in the Kuwait Capital Education Area, and decision- policy-makers in the SOHP. The interviews were recorded and transcribed verbatim. Thematic analysis of data was performed.

Findings: Thirty participants contributed to this study. There were 13 dental care providers, 4 team leaders, 9 key informants, and 4 policy makers in four in-depth and four focus-group interviews. Data analysis revealed two main categories influencing successful program implementation: (a) SOHP structure and characteristics including prevention protocol and resources, and (b) school environment characteristics including schools' engagement. However, at a policy level, maintenance dimension; three main categories emerged related to chronological phases of the program journey: (a) initiation, (b) expansion, and (c) sustainability. At the initiation phase, the role of gatekeepers, advocate leadership, employing evidence-based

dentistry were the main facilitators for establishing the program. At expansion phase, proactive organizational change led to developing a solid infrastructure. This led to the sustainability phase, which was characterized by awareness by policy-makers of population dental care need and sustained public funding. These elements were the main facilitators to successful program maintenance. Yet, some program constructs showed weak sustainability. For example, expansion of school-based fixed clinics was implemented due to a serious oral health care need among schoolchildren, as a reactive organizational change due to the Second Gulf-War. However, numbers of school-based fixed clinics declined dramatically, and were replaced by mobile prevention dental clinics due to unsupportive environment, power dynamics, and cost-benefit reasons.

Conclusions: Kuwait SOHP succeeded in implementing and maintaining school-based prevention procedures over thirty years, yet many program constructs showed poor sustainability. Revisiting program vision, theory, and recognition of elements related to successful implementation and maintenance will allow decision- and policy-makers to focus on pursuing means to improve capacity for more efficient and successful implementation of the program. This study provides insights that can be shared with wider national and international settings.

Keywords: School-based program, oral health intervention, implementation evaluation, maintenance, dental public health

5.2 Program Description

The Kuwaiti government established the School Oral Health Program (SOHP) in the Capital Region in 1983 (Morris et al., 2004). The SOHP delivers oral health education, prevention and treatment across six regional areas to roughly 80% of the 280,000 school-aged children in Kuwait. Nearly 4,000 hours are spent by the SOHP annually on health education sessions for children, parents and teachers (Ariga et al., 2014).

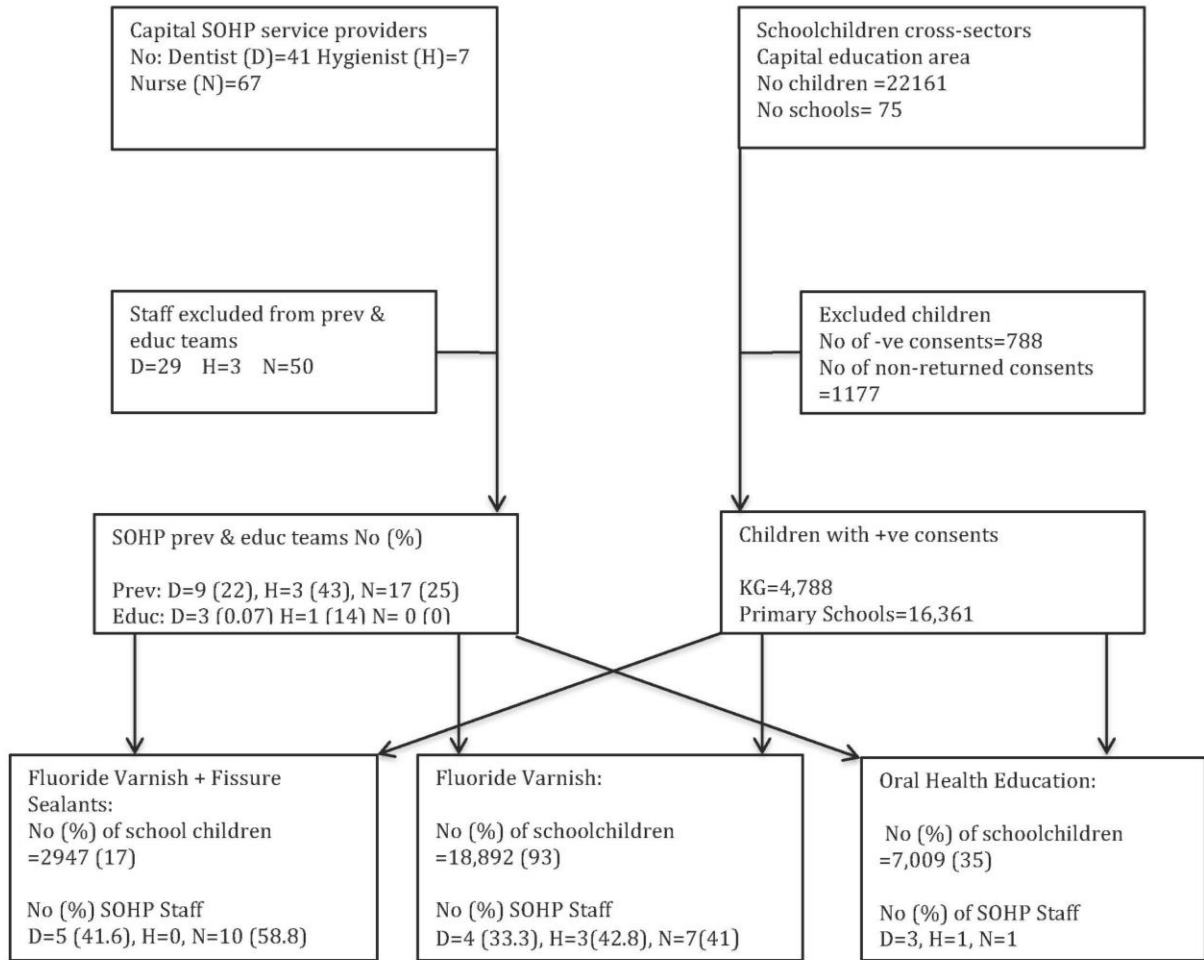
According to the SOHP's annual records and reports, parents of 70 to 95% of the children at different stages of schooling provided positive consent for their children to participate in the school-based oral health interventions; however, only 17% of the children received complete prevention services through the program (see Flow Chart 5.1). Furthermore, less than 25% of the dentists in the program joined prevention and education teams (see the Work Force table), which are responsible for delivering prevention activities to schoolchildren in the Kuwait capital area (Kuwait Ministry of Health, 2014 & School Oral Health Program, Kuwait-Forsyth). Oral health organization documentation (e.g., dental department and SOHP annual reports) along with published reports revealed relatively high dental decay prevalence among schoolchildren (Alsumait et al., 2015; Eisalhy et al., 2015).

However, throughout the SOHP journey, surveys assessing dental caries levels and oral hygiene status have been the main evaluation tools used since 1983 (Behbehani & Scheutz, 2004). Much attention has been focused on the effect of the program's clinical intervention, versus assessing contextual factors such as implementation and sustainability. Identifying disease levels using oral health surveys and clinical effectiveness were the main concerns of policy-makers (Nazar et al., 2012; Francis et al., 2008; Francis et al., 2016). In contrast, little is known

about school-based implementation activities, and reasons for implementation variations among schools in different areas. Also, literature reports indicate that few attempts have been made to explore elements around system-level contexts of school-based interventions that may impact the implementation and maintenance of the program (Jürgensen & Petersen, 2013). For example, the SOHP protocol has been subjected to various changes over time, such as a greater focus on school-based prevention using mobile dental chairs (Ariga et al., 2014).

Still, little is known about how and why these changes were made or the impact of the changes on the implementation or maintenance/sustainability of the program. In the context of this study, maintenance is described as a collective process and factor facilitating the institutionalization of the SOHP in organizational policies, while sustainability describes a set of factors affecting intervention continuation (Glasgow et al., 2001; Scheirer & Dearing, 2011). Thus, there is a need to explore factors influencing the delivery of the SOHP services (i.e., implementation) as well as factors that contribute to aspects of the program that were either terminated or sustained over the past 30 years.

Reach & Adoption



Flow chart 5.1. Reach and Adoption

5.3 Objectives

The purpose of this study is to identify factors that (a) facilitate or impede delivery of SOHP procedures according to service delivery staff and key informants in the Kuwait Capital area, and (b) influence program sustainability and maintenance according to decision- and policy-makers.

5.4 Methods

A qualitative method of inquiry was used to better understand the implementation process and factors enabling the maintenance of the School Oral Health Program over the past few decades in Kuwait. This study was reviewed and approved by the Human Research Ethics Board at the University of Alberta (Protocol no. 00051240).

5.4.1 Study design

Focused ethnography, which is a variant of the traditional ethnographic approach, was adopted in this project (Knoblauch, 2005; Higginbottom et al., 2013). Several characteristics of focused ethnography that made it highly compatible with our evaluation research purposes included: focusing on participants who have a shared experience in the workplace or a specific organizational setting, and held specific knowledge about the SOHP; episodic participation for data collection; and producing information on a particular aspect (i.e., evaluation of school-based program) or shared experience. We used focused ethnography to better understand the context of the SOHP from the perspectives of multi-level stakeholders (e.g., service providers, administrators, and policy-makers). The research team consisted of academics with expertise in evaluating community-based interventions, and qualitative researchers experienced in community-based and oral health intervention.

5.4.2 Participants and recruitment

A purposeful sampling technique was used to select the participants who could provide the richest information about factors contributing to the implementation and maintenance of the SOHP (Abrams, 2010). Twenty key informants from schools' staff and Capital Education Area administration were invited to participate in this study. Nine were interested to join the focus group. Additionally, 21 former and current service providers were invited to participate in the focus groups; 17 of them joined the focus groups. These included service providers in leadership positions (i.e., who oversee department policies and practices), and those working in clinical practice. Service providers in clinical practice were responsible for (a) the application of prevention procedures, including fissure sealant and fluoride varnish, and (b) education activities, including presentations to mothers and children and participating in school events. Four decision- and policy-makers were invited to participate in an individual interview. They were involved in (a) developing decisions about the treatment-prevention-education protocols, and (b) maintaining program activities.

All interviews (focus groups and in-depth interviews) were held during working hours. The research assistant, SB, who was a previous member of the prevention team, posted a participation invitation on the notice board in the Capital Program Dental Center. Focus group interviews were continued and participants were contacted as needed until the saturation point was reached, when no new topic or analytical codes, categories or themes emerged from the analysis of the data (Mayan, 2008).

One member of the research team, AA, who was a former school oral health employee, contacted some decision-makers in person, asked them to participate in the research, and

arranged for the in-depth interviews. The interviews took place in three locations: the service provider focus groups were held in the employee lounge in the Capital School Oral Health Center, and the individual interviews were held in the SOHP headquarters and the Ministry of Health. All participants signed informed consent forms and confidentiality agreements.

5.4.3 Data collection

Qualitative data were collected through focus groups and in-depth individual interviews, guided by the implementation and maintenance constructs of the RE-AIM model (www.re-aim.org). A five-step interview analysis approach was used including (a) thoroughly reviewing the interview, (b) identifying the meaning of the data, (c) building over-arching categories themes, (d) interrogating the data with regards to the research enquiry, and (e) tying the themes into meaningful statement to ensure informative and rich data collection (Rubin & Rubin, 2005). Participants were asked about their individual perceptions on factors influencing the implementation, sustainability and maintenance of different aspects of the program (Shediac-Rizkallah & Bone, 1998).

Four focus groups were held between June and September 2014, and facilitated by AA and SB following a semi-structured interview guide. Focus groups were initially held with providers and key informants from schools, investigating factors influencing implementation of program activities in schools' settings. After the focus group interviews the data were analyzed to further enlighten the in-depth interviews with decision-makers. Decision-makers were asked whether they thought the program activities were delivered as intended, and why or why not? They were also asked about the characteristics of the schools that successfully adopted the program activities.

Two of the individual in-depth interviews took place in December 2014, another was conducted in January 2015, and the last in-depth interview was conducted in May 2015. The interviews were conducted by one researcher (AA). The policy- and decision-maker interviews (4 one-on-one interviews) were conducted across two sessions for each participant, for a total of 8 sessions. The first sessions were very brief and were held to explain the overall purpose of the research and to gain an understanding of the participants' viewpoints on the research. They took place at the participants' offices. Participants were asked about factors related to maintenance and whether the education, prevention, and treatment constructs were sustained as originally planned, and if not, why? They were also asked to name some modifications that were implemented on the working protocol (and why they were implemented) and what type of problems the participants, as decision-makers, had encountered (Appendix 4 interview guide). As well, they were asked whether these modifications had delivered the intended results (as stated in the protocol).

5.4.4 Data analysis

Interviews and focus groups were audio-recorded and transcribed verbatim. For interviews conducted in Arabic, transcripts were translated to English, and a research assistant conducted a back-translation for validation purposes. The interviews and focus groups were conducted simultaneously with data analysis, which helped to inform the next round of interviews. Initials were given to participants according to their type of group to maintain confidentiality. For example, letter E was given to education team member and P were given to fluoride and fissure sealant team members. Transcribed data were read, re-read, and discussed by the researchers (AA and SB) for familiarization with the data and to gain an overall sense of the content.

Latent content analysis was used for identifying topic and descriptive codes, and for categorizing primary patterns in the data (Mayan, 2008; Morse et al., 2002). Descriptive and topic codes were iteratively used to identify categories and construct sub-categories to explore the relationship between themes regarding challenges encountered by the service providers and SOHP management. Thematic maps were developed to visualize any connections between and within each theme (Figures 5.1 & 5.2). The specifics of each theme, along with their definition, essences and relationships, were refined in a discussion meeting with two public health experts on the research team, after which consensus in analysis was obtained (Mayan, 2009). Throughout the data analysis, memos were recorded about potential relationships between themes and sub-themes, a process that helped researchers keep track of the analysis. It was appropriate to use verification strategies to detect and correct errors continuously. Member-checking was performed by AA, who also restated and summarized the results and verified them in three separate meetings with the interviewees.

The participants agreed on the resulting thematic content, with some disagreement on the extent (whether they were minor or major obstacles) of the barriers affecting the service delivery. Some participants also stated that the provided summaries did not reflect their views, feelings or experiences. For example, despite the fact that all providers agreed on control over children in schools was one main element, prevention teams believed that it was the second most prominent problem they encountered during delivery of service, while education team believed it was the most influential factor. The variation in the participants' response to the results summary was related to the nature of service provided. Several short meetings with decision-makers were held to discuss the outcomes of the in-depth interviews and to clarify any ideas that emerged. This

process, in addition to prolonged involvement, aimed to achieve endorsement credibility (Guba & Lincoln, 1994). In addition, transcripts and reflective notes were discussed with the academic advisor (Dr. M.A) who is a qualitative researcher in the public health field, to clarify vague and under- and over-emphasized points for peer debriefing purposes. Further peer debriefing and audit trail were performed with an external researcher (Dr. H.A), a doctorate fellow in the Harvard Dental Public Health School.

Data memos of the researchers' observations, reflexivity, ideas, interpretations, and moments of confusion were documented in a deliberate fashion. For example, a number of things were recorded at regular times such as setting management, on-site decision-making, systematic observations about arrangements made in the field, and actions that reflected competing priorities (Emerson et al., 1996). The memos helped to describe the setting that activities are taken place. Reflexivity refers to "the process of being highly attentive to how and why you make decisions and interpretations throughout the research process, while at the same time critically evaluating your personal researcher's role within the moments of the study process" (Mayan, 2009, p. 137). The researcher's personal reflective journals were also used to support categories and were integrated at intra- and inter-theme levels. The qualitative software program NVivo 10 was used to store collected data, which included interviews (in-depth and focus groups), field notes, and personal journals. It also assisted with the categorizing, revising and retrieving of codes, and helped to record methodological decisions and analytic insights.

5.5 Findings

Two main categories for factors associated with the implementation of program activities were generated from focus group interviews. The findings were supported by data collected in field

notes and personal journals of the researchers (AA and SB). The two main categories were (as depicted in Figure 5.1):

- 1) Internal context factors (SOHP structure and characteristics), and
- 2) External context factors (school environment characteristics).

The subcategories identified under internal context factors were protocol and resources, and the external context factor subcategories were school engagement and behavior of main and secondary stakeholders.

Implementation conceptual map

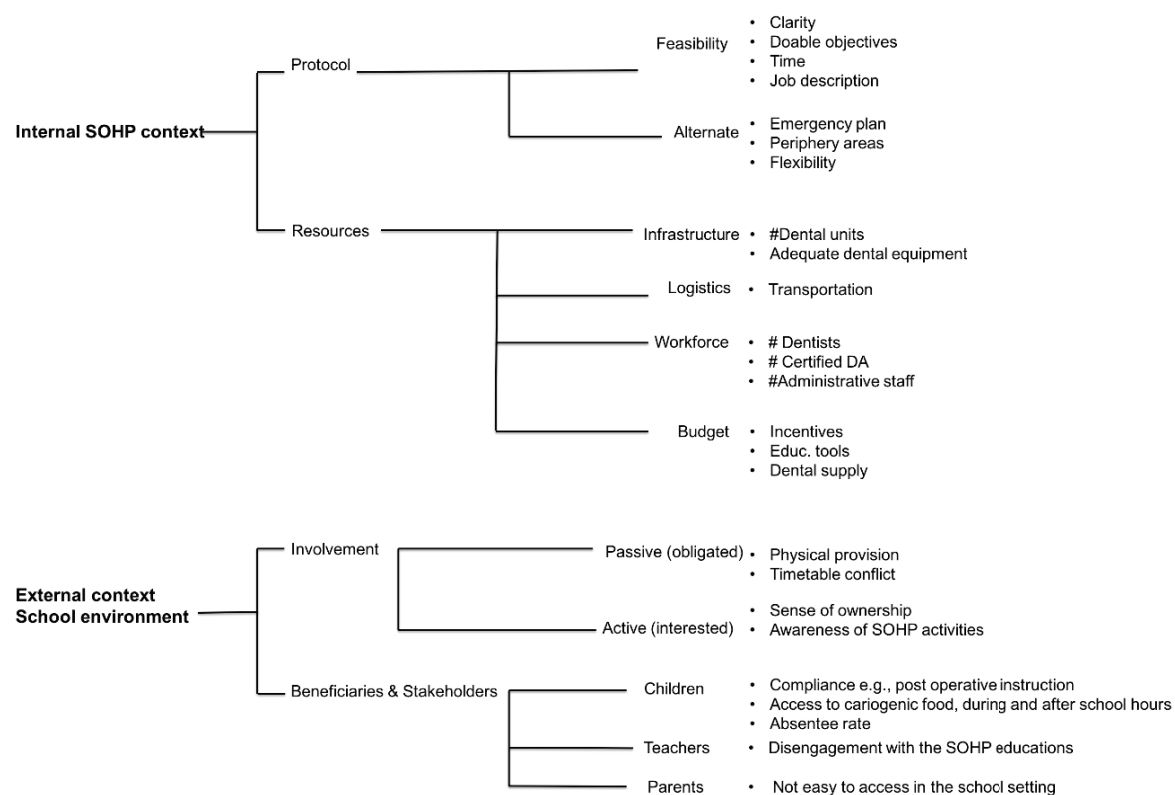


Figure 5.1. Implementation conceptual map

Three main categories were associated with maintenance of program dimension associated with phases were identified: (1) initiation, (2) program expansion, and (3) sustainability. The sub-categories identified under initiation were gatekeepers, leadership, and intervention planning. As illustrated in Figure 5.2, under program expansion were developmental change and remedial change, while under sustainability were central administration, policy development, power dynamics and funding.

5.5.1 Implementation

Implementation was defined as the way in which the program activities were delivered. Participants reported that successful delivery of dental health care in school settings was a challenge because of factors related to program design and structure (Internal context), and school setting and environment (External context). They emphasized that the children's oral health behavior was an important element in the SOHP's success. Detailed descriptions of each category and subcategory are presented below using the participants' own expressions and experiences.

5.5.1.1 Internal context

Participants explained that the high return of positive consent meant more children needed dental services; still, different kinds of dental services for different groups of children were detected. They also mentioned that the prevention protocol made no recognition of the different dental services that were required (fissure sealants, education, etc.) or of the resources that included infrastructure, human resources and budget. The subcategories identified for factors associated with internal contexts were mainly related to program protocol and resources.

5.5.1.1.1 Protocol

Overall, participants described the protocol as a uniform set of activities and procedures in the provision of services mainly to schoolchildren (prevention protocol). This protocol involved some deficiencies that prevented it from being implemented as intended. Critical barriers, from the service providers' perception, were lack of clarity, feasibility and the absence of alternate plans for adapting to different situations.

Newly assigned providers reported that the lack of information regarding service provision in different contexts of health center-based clinics was challenging. In the words of a new dentist:

“The protocol is a very good guide for clinical procedures, such as how to apply fissure sealants and fluoride varnish, but nothing is mentioned about how to approach schools and deal with settings for mobile dental clinics, for example” [PT].

Participants also described the program protocol as the guideline reference they used for clinical and prevention procedures (Dental Administration, Kuwait Ministry of Health, 2011). The first dimension of the protocol identified by the participants was protocol feasibility, described as the “extent that the working protocol can be applied as intended.” Participants believed that the program employed evidenced-based dentistry interventions that have been proven effective. However, the feasibility of implementing the program as intended was challenging. The lack of clarity about dental care operations in school-based settings was mentioned as a major weakness of the SOHP protocol that influenced its feasibility.

Participants thought that the protocol only included clinical details and lacked information about school settings and tasks assigned to prevention team members:

“Working in a school-based clinic is something different than what we learned during the rotations and internships.... If you are lucky, you will have an experienced trainer.... Nothing is mentioned about where to start in the program working protocol. Moreover, [there is] no job description for each staff-member, unlike working in the center-based clinic” [PT].

The other factor affecting the feasibility was the planned timeframe, as suggested by more experienced participants. Providers complained about the inadequacy of allotted time:

“It is difficult to have a precise estimated [of the] time needed for each school population. There are multiple factors that should be considered, such as caries prevalence of the children, absence rate among children, etcetera. At the end of the day, we were asked to finish by the scheduled time with anticipated productivity.... Umm, what I am trying to say is that working within a timeframe protocol sometimes is not possible and puts us under pressure” [PT].

This was echoed by a school mediator, who also agreed that the time allocation was too short:

“When we have the dental team visit, I feel like I am on the run.... I don’t think the proposed time for the mission is adequate. More time is needed, but at the same time, we don’t want them all year long... [laughs]” [SM].

Maintaining energy and achieving consistent outcomes were serious challenges for various reasons, ranging from lack of clarity of the operational process and job descriptions, to performing the prevention activities within the proposed timeframe.

The second dimension of the protocol that participants found challenging was the lack of alternative plans to accommodate field emergencies. For instance, during the H1N1 pandemic,

the regular prevention activities could not be employed, and there was no alternative plan to retain the program. In the words of an experienced dental hygienist, “I remember in 2009, and during the H1N1 and swine flu pandemics, we could not apply any school-based activities, not even group education sessions ... Only center-based clinics were operated” [ET].

All participants agreed that the program protocol should include specific regimens for populations in peripheral areas and that it should be more flexible regarding scheduling “After more than fifteen years in the program, I can tell you that children in the outskirts areas need special treatment and approaches, for sure.” [PT]. Participants also emphasized the importance of having flexible schedules so they could compensate for any delays for unpredictable reasons:

“Sometimes, it was not possible to keep the same team of nurses or dentists for the entire duration of the academic year. It is hard to compensate because of the tight schedule.... I believe we should have more flexibility with the assigned time” [PT].

5.5.1.1.2 Resources

The second factor associated with the internal context was resources. Limited resources were a key factor preventing the program from being on-track in implementing the prevention protocol in schools. Participants talked about the importance of having appropriate resources (quantity and quality) that would help the program achieve maximum service coverage. Dimensions identified for resources included infrastructure and logistics, and workforce and budget. All these dimensions could act as additional barriers to achieving the program’s objectives. For example, lack of sufficient capital and incentives reduced the motivation of dental personnel to join a school-based prevention team. In addition, there was a lack of education tools that matched the

available advanced technology that would attract the age group the program was targeting. There was also a lack of logistics infrastructure, which may delay the work where time is a limitation.

A service provider in a leadership position voiced frustration regarding the need for appropriate infrastructure for meeting program objectives:

“I do understand that the Maintenance department has great responsibilities [Inventory and Maintenance are responsible for equipment and materials], but we need more dental units in order to overcome the shortages we face.... Everything should be going on schedule. Adequate equipment ... staff transportation ... [and] coordinating between schools [and] staff, so the Maintenance department should be ready” [UPT].

One provider described how the logistics (transportation) difficulties cause extreme work disruptions. “Actually, we have another problem: transportation. Moving from one school to another is a problem for the nurses who do not have cars, and as you know, public transportation is not common in this country” [ET].

Workforce (staffing) shortages were another dimension identified by participants as a barrier to disseminating the service to schoolchildren. Only one-fourth of Capital Program dentists were involved in a prevention team. Limited benefits and heavy workloads were the main reasons cited by dentists for not joining a team. Participants suggested that adequate staffing was a barrier, and a senior service provider mentioned that the limited number of providers was mostly due to competing priorities. “Experienced dentists prefer center-based over being involved in the preventive team.... With the unclear program priorities, allocating dentists and staff is a really hard job” [ULP].

While providers appreciated having skilled dental assistants on the team, they felt that an insufficient number of administrative support staff also influenced their productivity: “Having a skillful dental assistant is a blessing and can be [one of the main] reasons for a productive school visit. However, having [only] one secretary makes us [have to] do all the preparation arrangements” [PT].

Participants also recognized the budget as being an important dimension of resources. Incentive was a major factor mentioned by different levels of participants. One of the decision-makers believed that the budget was a barrier to hiring enough staff (workforce) and to promoting the school-based prevention program among dentists who preferred to work in center-based clinics. “Due to low wages compared to other sectors and lack of incentives, dentists refuse to join the [school-based] prevention program. They prefer to provide treatment services in the center-based clinics” [DM].

Similarly, a participant reported “More outreach activities, [being] under meticulous supervision, and [lack of] rewards make the work in prevention teams less attractive” [UPT]. Another participant from the education team believed that they should assign a substantial budget for more innovative educational tools that match children’s interests:

“Children nowadays use electronic games and tablets all the time. We cannot attract their attention or convince them with conventional educational tools. On the other hand, the electronic games and tools are really expensive and we are dentists, not IT experts” [ET].

One of the school’s key informants also commented on the dental materials (supplies) used by the SOHP. “The materials you are using [like] the sticky gel is not agreeable to children. I took

my child to a private clinic and they used something else that was more agreeable to children” [SM].

5.5.1.2 External context

For focus group participants, optimum delivery of prevention care corresponded to having a supportive environment and cooperative school staff, combined with the proper oral health behavior of the enrolled schoolchildren. Participants described these factors as ‘external factors’ over which they had no control. The subcategories identified for factors associated with the external context were mainly related to the involvement of schools and beneficiaries’ behavior.

5.5.1.2.1 School engagement

The service providers’ perceptions of ‘involvement’ referred to the nature and extent of collaboration between schools and program administration. Some school staff were passively involved in the program because they were obligated to participate, while others were very active and supportive of the program. Participants believed that the physical space and time allocated to the program by the schools was essential to the success of each specific activity. However, some school administrators expressed a lack of interest in facilitating the implementation of the program in their school:

“When I arrived at the school and explained to the school principal that we would be here for two months to do so and so [and that] we needed a specific size and condition of space to perform the service, she started questioning me as to why last year they stayed only one week. I explained that we were applying different services (fissure sealant applications are different than fluoride applications) and she provided the same space that may be good for a fluoride team but was not good for a fissure sealant team, because we use different equipment and need a bigger space” [PT].

Passive involvement by school administration resulted in scheduling conflicts, which were difficult to resolve if the administrators were not engaged. In the words of a service provider:

“We [always] contact the schools a couple of days before the planned date to do education activities that are already prepared in coordination with the school months ago. [In one instance], on the scheduled day, we were informed that we could not use the school theater because they had another function. They asked us to come another time, but unfortunately we have a tight schedule and change is really difficult for us, since we have to re-arrange the whole thing” [ET].

In contrast, school administrators who were actively involved in the program had assigned a coordinator and made the program a priority for children. Active engagement of school staff greatly facilitated the implementation of the program. An example of school engagement was providing the program with a student list and a school timetable, both of which were essential for time management and efficiency of the planned activities. Participants believed that engaged schools had a high sense of ownership of the program, which played a major role in delivering the service and adopting the interventions. In the words of an enthusiastic school mediator:

“Whenever I have a SOHP team schedule in my school, I contact them two days before the visit asking about the nature of the visit [and] I make sure the space needed is available that day.... I try to prepare a list of the children ... and send a note to the parents to ensure that children should not be absent that day to gain the benefit of this school-based dental care” [SM].

Participants also emphasized the importance of the school staff being knowledgeable about SOHP services so they were aware of what was needed for each type of preventive service.

Unfortunately, the majority of the school mediators did not know about the three different SOHP teams (education, fluoride, and fissure sealant). On the other hand, working with cooperative school-staff was very efficient and productive. For example, some schools were well-organized, had prepared student lists, and had sent written notices to parents prior to the dental team visits to minimize absentee rates, as illustrated by the following field data excerpt:

“The school principal assistant was in charge of the dental team visit. She was aware of the nature of the visit [fluoride varnish]. The principal assigned three staff to help bring the students to the dental clinic. Also, she was very careful to avoid the students’ break-time to get the maximum benefit of the fluoride application. They [school-staff] were keen to take dental advice from the dental team. The dental staff commented to me [dental prevention team] that the session was very comfortable [and that] they were able to provide more education while delivering the service. They thought that the school staff attitude showed gratitude for the service they were providing, and that they were appreciated” [R-observation].

Despite the consensus opinion among participants about the effectiveness of prevention modalities, ambivalence around school settings led some participants to be skeptical about anticipated outcomes of the SOHP and the schoolchildren’s dental health. They believed that regardless of the efforts exerted to implement the program as required, the absence of supportive structure that led to instances such as access to cariogenic food inside and outside the school premises was a barrier to optimum oral health:

“Sometimes at the end of the school day, we found parents with their children in the mini-supermarket near the schools, with the children buying all kinds of cariogenic food [foods that help dental decay].... This made me [member of prevention team] feel useless. Why should we put an extra effort to get parents’ positive consent if they do not appreciate the service we were providing?” [PT].

5.5.1.2.2 Oral health behavior of stakeholders

The oral health behaviors of program beneficiaries, including children, teachers and parents, were identified as the second dimension of the external context. Participants discretely talked about the oral health behaviors of schoolchildren (main stakeholders), teachers, and parents (secondary stakeholders), indicating that they perceived the children's behavior as a key factor in successful program intervention implementation. The appropriateness of the school setting for the program and high absentee rates were also mentioned as potential confounding factors that could compromise the anticipated outcome.

In addition to the importance of having a good working environment, the service providers asked for more support from the schools to manage children inside the clinics, especially if they were brought in groups:

“Sorry to say, but when the security staff is assigned to bring the children to receive their fluoride applications or to the nurse's office, work goes smoothly, especially in the boys' schools. I would like the schools to assign more than one person to facilitate our mission at school, so we can finish on time and in a very efficient way” [ET].

Participants also believed that teachers and parents could contribute to children's oral health practices, and that such contributions would play a major role in the prevention outcomes. They reported that children's oral health behavior – whether at school or at home – was the key to good oral health status. However, participants believed that they had little control over this matter. A participant who was very dissatisfied with the general attitude of teachers towards the program stated:

“As soon as we finish the fluoride application, [the children] run to the washroom to rinse their mouth [post-application instruction recommends no food or drink for at least 30 minutes]. When we ask teachers why they allow the children to do that, they say we cannot stop them from going to the washroom. Or sometimes the break-time happens right after our [dental] activity” [PT].

The implementation of prevention activities was subject to multiple factors from the perception of the providers and school key informants. Participants believed that some of the factors were more detrimental to the effectiveness of the prevention regimen than others. The barriers were described as part of the SOHP, while other factors related to the school environment, which was described as not being overly supportive (school characteristics). Furthermore, some participants suggested that schoolchildren should have a voice in the program’s different activities, and specific challenges were identified with engaging children as the main target population.

5.5.2 Maintenance

Maintenance is described as the extent to which a program becomes institutionalized or part of routine organizational practices and policies (Gaglio et al., 2013). Other researchers define it as the extent to which a program or policy is sustained, modified, or discontinued following the initial trial or study period (Bennett & Glasgow, 2009). The participants’ interviews in the present study revealed aspects of how the program was established and modified, as well as the sustainability of different program constructs.

They described that the SOHP journey went through three milestones in chronological phases: (a) the initiation phase (1982-1984), (b) the expansion phase (1986-1998), and (c) the sustainability phase (1999-2014). The sub-categories identified under initiation were

gatekeeping, leadership, and intervention planning. Under program expansion, the sub-categories were developmental change and remedial change. Under sustainability, the sub-categories were central administration, policy development, power dynamics, and funding. After 1999, the amalgamation of all programs resulted in a single national oral health program, which has continued to the present.

5.5.2.1 Initiation phase (1982-1984)

Participants in the in-depth interviews described how the program originated. They referred to the initiation phase as an innovative pre-establishment period that included the pilot project and evaluated the feasibility of the school-based dental program. Subcategories identified for the initiation phase were the role of gatekeepers and leadership, and the procedures of intervention planning using an evidence-based decision-making process. This phase was completed by disseminating the outcomes of the pilot program (project) evaluation in the form of a long-term sustainability plan.

Maintenance conceptual map

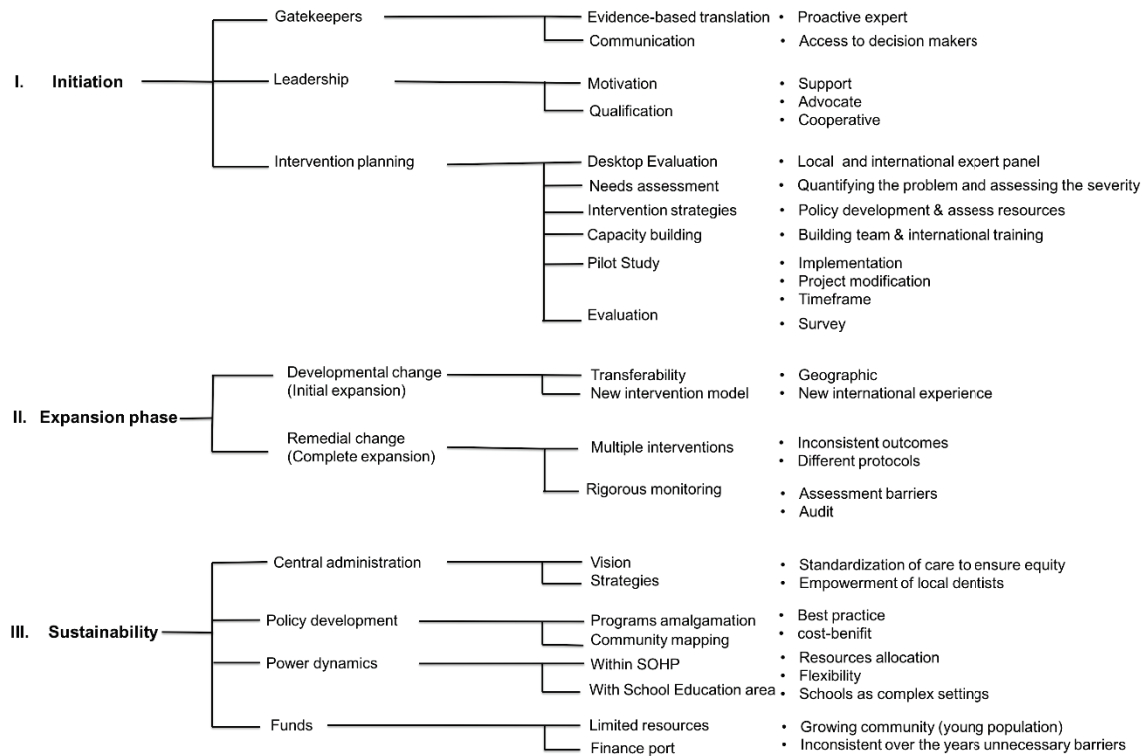


Figure 5.2. Maintenance conceptual map

5.5.2.1.1 Gatekeepers

Participants who were involved in the program from the beginning (in 1982) provided insight into this phase by highlighting the crucial role of gatekeepers' revolutionary visions and the impact of foreign training in bringing international expertise to the national policy. Their knowledge and connections to policy-makers and resources facilitated the transformation of evidence-based international practices to the local setting:

“A proactive [gatekeeper] had training [in North America], and he was part of ‘so and so’ in this country [Kuwait]. He came and spoke to the decision-makers about

the community-based intervention he'd learned about. Then they sent an expert [Advocate dental expert] for two months to learn more about our school-based intervention. She was very keen to learn about the nature of the school based program services ... When she came back, she highly recommended school-based intervention" [KI].

Engaging gatekeepers was instrumental in facilitating effective communications between international health institutions and governmental health advocate decision-makers:

"They [policy-makers' gatekeepers] facilitated attachment training for an advocate decision-maker for two months to learn more about our school-based intervention.... When they came back, they provided a constructive report to the policy-makers" [DM].

5.5.2.1.2 Leadership

Participants also emphasized the role of leadership in program initiation. Leadership characteristics were described as the competency of the policy-maker to be engaged with the system and to build team and workgroup capacity and capabilities. Healthcare advocate decision-makers with public-health credentials play a key role in establishing the welfare of populations and building health surveillance.

Participants also mentioned that the higher-level policy-makers were motivated. In addition, policy-makers were serious, highly cooperative, and supportive of their team's proposal. Furthermore, they sought international dental public health school training to develop their staff's capacity. Competent leadership was also an important factor facilitating oral health program establishment. "We should do something about children's oral health care, but let's

[first] find out what” [KI]. Shared motivation, advocacy, identification and incorporation of innovative concepts (leadership) led to the planning of a pilot intervention.

5.5.2.1.3 Intervention planning

The third subcategory of the initiation phase is intervention planning. Participants explained that taking appropriate steps toward planning an intervention facilitated the progression of the program. The main steps mentioned by the participants were desktop evaluation and needs assessment.

Desktop evaluation was defined as the initial step taken to search the available oral health interventions and the best evidence-based practices regarding dental health intervention targeting schoolchildren. A high-level governmental organization and funders conducted a desktop evaluation. It included consulting with local oral health specialists and international experts:

“They have done the initial literature search about community-based oral health interventions and then they have invited three experts from the States [U.S.A.] and three experts from Europe ... to compare and contrast available international experiences” [DM].

The desktop evaluation was followed by a needs assessment through an oral health survey to determine the prevalence of dental caries and to have a better understanding of the nature of the intervention. “They invited a school-based team ... and asked us to prepare a national survey proposal including children and adults ... to better understanding the prevalence and trends of dental disease” [PM]. The national survey “to assess oral health status among Kuwaitis revealed a high caries level among schoolchildren, which was a legitimate reason to develop strategies to prevent this chronic preventable disease” [KI]. In addition, participants

explained that policy-makers sought to improve the capacity (i.e., building capacity) of a project's local team members and to provide adequate training to them in the original international program context.

Transferring international experience to the local setting was, however, a challenge. One advantage of the training was to close any gaps that may occur by understanding the context in which the original program was developed and how this would relate to their context: to understand the cultural, political and economic differences and how to modify them to fit the local context.

The actual implementation of the planned project provided insight into infrequent problems that were specific to the local context (replicated program) and did not exist in the original program. The problems were recognized and analyzed, and solutions were sought and implemented:

“Despite the ministry choosing ten dentists to have an intensive training, after a couple of months at the schools, we experienced a ‘no show’ problem among patients.... We had a high rate of patients not showing up and we had a timeframe we needed to stick to.... As you know, it is a free-of-charge service, and people were not paying for anything here.... In the States, they pay for everything, so they were more committed to the appointments” [DM].

Accordingly, participants mentioned that modifications to the pilot project were very important for the program's success. “We decided to schedule three children for the same slot [and] we adjusted a couple of issues to fit in the Kuwaiti context” [DM].

The initiation phase was concluded with a second survey that assessed the outcome of the pilot projects. Assessment was seen as a major element of the intervention planning and an

essential step to take the intervention to the next level “The objectives were precise and achieved, and the project was successful ... People were happy to expand the experience and include more Kuwaiti regions” [DM]

5.5.2.2 Expansion phase (1984-1998)

Expansion of the intervention to more regions was guided by major organizational changes. The changes were described in two phases: developmental changes (initial expansion/pre-war) and remedial changes (complete expansion/post-war). The developmental changes were planned by policy-makers who were involved in the initial expansion, and was strategic and executed as part of a continuation of the pilot project. In order to benefit from broader international expertise, another model taken from the European experience of school-based interventions was also established as a parallel program.

Complete expansion was implemented in reaction to an intensive need for health services as a result of post-war effects. Multiple school-based prevention programs were launched during the post-war era as part of service re-orientation to satisfy population needs. “The program has gone through two stages of expansions before the war ... and that was planned. After the war, many school-based models were established as a consequence of the great oral health needs” [KI].

5.5.2.2.1 Developmental Changes (Initial expansion)

The participants described the factors associated in this phase around the Kuwait invasion (the Second Gulf War) period. Developmental changes were proactive changes planned by decision-makers in order to expand the school-based oral health service to include a more diverse

population. Participants reported that the initial transferability of existing experience was underway, which was part of proactive planned change in the dental health care, so more children in different Kuwait regions could benefit from the school-based services (i.e., geographic expansion). Additionally, a new model of a school-based program run by another international dental school (European) was established, which was the second stage of expanding local experience sought by the Ministry of Health. “After around two years of the initial success of the pilot project, a second program was developed in the Ahmadi region [another governorate] [as] they wanted to broaden their experience in school-based intervention” [KI]. Participants also described this period as an initial expansion of the existing project and an initiation of a parallel program. The European-based program was established with a new oral health prevention philosophy in another Kuwaiti region. “After the initial success of the school-based program, the policy-makers were keen to expand the experience and initiate another program that adopted European prevention school strategies” [KI].

A higher level of decision-makers decided to expand the local program experience in the community-based intervention, as well as in another international school-based intervention in order to customize the future national program:

“The policy-makers wanted to have the European experience to learn from different experiences in a school-based program.... They thought that by then they will be able to decide on the best dental prevention program for the Kuwaiti population” [DM].

5.5.2.2.2 Remedial change (Complete expansion)

According to the participants, remedial changes occurred to embrace the need after the war. The post-war characteristics of Kuwait were dynamic and tense, and affected society at all levels. Participants sadly explained the loss of more than 60% of the infrastructure during the war (Morris et al., 2004). One participant reported, “It was a great mess and clinics were totally destroyed ... the staff left the country... people lived with no dental services for almost a year” [DM].

The subsequent lack of healthcare services led to increased demand for oral health care. As a result, health organizational change was required, and arose in the form of complete expansion of school-based oral health services. This was the main reason for the expansion of the school-based oral health intervention, as part of health services re-orientation, using international expertise. A well-informed participant described the post-war era and stated that additional baseline data were required to adjust the level of the health services needed:

“The loss of infrastructure and widespread post-war trauma led to a spike in the increase in dental caries levels, which made policy-makers take immediate action and expand the school-based intervention nationwide, cooperating with more international dental schools to fulfill the community need” [KI].

Participants described implementing multiple prevention programs with substantial budgets, as significant organizational change occurred to ensure the population needs were met. Nonetheless, having multiple prevention models with different visions, strategies, tools and infrastructure required rigorous monitoring.

Furthermore, variations in service activities among different regions needed different monitoring strategies, which led to different oral health outcomes. This led to encountering assessment barriers. Using a conventional oral health survey was not conducive to detecting the impact of different strategies employed. Different initiatives and activities yielded different outcomes, so simply measuring decay levels was not a good reflection of the program's performance. One participant surmised that assessment barriers emerged due to the different strategies of the initiatives, which then led to assessment difficulties:

“Each program had different regimens, so each program had different results. The inconsistent approaches made it difficult to compare amongst the programs. I'll give you an example: one program was using mobile dental units and one was using luxurious fixed school-based clinics and had a high rate of deciduous teeth extraction. The other was using fluoride rinse, etc. We had a very difficult time trying to compare the clinical protocols as well” [PM].

Part of the rigorous monitoring regulation was auditing. Participants stated that professional auditing and third-party assessment was required by the government to regulate joint venture and tender projects. The new requirements were developed to assess the external and internal credibility of reports and the productivity of the programs. “Different assessment tools were used to evaluate different programs, including oral health survey, auditing, monitoring productivities and annual reports ... which was part of the Ministry of Finance regulations on government-funded programs” [PM]. Participants described mixed feelings about the abrupt regulations the government had implemented after the health service re-orientation period, as illustrated below:

“New rules were out regarding auditing public health joint-venture partnerships by the State Audit Bureau of Kuwait for credibility and accountability, and only

those who agreed on the rules of partnership were encouraged to continue in the service: it was fair game” [PM].

Another participant added:

“There was no MOU [memorandum of understanding], no previous agreement upon the approaches of service delivery. Expanding the number of outpatient clinics used to be done by word of mouth before receiving any official letter. We used to do it as gentlemen’s agreement. But later, when the new rules came out, the program was interrogated because of this action” [KI].

5.5.2.3 Sustainability phase (1999-2014)

Sustainability is the last major milestone in the SOHP journey. It includes main changes in the SOHP strategies, which have continued through the date of this research. The subcategories identified as factors associated with the sustainability of the program were mainly related to (a) the central administration’s organization-wide change of the programs, (b) policy development, (c) power dynamics, and (d) funding. The participants described sustainability as the continuity of the program’s components, and factors related to modifying the program’s strategies and objectives. The introduction of new regulations and policy-makers were two key elements for achieving the sustainability goals of the program. Participants were in consensus that establishing the National Oral Health Program by combining all programs into one program that served all public schools in Kuwait was the cornerstone of the school-based program.

5.5.2.3.1 Central administration's organization-wide change of the programs

Participants described the main feature of this phase as central administration making major organizational changes. As a result of the new vision of the new policy-makers, equity was a core value. The main dimension of the subcategory was emphasizing empowerment and ownership among local dentists.

Standardization of care was one way to improve equity among schoolchildren. One of the policy-makers stated that “[t]he children in different [regions] were receiving different treatments.... They were not guinea pigs.... All children in Kuwait should have the same treatment and care” [PM].

New dental administration also believed that it was a challenge to manage multiple programs with variant strategies. Building new strategies by developing a joint venture with one international partner under new management was another way the new policy-makers sought to achieve the required change and attain standardization of care:

“I was not involved in the early stages of the program. I stepped in later. I found that we had to deal with different programs in all aspects, including the management systems. In my opinion, that was an administration disruption and we needed to fix it right away” [DM].

One participant stated that the need for developing new strategies and involving local dentists was an essential change to improve delivery by understanding the social and environmental context of the school setting:

“When they established the programs, few local dentists were involved. They were involved mainly in facilitating connections with school administration.

Giving a bigger role to local dentists and a higher level of tasks made them feel they were part of the program and that they provided great work” [DM].

Another participant added that involving local dentists was important not only for improving delivery, but also for empowerment purposes. For example, a key informant added that during the war, the loss included an expat workforce. “The majority of the dentists were expats.... Many of them left during the war and did not come back, which created another barrier” [KI].

However, add-on community-based program initiatives should involve local dentists. They are essential not only for facilitating delivery of service, but also for improving ownership. One participant stated:

“When they established the programs, few local dentists were involved. They were involved mainly in facilitating connections with school administration. Giving a bigger role to local dentists and a higher level of tasks made them feel they were part of the program and that they provided great work” [DM].

5.5.2.3.2 Policy development

Participants mentioned that the centralization of decision-making was one of the main modifications in the program’s re-structuring that facilitated the program’s future integrity.

“There was discrepancy in management across the programs, so we had to unify them to produce consistent outcomes” [DM].

Participants noted that a proactive change in the system occurred when the leaders in the health organization recognized the need for a major change in the working protocols. Examples

included amalgamating program protocols by including the strength of individual programs, and following best-practice guideline and evidence-based dentistry. One participant explained in more detail:

“Each program had something exceptional. For example, one program had the best school-based clinic strategies, another program had a very strong training system, and another one was very efficient at providing service according to the children’s needs, following community mapping. So, we combined the best of each program, incorporating our vision and developing a standardized protocol for all” [DM].

Despite the effectiveness of the school-based clinics, a great shift in the program clinical protocol was in favor of center-based over school-based clinics. Decision-makers justified this change by pointing to the schoolchildren’s high normative need, limited number of school hours, and economic reasons:

“When I was told that we have to shift to center-based clinics, I understood the concept behind this decision [was] that the clinics will work after hours and the accessibility to dental care will be more for children with parents” [DM].

Another participant justified this from the perspective of a community mapping and cost-effective viewpoint, along with oral health care marketing:

“Our population is a young population. We need treatment services, and school hours are limited. Unfortunately, we have 120 working days at schools over the academic year. We have only five hours, and dental services are time-consuming and very expensive. In center-based clinics, we operate 12 hours a day, five days a week, in addition to emergency service during the weekend.... You know what? Parents’ exposure at the center-based clinics made the service well-known as well” [PM].

5.5.2.3.3 *Power dynamics*

Power dynamics were another hindrance that emerged from the participants' interviews.

Participants described power dynamics as a complex process within the SOHP (organization) and with the partners, especially in school settings. One example of power dynamics was competing priorities within the program organization, such as deciding whether prevention or treatment regimens should be a higher priority. One decision-maker stated "if the decision were mine, I would invest more in prevention" [DM].

Another participant described that control impacted variations amongst SOHP coordinators and school administrations, as follows:

"Despite the fact that they have been hosting school oral health services for more than 30 years, the relationship with school administrations varies across the regions. We have no control over their schedules.... Some schools share schedule preparation, and some were very rigid" [DM].

Participants explained that another type of power dynamic was social connectedness with parents through school-based clinics; describing schools as self-organized, self-referential, and following inner-directedness. This was unlike center-based clinics, where providers were in direct contact with parents. "The relationship with school administrations varies across the regions. We have no control over their schedules. We keep old cooperation relationships with them, since they have been hosting school oral health services for more than 30 years" [DM]. Participants mentioned that cross-sector collaborations were important, and that involving more than two organizations in a community-based program was necessary for successful intervention, and may lessen the power concentration. "This is a school-based intervention.... In other words,

[it is] community-based.... It is a community responsibility [and] all civil society should have a role” [PM]. Another participant added that, striving for a valid partnership could support working through the power-dynamic issues:

“We don’t have any MOU [memorandum of understanding]. We meet with the education area principals on an ad-hoc basis, meaning whenever we have a problem or activity ... not a regular meeting. Moreover, we need more collaborative work with everyone ... schools, parents, and civil society organizations” [DM].

5.5.2.3.4 Funding

Governmental funding has been the only source of program funding for the past 30 years. However, finance regulations have been subjected to changes over that time period. During the initiation and expansion phases, funding came from the Ministry of Health budget; later, funding was provided by a third party through the Ministry of Finance.

Participants described two types of funding barriers they experienced in financing program activities. The first barrier was a lack of resources due to limited budgets despite a growing population. Lack of resources was a key element for resource allocation and the movement towards mobile dental clinics. Despite the increases in the budget, one participant described the challenges encountered by rapid increase in population, which made it difficult to provide the service in a consistent manner:

“The Kuwaiti population is a young population. The National Oral Health Program is the main proxy for oral health services. However, we have to decide on the type of service the population needs with the limited resources we have. Especially, dental caries is a multi-factorial disease and the prevention services were not enough ... [so] the lack of adequate resources is a problem” [DM].

A second funding barrier was government rules and regulations regarding finance stability, as well as collaboration between government departments (Ministry of Health, Ministry of Finance) and private sectors, which were described by participants as being unnecessary obstacles. For example, problems at a higher level of partnership may influence the suspension of the services and may sometimes affect staff financial rights. One participant pointed to bureaucratic funding procedures as a strong barrier to performing necessary changes in program policy, stating:

“Having a third party was not a practical regulation applied by the tender department at the Ministry of Finance. We went through unnecessary problems. Every year, we have delays in work due to the bureaucratic procedures, since we have to go through obtaining working permits for our expats staff” [DM].

Another participant explained that direct funding might stabilize the service delivery because fund instability problems due to unsolved bureaucratic problems were the main cause of temporary service suspensions:

“Some problems were more complex. For example, at one point, the funding was suspended due to hitches with higher-level funding partners leading the staff to strike, but this is not a problem that we faced on a regular basis” [PM].

The program has been maintained for more than thirty years and is institutionalized in the Ministry of Health as well as to a lesser extent in the Ministry of Education. However, while some constructs are sustainable and show high resistance to wear over the past fifteen years, others show poor sustainability. Factors related to implementation and maintenance will be discussed thoroughly in the Discussion section.

5.6 Discussion

Valuable information and insights emerged from the focus group and in-depth interviews regarding the limitations and facilitators of implementing the SOHP program that led to the institutionalization of some program constructs and modified others. These insights included ‘how’ and ‘why’ some program activities were institutionalized whereas other activities were less resistant to attrition over time. Overall, infrastructure limitations and environmental characteristics were cited as the main barriers to the implementation of program activities, while evidenced-based decision-making, leadership, and population needs were the main elements leading to program institutionalization. Participants reported that higher program attrition was found in hosting settings (schools) due to the nature of partnerships and cost factors.

5.6.1 Implementation

Janssen and Estevez (2013) refers to successful implementation as “satisfaction on the different elements of the program implementation” (Janssen & Estevez, 2013, p. 212). Participants described it as integrity or the quality and consistency of delivery when the intervention is replicated in a real-world setting. Moreover, from the participants’ points of view, major problems that hindered implementation were lack of financial resources and technical support, along with an unsupportive structure. These findings have been consistently reported in published studies that investigated the capacity-building of chronic diseases and oral health programs (Flaman et al., 2010; Jürgensen & Petersen 2013; Petersen 2004).

5.6.1.1 Internal context

Participants suggested that the major factors relating to internal context barriers were defined as “idealistic strategies” and lack of resources. Participants believed that the program’s idealistic strategies were inconsistent with the available resources. Furthermore, some participants suggested that the environment is not supportive, compounded by underestimating the time needed to implement the program effectively. This compromised the program’s fidelity.

Despite the fact that the program was established on sound evidenced-based intervention principles, many interventions failed to meet the objectives at the implementation phase because too little attention was given to the evaluation process that assesses the external validity of the intervention. Balancing program strategies and resources is a deep-seated fundamental principle in program planning (Alkin, 2011). One of the core elements of program planning is providing administrative capacity that influences the size and scope of program activities, including physical provision, oversight, and staffing to ensure adequate implementation (Harris, 2010). These elements can realistically estimate the program’s output and effects.

5.6.1.2 External context

The program’s internal context is closely associated with the external context and program setting. Participants explained that levels of engagement of school staff, school environment (access to unhealthy food), and schoolchildren’s oral health behavior (dieting habits, compliance to post-operative instructions) were the most influential elements affecting the program’s outcomes.

In the current study, participants reported that differences in the characteristics of school environments affected the implementation across sites (between schools). This is consistent with other implementation evaluations of public health interventions, where the implementation of specific interventions depends on the characteristics of hosting sites. In addition, the more complex the intervention, the more implementation variations are to be expected (Farris et al., 2007; Glasgow et al., 1999).

The type of relationship among the stakeholders is a crucial element in the success of an intervention, even if evidenced-based and ‘best practice’ interventions are used. If the social pathways between the various stakeholders are not well understood, it will be hard to achieve anticipated outcomes (Bracht et al., 1994; Newton & Bower, 2005). Regardless of the longevity of the program, partnership should not be taken for granted. Participants suggested that social connectedness, awareness, and mutual benefit were key elements for successful cooperation between SOHP providers and school staff to maintain constant implementation. In other words, school staff engagement played a major role in program adaptation. This key element may enhance engagement, thereby better enabling implementation, and helping to maintain a shared purpose and interest by overcoming communication difficulties among program stakeholders. However, despite this aim, establishing and maintaining adequate engagement among partners was a major challenge to facilitating program delivery as intended (Cargo & Mercer, 2008).

It has been suggested that building community support is another core element in program planning that affects implementation success (Harris, 2010; Rossi et al., 2004). Seifer (2006) reported that one way to build common ground among communities is to identify the interests of the target population. This can be achieved by getting to know the setting, culture and

stakeholders. Another way to establish common ground among community partners is to assess factors that affect the implementation in some way, and to clarify potential changes in the environment (Watt 2005; Watt et al., 2001). Similar to our findings, two main types of involvement in school interventions have been reported in the literature: compulsory (formal) and voluntary (informal), both of which are reported to affect the implementation of program activities (Keshavarz et al., 2010). When a program is operated in schools, it has to be compatible with a dynamic complex setting with different rules, values, and interaction patterns.

A second identified external context element was the target beneficiaries. The participants believed that the behavior of the target population could have an impact on anticipating positive outcomes. Unhealthy behaviors and attitudes of children and parents, in addition to access to cariogenic food within and outside school premises, made participants skeptical about the intervention's value. This is consistent with other reports that changes in lifestyle and especially in diet have been exceptionally rapid in Kuwait (Eisalhy et al., 2015; Honkala et al., 2012). Per capita consumption of sugar almost doubled there between 1991 and 2005, from 19 to 37 kg/year, respectively (Al-Kandari 2006; Honkala 2014). These changes could be due to the fact that all government schools have vending machines and/or canteens, which mostly offer unhealthy snack choices, with low-nutrient, high-energy dense foods and sugar-saturated soft drinks (Al-Ansari et al., 2006; Honkala et al., 2012; Vigild et al., 1999).

In brief, the above-mentioned factors were all included in the need for capacity-building improvement, including development of sustainable skills, structure, lobbying for program provision, supportive structure and partnership. These capacity-building factors were the invisible work of high fidelity intervention (Nutbeam 1998; Van den Branden et al., 2015).

5.6.2 Maintenance

In the current study, maintenance was assessed at the system level. Maintenance is defined as “the degree to which the program is sustained over the time within the organization delivering it” (Glasgow et al., 2001, p. 688). Gaglio et al., (2013) expands this definition by stating that “the extent to which a program or policy becomes institutionalized or part of the routine organizational practices and policies” (p. 38). Through a systematic review, Gaglio et al. (2013) also categorized maintenance as “high maintenance” when the intervention was sustained more than six months. Therefore, the studied program showed high maintenance, since it was developed in the early 1980s. Furthermore, data analysis revealed that SOHP was highly institutionalized in the Ministry of Health, which was the main service provider of program activities, and to a lesser extent in the Ministry of Education as the hosting organization (Behbehani & Scheutz, 2004; Morris et al., 2008).

Participants reported that many key factors were attributed to the establishment of the program that facilitated its continuation and institutionalization. They also mentioned that some program constructs were more sustainable than others. Participants reported that the program was maintained over the past three decades and went through three main chronological phases, each of which had its unique factors. The outcome of these phases has shaped the current characteristics of the program.

5.6.2.1 Factors related to the program initiation phase

Participants believed that there were numerous factors that facilitated the program maintenance and led to the high sustainability of the program. These factors included establishing the program

on sound Evidenced-Based Dentistry (EBD) interventions, having the program led by advocate champions with leadership power, having a high awareness of the population's needs among health organizations, and the existence of the funds to intervene.

Participants believed that using EBD interventions were an important factor that affected the sustainability of the program. Developing an intervention on sound scientific principles would facilitate adoption by health professionals, and organization culture would be more willing to challenge an entrenched attitude. This is consistent with Morris et al., (2004) and Sosnowy et al., (2013).

The role of leadership quality and power was noticed not just during the establishment of the program, but also in developing the sustainability plan (Brownson et al., 1999; Morris et al., 2004; Sosnowy et al., 2013). Despite what has been reported in the literature, there was a developmental change in the form of a sustainability plan, due to the successful results of the pilot project. This was followed by an expansion to more than one region. That champion roles and leadership power are able to sustain innovation is consistent with Johnson et al. (2004), who stated that leaders with power and advocacy have the ability to implement and sustain innovations.

Another factor mentioned by participants as facilitating intervention maintenance was the awareness among health organization policy-makers of the public's dental health problems. Participants reported that the core of health organization actions were always based on the population's health needs (Ariga et al., 2014), which informed the type of intervention and the allocation of available resources in a political climate related to each phase.

5.6.2.2 Factors related to the organization-change phase

Policies that affected program sustainability sometimes were developmental, and decisions were made proactively. At other times, remedial and reactive actions were implemented to a specific unpleasant incident, such as the Kuwait invasion (1990). Proactive decisions and planned actions, like implementing the studied program and having a clear sustainability program based on sound scientific intervention and population needs, showed more resistance to wear than remedial reactive change.

On the other hand, unplanned remedial organization change, to accommodate the emerged needs of populations due to an unexpected event (e.g., war), were less sustainable than planned developed activities. This type of change led to an ad-hoc decision-making process (Glanz et al., 2008), as was detected during the post-war era, and is consistent with the current study. Participants also mentioned that the policy-makers established new goals in the post-war era for health services re-orientation to improve health, reduce dental diseases, and improve equity and quality of care within the new context. Still, reactive actions and strategies, such as implementing multiple interventions with different approaches, created future impediments such as assessment and monitoring difficulties. Consequently, all existing programs were discontinued, and a new national program was developed with strategies obtained from previous experiences (Ariga et al., 2014).

5.6.2.3 Factors Related to the Sustainability Phase

Decision-making via a “top-down” organizational process influenced the institutionalization of major program constructs, such as shifting from school-based clinics to center-based clinics.

Reactive decisions were made in response to barriers at the administration level and lack of proper partnership. This factor was interconnected with the power-dynamics and the nature of intersectoral relationships, which were additional obstacles reported by participants.

As policy implementers are likely to react negatively to new policies that are formulated by national-level policy-makers without their involvement, the use of participatory approaches in the design and implementation of policy is necessary for efficient implementation (Cargo & Mercer, 2008; Israel et al., 2010). Priorities within the organization, as well as between the organization and the community, and between the organization and its funders, were major problems to sustaining the expensive intervention. For example, although the main communication was with school principals because of their positions in their education organization, the principals were not always able to attribute and facilitate the realignment of program needs with their priorities. This may have been because organizational mandates are dictated by higher policy-makers or funding agencies.

Furthermore, the nature of intersectoral relationship is a key factor in intervention maintenance (Nutbeam 1998). The Ottawa charter explained that sustainable innovation should be proven to be beneficial to diverse stakeholders prior to and after implementation in a target prevention (Petersen 2003), as this will enhance trust as a core value (Cargo & Mercer, 2008; Seifer 2006). Re-assessment and re-allocation of resources to adopt specific program modifications according to school settings is a mandate in order to ensure mutual benefit and re-emphasize intersectoral relationships that positively affect sustainability (Johnson et al., 2004).

Relationships can vary from networking, alliance, partnership, coalition, to full collaboration, and each relationship level/category has special characteristics. The participants in the current study mentioned that there was no MOU (Memorandum of Understanding), i.e., no official contract between community partners. Furthermore, meetings with school administrations and education principals were on an ad-hoc basis. Therefore, the affiliation between organizations is at the network-alliance level, which is characterized by loose association and semiformal links. However, in order to achieve a partnership relationship, a formal contract, new resources, and shared risks and rewards need to exist.

Direct public funding was provided by the Ministry of Finance to expand the program to cover all Kuwaiti regions. This new fund was associated with adequate infrastructure and intensive school-based dental care at the time of the initiation (Behbehani & Shah, 2002; Morris et al., 2008; Vigild et al., 1999). The continuation of the fund was a facilitating factor of program maintenance. Nonetheless, the participants were of the opinion that having a third party (private-sector) managing the capitation was an undesirable regulation, which is consistent with published reports that direct organizational funding facilitated the sustainability of a program (Seifer 2006).

In brief, despite the fact that this intervention was based on EBD and that there was a clear need for the intervention, expensive dental intervention programs are usually susceptible to wear over time in the absence of a sound maintenance plan. In order to assess the sustainability of the intervention, we need to thoroughly understand the political, economic, and policy-making determinants and process. Furthermore, in order to build successful relationships, many factors should be considered, including necessity, opportunity, and intersectoral relationship prospects

for each specific context and time-frame (Gregson et al., 2001; Johnson et al., 2004). Overall, the key factors associated with program maintenance were the decision-making process, power in the form of establishing policy, awareness of population needs within a health organization, and economics in a political context.

5.7 Limitations

There are several limitations to this study, including lack of baseline data, insufficient time allotment, and conflicts with participants' schedules. Additionally, the lack of objectively measured outcome data may have an effect on conflicts between dental public health objectives and the underpinning financial drivers of a sustainable school-based oral health service.

Lack of formal baseline data was a significant limitation we encountered. No specific measures were employed in the past, so we could not compare whether the fidelity to the program was consistent or had been changed over the past three decades.

Furthermore, due to the relatively short academic year, researchers were not able to organize the focus groups, and some of the field notes were discussed in a retrospective manner. However, and despite the fact that deeper insight was gained from the schools' key informant data, school staff were not included in this research. In future efforts, data from the schools may be of great help to better understand day-to-day barriers and solutions.

Working within the decision-makers' schedules was yet another challenge, especially since some of the in-depth interviews occurred during a staff strike event. Therefore, the perceptions of the interviewees may have been influenced by the unusual and unpleasant strike

event, especially in the absence of baseline data and previous documentation regarding implementation and maintenance of the program.

5.8 Recommendations for Research and Practice

This study strengthens the assertion that the dental public health program requires additional attention to develop evaluation tools that address implementation fidelity and maintenance factors. The study was conducted on one of the most long-standing school-based interventions in the world, using evidenced-based interventions with high internal validity. Dental health interventions are expensive, and therefore external validation of evaluation tools is required for dental public intervention planning and for the efficient use of resources.

The outcomes of this study may be useful for improving the performance of the SOHP. On a larger scale, lessons of the current research may be used by public health professionals who are involved in planning school-based interventions at the region. Especially since literature revealed that few published reports about implementation evaluation of school-based programs derived from the context of developing or less developed countries (Jürgensen & Petersen 2013; Evans et al., 2013; Watt et al., 2001).

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Chapter Six

Discussion and Conclusions

In this chapter, a brief summary of the evaluation outcomes within the research conceptual framework is presented, followed by the results of a mixed-method approach used to evaluate the impact of the SOHP on children's oral health status and OHRQoL, and their mother's oral health knowledge, attitudes, and practices. An exploration of the SOHP contextual factors affecting the delivery system and maintenance of the program is also discussed in detail. Finally, the chapter ends with an overview of the study's conclusions and limitations, along with some considerations for future work.

6.1 Summary of Evaluation Outcomes

By using program data resources, conducting a cross-sectional study, and utilizing a focused ethnographic qualitative approach, we successfully demonstrated the use of the RE-AIM framework and Ecological Health Model (EHM) in evaluating the strengths and limitations of one of the world's longest running school-based oral health prevention programs. The amalgamation of evaluation frameworks and models, including the Conceptual Model of Social Determinants of Oral Health (Fisher-Owens et al., 2007), provided a comprehensive set of criteria for evaluation using a mixed-method, multi-layer approach.

This study had two broad aims: (a) exploring the impact of the SOHP on children's oral health status and OHRQoL, and on their mother's oral health knowledge, attitudes and practices; and (b) investigating the contextual factors affecting the delivery system of the SOHP. The factors were investigated by (a) program implementation and performance as perceived by service providers and receivers (prevention team and school employees as key informants), and (b) SOHP policy changes and policy-making that facilitated the maintenance of the program.

With respect to the RE-AIM framework, the results of the current study indicated that the SOHP program had limited success in terms of reach, indicated by low service coverage for the primary target population (schoolchildren) compared to the total eligible population. On the other hand, it was highly successful in terms of acceptance by the parents, as 91% of them provided positive written consent for their children to participate. Implementation and adoption (at the provider level) were relatively weak because of barriers encountered by providers and decision-makers. Maintenance was highly successful, considering that the program continued with public funding for more than 25 years. It is successfully institutionalized in the health organization and, to a lesser extent, in the educational system. This study found that factors related to maintenance were interconnected with other model dimensions, and thus were

imperative in the progress and impact of the program. Notably, maintenance is a core dimension of the developed evaluation model, based on the data generated in this study (Figure 6.1).

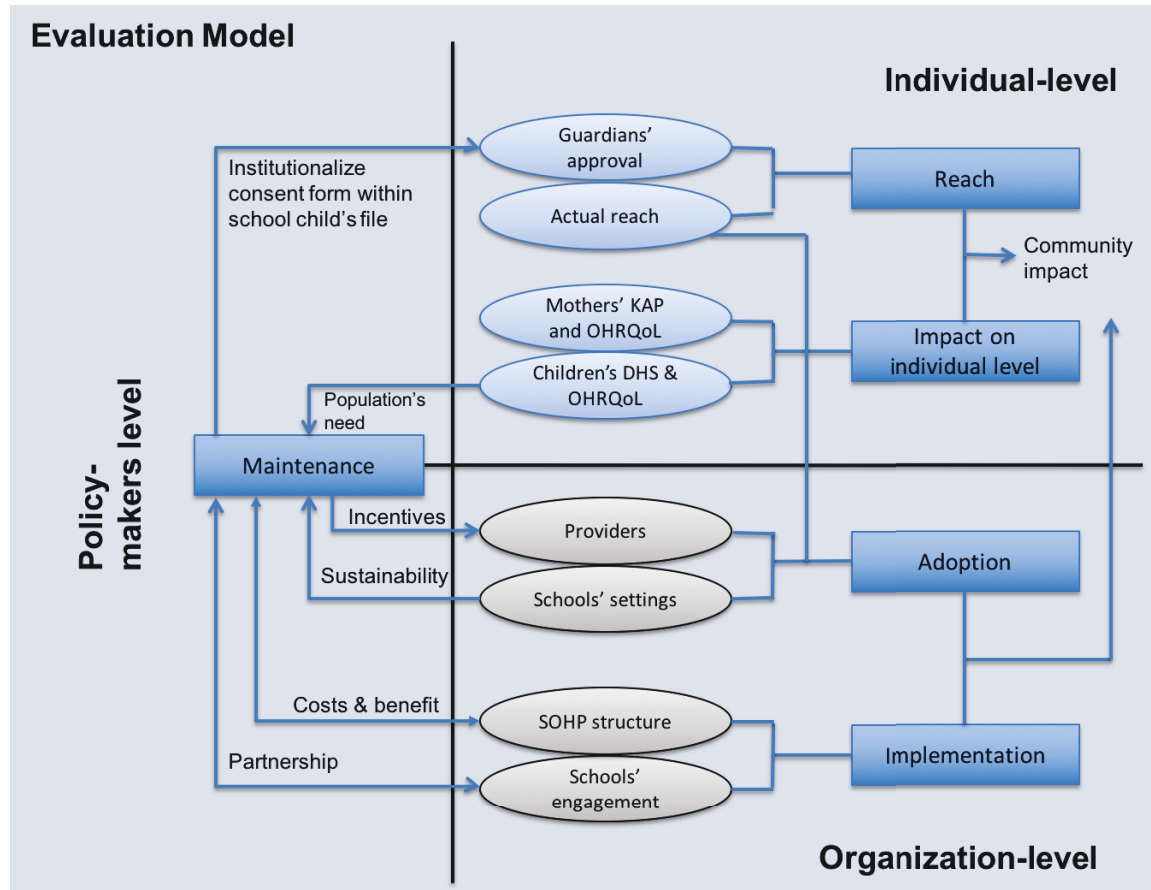


Figure 6.1. Evaluation Model

6.2 Sequential Explanatory Mixed-Method Design

A sequential explanatory mixed-method approach was used to develop a broad understanding of whether the SOHP has reached its objectives, and to determine whether the program activities have been implemented with fidelity and achieved their outcomes as intended. Data from the

quantitative and qualitative phases were analyzed separately to answer the proposed research questions directed to individual-, family-, and organization-level constructs of analysis (Tashakkori & Teddlie, 1998).

The first phase of this evaluation research was a quantitative study assessing the impact of the SOHP on children's oral health status and oral health-related quality of life, as well as on mothers' oral health KAP (Figure 6.1). Quantitative results showed some positive effects on dental decay levels of children compared to a previously published national report (Al-Mutawa et al., 2006).

In the intermediate stage, both quantitative results and secondary analysis of internal program documentation were used. The outcome of the quantitative projects related to children's oral health status and mothers' oral health awareness and percentage of service coverage, directed the explanatory component of the qualitative inquiry by enhancing the qualitative interview guides to include specific questions that quantitative data could not answer. The interview guides focused on identifying the factors affecting successful implementation of prevention activity. The interview guides also explored how policies were made in the SOHP. Using the results of the quantitative projects enhanced the exploration of factors hindering the SOHP from fully reaching its goals and objectives. The qualitative results highlighted the underlying reasons for changing working protocol and preventive modalities, and for the change in vision during the long history of the school-based program.

Consequently, this approach facilitated studying the prevalence of dental diseases for a large population of schoolchildren, at the same time capturing the interactions among complex

and changing contextual settings that influenced the implementation process of a school-based intervention (Ivankova, 2006; Ivankova et al., 2009). Both quantitative and qualitative phases had the same research priority. This sequential explanatory mixed-method approach also enabled an enhanced exploration of a complex dynamic school setting in relation to the SOHP mission (Keshavarz et al., 2010; Stokols, 1996).

6.2.1 Quantitative results

Employing oral health examinations and questionnaires enabled us to learn about normative needs, as determined by oral examination, and perceived needs, as identified by the children's perceptions of their oral health status and general health. The goal of the quantitative phase was to measure the potential effect of enrolment in the SOHP on the children's oral health status and oral health-related quality of life, and the mothers' oral health awareness. We quantified children's dental conditions by determining the prevalence of dental caries, severity of the disease, and their oral hygiene status. Children's perceived oral health was also determined via oral health questionnaires that included close-ended questions and categorical responses. All survey instruments employed in our study were previously validated (Al-Ansari et al., 2003; Brown & Al-Khayal, 2006; Kressin et al., 2008). Validation of the instruments was further supported by the inter-examiner's inter-rater reliability measure ($\kappa > 0.83$). The internal reliability (or consistency) of the questionnaires was also satisfactory (Cronbach's $\alpha > 0.7$).

The descriptive data provided us with broad information about the trends of dental caries among schoolchildren, as well as the association between the studied mother-child variables.

Results were aggregated and analyzed to explore the association between enrollment in the SOHP and other studied variables in both groups, including demographics such as mothers' education, age, and family composition.

The results showed that the program had a positive yet weak impact on the studied variables. For example, oral hygiene status was improved among children enrolled in the SOHP. Although the difference between the two groups was statistically significant, the difference was too minimal to be of clinical importance. Another question arose after analyzing the quantitative data and program documentary data. This question was related to the fact that the coverage of the prevention services was low, even though the majority of schoolchildren had written approval from guardians to receive dental prevention care via school-based intervention. Further, from a secondary analysis of internal documentation of the program (annual report), it was not clear why there was a variation in the service coverage among the schools. This informed our interview guide for the qualitative project of this mixed-method research.

6.2.2 Qualitative results

The quantitative data were derived from a numerical non-contextual cross-population approach. In contrast, the focused ethnography qualitative approach used in phase two is a contextual method that focuses on a distinct issue or shared culture in a specific setting. It is compatible with implementation evaluation and capable of addressing underlying issues (Knoblauch, 2005). For this phase, we purposively selected our participants (i.e., school key informants, service providers, and decisions-makers) to explore the factors influencing program performance. The qualitative project utilized data gathered from focus groups and in-depth interviews, field notes,

and researchers' journals. Findings were generated from providers' perceptions on the implementation and maintenance of the SOHP.

To ensure the trustworthiness of the study's findings, we used Guba and Lincoln's (1989) framework of credibility, confirmability, transferability, and dependability. The trustworthiness criteria were achieved by prolonged engagement, peer debriefing, member-checking, and thick description within the context of exploring the study objectives thoroughly (as detailed in Chapter 5).

The findings of the current research particularly emphasized the need to improve the capacity of the organization and the value of solid partnerships for successful intervention. They also highlighted the importance of investigating policy-making determinants and how they facilitate an understanding of the unwritten strategies of the program, which is consistent with previously published reports (Cargo & Mercer, 2008; Seifer, 2006). For instance, exploring factors that facilitated the sustainability of some program constructs and discontinuation of others led to a better understanding of how decisions were made and how they were influenced by the vision of decision-makers. This information, in turn, may be considered when future recommendations for program improvements are made.

6.2.3 Integration of quantitative and qualitative results

The quantitative data from cross-sectional surveys, secondary analysis of annual reports, and qualitative data from focus groups and in-depth interviews were compared and contrasted to enhance the validity of the results (Knoblauch, 2005). Triangulation of the data analysis enhanced the validity and credibility of our evaluation results, as follows. First, the internal program report

information was triangulated (education and prevention with program documents).

Correspondingly, the impact of the program on children's oral health status was complemented by secondary data analysis to answer the questions of this evaluation regarding the reach and association between SOHP enrolments and oral health status impact of the school-based program on schoolchildren.

Second, qualitative focus groups and one-on-one interviews highlighted factors related to the rate of penetration into the target population, the rate of service coverage, prevention program adoption among providers, and adaptation of program activities among the capital's public schools. Evidence from multiple data sources was then integrated into each dimension as applicable, and existing quantitative and qualitative outcomes and interconnected relations between evaluation outcomes within individual RE-AIM dimensions were explored. Cross-RE-AIM evaluation dimensions were also detected. For example, low application of dental sealant was detected among schools in the peripheral sectors. This information was interconnected with the providers' suggestions that different dental care needs between sectors in the capital areas required different prevention services. Furthermore, different levels (e.g., individual and organizational) also require different services, such as at the coordination between providers, managers, and decision- and policy-makers at cross-community and organization levels, as described in our evaluation model, displayed in Figure 6.2.

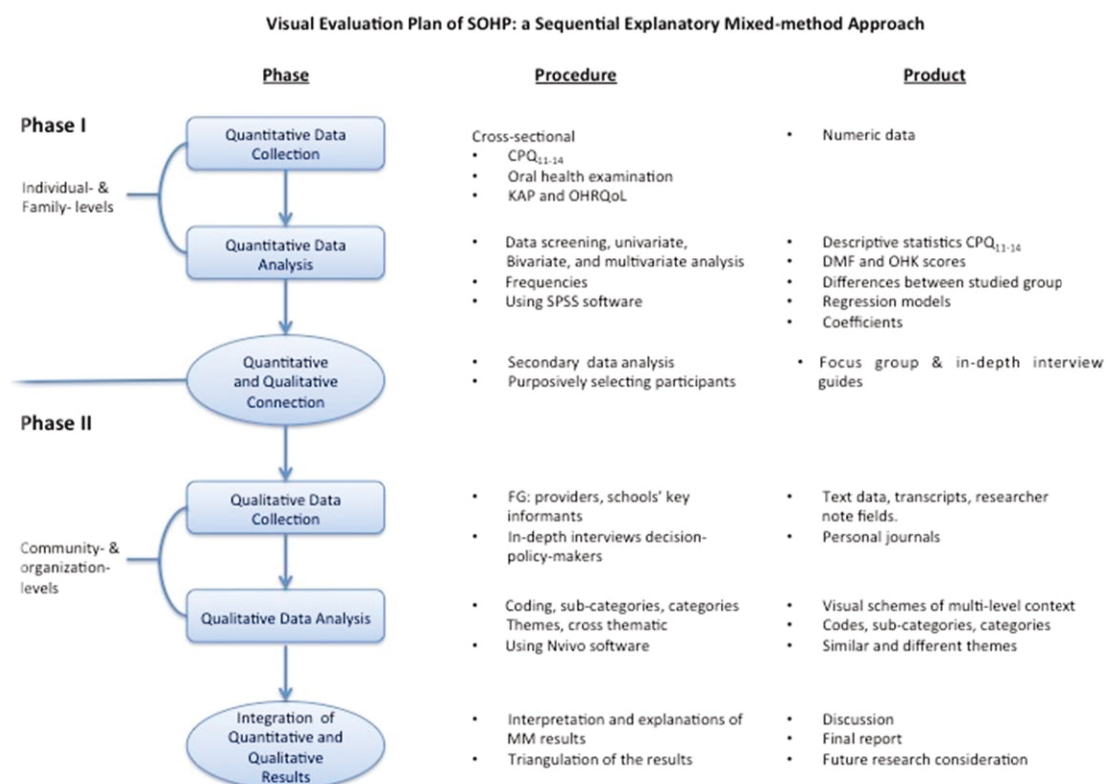


Figure 6.2. Visual evaluation plan model

6.3 Ecological Health Model

Recently, public health researchers have emphasized the multi-level nature of factors influencing general health. Likewise, factors affecting oral health have been determined at the individual, family, and community levels (Fisher-Owens et al., 2007; Watt, 2005). Thus, simple models that are individually based are no longer adequate for evaluating the outcome of dental prevention programs with multiple influences. The core principle of the EHM is that individual children live in families, families are embedded in communities, and communities are influenced by population-level determinants. Therefore, an ideal health promotion program should take a

multi-level approach to be more effective and successful (Green & Glasgow, 2006; Newton & Bower, 2005). A similar approach was used by the Kuwait SOHP that involved schoolchildren, mothers, and teachers for their school-based oral health program (Petersen et al., 1990; Vigild et al., 1999).

6.3.1 Individual level

In addition to genetic factors, other factors that serve as determinants of child's oral health status include social, physical, and behavior, as well as the use of the dental care system (Watt et al., 2001; Fisher-Owens et al., 2007). In our study, we performed oral examinations to assess the children's normative needs, and we also obtained the children's perception about the impact of oral diseases on their quality of life.

Surprisingly, there was no difference in OHRQoL between the SOHP and non-SOHP groups, even though an overall improvement in OHRQoL was detected among both groups. The overall improvement in OHRQoL in Kuwaiti schoolchildren may be due to the diffuse effect of the SOHP that provided treatment and education activities in center-based clinics. The relationships between individuals' clinical status (e.g., dental caries, xerostomia and fluorosis) and their subjective oral health outcomes such as OHRQoL are often weak and indirect (Baker et al., 2010; Benson et al., 2015; Gupta et al., 2015). This discrepancy may be due to the interference of environmental and individual factors (Baker, 2007). Therefore, more attention should be given to cultural norms and values, and oral health literacy among the population of interest when assessing the OHRQoL and oral health status of a population (Barbosa & Gavião, 2008).

Finally, our data showed that the majority of the children were eligible for dental prevention care through SOHP. Those who received dental prevention services (e.g., dental sealants and fluorides) had better dental health, which is consistent with published reports (Burt, 1998). On the other hand, program documentary analysis revealed that the mere presence of dental care does not ensure service utilization.

6.3.2 Family level

Multiple factors influence the oral health status of a child, including family composition, socioeconomic status, health status of parents, culture, physical safety, and social supports (Fisher-Owen et al., 2007). Among these, we studied parents' oral health Knowledge, Attitude, Practice (KAP), OHRQoL, family composition, and mothers' educational level as an indicator of socioeconomic status (SES).

Our results revealed that the mothers of children enrolled in the SOHP had better oral health KAP and quality of life. Yet, no associations were found between mothers' knowledge and their own oral health practice, or mothers' KAP and number of carious lesions of their child. Similar to our results, mothers' awareness of the importance of supervised tooth brushing did not result in involvement in their child's brushing practices in almost half of the cases in a previous study (Blinkhorn et al., 2001), which suggests that knowledge is not necessarily associated with practice. These results were not only consistent with published reports regarding the limitation of the KAP model (i.e., knowledge and attitude not always being translatable to behavior), but also support the suggestion for the use of the KAP model mostly at the initial phase of an education program in order to assess levels of knowledge, and detect any resonance of oral health behavior

and inconsistency between knowledge and practice. This will be useful for planning theory-driven dental education interventions aimed at changing oral health practices and habits.

6.3.3 Community and organizational level

A body of literature that emphasizes the influence of community factors on oral health determinants (Newton & Bower, 2005), includes social and physical environmental factors such as water fluoridation and health/dental care system characteristics. Prior to 1982, community water fluoridation was implemented in Kuwait, but due to technical problems, it was discontinued (Behbehani & Shah, 2002). After 1983, Kuwait implemented the SOHP as a joint venture with international dental institutes to provide dental care to schoolchildren.

Despite the fact that free dental care and community-based dental health improved the access to dental health system (Grembowski et al., 1989), our results indicated that better outcome of the school-based program may be achieved by embracing a collegial intersectoral partnership. This would establish mutual benefits across health and education organizations, which could be attained by improving the sense of ownership, and enhancing school setting characteristics. Our findings are consistent with published reports showing that the core values of participatory research lead to organizational and public health system development (Nutbeam, 2000; Cargo & Mercer, 2008).

In brief, we used an ecological health model to identify the framework of this research evaluation, incorporating mixed-method data at the individual, family, and organizational levels to show factors affecting SOHP contexts. The results highlighted the performance of the program in dynamic school settings, which is discussed in greater detail in the following sections.

6.4 RE-AIM Evaluation Model

The RE-AIM model is a relatively new evaluation model that has been widely used in the public health domain (Glasgow, 1999; Gaglio et al., 2013). No reports have yet been published on the model in the dental public health field. The main advantage of this approach is assessing both the internal and external validity of an intervention (Glasgow et al., 1999). In our study, RE-AIM helped us generate valuable information on different aspects of the SOHP program that engaged multi-level stakeholders. The five dimensions of the model include factors that influenced SOHP performance and impact on individual-level (Reach and Effectiveness) and system-level (Adoption, Implementation, and Maintenance). The RE-AIM dimensions were interconnected, as illustrated in our evaluation model (Figure 6.2).

6.4.1 Reach

Reach was assessed through multiple inquiries, including: (a) what proportion of schoolchildren were enrolled in the program, (b) what proportion of them received the intended services, (c) did the program account for the needs of the population, and (e) what factors determined the reach of the program. We used data from the 2013-2014 Kuwait SOHP and capital program to assess the reach of the SOHP'S prevention program for schoolchildren in the Kuwait capital area. The semi-annual and annual reports of the prevention and education activities were reviewed. In calculating the number of children enrolled, staff engaged and eligible schools involved, we noted that around 90% of the children had parental approval for prevention care. Yet, only 17% of children with parental approval received full prevention services (education, fluoride varnish, and dental sealants), only 35% received educational sessions, and 80% received fluoride

varnish through school-based interventions. Therefore, the impact of the preventive measures was found to be varied among the studied population (Al-Mutawa et al., 2006; Al-Mutawa et al., 2011).

The high proportion of returned consents may be explained by two factors: the inclusion of SOHP consent forms with the schools' administrative paperwork, and the longevity of the Kuwait SOHP, which gives it credibility. Including the consent forms within the schools' routine application forms facilitated reaching a vast number of parents. Additionally, long-standing health interventions accelerate trust between providers and the target population, which leads to a high population reach (Cargo & Mercer, 2008). Furthermore, our qualitative analysis revealed that variations among different prevention activities might be due to barriers encountered by the provider teams, such as inconsistency in the strategies planned, and resources available to match the increased number of children.

The increased number of eligible children was a factor that caused limited service coverage, which was not compensated by the budget increase. Since the program's inception, the number of children eligible for SOHP has increased threefold, but this increase has not been consistent with increases in the budget. This may partially explain the limitations in the actual reach (Morris et al., 2008). Additionally, the qualitative analysis revealed that reach percentages were affected not only by the available resources, but also by the time consumed per procedure. For example, the reach of fluoride varnish was higher than that of oral health education, despite the fact that a group education session costs less than a fluoride varnish application.

Finally, policy-makers' vision and service re-orientation could be another factor affecting the reach of the prevention activity. Policy-makers spearheaded the move to provide services through center-based programs rather than school-based clinics, which led to decreasing interest in the prevention program. This information is consistent with published reports stating that prevention programs are less attractive to decision-makers because the pay-off of prevention intervention is not immediate, and involuntary risks (chemicals) garner more attention from policy-makers than voluntary ones (dental decay) (Seifer, 2006). Furthermore, there is a notable lack of local public reports and baseline data published about dental public health interventions, including the studied program (Brownson et al., 2006; Honkala, 2014; Jürgensen & Petersen, 2013).

One barrier we encountered during our analyses was the lack of information about whether or not the populations in need received appropriate prevention procedures. The root of this problem was that Kuwaiti children were considered a high risk population due to high decay prevalence (Morris et al., 2008), so policy-makers considered all eligible children to be at risk and therefore in need of intensive prevention procedures. Yet, results from our qualitative data showed that children at the peripheral areas had different needs than those living in central areas at the capital governorate. For instance, children in the peripheral areas were more in need of restorative procedures than fissure sealants (prevention procedure).

Program documentation, field notes, focus groups, and in-depth interviews revealed that a vast amount of effort has been invested in collecting positive written approval for prevention activities. However, there was lack of resources invested in meeting the schoolchildren's need for dental prevention care through school-based interventions.

6.4.2 Effectiveness

The effectiveness of the program was assessed based on whether (a) the achievement of the program met the proposed objectives and activities included in the program's logic model, including improved oral health status and oral health quality of life of the schoolchildren, and (b) improved the oral health knowledge, attitude, and practice of the mothers.

Due to cost and time restrictions, efficacy designs such as a quasi-experimental study, which is a costly and time-consuming community-based approach assessing the effectiveness of intervention programs, could not be employed, (Rossi et al., 2004). Instead, a cross-sectional study was conducted to evaluate dental diseases in a controlled manner, and assess the impact of oral health education and oral health preventive interventions on the oral health of school-aged children. To assess the impact of the SOHP on schoolchildren and detect any associations between SOHP enrollment and dental health status, we chose variables that have been demonstrated to detect prevalence of dental caries, oral hygiene, and quality of life. In addition, among the mothers who were the secondary target population of the SOHP program, we assessed oral health knowledge, attitude, practices, and OHRQoL. As mentioned earlier in this document, the intervention group had received at least one oral health education session, two applications of fluoride varnish, and fissure sealants, if eligible. The non-intervention group had not enrolled in any dental preventive school-based activities and had not visited the SOHP center-based clinics in the past year.

Our quantitative results showed that students enrolled in the SOHP program had improved oral health (i.e., less prevalence of dental diseases and better dental health status)

compared to those who were not enrolled in the program. The SOHP group also had better oral health status than the reported caries prevalence for all schoolchildren in various Kuwaiti governorates (Al-Darwish et al., 2014; Al-Mutawa et al., 2011; Al-Mutawa et al., 2006). The overall mean of the children's CPQ₁₁₋₁₄ was generally better than that in a study undertaken previously in the region (Brown & Al-Khayal, 2006) and very similar to studies undertaken in other countries (Foster Page, Thomson, Jokovic, & Locker, 2005). Surprisingly, there was no difference in OHRQoL between the SOHP and non-SOHP groups, even though mothers of children enrolled in SOHP had better oral health knowledge. However, oral health attitude and practice variables showed no differences among the studied populations.

Furthermore, the duration and intensity of different prevention procedures used in the SOHP may be a factor affecting service coverage and impact. The intensity and exposure of prevention procedures may be elements that enhance the effectiveness of different dental prevention modalities. As an example, dental sealants of high intensity showed greater positive impact on caries levels, despite the fact that Fissure Sealant (FS) applications are a high-cost and technique-sensitive procedure, and that FS campaigns require months to complete compared to fluoride varnish campaigns, which only last a few days. In addition, our qualitative data revealed that school administration preferred short and concise services, which meant that cost, time, skilled providers, population selection (elective procedure), and unsupportive environments were limitations for high implementation and better impact of fissure sealant applications.

However, focus groups and in-depth interviews revealed that the impact of SOHP was compromised and inconsistent with the extensive effort applied because dental caries is a multifactorial disease greatly influenced by individual behavior and culture. Therefore, inadequate

adherence to recommended dental care compromised the effect of the prevention care provided by the SOHP. These results are consistent with published reports on the same population that showed diet and lifestyle in Kuwait were a risk factor for chronic diseases, including dental decay, diabetes and obesity (Al-Kandari, 2006; Al-Ansari et al., 2006; Alqaderi et al., 2015; Eaisalhy et al., 2015).

In brief, the program seems to have a positive impact at an individual level. According to Glasgow et al., (2006), if the program has low reach, the impact of the program on the community will be considered low, despite the actual effectiveness of the program. Our quantitative and qualitative results showed that the impact was low, mainly due to the limitations related to implementation and adoption dimensions. These results also showed how the reach, effectiveness and implementation dimensions were highly related to one another.

6.4.3 Adoption

Adoption was estimated based on (a) the proportion of providers involved in the school-based prevention and (b) the proportion of schools hosting the prevention services. The setting in which the intervention is conducted has received little attention in public health evaluation research, and few reports have considered it as a main factor in the evaluation studies (Glasgow et al., 2001; Habicht et al., 1999). Adoption can be measured either at the setting or provider level, or at both.

According to dental administration and SOHP documentary data (including semi-annual and annual program reports for the 2013-2014 academic year), almost one-quarter of the dental care providers of the capital school oral health program were involved in the school-based

prevention activities. The prevention and education teams visited almost all primary schools in the capital education area in Kuwait from September to April in the 2013-2014 academic year. Yet, they reached only around one-third of the students in those schools. Variations regarding adaptation of SOHP services that were detected among different school areas were explained by school administration cooperation, duration of procedures, and unexpected events.

On a provider level, interviews and field note data revealed that being part of prevention teams was not appealing to program oral health providers. Low incentives, time restrictions for procedures, and a generally unsupportive environment make school-based activities less attractive to oral health providers. This is consistent with a previously published study reporting that 38% of school-based oral health programs were impeded by lack of human resources and capacity (Jürgensen & Petersen, 2013).

At the setting level, despite the fact that SOHP was partially institutionalized at the education organization, a low number of schools adopted full prevention activities, and only one fixed school-based clinic providing comprehensive dental care (education-prevention-treatment) was reported in the capital program. This might serve as a model to investigate factors facilitating the adaptation of different SOHP activities from the viewpoint of school staff.

In our qualitative interviews, key school informants reported that, because of competing priorities and time restraints, having the program for a specific time throughout the academic year was acceptable, but not all year long. The high absence rate in Kuwait primary schools made time a critical factor for both prevention program providers and teachers (school staff). This result is consistent with published reports regarding time constraints evoking conflicts over

priority among different stakeholders, and thus compromising the adaptation of services (Flaman et al., 2010; Johnson et al., 2007).

Furthermore, since this study is the first formative systematic evaluation research, policy-makers mentioned that a lack of insightful reports about aspects related to unsuccessful implementations and school environments made fixed school-based dental clinics less sustainable and difficult to maintain. This is consistent with the Ministry of Health records, which showed the number of fixed school-based clinics almost disappearing in the capital program, dropping from ten clinics in 1996 to one in 2002.

Both secondary data analysis of internal program documentation and qualitative data analysis were used to evaluate the adoption dimension. More information about system level is discussed in the next sections.

6.4.4 Implementation

Implementation was assessed by (a) exploring factors at the school-setting level that influenced the extent to which the program activities were implemented as intended in the real-world, not in an experimental control setting, and (b) investigating why there was a variation in the delivery of some program components, as detected in the annual reports.

A systematic review conducted to identify studies using RE-AIM framework (Gaglio et al., 2013), showed that most of the implementation evaluation studies utilized a quantitative approach and that less than 5% of the included studies used a qualitative method approach (Gaglio et al., 2013). Thus, the lack of qualitative data about the implementation environment justified the published evidence that most of the community-based dental programs failed

to sustain the implementation stage, despite being based on evidence-based successful pilot projects (Barton, 2007; Saunders et al., 2005). Additionally, according to the 2012 WHO global survey, almost one-fifth of school-based programs mentioned that they have regular monitoring systems and implementation assessments, and more than half had regular monitoring projects (Jürgensen & Petersen 2013). However, no information exists about the tools used in these assessments.

In the current study, program annual reports, field notes, focus groups, and in-depth interviews with program providers and the schools' key informants were the sources of our findings, which revealed two groups of influencers for the implementation: one group was related to the SOHP structure (internal context), and the other was related to the schools' structure (external context). The internal context was defined by the program's strategies, structure, and infrastructure, while the external context was defined by factors related to school setting, including each school's engagement and the oral health-related behavior of the schoolchildren and parents.

For the internal context, major barriers included inconsistent program's objectives to available resources around time restriction and close monitoring systems, which compromised the feasibility of the planned strategies. This may be due to a lack of process evaluation reports to facilitate the adjustment of available resources for strategy planning to ensure the efficient use of limited resources (Oakley et al., 2006; Saunders et al., 2005). The participants also mentioned that budget and resource factors played a major role in delivering the activities as planned, which is consistent with the published literature, in that organizational capacity was frequently cited as

a barrier to school-based oral health programs (Hayes & Officer, 2012; Jürgensen & Petersen 2013).

Factors shaping the external context included level/type of school engagement, and adherence of the schoolchildren to prevention procedures perceived by the participants in this study. Interestingly, a previously published study reported that school teachers in Kuwait primary schools had a positive attitude towards the SOHP and being involved in the oral health education program (Petersen et al., 1990). That study was conducted in the development expansion phase of the program, but since then little has been reported on the perception of school staff about the SOHP. Our findings revealed a consistent lack of cooperation of school staff, and program stakeholders were perceived as being a frequent barrier, as reported in the literature (Jürgensen & Petersen 2013; Seifer, 2008). This also was reported for most of the programs carried out in American regions, and in one-third of the health organizations that carried different types of school-based dental programs (Jürgensen & Petersen, 2013).

Finally, consensus opinion about time constraints was reported by this study's participants as one of the main elements influencing the fidelity of program implementation. Additionally, the findings about barriers related to program structure and school setting led to ambivalent beliefs concerning school settings and the effectiveness of the current school-based approach. This contradicts the published reports about the effectiveness of school-based oral health interventions (Petersen 2003). The greatest depth of information was gained during the focus groups and field notes, and the weakest source of information was obtained from program documentation.

6.4.5 Maintenance

Maintenance was assessed by ascertaining (a) to what extent the program was institutionalized in the host site (Ministry of Health) and (b) by describing the retention of the program in the community (schools of the capital program). Assessing maintenance is a complex process. Our study found that the maintenance dimension was fundamental to individual- and system-levels dimensions. The RE-AIM literature has defined maintenance as the continuation of an innovation over time (Glasgow et al., 1999). In the literature, a total of eleven related terms were found for maintenance; confirmation, continuation, durability, incorporation, institutionalization, retention, level of use, routinization, stabilization, sustainability, and sustained use. The words ‘sustainability’ and ‘institutionalization’ were the most frequently used terms (Johnson et al., 2004).

In order to understand the SOHP context in-depth, a review of literature along with in-depth interviews with decision-makers provided us with detailed information about the program’s initiation. Generally, participants described factors facilitating and impeding maintenance over the initiation, organizational expansion, and sustainability phases, which led to the establishment of the SOHP.

Maintenance of SOHP was assessed based on the duration of the program’s continuation over the past three decades (Ariga et al., 2014) and the degree to which the program’s components were institutionalized in the form of expanded school oral health centers. Our findings also showed that solid evidence-based public health planning, advocate policy-makers, and consistent funds were the key elements for the feasibility of program maintenance. On the

other hand, catastrophic events, competing priorities within the organization, power dynamics cross-organization, costs, and logistic factors were the main reasons for the attrition of some program components at local education organizations.

Our results concerning organizational change showed that proactive organization policies embracing sustainability planning and central administration power led to program retention. This resonated with published reports that sustainable community-based interventions were mounted by advocate champions who had a clear public health vision and sustainability strategies (Brownson et al., 2006; Glasgow et al., 2002; Nutbeam, 1998) . However, published reports have shown that the lack of advocate leaders and sustainability plans at the early stages of program initiation were a problem in a number of school-based oral health programs (Petersen, 2003; Pluye et al., 2004).

Furthermore, organizational change and policy-makers vision led to establishing concrete infrastructure and incorporating the program in the current health field. This is referred to as the “top-down” approach in organization management literature (Sabatier, 1986), which typically begins with a change in organization policy or process. This approach is based on the notion that improvement of individual capacity may be achieved through organization restructuring. However, published reports suggested that focusing on changing organizational levels will not necessarily successfully influence individuals’ capacities or improve school-based preventions (Bermudez Parsai et al., 2011). In contrast, a number of researchers recommend the “bottom-up” organizational approach (Crisp 2000), suggesting that building the capacity of key individuals may be the optimal way to enhance the sustainability of program components within organizations (Flaman et al., 2010).

In brief, despite the fact that this intervention was evidence-based and that there was a clear need for a dental prevention program, expensive complex dental interventions are usually susceptible to being suspended over time in the absence of a sound sustainability plan. In order to plan a sustainable intervention, we need to thoroughly learn about the political, economic, and policy-making processes. Furthermore, in order to build successful relationships, many factors should be considered, including necessity, opportunity, and intersectoral relationship prospects for each specific context and time-frame (Brownson et al., 2006; Sorensen et al., 2003).

Overall, the key factors associated with program maintenance were the solid evidence-based interventions based on assessment needs, decision-making processes, power, awareness of population needs within a health organization, and economics within a political context.

6.5 Limitations

This study had a number of limitations that need to be acknowledged. First of all, since there were only a small percentage of schoolchildren who did not participate in the school-based prevention setting, recruiting non-SOHP groups was a challenge. Therefore, data collection about the oral health of children took more time than expected. Similarly, since we used purposive sampling for the in-depth interviews, the process was interrupted due to the busy schedules of the decision-makers.

A direct causal link between dental disease and prevention modalities in a cross-sectional study could not be verified. Although this study did not look at cause and effect between interventions used in the school-based program, the findings did point to a significant association between dental decay and enrollment in SOHP in a controlled manner, and provided an in-depth

exploration of the contextual implementation environment that provided an insight about the program performance.

Another limitation was related to lack of data about local community dynamics (Vigild et al., 1999) and the absence of socio-demographic assessment tools in Kuwait (Shah, 2012). Consequently, program planners designed protocol on the assumption that all schoolchildren were considered a high-risk population and should receive standardized prevention care, which contradicts the qualitative data reported by participants. Providers revealed that schoolchildren at the peripheral areas needed different dental care and different approaches.

A lack of baseline data about oral health determinants for the Kuwait community or surrounding countries that share the same culture and ethnicity was also a limitation of our study. Therefore, we had to compare our results with the international chronic disease interventions in different public health areas.

6.6 Conclusions and Future Considerations

Oral health programs pursue courses of action that are intended to make meaningful improvement in a population's health. The literature review conducted for this study revealed the lack of a systematic evaluation model in the dental public health field. Furthermore, recommendations of evaluation researchers suggest the importance of planning evaluations in advance (i.e., at the outset of a program's implementation) of providing services whenever possible. Notwithstanding, as is common in many community-based oral health programs, there was no initial comprehensive evaluation plan for the Kuwait Capital SOHP, and this evaluation research was designed after more than 30 years of the program's operation. This led

to the development of a complex evaluation model, based on a mixed-method sequential explanatory approach, including oral health measures and quality of life, and qualitative data about deep-seated elements affecting implementation and maintenance was long overdue.

The results of this evaluation research indicate that using an evidenced-based intervention guided by best practice seems to have a positive impact on children's oral health status. Still, the outcome of this evaluation also indicates that evaluation should be customized to the target population. Our study results highlighted that the main impediments affecting program performance were organizational internal barriers hindering successful implementation, and reactive organization change.

The ultimate goal of this study was to develop an evaluation model that facilitates the assessment of school-based oral health programs, and closes the gap in the literature on evaluation reports by using solid theoretical frameworks and sound outcome measures (Cooper et al., 2013; Watt et al., 2001). For performing individual-, family-, and system-level assessments, the EHM and RE-AIM frameworks can be used as facilitating tools for effective evaluation, especially in a complex school-based oral health intervention. Further, the gap between research and practice is well documented (Glasgow et al., 2003). Dental clinicians and researchers have heavily contributed to investigating internal validity by measuring efficacy of dental interventions, rather than assessing external validity by measuring its effectiveness, feasibility in reaching target population, and adoption.

Employing the RE-AIM model using mixed-method approaches in a pre-planning community-based oral health field is a challenge, but it can benefit from the triangulation of data

and method-enhanced internal and external validity. Moreover, this approach may be used as an alternative to gold-standard experiments, such as randomized clinical trials, meta-analyses, and quasi-experiments for community-based oral health evaluation purposes.

6.6.1 Recommendations and future considerations for research and policy implications

Two levels of recommendations are provided in this study. These recommendations are at the research level and the policy level. The research level recommendations for future enquires that may close the gap in the dental public health planning/evaluation literature. Further, the policy level recommendations can be used for Kuwait SOHP context and dental promotion programs that share similar social, economic, and culture background.

6.6.1.1 Research recommendation

In order to plan or evaluate a new program, there is a need to look at three main issues:

1. Emphasizing the use of a theoretical framework coupled with a solid program theory that considers the psychosocial factors of the target population and assesses the oral health determinants that most influence a specific population and community, and then applying program activities specifically targeting these factors with consideration to psycho-social aspects.
2. Investigating the determinants of the policy-making process and the political context of the target community to improve the decision-making. This will consequently enhance the sustainability of the intervention.
3. Assessing the available resources and funding for efficient strategy planning.

6.6.1.2 Policy implications

At the local level, our recommendations for the Kuwait SOHP program to improve the impact of the program on schoolchildren include the following:

1. Improving the organizational capacity and unifying the vision, mission, and goals among different stakeholders.
2. Revisiting the program's theory and logic model, and modifying program strategies to be consistent with theoretical considerations, contexts, and resources. For example, adopting a screening and referral system may improve the efficiency of resource utilization and customized care, especially since free dental care and the current dental care system provided in Kuwait eliminates barriers such as cost, insurance, and transportation.
3. Institutionalizing partnerships and implementing community-based partnership principles and structuring for sustainable, strong, cross-organization relationships. Most importantly, this will involve and empower children and their parents to have a role in the program's strategies.
4. Incorporating evaluation as an integral part of the SOHP budget in order to increase its efficiency. A program needs to consistently track its inputs, outputs, and processes for delivery of services, with documentation of setting characteristics. Additionally, the program needs to assess appropriate and valid outcome measures in order to improve its effectiveness in helping participants, assure potential funders that their programs produce results, and show the general public that their services produce benefits that merit support.

6.7 References

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Appendices

Appendix 1.

Oral Examination Sheet

Capital Program Oral Health Examination Form

Date of Examination: _____ School Name: _____
 Level of Grade: _____ Examiner Code: _____ Recorder Code: _____
 Participant ID: _____ Civil ID: _____

1. Oral Hygiene Status using Silness-Loe Index (Plaque Index System)

Oral Hygiene (Plaque Index)											
	M	D	B	L	index		M	D	B	L	index
16						24/64					
12/52						36					
44/84						32/72					
Plaque Index for Patient= score of plaque/ No of surfaces											

2. Clinical consequences of untreated caries using PUFA/ pufa index:

Tooth #	PUFA/pufa								
	P/p	U/u	F/f	A/a	Tooth #	P/p	U/u	F/f	A/a
17					27				
16					26				
15/55					25/65				
14/54					24/64				
13/53					23/63				
12/52					22/62				
11/51					21/61				
41/81					31/71				
42/82					32/72				
43/83					33/73				
44/84					34/74				
45/85					35/75				
46					36				

47					37				
Patient's PUFA score:									
Patient's pufa score:									

3. Caries status measured according to WHO criteria

- a) deft/defs:
- b) DMFT/DMFS

Tooth #	Teeth Surface												
	T	M	O	D	B	L	Tooth #	T	M	O	D	B	L
17							27						
16							26						
15/55							25/65						
14/54							24/64						
13/53							23/63						
12/52							22/62						
11/51							21/61						
41/81							31/71						
42/82							32/72						
43/83							33/73						
44/84							34/74						
45/85							35/75						
46							36						
47							37						
Patient's DMFT/DMFS score:													
Patient's dmft/dmfs													

OPERATOR GUIDLINE

Rules to be followed while recording:

1. Oral Hygiene Status using Silness-Loe Index (Plaque Index System)

- a. The measurement of the state of oral hygiene by Silness-Loe plaque index is based on recording both soft debris and mineralized deposits on the following teeth.
- b. Missing teeth are not substituted.
- c. Each surfaces of the teeth is given a score 0-3
- d. The scores from the four areas of the tooth are added and divided by four in order to give the plaque index for the tooth with the following scores and criteria
- e. Score;
 - Zero: No plaque
 - One: A film of plaque adhering to the free gingival margin and adjacent area of the tooth. The plaque may be seen in a situation only after application of disclosing solution or by using the probe on the tooth surface.
 - Two: Moderate accumulation of soft deposits within the gingival pocket, or the tooth and gingival margin, which can be seen with the naked eye.
 - Three: Abundance of soft matter within the gingival pocket and/or on the tooth and gingival margin.

2. Clinical consequences of untreated caries using PUFA/ pufa index: this index will measure the severity untreated caries in both primary and permanent teeth.

- a. **P/p**: Pulpal Involvement is scored when the opening of the pulp chamber is visible or when the coronal tooth structures have been destroyed by carious process and only or tooth fragment is left. No probing is performed to diagnose pulpal involvement.
- b. **U/u**: Ulceration due to trauma from sharp pices of tooth is recorded when sharp edges of dislocated tooth with pulpal involvement or root fragments have caused traumatic ulceration of the surrounding soft tissues, eg, tongue or cheek
- c. **F/f**: Fistula is scored when pus releasing sinus tract related to a tooth with pulpal involvement is present.
- d. **A/a**: Abscess is scored when a pus containing swelling related to a tooth with pulpal involvement is present.

For individual person the score can range from 0-20 pufa for primary dentition and from 0-32 for permanent dentition.

3. Caries status measured according to WHO criteria:

- a. This will have measured according to WHO criteria
- b. Both DMFT/DMFS and dmft/dmfs should be recorded at the tooth and surface levels respectively.

Primary (Code)	Permanent (Code)	Status
S	0	Healthy
A	1	Non-Cavitated
D	2	Cavitated
M	3	Missing due to caries
F	4	Filled due to caries
L	5	Fissure sealant
C	6	SS Crown
O	7	Other restoration (esthetic)
T	8	Trauma
-	U	Un erupted
9	9	Not recorded
P	10	Missing for other reasons than caries

1) Sound (S or 0):

- Sound tooth/ surface without any signs of non-cavitated or cavitated caries lesions.

2) Non-Cavitated Caries (A or 1):

- Non-Cavitated caries lesion in primary or permanent teeth
- The tooth must be viewed wet. When wet there is (a) a carious opacity (white lesion) (b) brown carious discoloration which is wider than natural fissure/fosa that is not consistent with the clinical appearance of sound enamel

3) Caries (D or 2): Any established cavitated caries lesion in primary or permanent teeth.

- Opacity/brownish discoloration with microcavitation.
- Loss of surface integrity.
- Frank cavitation
- Active lesion (soft base)
- Temporary fillings, secondary caries are considered under this category.
- If in-doubt mark it as uncavitated.

4) Missing (M or 3):

- Missing tooth due to caries

- Tooth missing due to any other reason is not considered
 - In primary teeth whenever it is difficult to obtain history, if a particular primary tooth is missing without any signs of its permanent successor than it can be considered as missing due to caries.
- 5) Filled (F or 4):** Permanent filling due to caries in primary or permanent teeth.
 - Crowns are not considered here.
 - Preventive filling are not considered here.
 - Aesthetic restorations are excluded here.
 - 6) Fissure sealant (L or 5):** Complete or partial fissure sealant without caries
 - 7) Stainless Steel Crowns (C or 6):** Primary or permanent tooth with stainless steel Crown.
 - 8) Other restorations (O or 7):** Any restoration other than filled due to caries
 - 9) Trauma (T or 8):** Any primary or permanent tooth with trauma.
 - 10) Unerupted (U):** Any unerupted tooth.
 - 11) Not recorded (9):** If data is not recorded for any reasons, it is recorded as 9.
 - 12) Missing due to other reasons (P or 10):** If tooth is missing due to any other reason other than dental caries.

General Rules:

1. Caries status is recorded at both tooth and surface levels, 4 surfaces for anterior teeth and 5 surfaces for posterior teeth
2. Each is counted only once as either decayed, filled or missing (D/2-F/4)
3. Tooth with all other findings (Codes A/1, L/5, O/7, T/8) will be considered as sound, finding will be recorded in corresponding surfaces of these teeth.
4. Tooth with any surface decayed (Code D/2) with other findings on the same or other surfaces will be considered as decayed (Code D/2)
5. Crowned tooth will not be considered under DMF/dmf calculation

DMFT= Teeth with codes (2+3+4)

dmft=Teeth with codes (D+M+F)

DMFS= Teeth surfaces with code(2+3+4)

dfms= Teeth surfaces with codes (D+M+F)

Appendix 2.

Child Perception Questionnaire (CPQ₁₁₋₁₄)



Civil ID: _____ Participant ID: _____ School Name: _____

These next few questions are about how you feel about your teeth. There are no “right” or “wrong”

1. Would you say the health of your teeth, lips, jaws and mouth is:

☐ Excellent ☐ Very Good ☐ Good ☐ Fair ☐ Poor

2. How much does the condition of your teeth, lips, jaws or mouth affect your life overall?

☐ Not at all ☐ Very little ☐ Sometime ☐ A lot ☐ Very much

In the past 3 months, how often have you had:

3. Pain in your teeth, lips, jaws or mouth?

☐ Never ☐ Once or twice ☐ Sometimes ☐ Often ☐ Every day or almost every day

4. Bleeding gums?

☐ Never ☐ Once or twice ☐ Sometimes ☐ Often ☐ Every day or almost every day

5. Sores in your mouth?

☐ Never ☐ Once or twice ☐ Sometimes ☐ Often ☐ Every day or almost every day

6. Bad Breath?

☐ Never ☐ Once or twice ☐ Sometimes ☐ Often ☐ Every day or almost every day

7. Food stuck in between your teeth?

☐ Never ☐ Once or twice ☐ Sometimes ☐ Often ☐ Every day or almost every day

8. Food stuck in the top of your mouth

☐ Never ☐ Once or twice ☐ Sometimes ☐ Often ☐ Every day or almost every day

For the next questions, has this happened because of your teeth, lips or mouth?

In the past 3 months, how often have you had?

9. Breathed through your mouth?

☐ Never ☐ Once or twice ☐ Sometimes ☐ Often ☐ Every day or almost every day

10. Taken longer than others to eat a meal?

☐ Never ☐ Once or twice ☐ Sometimes ☐ Often ☐ Every day or almost every day

11. Had trouble sleeping?

☐ Never ☐ Once or twice ☐ Sometimes ☐ Often ☐ Every day or almost every day

In the past 3 months, because of your teeth, lips, mouth or jaws, how often has it been:

12. Difficulty to bite or chew food like apples, corn on the cob or steak?

☐ Never ☐ Once or twice ☐ Sometimes ☐ Often ☐ Every day or almost every day

13. Difficult to open your mouth wide?

☐ Never ☐ Once or twice ☐ Sometimes ☐ Often ☐ Every day or almost every day

14. Difficulty to say any words?

☐ Never ☐ Once or twice ☐ Sometimes ☐ Often ☐ Every day or almost every day

15. Difficult to eat foods you would like to eat?

☐ Never ☐ Once or twice ☐ Sometimes ☐ Often ☐ Every day or almost every day

16. Difficult to drink with a straw?

☐ Never ☐ Once or twice ☐ Sometimes ☐ Often ☐ Every day or almost every day

17. Difficult to drink or eat hot or cold foods?

☐ Never ☐ Once or twice ☐ Sometimes ☐ Often ☐ Every day or almost every day

QUESTIONS ABOUT FEELINGS

Have you had feelings because of your teeth, lips or mouth? If you felt this way for another reason, answer 'Never'.

In the past 3 months, how often have you had:

18. Felt irritable or frustrated?

☐ Never ☐ Once or twice ☐ Sometimes ☐ Often ☐ Every day or almost every day

19. Felt unsure of yourself?

☐ Never ☐ Once or twice ☐ Sometimes ☐ Often ☐ Every day or almost every day

20. Felt shy or embarrassed?

☐ Never ☐ Once or twice ☐ Sometimes ☐ Often ☐ Every day or almost every day

21. Been concerned what other people think about your teeth, lips, mouth or jaws?

☐ Never ☐ Once or twice ☐ Sometimes ☐ Often ☐ Every day or almost every day

22. Worried that you are not as good-looking as others?

☐ Never ☐ Once or twice ☐ Sometimes ☐ Often ☐ Every day or almost every day

23. Been upset?

☐ Never ☐ Once or twice ☐ Sometimes ☐ Often ☐ Every day or almost every day

24. Felt nervous or afraid?

☐ Never ☐ Once or twice ☐ Sometimes ☐ Often ☐ Every day or almost every day

25. Worried that you are not as healthy as others?

☐ Never ☐ Once or twice ☐ Sometimes ☐ Often ☐ Every day or almost every day

26. Worried that you are different than other people?

☐ Never ☐ Once or twice ☐ Sometimes ☐ Often ☐ Every day or almost every day

QUESTIONS ABOUT SCHOOL

Have you had these experiences because of your teeth, lips or mouth? If it was for another reason, answer 'Never'.

In the past 3 months, how often have you had:

27. Missed school because of pain, appointments or surgery?

☐ Never ☐ Once or twice ☐ Sometimes ☐ Often ☐ Every day or almost every day

28. Had a hard time paying attention in school?

☐ Never ☐ Once or twice ☐ Sometimes ☐ Often ☐ Every day or almost every day

29. Had difficulty doing your homework?

☐ Never ☐ Once or twice ☐ Sometimes ☐ Often ☐ Every day or almost every day

30. Not wanted to speak or read out loud in class?

☐ Never ☐ Once or twice ☐ Sometimes ☐ Often ☐ Every day or almost every day

QUESTIONS ABOUT YOUR SPARE-TIME ACTIVITIES AND BEING WITH OTHER PEOPLE

In the past 3 months, how often have you had:

31. Avoided taking part in activities like sports, clubs, drama, music, school trips?

☐ Never ☐ Once or twice ☐ Sometimes ☐ Often ☐ Every day or almost every day

32. Not wanted to talk to other children?

☐ Never ☐ Once or twice ☐ Sometimes ☐ Often ☐ Every day or almost every day

33. Avoided smiling or laughing when around other children?

☐ Never ☐ Once or twice ☐ Sometimes ☐ Often ☐ Every day or almost every day

34. Not wanted to spend time with other people?

☐ Never ☐ Once or twice ☐ Sometimes ☐ Often ☐ Every day or almost every day

35. Argued with other children or your family?

☐ Never ☐ Once or twice ☐ Sometimes ☐ Often ☐ Every day or almost every day

In the past 3 months, because of your teeth, lips, mouth or jaws, how often have:

36. Other children teased you or called you names?

☐ Never ☐ Once or twice ☐ Sometimes ☐ Often ☐ Every day or almost every day

37. Other children made you feel left out?

☐ Never ☐ Once or twice ☐ Sometimes ☐ Often ☐ Every day or almost every day

38. Other children ask you questions about your teeth, lips, jaws or mouth?

☐ Never ☐ Once or twice ☐ Sometimes ☐ Often ☐ Every day or almost every day

Note : the following question is removed since this type of instrument is not used in Kuwait

Q. Had difficulty playing a musical instrument such as a recorded, Flute, Clarinet, and Trumpet?

Thank you

Appendix 3

Mothers' Questionnaire

ORAL HEALTH KNOWLEDGE, ATTITUDE, AND PRACTICE OF MOTHERS'

Personal details:

Age:

How many children:

Nationality:

Qualification:

☐ High school

☐ College

☐ Post-graduate

Do you have children enrolled in SOHP?

☐ Yes

☐ NO

If yeas, for how many years?

☐ One year

☐ Two years

☐ More than two years

➤ Oral Health Knowledge of mothers: (three-point scale)

1. Dentition Questions: three-points scale:

a. How many set of dentition human has?

☐ Two

☐ Three

☐ Don't know

b. Mixed dentition starts at age 6?

☐ Yes

☐ No

☐ Don't know

c. Number of children/adult teeth?

☐ 20/32

☐ 26/36

☐ Don't know

2. Bacteria role in oral health:

a. Oral bacteria can be transmitted from caregiver to child?

☐ Yes

☐ No

☐ Don't know

b. Oral bacteria can lead to systematic problem, eg, heart disease?

☐ Yes

☐ No

☐ Don't know

3. Diet & Oral Health habits:

a. Tobacco can cause oral cancer?

☐ Yes

☐ No

☐ Don't know

b. Soft drink can cause teeth wearing?

☐ Yes

☐ No

☐ Don't know

c. Sticky food common is a cause of dental decay?

☐Yes ☐No ☐ Don't know

d. Bottled water is fluoridated?

☐Yes ☐No ☐ Don't know

4. Oral hygiene information

a. Fluoridated toothpaste can prevent dental decay?

☐Yes ☐No ☐ Don't know

b. Frequency of tooth brushing should be at least twice a day?

☐Yes ☐No ☐ Don't know

c. The best amount of toothpaste is to cover all the brush bristles?

☐Yes ☐No ☐ Don't know

d. We should change toothbrush every 3-6 months?

☐Yes ☐No ☐ Don't know

e. Dental floss can be used to clean the tongue?

☐Yes ☐No ☐ Don't know

f. Regular checkup is once a year?

☐Yes ☐No ☐ Don't know

g. Supervising children's during tooth brushing till 8 yrs of age?

☐Yes ☐No ☐ Don't know

➤ **Oral Health Attitude of mothers: (three-points scale)**

1. Oral Health is an integral part of general health?

☐Yes ☐No ☐Maybe

2. Healthy diet is essential for optimum oral health?

☐Yes ☐No ☐Maybe

3. Mother's oral health can be role model to children?

☐Yes ☐No ☐Maybe

4. School curriculum should include oral health?

☐Yes ☐No ☐Maybe

5. School is a good medium of oral health program?

☐Yes ☐No ☐Maybe

6. Unhealthy food should be banned from school canteens?
☐ Yes ☐ No ☐ Maybe

➤ **Oral Health Practice of mothers: (four-points scale)**

1. How many times you brush your teeth?
☐ Once a day ☐ Twice a day ☐ Three times a day
☐ More than three times a day
2. What type of toothbrush you use?
☐ Soft ☐ Medium ☐ Hard ☐ Don't know
3. Do you floss?
☐ No ☐ Sometimes ☐ Most of the time ☐ Always
4. Do you use fluoridated toothpaste?
☐ Yes ☐ No ☐ I don't know
5. How often you drink pops?
☐ Never ☐ Sometimes ☐ Most of the time ☐ Always
6. Do you take excessive sugary food on a daily bases?
☐ Never ☐ Sometimes ☐ Most of the time ☐ Always
7. When is the last time you visited the dentist, and why?
☐ Less than a year ago ☐ More than a year ☐ More than two years ☐ Never
8. If yes, the reason of the visit was?
☐ Regular checkups ☐ Completing treatment
☐ Emergency ☐ Other reason,
9. Do you drink fluoridated bottled water?
☐ No ☐ Sometimes ☐ Most of the time ☐ Always

➤ **Oral Health related Quality of Life (OHR-QoL) three items instrument: (5-points scale)**

During the past 3 months, how often you had problems with your teeth or gums that:

1. Affected your daily activities? (Such as attending work).
☐ Never ☐ Once or twice ☐ Sometimes ☐ Often ☐ Every day or almost every day
2. Affected your social activities? (Friends gathering or family gathering)
☐ Never ☐ Once or twice ☐ Sometimes ☐ Often ☐ Every day or almost every day

3. Caused avoidance of conversations? Because of how your teeth look
☐ Never ☐ Once or twice ☐ Sometimes ☐ Often ☐ Every day or almost every day.

Appendix 4.

Interview Guide

Draft guiding questions for the face-to-face interviews with service providers, key informants, and decision- and policy-makers have been developed. The interviews were carried out in the Capital school oral health program center, one primary school at the Capital Education Area, and Offices of decision-makers. Aishah Alsumait (researcher –previous head of the capital SOHP) and Sahar Behzadi (research assistant who was a previous prevention team member at the Capital SOHP) invited the service providers who are providing SOHP dental care services in the capital area. Aishah (researcher) choose the key informants according to the input from capital head, prevention, and education team leaders.

The facilitator (AA) started the session by introducing herself and obtaining the consent from participants. The Focus group was conducted in Arabic languages, while individual interviews will be conducted in English language since all the interviewee had their post-graduate education in North America.

Participants answered the following questions:

I. Implementation questions:

a. SOHP service providers

1. Please say to what extents have the various SOHP program components (education & prevention) been delivered as intended (in the protocol)?
2. As a service provider, what type of facilitators have you experienced when delivering the program services? What barriers have you encountered? How do you deal with the barriers?

- a. Key informants
- 3. As a key informant for schools, what problems have you faced since you adopted education sessions, fluoride and fissure sealants in you school? How you deal with problems you encounter in schools?
- 4. For schools that have successfully adopted SOHP, what factors have facilitated SOHP services?

II. Maintenance questions with decision-makers:

- 1. Please say how various education, prevention, and treatment components of the SOHP sustained have been delivered as originally planned?
- 2. What modifications have been made to the original program; explain how you decided to do these modifications?
- 3. As a decision-maker, what type of problems have you encountered to maintain the program over the past thirty years?