



AMERICAN UNIVERSITY OF BEIRUT

ASSESSMENT OF DENTAL DECAYS AND ORAL  
HYGIENE AMONG ADOLESCENTS:  
A COMPARISON BETWEEN PRIVATE AND  
PUBLIC SCHOOLS

by

KATY AKRAM BITAR

A thesis

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for the degree of Master of Science in Epidemiology  
to the Department of Epidemiology and Population Health  
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# AMERICAN UNIVERSITY OF BEIRUT

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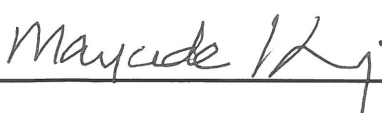
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## AN ABSTRACT OF THE THESIS OF

Katy Akram Bitar for Master of Science  
Major: Epidemiology

Title: Assessment of dental decays and oral hygiene among adolescents: a comparison between private and public schools

**Objective:** To assess the decays and oral hygiene status in a sample of 12-18 years school children in greater Beirut in terms of prevalence and associated factors.

**Methods:** A comparative cross-sectional study of adolescent students aged from 12-18 years old, grades 7 to 12, in public and private schools in Greater Beirut-Lebanon. The unit of observation was both the child and the parents. The sample selection was done in 7 public schools and 9 private schools in Beirut. The final study sample included 830 adolescents. The data collection comprised 3 main sources: a dental screening of participants that comprised a score of Decayed, Missing and Filled teeth (DMFT) and the plaque index. A parents questionnaire that included sections on socio-demographic background, health status, habits and use of dental services; and an adolescent questionnaire including oral hygiene and nutritional habits characteristics, oral health related quality of life assessment and tobacco exposure questions to assess potential risk factors that could be associated with oral health. Descriptive analysis, bivariate and multivariable analyses were conducted to detect differences between schools and to test for associations between risk factors and DMFT and plaque indices taking into account clustering effect.

**Results:** The average DMFT score was high, statistically significantly greater in public ( $5.83 \pm 0.17$ ) compared to private schools ( $4.08 \pm 0.15$ ). The plaque index was fair with an average of  $1.04 \pm 0.018$ , and not significantly different between school types. The bivariate analysis revealed that DMFT increases with age, being a female, having a lower parental educational level and family income, bad oral health perception, breast feeding, increased

soda and sweets intake, maternal smoking during pregnancy, parental smoking and having a past orthodontic treatment. As for dental plaque, a high plaque index was significantly associated with being a male, having a bad oral health perception, a decreased tooth brushing frequency, increased intake of fast food and soda and having a current orthodontic treatment. The multivariable analysis showed that age, gender, parental educational level, monthly income, past orthodontic treatment and oral health perception remained significantly associated with DMFT. Furthermore, gender, a current orthodontic treatment, oral health perception, the frequency of tooth brushing and soda intake remained significantly associated with the plaque index.

**Conclusion:** The DMFT score in Lebanon is high, particularly in public schools, when compared to developed countries and to the majority of the Eastern-Mediterranean countries. Given the enormous burden of dental caries and the paramount inequalities existing between adolescents from different social backgrounds, it is essential to develop prevention and early detection programs targeting schoolchildren and their parents, and ensure preventive care to disadvantaged individuals thus decreasing the burden of dental decays and the magnitude of social disparities.

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## ABBREVIATIONS

- AUBMC: American University of Beirut Medical Center
- CDC: Center for Disease Control and prevention
- DMFT: Decayed, Missing, Filled Teeth
- EMRO: Eastern Mediterranean Region
- ETS: Environmental Tobacco Smoke
- FDI: International Dental Federation
- KSA: Kingdom of Saudi Arabia
- MEHE: Ministry of Education and Higher Education
- NHANES: National Health and Nutrition Examination Survey
- NGO: Non-Governmental Organization
- NIDCR: National Institute of Dental and Craniofacial Research
- PBS: Public school
- PVS: Private school
- SES: Socio Economic Status
- SHS: Second Hand Smoking
- UAE: United Arab Emirates
- USA: United States of America
- WHO: World Health Organization



# CHAPTER I

## INTRODUCTION

Oral health means more than good teeth; it is a standard of the oral and related tissues that enables the individual to eat, speak and socialize without active disease, discomfort or embarrassment. It is integral to general health and essential for the well-being (WHO World Health report 2003; WHO 1982).

Various conditions can affect oral health such as dental caries, periodontal diseases, oral soft tissue lesions, oro-pharyngeal cancer, salivary gland lesions and birth defects. Dental caries is the most prevalent form of oral diseases and one of the most prevalent chronic diseases of people worldwide. Individuals are susceptible to this disease throughout their lifetime (Selwitz et al, 2007). Dental caries consist of an infection of bacterial origin that causes demineralization and destruction of the hard tissues of the teeth (enamel, dentin and cementum). It affects young children's growth and quality of life if left untreated (Sheiham 2006). Speech development, psychological, behavioral and social interaction problems, as well as loss of school days and learning difficulties have been reported in the severe cases of dental caries infection (Majewski et al, 1988).

Several factors are associated with dental caries, among them the individual's poor oral hygiene. Moreover, poor oral hygiene leads to dental plaque formation which is defined as the soft adherent structured deposits forming on the tooth surface. Plaque can be visualized on teeth after 1 or 2 days without any oral hygiene measures and is considered

the primary cause of gingivitis eventually leading to periodontal disease (Van Gaster et al, 2007).

Several indices are used to assess oral health. In epidemiological studies, the 2 most common indices used are the DMFT and plaque index. The DMFT index consists of the sum of the number of Decayed, Missing and Filled teeth (Da Silveira Moreira 2012; WHO oral health report 2003); it measures the individual's total lifetime tooth decay. Several indices had been developed to assess the individual levels of dental plaque control. The most widely used is the plaque index developed by Loe and Silness, based on recording both soft debris and mineralized deposits on 6 different teeth, with a score ranging from 0 to 3 (Loe and Silness 1964).

Adolescents represent a challenging group in terms of their oral health because they have a vulnerable mainly completed dentition at a time when they are establishing their independence from parental influence (Stokes et al, 2005) and are starting to engage into new risky behaviors such as smoking(Johnston et al, 2012). Globally, oral health research has focused on children of 12 years, an age when children leave primary school, thus, data can be obtained through a reliable sample of the school system. Hence, the age of 12 was determined as the age of global monitoring of caries for international comparisons and monitoring of disease trends (Da Silveira Moreira 2012).

The Global weighted mean DMFT value at 12 years of age was estimated to be 1.67 in 189 countries in 2011 (Natarajan, 2011). Some countries succeeded in achieving a very

low DMFT index such as Canada and USA (DMFT of 1 and 1.19 respectively) whereas other countries still have high DMFT scores such as KSA, Bolivia (WHO, 2014).

Available studies in Lebanon show elevated DMFT level. Hussein et al (1996) assessed caries and periodontal diseases in children of 12 and 15 years of age in different Lebanese urban, semi-urban and rural areas. The overwhelming majority of both ages had dental caries. Their DMFT scores for the 12 and 15-year old children were 5 and 7.6 respectively. A more recent study (Doughan & Doumit, 2002) examined 1595 individuals of 6, 12 and 15 years of age, representative of the different Lebanese districts were examined for dental decays. DMFT indices at 12 and 15 years of age were 5.72 and 8.09 respectively which are slightly higher than the earlier results. Data have not been updated for more than a decade. Only 1 study is available conducted 2 years ago that focused on the 6 to 11 years old elementary school children in Beirut and aimed to compare oral health determinants and DMFT scores between private and public schools (Unpublished thesis, Moukarzel 2012). The DMFT scores reported in this study were  $7.30 \pm 3.98$  and  $3.50 \pm 3.41$  in public and private schools respectively. Both DMFT values are higher than the maximum DMFT value of 3 accepted by the WHO (World Dental Federation, 1982) albeit children in private schools are closer to that threshold. Nevertheless, the DMFT index in public schools is almost double that of private schools. This significant difference highlights the great impact of socio-economic status and social background of the parents on their child's oral health and emphasized the paramount social inequity in oral health care in Lebanon.

This study was conducted to assess the burden of dental decays and oral hygiene among Lebanese adolescents in the Greater Beirut area, investigate the socio-economic and

behavioral factors associated with oral health and explore the disparities among adolescents from different social backgrounds.

**Significance:**

Data available on dental caries in 2002 do not reflect the current oral health status of adolescents in Lebanon. More importantly, data are lacking on the socio-behavioral factors associated with caries. For instance, smoking is a potential determinant that was not explored in earlier studies for this specific age group and which is believed to be a contributable factor to decays. Furthermore, given that a recent study was conducted in the age group ranging from 6 to 11 years of age, it is of great importance to complement this cohort with accurate and updated data on the adolescent age group aiming to build a significant infrastructure for a Lebanese oral database that may serve ulterior goals.

Public health workers can benefit from this database to plan adequate health promotion programs that target adolescents and contribute to raising their awareness on oral hygiene and dental related diseases. In addition, the information will help draw the attention of different stakeholders (such as the Ministry of Health, Ministry of Education and insurance companies) to the existing oral health status of the Lebanese adolescents and enable them to address oral health needs more appropriately. Furthermore, these data could also be used to establish a comprehensive database that will be used in future studies by other investigators addressing this specific public health problem.

## CHAPTER II

### LITERATURE REVIEW

The literature review is focused on the burden of dental caries and plaque, covering the definition of the two components and corresponding indices used to assess dental decays and oral hygiene, as their etiology, their magnitude globally and locally and their associated risk factors.

#### **A. Dental caries**

##### ***1. Definition***

Dental caries is an infection that causes demineralization and destruction of the hard tissues of the teeth. Plaque on the surface of the tooth consists of a bacterial film that produces acids as a byproduct of its metabolism; certain bacteria within the plaque are acidogenic, they produce acids when they metabolize fermentable carbohydrates. These acids can dissolve the calcium phosphate mineral of the tooth enamel or dentin in a process known as demineralization. If this process is not halted or reversed via remineralization, it eventually becomes a frank cavity. The mutans streptococci and the lactobacilli, either separately or together, are the primary causative agents of dental caries (Featherstone, 2000).

## ***2. Signs and symptoms***

The earliest sign of a carious lesion is the appearance of a white spot on the surface of the tooth, indicating an area of demineralization. As the lesion continues to demineralize, it will turn into a cavity (Featherstone, 2008). Once the cavity is formed, the lost tooth structure cannot be regenerated. When the decay becomes deeper and passes through enamel into the dentinal tubules, which have passages to the nerve of the tooth the resulting pain can be transient, temporarily worsening with exposure to heat, cold, or sweet foods and drinks. Once the decay has progressed enough to allow the bacteria to overwhelm the pulp tissue in the center of the tooth, pain becomes more constant. Death of the pulp tissue and infection are common consequences and the tooth will no longer be sensitive, but can be very tender to pressure (Yu et al, 2007). In severe cases of dental decays, infection can spread from the tooth to the surrounding soft tissues. Occasionally, a dental infection will spread to the paranasal sinuses, through the blood system or through the lymphatic system and may lead to complications such as cavernous sinus thrombosis and Ludwig angina that may be life-threatening (Fehrenbach et al, 1997).

## ***3. Burden of dental decays***

### ***a. At the global level***

The Global weighted mean DMFT value for 12 year olds decreased from 2.43 in 1980 (Leclercq et al, 1987) to 1.67 in 189 countries in 2011 (Natarajan, 2011). Dental caries remains a major oral health problem globally affecting 60-90% of schoolchildren and

the vast majority of adults. It is also the most prevalent oral disease in several Asian and Latin American countries, while it appears to be less common and less severe in most African countries. Currently, the disease level is high in the Americas but relatively low in Africa (Figure 1) (World Health Organization, 2003). However, an increase in the incidence of dental caries is expected in many developing countries in Africa, due to the changes in living conditions and particularly the increase in sugar consumption added to it an inadequate exposure to Fluoride (World Health Organization, 2003).

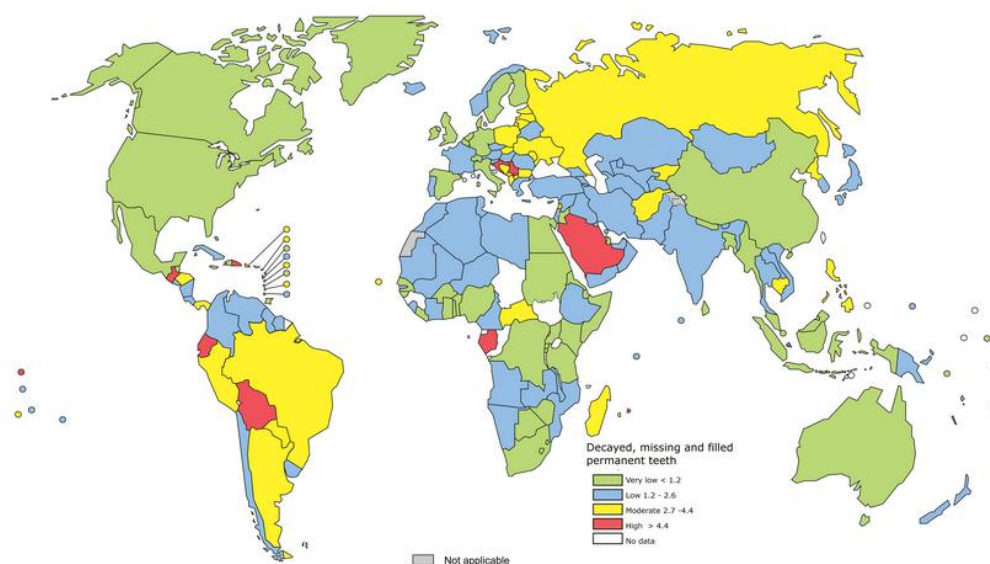


Figure 1- Global caries map for 12 year olds (World Health Organization, 2014)

b. At the regional level: Eastern Mediterranean region

WHO Region specific weighted DMFT among 12-year-olds for the EMRO (eastern Mediterranean Region) was estimated to be in total 1.58 in 2004 and increased slightly to 1.63 in 2011 (Natajarian, 2011). This score is similar to the global DMFT measure. Dental

caries prevalence among adolescents exhibits its highest rates in Saudi Arabia; it is moderate in other countries such as Jordan whereas it is low in most of the eastern Mediterranean countries such as Egypt, Syria and Iraq. The lowest DMFT level is in Libya (<1.2).

The differences among countries highly reflect the distinct lifestyles, the level of exposure to fluorides and the development of oral health systems (World Health Organization, 2003). For instance, the prevalence rate of dental decay in Libya is low, in spite of the unsatisfactory tooth brushing behavior among children. This can be attributed to the acceptable levels of Fluoride in drinking-water (Al-sharbaty et al, 2000). On the contrary, the DMFT index in Saudi Arabia increased over the past 3 decades, from 2.1 in 1982 up to 5.9 in 2002 (WHO, 2014). More recent studies reported different DMFT averages in KSA, depending on the area of the study and the study population (Al Dosari et al reported an average DMFT of 7 in 2003 among adolescents; the same group reported a DMFT of 3.5 in a larger sample in 2010). The increase of DMFT scores in Saudi Arabia is due to different factors, such as the dramatic societal changes, unhealthy oral health behaviors and practices (Al- Ansari, 2014) mainly the increased consumption of processed sugar (WHO, 2014) in addition to the inadequate access to oral health care particularly in remote areas and the non-availability of fluoridated water (Al- Ansari, 2014).

c. At the local level: Lebanon

Lebanon's DMFT score is among the highest in the Eastern Mediterranean Region (WHO, Geneva 2004). Furthermore this index is higher than the goal set by the World



Health Organization whereby the average DMFT should not exceed 3 at 12 years of age by the year 2000 (World Dental Federation, 1982). In 2002, Doughan et al. showed that the DMFT index was 5.72 and 8.09 for the 12 and 15 years-old children respectively. They also showed that the DMFT index increased with age. Moreover, the DMFT index was slightly lower in private schools compared to public schools which might reflect the differences in the socioeconomic factor (Doughan et al, 2002). A previous study by Hussein et al in 1996 showed DMFT scores that are similar to those in 2002 with the overwhelming majority (92%) of adolescents aged 12 and 15 years being affected by dental decays (Hussein et al, 1996).

A more recent study by Moukarzel et al (2012 unpublished thesis) reported a mean DMFT score of  $7.30 \pm 3.98$  and  $3.50 \pm 3.41$  among 6 to 11 years old schoolchildren in public and private schools respectively (Moukarzel et al, 2012); the DMFT score in public schools was almost the double of that in private schools. This finding highlights the paramount social inequity existing in Lebanon in terms of oral health care. The high incidence of dental decay also reveals the need to establish prevention programs and early detection strategies that cover children and adolescents of the various social levels, targeting specifically the most disadvantaged individuals.

#### ***4. Etiology of dental caries***

Dental caries result from the interaction of 4 major factors that are the host which is the tooth, the diet or substrate, the cariogenic microorganisms and time or frequency that depicts the duration of the interaction of the other 3 factors. Figure 2 represents the Venn

diagram schematizing the different factors contributing to dental decays (Usha C et al, 2009).

a. Tooth susceptibility (the host)

The host susceptibility refers to the enamel mineral and the enamel crystal structure of the teeth that differs from one person to another. It also embraces the quantity and quality of the saliva which plays a major protective role in the oral cavity through its buffering, mechanical washing, antimicrobial, and remineralization activities (Ferraro et al, 2010).

b. The cariogenic microorganisms (the agent)

The two most important groups of bacteria that predominantly produce lactic acid are the mutans streptococci and the lactobacilli. Each group contains several species each of which is cariogenic. These two groups of bacteria, either separately or together, are the primary causative agents of dental caries (Featherstone, 2000).

c. Diet/ substrate (the environment)

Fermentable carbohydrates such as glucose, sucrose, fructose and starch can be metabolized by the acidogenic bacteria to create organic acids that diffuse into the porous subsurface of the enamel and cause demineralization (Featherstone, 2000). Among sugars, Sucrose is the most cariogenic because it can form glucan which enables firm bacterial adhesion to teeth (Tinanoff et al, 2000).

d. Duration of interaction

Research had shown the definite relationship of dietary sugars, the quantity, quality, and frequency of intake on the incidence and prevalence of caries (Krasse, 2001). The longer the interaction of the dietary sucrose and the cariogenic microbes in the plaque, the more deleterious is the effect of acid on the dissolution of tooth mineral (Usha C et al, 2009).

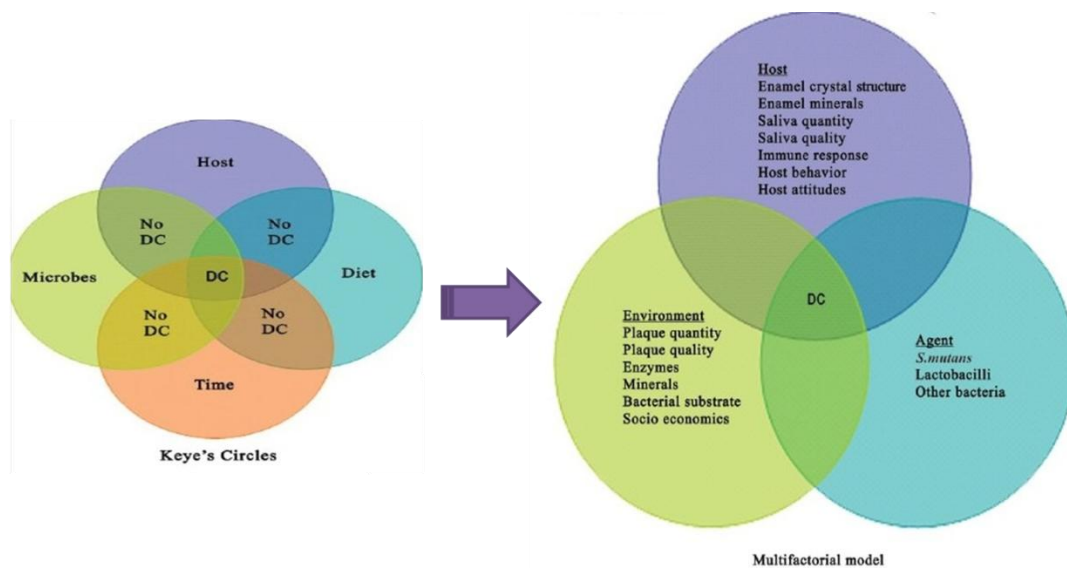


Figure 2- Cause and determinant factors of dental caries (Usha C et al, 2009)

The interrelationship between these 4 factors has oversimplified the complex behavior of dental decays and therefore it contributed to the incomplete success of the management and prevention at the individual as well as the community levels (Usha C et al, 2009). However, recent public health approaches are increasingly focusing on the multilevel nature of health determinants. This led to the establishment of conceptual models describing a range of influences at the community, family, and child levels (Fisher-Owens

et al, 2007). Figure 3 summarizes the child, family, and community influences on oral health outcomes among children.

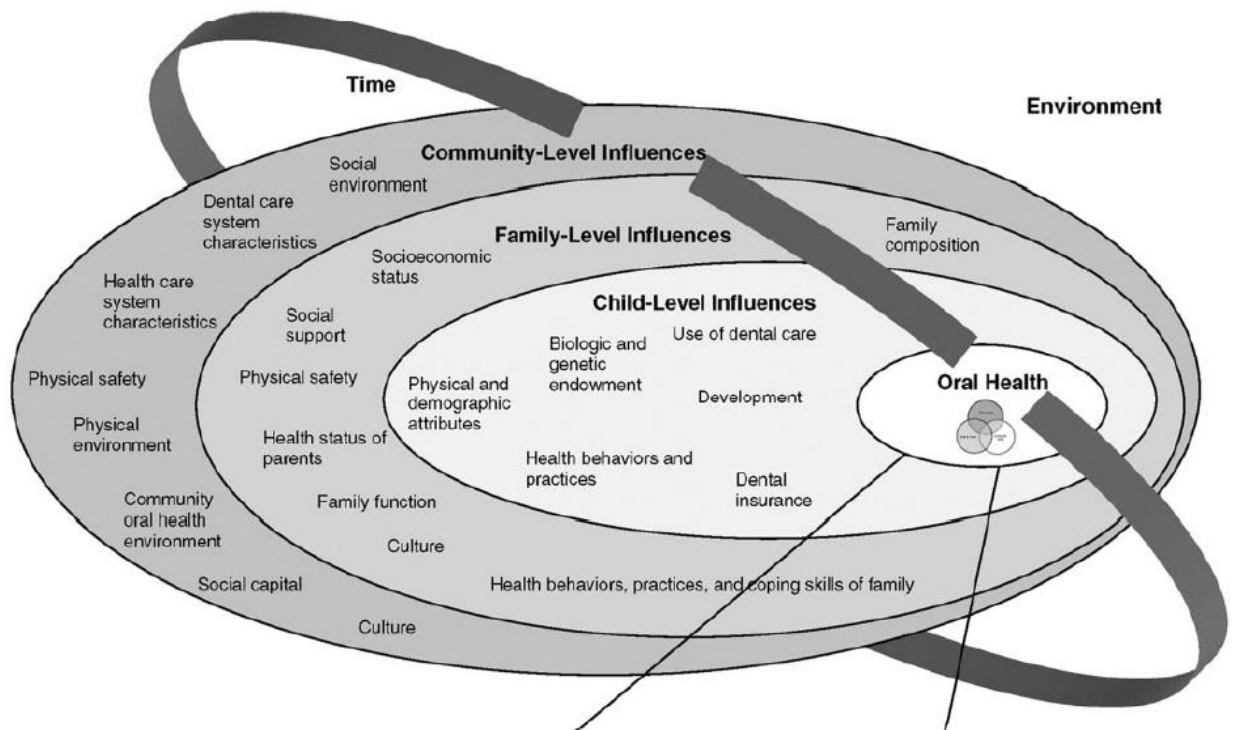


Figure 3- Child, family, and community influences on oral health outcomes of children (Fisher-Owens et al, 2007)

## 5. *Risk factors associated with dental caries*

### a. Age

The prevalence of dental caries in permanent teeth is proven to increase with age. In the United States for example, 42% of children 2 to 11 have had dental caries in their primary teeth, 59% of adolescents 12 to 19 have had dental caries in their permanent teeth and 92% of adults 20 to 64 have had dental caries in their permanent teeth (National Institute of Dental and Craniofacial Research, 2004).

### b. Gender

There had been a consistent trend in caries development by gender, with females having higher prevalence than males. This difference can be attributed to several factors:

- Genetics: variations in genes with a sex-linked mode of inheritance that would alter the host's oral environment and the host's response to the initiation of caries (Ferraro et al, 2010).
- Saliva: flow rates of saliva and compositional analysis have been shown to be generally less protective in women than in men due to hormonal fluctuations during events such as puberty, menstruation, and pregnancy (Ferraro et al, 2010, Lukacs et al, 2006).
- Pattern of tooth eruption, females tend to acquire their teeth at an earlier age than males, providing more opportunity for the caries developing process to take place (Ferraro et al, 2010, Lukacs et al, 2006).

c. Geographic location

The variation in the DMFT index with the geographic location within countries depends largely on the oral health care system adopted and the access to dental services in addition to the preventive measures undertaken such as water fluoridation and the access to it. In developed countries a decline in caries has been observed over the past 20 years as a result of a number of public health measures, including effective use of Fluoride, along with changing living conditions, lifestyles and improved self-care practices (Petersen et al, 2005). However, the treatment of oral diseases remains inaccessible and unaffordable not only in low and middle-income countries, but also in certain rural areas or among poor populations within the high-income countries (World Dental Federation, 2014).

d. Socio-economic status (SES)

Several studies confirmed the association between low socioeconomic status (SES) and a high DMFT in both developed and developing countries, particularly a high prevalence of untreated decays.

A recent analysis of the Data from the National Health and Nutrition Examination Survey (NHANES, 2007–2008) in US Children revealed a significant SES-caries relationship; higher SES was associated with lower untreated caries prevalence whereas children from low or very low food security households suffered from a significantly higher prevalence of untreated cavities (Donald et al, 2014). Moreover, among Australians, poor dental health and untreated decays were strongly associated with lower income, those

living in rural areas, Indigenous Australians, and those with no private insurance thus relying exclusively on public dental services (Richardson et al, 2011).

e. Diet and eating behavior

The evidence suggesting that sugar is an etiological factor in dental caries is already well-established and lies in the multiplicity of studies present rather than in the power of any one (Sheiham, 2001). More recently, it has been suggested that the role of diet in caries development is not so much related to the diet itself, but rather to individual eating behavior (Bruno-ambrosius et al, 2005). A significant association between skipping regular meals and caries development, and four to five times increased risk for caries was revealed (Bruno-Ambrosius et al, 2005). This was explained by the substitution of regular meals by light snacks with high sugar content. Early childhood and adolescence are particular periods in which the risk of dental caries remains especially high. One of the main contributing factors is the high consumption of sugars ingested in soft drinks (Tahmassebi et al, 2006).

f. Health status

Certain health conditions are associated with increased prevalence of dental caries such as antiasthmatic medications that increase the prevalence of decays by reducing the salivary flow (Shashikiran et al, 2007). Reduced saliva predisposes to enamel hypomineralization and caries formation (Yeh et al, 2012). Salivary flow is also declined in diabetics and in patients suffering from xerostomia, in patients with a history of

radiotherapy, in certain medical conditions such as autoimmune and inflammatory conditions (Sjogren syndrome, primary biliary cirrhosis), in various infections such as the human immunodeficiency virus and hepatitis C and in certain cancer tumors (Lymphoma) (Plemons et al, 2014).

g. Tobacco exposure

i. Maternal and environmental tobacco exposure

Maternal smoking is found to be associated with the occurrence of caries in preschool children, even after adjusting for social class, nutritional status, and weekly expenditure on confectioneries (Williams et al, 2000). Furthermore, postnatal Environmental Tobacco Smoke (ETS) measured by current exposure at home is independently positively associated with the prevalence of dental caries. A dose-response relationship was observed between cumulative postnatal ETS exposure at home and dental caries (Tanaka et al, 2009). Several pathways were proposed for biological plausibility of this association. Environmental tobacco smoke may directly influence teeth and oral microorganisms, exposure to ETS during the period of tooth formation may also influence tooth mineralization. Moreover, blood levels of vitamin C in smokers and children who reside with smoking parents are decreased. Low vitamin C levels are associated with the growth of *S. mutans*, the bacterial agent responsible of carious lesions (Hanioka et al, 2011).



ii. Adolescent smoking status

Few studies have shown a relationship between smoking among adolescents and adults, and a higher incidence of dental caries, particularly coronal and root caries (Axelsson et al, 1998; Hirsch et al, 1991). It seems that smoking is a risk indicator of increased caries activity through a reduction in the PH and a decrease in salivary flow (Reibel 2003). However, a recent epidemiologic survey conducted in Sweden failed to demonstrate a relationship between tobacco use and caries in adults and elderly. As caries is a multi-factorial disease with clear lifestyle, socio-economic and socio-demographic gradients, the tobacco use may be a co-variable in this complex cycle rather than a direct etiological factor (Holemen et al, 2013).

**B. Dental plaque**

*1. Definition of dental plaque*

Dental plaque is the soft adherent structured deposits called biofilm that accumulate on tooth surface. It contains about 500 bacterial species and its formation follows a specific regimen with adhesion of initial colonizers to the enamel salivary pellicle followed by secondary colonization through interbacterial adhesion (Rosan et al, 2000). Dental plaque is visualized 1 or 2 days without any oral hygiene measures and it is considered the primary cause of gingivitis eventually leading to periodontal disease. It is also incriminated in dental caries formation. Evidence suggest that, on the long-term, individuals with high plaque levels are more likely to experience caries, periodontal disease and subsequent tooth loss

compared to individuals with low levels of plaque, and they experience all those conditions with greater severity (Broadbent et al, 2011).

## ***2. Factors associated with plaque retention***

Poor oral hygiene is the main factor associated with plaque formation. Other local and iatrogenic factors can cause the preferential accumulation of plaque at stagnant sites not easily reachable during oral hygiene practices (Marsh, 2004).

### **a. Local retentive factors**

Mainly dental crowding that disables the individual to adequately remove dental plaque and enhances the retention of the biofilm (Geiger et al, 1974).

### **b. Iatrogenic etiologic factors**

Dental caries that increase plaque retention, dental calculus that is not a primary etiologic factor but accelerates plaque retention and guides the plaque subgingivally and inadequate dental restoration with overhanging margins causing gingivitis and periodontal pocket formation (Grosso et al, 1985).

Orthodontic treatment is also considered one of the factors that increase plaque retention. During orthodontic therapy with fixed appliances, inflammatory reaction of gingival tissue can very often be observed. The main reason for the increased accumulation of dental plaque is the appearance of new retentive places around the orthodontic fixed appliances (brackets and elastics) attached to the teeth. The bonded attachments used

nowadays in orthodontics present a major advancement in orthodontics compared to the multibanded appliances used in the past and that favored food lodgment. However, even with the changes in the design of fixed appliances, plaque retention around the brackets did not decrease significantly (Ristic et al, 2007). Evidence suggest that, in the majority of cases, orthodontic treatment with fixed appliances causes localized gingivitis which rarely progresses into gingivitis (Ristic et al, 2007; Van Gastel, 2007).

### ***3. Available data on dental plaque***

Data on dental plaque assessment among adolescents using the Loe and Silness plaque index are scare. In Jordan, El-Qaderi et al (2006), in a cross-sectional study reported a mean plaque index of  $1.46 \pm 10.69$  among 1362 school children aged 14 and 15 years (El-Qaderi et al, 2006). In the United Arab Emirates, Gopinath et al assessed oral hygiene and gingival health among a group of 405 school children. They reported an average plaque index of  $1.67 \pm 0.75$  among females and  $1.54 \pm 0.76$  among 6 to 12 years old children (Gopinath et al, 2015). In both countries, UAE and Jordan, the plaque index is considered fair.

In Lebanon, only one study assessed the plaque index among 6 to 11 years old school children (Moukarzel et al, 2012). The average plaque index was significantly higher in public schools ( $1.35 \pm 0.23$ ) compared with private schools ( $1.2 \pm 0.15$ ).

### **C. Objectives**

1. Measure and compare the DMFT and plaque indices between adolescents in private and public schools.
2. Explain social disparities in DMFT and plaque indices.
3. Investigate the association of DMFT and plaque indices with socio demographic factors and behavioral determinants. Socio demographic factors include age, gender and school grade of students and socioeconomic status, education, occupation and annual income of the parents. Behavioral determinants include fluoride use, the frequency of tooth brushing and the dietary intake characteristics (Fast food, sweets and soda intake).

### **D. Hypothesis**

1. Adolescents in public schools will have higher DMFT and plaque indices scores compared to those in private schools.
2. Adolescents with poor oral hygiene and unhealthy dietary habits including smoking status and/or exposure to second hand smoking will have higher DMFT and plaque indices in comparison to their counterparts.

## CHAPTER III

### METHODS

#### **A. Study Design**

This is a comparative cross-sectional study of adolescent school children aged from 12 to 18 years, in grades 7 to 12, enrolled in public and private schools in the Greater Beirut area, Lebanon. The units of observation were both the child and the parents the child.

#### **B. Sample size and selection**

A total number of 830 school children was reached out of 3680 approached, yielding an average response rate of 22.55% (30.16% and 18.36% in public and private schools, respectively). Public schools from various areas in Greater Beirut were approached after securing the permission of the Ministry of Education and Higher Education, and the approval of the school administration was obtained. The 7 public schools approached agreed to take part of the study. Of the twenty private schools approached, conveniently chosen for their availability and accessibility, only 9 agreed to participate.

The data collection procedures included several stages. Students whose ages ranged between 12 and 18 (Grades 7 to 12) were approached by the research team who summarized for them the main objectives of the study and the different levels of participation. The students were asked to deliver the consents and parents questionnaires to their legal guardians and to return the questionnaires with their parents' response within two weeks. The parental informed consent included the parents' willingness to fill a self-

administered questionnaire, the permission to give their children a self-administered questionnaire and be subsequently examined by the research team. Students whose parents approved to participate were approached at a time and date deemed suitable by the school administration. The students were asked if they would voluntarily consent to be examined by the research team and fill the adolescent's questionnaire. The adolescent questionnaire was distributed in class and filled by the participants in the presence of one of the research team investigators. The research investigator provided assistance to the participants to ensure they understood and filled the questionnaire as they should. Only those who assented to both or either procedure were included in the study.

The data collection procedure with the number and percent response at each level are summarized in Figure 4. The final numbers of children in public and private schools were nearly equal, albeit the rate of response was greater in the public schools because approximately additional 1000 private school children were approached.

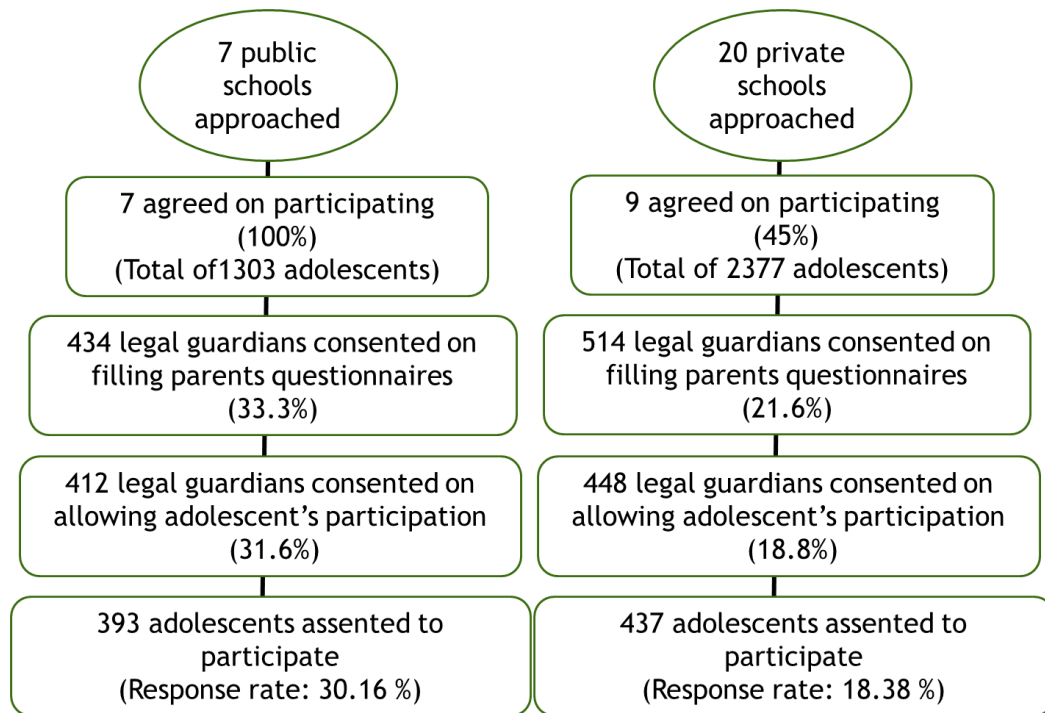


Figure 4: Summary of the numbers and percentages of respondents at each level of the study.

## C. Measures

### 1. Oral health

*Oral health was measured by two indices: DMFT and plaque index*

#### a. The DMFT Index

This index measures:

- Number of decayed teeth with untreated carious lesions (D): Decays can be deep or

superficial, affecting one or more tooth surfaces, moreover, if a decay is concomitantly present with a filling, the tooth is counted as decayed.

- Number of teeth extracted and therefore missing (M) due to caries. Teeth that are congenitally missing, unerupted or removed for reasons other than dental caries are not considered as missing.
- Number of filled teeth (F): fillings can be large or small, extending on one or more tooth surfaces, and from various dental materials such as composites and amalgam. If a tooth is restored for reasons other than caries (such as trauma) it is not counted as filled in the DMFT index.

The total number of Decayed, Missing and Filled teeth was calculated for each participant and the sum of the 3 components yield a DMFT score for each individual. The average DMFT score was then calculated for public and private schools participants. For children at 12 years old, a DMFT of less than 1.2 is considered “very low”, “low” from 1.2 to 2.6, “moderate” from 2.7 till 4.4, “high” when it ranges from 4.5 till 6.5, and “very high” when it exceeds 6.5 (WHO, 2004).

b. The Plaque Index

This index evaluates the oral hygiene and records both soft debris and mineralized deposits on the four surfaces of 6 teeth: 3 maxillary teeth (teeth number 16-12-24) and 3 mandibular teeth (teeth number 36-32-44). Each surface is given a score from 0-3 and the



scores of the four areas are added then divided by four to obtain the plaque index of the tooth. The scores represent the following:

- 0: No plaque
- 1: A film of plaque adhering to the free gingival margin and adjacent area of the tooth. The plaque may be seen in situ only after application of disclosing solution or by using the probe on the tooth surface.
- 2: Moderate accumulation of soft deposits within the gingival pocket, or the tooth and gingival margin which can be seen with the naked eye.
- 3: Abundance of soft matter within the gingival pocket and/or on the tooth and gingival margin.

A plaque index score is considered excellent when it is below 0.1, good if the score ranges between 0.1 and 0.9, fair if the range is between 1 and 1.9 and poor when the plaque index score is 2 and above.

## ***2. Socio-demographic and behavioral factors***

- Socio demographic variables included age, gender, education and occupation of parents (highest educational level reached by the parent), family monthly income and perceived oral health.
- Behavioral variables, such as dental hygiene (frequency of tooth brushing, use of dental floss and mouthwash), nutritional habits (frequency of soda and sugar

intakes), participant exposure to smoking: second hand and maternal smoking during pregnancy (both cigarettes and waterpipe) and the participant smoking status (if ever tried waterpipe or cigarettes smoking, and if yes the frequency of smoking during the past month).

#### **D. Data collection**

Data were collected from 3 sources: the dental examination and 2 self-administered questionnaires, one addressing the parents and the other addressing the adolescent.

##### ***1. Dental examination***

The clinical examination was performed on adolescents whose parents consented on the dental examination at first, and who subsequently assented themselves on the dental examination. Screening of the participants to collect data on DMFT and plaque indices was performed by the author, a trained orthodontist from the American University of Beirut Medical Center (AUBMC), using non-invasive dental instruments including mouth mirrors and probes. These instruments were all disposable and sterile to eliminate the risk of cross-infections. Disposable latex gloves and facial masks were also used during the examination. The average dental examination time was 5 minutes with an additional 5 to 10 minutes to fill out the adolescent questionnaire. On average, 25-30 children were screened at every session in schools with the highest number of participants. To ensure privacy, all the examinations were submitted in an empty classroom with the child sitting on a chair with the head held back with maximum exposure to direct sunlight.

Dental decays were detected by a thorough inspection of all the visible surfaces of erupted teeth using the probe and the mouth mirror.

To measure the plaque index, the probe was passed over the four surfaces of six specific teeth. Plaque scores were registered for each surface of each tooth. The average of all these measurements was calculated and considered the plaque index of the each participant.

Calibration of the measures including the DMFT and plaque indices was performed prior to the data collection phase against an expert general dentist at AUBMC (NA) to ensure reliability and validity of the measurements. Both the examiner and the expert dentist assessed the DMFT and the plaque indices measures separately, on ten patients attending the dental clinic at AUBMC, during the same dental visit and without checking any of the patient's x-rays. Two-way mixed intra-class correlations (ICC) were computed to test for the consistency in continuous measures as proposed by Hallgren (2012) yielding ICC coefficient values of 0.96 for the plaque index and 0.98 for the DMFT measurements.

## ***2. The questionnaires***

Two questionnaires were constructed, one sent to parents and one filled by the child after his/her dental examination (see appendix).

The questionnaire addressing the parents provided information on the following:

- Socio-demographic and socio-economic status of the parents

- Health status of the parents
- Maternal smoking during pregnancy
- The general health status of the child assessing the presence or absence of a chronic disease, the breathing mode of the adolescent and his/her exposure to second hand smoke.
- Sucking habits: if they were present at childhood and if they remained
- Feeding mode in early childhood (breast feeding/bottle feeding)
- Parents' perception of their children oral health
- Parents' utilization of dental services
- Parents knowledge about the different available dental care centers and the cost of the treatment they offer
- Treatment costs that the parents are willing to spend on dental services.

The adolescent questionnaire included the following:

- Dietary habits including questions on sugar and soda intakes
- Oral health related quality of Life questionnaire (in its validated Arabic version)
- Oral health behaviors encompassing information on dental hygiene habits, frequency of tooth brushing, fluoride intake, frequency of visits to a dental office
- Smoking status of the adolescent.

To avoid any confusion, the questions were written in a simplified, straightforward and comprehensible manner. The consent forms and the questionnaires were written in English and translated to Arabic.

When the parents or legal guardians were illiterate or visually impaired, assistance was provided via an oral consent given by the research team or the school in charge of the child in the presence of a witness.

### **E. Statistical analysis**

Frequency distribution for all variables was performed to check for outliers and data entry errors, and examine variability of measures and indicators. Descriptive analysis was performed to check the distribution of gender, socio-demographic and socioeconomic status, maternal and adolescents smoking habits, presence or absence of chronic diseases, breathing, feeding modes and dietary and oral hygiene habits for the entire group of participants. Socio-demographic variables were compared between the examined and non-examined adolescent groups (individuals whose parents consented on all the steps of the study versus individuals who consented exclusively on filling the parents' questionnaires). Subsequently DMFT and plaque indices were compared between private and public schools. Bivariate analysis was conducted to assess the relationship of each covariate under investigation with oral health measures. The variables that were significantly associated with DMFT index and/or plaque index were stratified by type of school (private or public).

A multivariate linear regression analysis was performed to model oral health measures with the clinically and statistically significant covariates (Level of statistical significance of  $p= 0.1$ ). No collinearity was found between the variables included in the final models. Regression coefficients and their 95% Confidence intervals were presented.

The bivariate and linear multivariable analyses were carried out on DMFT and plaque indices separately to come up with a model incorporating all the covariates statistically and clinically relevant to the outcomes of interest. The percent variability of the two main outcomes (DMFT and Plaque Index) explained by the predictors in the final models will be reported. The statistical analysis was performed accounting for cluster effect at all levels. The analysis of these data was conducted using STATA statistical package.

#### **F. Ethical considerations**

##### ***\* Respect for person***

To protect privacy and confidentiality, identifiers (serial numbers) were used for schools, children and examiners.

##### ***\*Beneficence/non-maleficence***

The approval to examine the adolescents was received from the Ministry of Education and Higher Education for public schools and the school's administration in private institutions. The students were then approached directly and the parents' consent was acquired. The latter was comprised of three parts:

1- Approve to fill out the questionnaire

2- Approve to have their child examined

3- Approve to have their child fill out the adolescent questionnaire

The oral screening involved seating the child with his mouth opened and using non-invasive, sterile and disposable instruments (intraoral mirror and a dental probe).

Assistance was provided for the illiterate or visually impaired parents or legal guardians are through assistance via an oral consent given by the research team or the school in charge of the child in the presence of a witness.

All adolescents were assented prior to their participation. The written assent included a brief description of the study and allowed the child to agree freely on filling a self-administered questionnaire and/or being examined by the research team. In all instances, recommendations concerning the child's oral health and treatment were sent to the parents or legal guardian(s). Each child who needed follow-up or treatment on dental decays and oral hygiene were provided with the necessary information contacts (address and phone numbers) of one of the specialized dental centers with affordable treatment cost such as Lebanese University, Saint-Joseph University and Beirut Arab University.

**\* *Justice***

Both public and private schools in the Greater Beirut area were approached. All adolescents, girls and boys, whose age ranges between 12 and 18 had the same probability of being included in the study.

## CHAPTER IV

### RESULTS

#### **A. Introduction**

Basic demographic characteristics were compared between examined and non-examined adolescents. The results of the univariate and multivariate analyses including the components of the clinical examination along with the corresponding adolescents and parents questionnaires are presented for the 830 participants (393 in public schools and 437 in private schools). The statistical analysis at all levels was performed adjusting for the clustering effect of the schools (accounting for the differences among the 16 different schools included in the study).

#### **B. Socio-demographic characteristics of the examined and non-examined adolescents**

The non-examined adolescents (n= 118) are those whose parents consented exclusively on filling out the parents questionnaire, thus with the information restricted to the questionnaire. The examined adolescents group (n= 830) represents the total number of adolescents in public and private schools whose parents consented on all the steps of the study. The socio-demographic characteristics of both groups are displayed in Table 1, regarding mean age, grade (middle or high-school) and gender, the number of children in the family, the monthly family income, the educational level of the informant and the school type. The groups were similar in terms of gender and age. The non-examined were significantly less likely to come from larger families, more likely to have a family income



greater than 3,000,000 LL and a high (college/ university) educational level. Moreover, the proportion of non-examined in private schools (14.98%) was statistically significantly higher than that in public schools (9.45%) suggesting that parents whose adolescents are in private schools are less likely to allow their children to participate.

### **C. DMFT and Plaque indices: a comparison between public and private schools (n= 830)**

The average DMFT index for the overall sample was  $4.91 \pm 0.12$ , significantly higher in public schools ( $5.83 \pm 0.17$ ) compared to private schools ( $4.08 \pm 0.15$ ) ( $p= 0.026$ ) with very similar ranges. The difference stems mainly from the number of untreated decays: 66.81% of adolescents in private schools had one or more untreated cavity (crude number of 1055 untreated cavities among 437 adolescents) compared with 90.05% in public schools (crude number of 1724 untreated decays among 392 adolescents).

Indeed, the average number of decayed teeth per person was significantly higher in public ( $4.39 \pm 0.153$ ) compared to private schools ( $2.41 \pm 0.127$ ). In both schools the minimum was 0 decayed teeth per person, but the maximum number was 14 decayed teeth in private and 18 in public schools. The average number of missing teeth was also significantly higher in public schools ( $0.14 \pm 0.022$ ) compared to private schools ( $0.04 \pm 0.015$ ) ( $p= 0.006$ ). The minimum number of missing teeth per person was 0 in both school types and the maximum number was 3 and 5 in public and private schools, respectively. The average number of filled teeth was similar in both school types.

The average plaque index score for the overall sample was considered fair ( $1.04 \pm 0.018$ ) registering no statistically significant difference between public ( $1.06 \pm 0.025$ ) and private schools ( $1.03 \pm 0.025$ ) (Table 2)

#### **D. DMFT and Plaque indices: bivariate associations with co-variates**

The means of DMFT and plaque index were examined with the selected co-variates adjusting for the clustering effects of the schools.

##### ***I- DMFT***

###### **a. Socio-demographic characteristics**

The variables that were considered under the socio-demographic characteristics included age, gender, number of children in the family, educational level of the parents and monthly family income. All these variables were significantly associated with the DMFT index. Age had a positive association with DMFT: the older the person, the higher the DMFT ( $p= 0.001$ ). The DMFT was also statistically significantly higher among females ( $5.23 \pm 0.17$ ) compared with males ( $4.49 \pm 0.16$ ). The educational level of the informant was negatively associated with the DMFT ( $p= 0.000$ ). The average DMFT score was higher (6.69) for adolescents whose parents reported a low (illiterate, primary or elementary) educational level, and lower (3.84) for adolescents whose parents had a high (college/ university) educational level. A similar trend was observed for the monthly family income, whereby a lower DMFT was associated with a higher monthly income ( $p=0.001$ ). (Table 3)

b. Health status characteristics

The variables under health status characteristics included presence of chronic disease, breathing mode, feeding mode and oral health perception. Of all variables in this section, only two were significantly associated with DMFT: the first variable was the feeding mode during the first 6 months of life ( $p= 0.000$ ) whereby breastfeeding scored a higher DMFT ( $5.23 \pm 0.207$ ) than bottle feeding ( $4.35 \pm 0.220$ ). The second variable was the adolescent's oral health perception. When a bad oral health was perceived, the DMFT score was almost double that of a good oral health perception ( $6.69 \pm 0.40$  and  $3.83 \pm 0.19$  respectively). (Table 4)

c. Oral hygiene characteristics

In the oral hygiene section that comprised Fluoride intake, frequency of tooth brushing and whether or not the adolescent had a previous dental consultation, none of the variables was found to be significantly associated with DMFT. However, a borderline significance was noted between Fluoride intake and DMFT ( $p= 0.06$ ) with a higher DMFT among those who did not have any fluoride intake other than the toothpaste (DMFT of  $4.9 \pm 0.28$  and  $4.09 \pm 0.14$  respectively). (Table 5)

d. Nutritional habits

The variables in this section were the eating behavior (number of meals/ day) and the frequency of soda, sugar and sweets intake. Two of these were statistically significantly

associated with DMFT. The first variable was the frequency of soda intake ( $p= 0.005$ ) and a positive correlation indicating that the greater the frequency of intake, the higher the DMFT. When the frequency of soda intake decreased from 4 to 7 times per week to occasionally or never, the DMFT index decreased from  $5.15 \pm 0.17$  to  $4.11 \pm 0.22$ . The same trend was also observed for the second variable, the frequency of sweets consumption ( $p= 0.024$ ); the DMFT decreased with a lower consumption, reduced from  $5.25 \pm 0.17$  to  $3.79 \pm 0.40$  when the consumption dropped from 4 to times per week to occasionally or never. (Table 6)

e. Smoking exposure

Two variables were significantly associated with DMFT: maternal smoking during pregnancy ( $p= 0.016$ ) and parental smoking status ( $p= 0.05$ ). The DMFT score was higher: for adolescents whose mother smoked during pregnancy ( $5.54 \pm 0.35$ ) compared to those whose mother did not ( $4.71 \pm 0.13$ ); when both parents smoked ( $5.3 \pm 0.20$ ) compared to when none did ( $4.31 \pm 0.24$ ). The adolescent own smoking status was not statistically significantly associated with the DMFT. (Table 7)

f. Orthodontic treatment

The average number of decayed teeth was the lowest among adolescents undergoing orthodontic treatment ( $1.94 \pm 0.23$ ) compared to those who had never had orthodontic treatment ( $3.59 \pm 0.12$ ) ( $p= 0.000$ ). The average number of missing teeth was also significantly associated with orthodontic treatment ( $p = 0.032$ ) whereby a higher number

of missing teeth was found among those who never had orthodontic treatment ( $0.10 \pm 0.13$ ) compared to those who have or had orthodontic treatment ( $0.02 \pm 0.30$  and  $0.02 \pm 0.42$  respectively). The average number of filled teeth was found to be statistically significantly higher among participants who underwent orthodontic treatment ( $2.82 \pm 0.32$ ) and those who are currently undergoing orthodontic treatment ( $4.43 \pm 0.30$ ) compared to those who never had it ( $1.21 \pm 0.07$ ) ( $p= 0.001$ ). The average DMFT score was statistically significantly higher among students with a past orthodontic treatment ( $5.72 \pm 0.42$ ) compared with those with current orthodontic treatment ( $4.43 \pm 0.13$ ) but not statistically different when comparing participants with no orthodontic history to those with past orthodontic history. (Table 13)

## ***2. Plaque index***

### **a. Socio-demographic characteristics**

Only gender was significantly associated with the plaque index ( $p= 0.010$ ) which was higher among males than females ( $1.11 \pm 0.03$  and  $0.99 \pm 0.02$  respectively). (Table 8)

### **b. Health status characteristics**

The adolescent's oral health perception was the only variable associated with plaque index in this category ( $p = 0.007$ ). The plaque index score was high ( $1.119 \pm 0.07$ ) when the oral health was perceived as bad and significantly lower ( $0.95 \pm 0.03$ ) when the oral health was perceived as good. (Table 9)

c. Oral hygiene characteristics

The only variable statistically significantly associated with plaque index was the frequency of tooth brushing ( $p= 0.000$ ). The plaque index increased when the frequency of tooth brushing decreased; the average plaque index was  $0.98 \pm 0.02$  among adolescents who brushed their teeth 2 to 3 times/ day compared to  $1.3 \pm 0.07$  among those who rarely brush their teeth. (Table 10)

d. Nutritional habits

Among the nutritional habits characteristics, only two were significantly associated with plaque. Fast food consumption was positively associated with the plaque index ( $p = 0.009$ ) whereby the average index increased from  $0.98 \pm 0.03$  to  $1.04 \pm 0.02$  when fast food consumption increased from occasional/ never to 4 to 7 times per week. The same trend was found with soda consumption ( $p = 0.001$ ). The plaque index increased from  $0.93 \pm 0.03$  to  $1.05 \pm 0.02$  when the frequency of soda intake increased in the same direction. (Table 11)

e. Smoking exposure

None of the variables in this category was associated with plaque index. (Table 12)

f. Orthodontic treatment

Plaque index was higher among students undergoing orthodontic treatment ( $p= 0.004$ ) compared with students who never had orthodontics or had it in the past. The

average plaque index among participants with orthodontic appliance was  $1.19 \pm 0.05$  compared with  $1.03 \pm 0.02$  among those who did never had orthodontic treatment and  $0.99 \pm 0.05$  among those with a past orthodontic treatment. (Table 13)

## **E. Characteristics of adolescents in public and private schools**

The variables that were significantly associated with the DMFT and/ or the plaque indices were compared between public and private schools adjusting for the clustering effects of schools.

### ***1- Socio-demographic characteristics***

All socio-demographic variables were significantly different between public and private schools except for gender ( $p= 0.504$ ). The mean age was statistically significantly higher in public ( $15.3 \pm 0.078$ ) compared with private schools ( $14.10 \pm 0.068$ ) ( $p= 0.009$ ). Furthermore, families whose adolescents' were in public schools had a higher number of children compared to families in private schools ( $p= 0.000$ ). Educational level of the parents was also found to be statistically different ( $p=0.000$ ) with a greater percentage of illiterate parents and parents who had reached primary or elementary classes in public (13.49 %) compared to private (1.92 %). On the opposite, the percentage of parents who reached university was much higher in private schools (64.66 %) compared to public schools (17.46 %). Finally, the monthly family income showed significant differences ( $p=0.000$ ) between the two groups with 83.56 % of the parents in private schools having a

monthly income greater than or equal to 1.000.000 LL compared to only 40.58 % in public schools. (Table 14)

## ***2- Health status characteristics***

The percentage of adolescents with chronic disease was low and not significantly different ( $p= 0.922$ ) between public (7.71%) and private schools (7.43%). Similarly the breathing pattern was comparable among the two groups ( $p= 0.880$ ). Feeding mode during the 1<sup>st</sup> 6 months of the child's life was significantly different between the 2 groups ( $p= 0.000$ ) with a higher percentage of breastfeeding in public schools (46.76 %) compared with private schools (28.54%). Oral health perception was also statistically significantly different by school type with 41.75 % of the students perceiving their oral health to be good in private schools compared with only 27.82 % in public schools. Meanwhile, only 8.25 % showed bad oral health perception in private versus 15.22 % in public ( $p= 0.000$ ). (Table 15)

## ***3- Oral hygiene characteristics***

Both frequency of tooth brushing and fluoride intake were statistically significantly different between school types. For the frequency of tooth brushing, we noticed that only 3.63 % rarely brushed their teeth in private compared to 10.91 % in public schools. Furthermore, about 51.02 % of participants brushed their teeth between 2 to 3 times/ day in private schools compared with 42.64 % in public schools. Fluoride intake was significantly higher in private (27.07%) compared to public (14.07%) schools ( $p = 0.033$ ). (Table 16)



#### ***4- Nutritional habits***

Only the frequency of Soda intake was statistically different by school type ( $p=0.000$ ). The percentage of participants who occasionally or never drank soda in private schools was almost the double of that in public schools (36.54% in private compared to 17.41% in public schools). Moreover, 54.05% of school children in public schools drank soda from 4 to 7 times/ week compared to 42.07% in private schools. (Table 17)

#### ***5- Smoking exposure***

All the 3 variables of smoking exposure were significantly different between public and private schools. There was a higher percentage of maternal smoking during pregnancy among adolescents in public (17.49%) compared with adolescents private schools (6.51%) ( $p=0.000$ ). Adolescents' smoking status was also significantly different between the two groups ( $p=0.000$ ). The percentage of adolescents who never smoked in public schools was 59.73 whereas it was 79.56 in private schools. The most significant difference between the 2 groups was for Narguile smoking with 23.47% of students in public and 9.49% of students in private schools. Parents smoking status was also significantly different between the 2 groups ( $p=0.001$ ). The percentage of having none of the parents smoking in private schools (35.5%) was almost double of that in public schools (19.14%). (Table 18)

## **F. Multivariable analysis**

The multivariable analysis consisted of multiple linear regression of the 2 main outcomes, DMFT and plaque indices, both considered as continuous variables. All variables that had a p-value equal or less than 0.1 in the bivariate analysis were included in the multiple linear regressions. The choice of a p value of 0.1 and below for a variable to be included in the multiple regression analysis was to be conservative.

### ***1. DMFT***

Out of all the variables evaluated, fourteen had a p-value equal or less than 0.1 at the bivariate analysis level and were included in the regression analysis. However, including too many variables in the multiple regression analysis while accounting for clustering effect, such as in this case, affects the goodness of fit of the model (overall significance). Therefore, several models were checked in order to come up with the most parsimonious one.

The final model included the following variables: age and gender of the adolescent, the number of children in the family, the parental educational level, the monthly family income, the orthodontic history of the adolescent, oral health perception, frequency of sweets intake and maternal smoking. The overall model significance was high ( $p= 0.000$ ) and the variables included explained 24% of the variability in the DMFT.

Among the socio-demographic variables, a significantly higher DMFT was associated with age, being a female, large number of children/ family, lower monthly family income and lower parental educational level. In this context, DMFT increased by 0.447 units on average with every one unit increase in age ( $p= 0.001$ ). Furthermore, females

had a higher DMFT increasing by 0.658 units on average when going from males to females ( $p= 0.037$ ). Moreover, the DMFT increased by 0.963 units on average when comparing adolescents in families with 3 children or less to those in families with more than 3 children ( $p= 0.011$ ). As for the parental educational level, our results suggested that going from low to high parental educational level decreased the DMFT index by 0.697 units on average ( $p= 0.031$ ). The same trend is also observed with the monthly family income; the DMFT index decreased by 1.405 units when comparing families with a monthly income of less than 3 000 000 LL to families earning more than this amount.

Orthodontic history was also associated with DMFT ( $p= 0.006$ ) whereby a higher DMFT was associated with participants who had previous orthodontic treatment compared to the participants who never had.

Oral health perception was associated with DMFT particularly when comparing adolescents who perceive their oral health as bad compared to those who perceive their oral health as good ( $p= 0.005$ ).

Among the nutritional habits and smoking exposure characteristics, neither the frequency of sweets consumption or maternal smoking during pregnancy reached statistical significance in the multiple regression model. (Table 19)

## ***2. Plaque index***

The variables that had a p-value equal or less than 0.1 were included in the multiple regression model. Those variables were: Gender, oral health perception, fluoride intake, frequency of teeth brushing, frequency of soda and fast food consumption and orthodontic

history. The overall model significance was high ( $p= 0.000$ ) and the variables included explained 10% of the variability in the plaque index.

A higher plaque index was associated with being a male, having currently an orthodontic treatment, bad oral health perception, reduced frequency of tooth brushing and an excessive soda intake.

In this context, the average plaque index decreased by 0.08 units on average when going from males to females ( $p= 0.05$ ), increased by 0.251 units when comparing adolescents who never had orthodontics to those undergoing orthodontic treatment ( $p= 0.000$ ). Moreover, the better the oral health perception the lower the plaque index (with a  $p$  value of 0.023 when comparing bad to good oral health perception). Similarly, the plaque index dropped significantly when the frequency of teeth brushing increased. The plaque index decreased by 0.272 and 0.355 on average when comparing rare/ occasional teeth brushing to  $\leq$  once/ day and 2-3 times/ day respectively. Last of all, an increased frequency of soda intake was associated with an increased plaque index. (Table 20)

# CHAPTER V

## DISCUSSION

### **A. Summary And Discussion Of Major Findings**

This is a cross-sectional study, based on a sample of 12 to 18 year-old school children, from different social backgrounds, assessing the prevalence of dental decays and oral hygiene status of adolescents using the DMFT and plaque indices and comparing private to public schools in the greater Beirut area. This study is the first in Lebanon to investigate the association of DMFT and plaque indices with a range of correlates encompassing the child, family and community influences, in order to identify potential risk factors affecting oral health.

#### ***1. Burden of dental caries and dental plaque***

Our results revealed that the burden of dental caries in Lebanon in both public and private schools remains high and does not yet meet the goal of the World Health Organization for the year 2000 of having a maximum DMFT score of 3 among 12 year-old children (World Dental Federation, 1982). However, our results revealed that the situation is more alarming in public schools whereby the average DMFT is high ( $5.83 \pm 0.17$ ), compared to a moderate DMFT score ( $4.03 \pm 0.15$ ) in private schools. If the mean DMFT for each school is considered separately, we can note a wide variation within private schools with averages of DMFT score ranging from 2.75 to 5.73 while a narrower range of DMFT scores exist in public schools (minimum of 5.42 and maximum of 7.05). Further exploration of DMFT averages for each school revealed that in two private schools the

DMFT scores were 5.73 and 5.62, higher than the mean DMFT for the whole group of private schools that is 4.08 and very similar to the average DMFT for public schools that is 5.83.

The high DMFT score reflects the large number of untreated decays among the vast majority of adolescents with 90% of participants in public schools and 66.8% of adolescents in private schools suffering from untreated cavities.

The burden of dental caries in Lebanon is much higher than that in developed countries which exhibit a better control over oral diseases by offering both preventive and curative services to patients (FDI, 2014) and as a result of efficient public health measures such as fluoridation and improving awareness on self-care practices (Petersen et al, 2005). For instance, based on the NHANES data on oral health in the United States, the average DMFT score for ages 12 to 15 and 16 to 19 were 1.78 and 3.31 respectively (NHANES, 2004). However, reports of the NHANES also showed disparities within the American population with Hispanic adolescents and those living in families with lower income having a higher prevalence of decays, more untreated decays and more severe permanent teeth decays (NHANES, 2004). This means that poor and disadvantaged populations have not yet benefitted from these advances in oral health care and widespread inequalities still persist both within and between countries (World Dental Federation, 2014).

Furthermore, the average DMFT in Lebanon is much higher than the average DMFT for the Eastern- Mediterranean region (WHO, 2011). If we compare the average DMFT reported in Lebanon to the data from neighboring countries, we can note that the only

country to have a DMFT higher than that of Lebanon is Saudi Arabia (DMFT estimated to be 5.9 in 2002, WHO 2014).

At the local level, the study of Moukarzel et al (2012) reported a high prevalence of dental caries, among 6 to 11 years old children with wide disparities between public and private schools for the DMFT score being almost the double in public schools ( $7.30 \pm 3.98$ ) compared with private schools ( $3.50 \pm 3.41$ ). Their results are in line with our findings with regard to the high incidence of dental caries and the disparities based on school type ( $5.83 \pm 0.17$  in PBS,  $4.08 \pm 0.15$  in PVS). It may be argued that the DMFT scores of the two studies are not comparable given that the previous study assessed the total mouth disease taking into account the primary and permanent teeth whereas in our study the permanent teeth were assessed exclusively. However, the scores reflected dental health, and as such, the trend holds in terms of greater DMFT scores in the public schools.

For the adolescent age group, when comparing our results to the data previously available in Lebanon, we notice that there are differences in DMFT scores. For instance, Doughan et al in 2002 reported DMFT scores of 5.72 and 8.09 among 12 and 15 years old adolescents. However, our data revealed an average DMFT score of 3.6 at age 12 and 5.05 at age 15, probably indicating differences inherent to the studies, nevertheless indicating an obvious developmental occurrence: a lower rate of disease at age 12 years, when more disease-free freshly erupted permanent teeth are examined. Regarding comparisons between our study and that of Doughan et al, differences may be attributed to the selected samples and possible variation in applying the DMFT. The study of Doughan et al, included adolescents from the 6 districts of Lebanon whereas our study focused on the

Greater Beirut area. Furthermore, the 12-year gap between the 2 studies with the apparent decrease of DMFT among Lebanese adolescents in our study may reflect improved oral health care practices and lower exposure to risk factors. Additional research is needed to explore this assumption.

Despite this apparent decrease, the DMFT score in Lebanon remains high and the association of DMFT with income and education sheds the light on the existing disparities and inequities in terms of preventive and curative oral care among Lebanese adolescents from different social background and financial capabilities.

For comparative purposes, we display in Figure 5 bar graph representing the DMFT averages for Lebanon at ages 12 and 15 as determined in our study, in the study of Doughan et al in 2002, the NHANES DMFT scores at ages 12 to 15 and 16 to 19 for the year 2004, the average DMFT for the EMRO region and KSA as reported by the WHO in 2014.



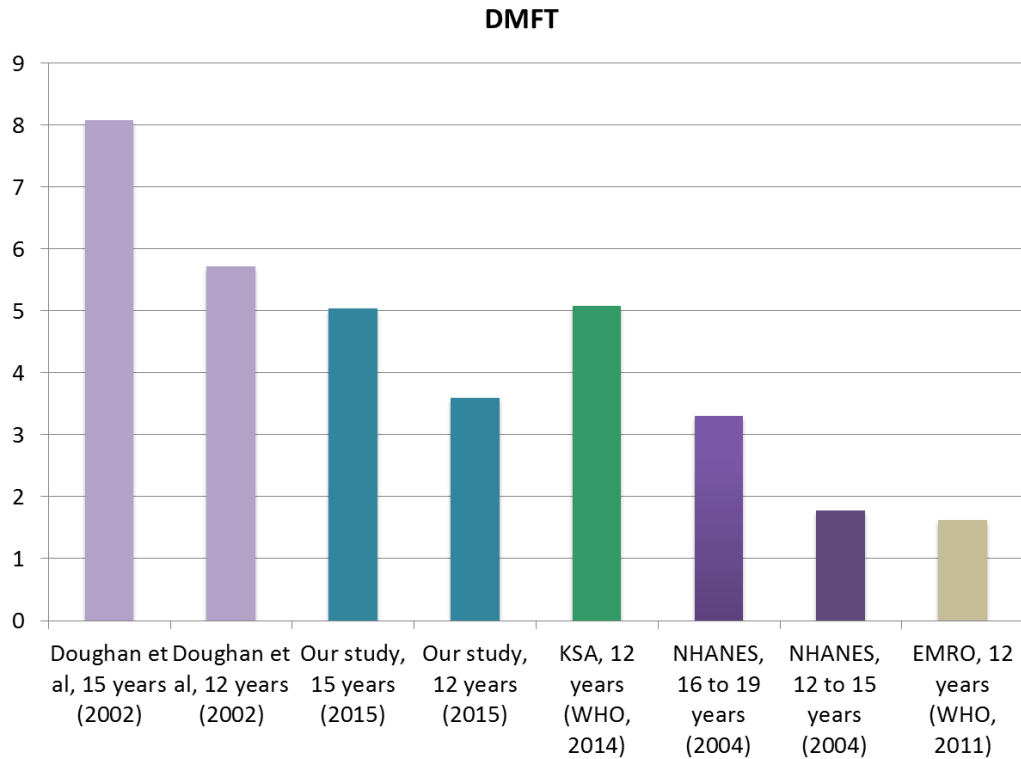


Figure 5: Bar graph comparing the DMFT scores revealed in this study with other available data

The plaque index was measured by assessing the presence and abundance of plaque on four surfaces of six teeth. In some cases, it was not possible to measure plaque on all the 6 teeth because some of them were missing, not yet erupted or have an orthodontic band covering its surfaces. In 5.3% of the cases measurements were performed on 4 teeth instead of 6 and in 9% of the cases measurements were recorded on 5 teeth instead of 6.

The average score for the overall sample was  $1.04 \pm 0.018$  with no significant differences between public and private schools, in contrast to the findings of Moukarzel et al in 2012 who reported a significant difference between the 2 school types and higher plaque index averages (1.35 and 1.2 in public and private schools, respectively). However,

in both studies and for both types of schools the average plaque index is considered fair (within the range of 1 to 1.9), reflecting the insufficient oral hygiene practices of the adolescents that would put them at a higher risk of developing gingivitis, and eventually periodontal diseases considered the leading cause for tooth loss (World Dental Federation, 2014).

## ***2. Factors associated with dental decays and dental plaque***

The multivariable analysis allowed us to assess the variables that were associated with DMFT and plaque indices. Several socio-demographic factors appeared to be significantly associated with DMFT: the DMFT index increases with age; this finding is confirmed in previous studies (Doughan et al, 2002; NHANES 2004). In line with the literature, a higher DMFT is found among female adolescents (Ferraro et al, 2010, Lukacs et al, 2006). Moreover, the variables used to assess the socio-economic background of the adolescent were the monthly family income, the parental education and the number of children in the family; all three indicators were significantly associated with DMFT. In this context, a high DMFT is associated with adolescent in families that have more than 3 children, having a monthly family income that is below 3 000 000 LL and having a low parental educational level. The association of DMFT and SES has been thoroughly investigated in the literature and the evidence suggest a strong association between a low SES and a high DMFT score particularly a high prevalence of untreated decays (Donald et al, 2014; Richardson, 2011).

Orthodontic history was also associated with a higher DMFT only when comparing those who never had orthodontics to those who had it in the past. This increase can be due

to the inadequate oral hygiene practices during orthodontic treatment that might have led to more cavities or to the initial malocclusion and dental crowding that favored more decays formation among these adolescents prior to orthodontic treatment. However further research is needed to explore this association.

The last variable found to be associated with the DMFT at the multivariable analysis level was the adolescent's oral health perception; participants who perceive their oral health to be bad had significantly a higher DMFT compared to those who perceive their oral health as good. Adolescents are aware of their dental related problems and therefore they are able to identify their needs. Despite that, a large proportion of adolescents still have untreated dental decays, particularly in low income families. This is attributed to the social and financial obstacles hindering the adolescents but more importantly their parents from utilizing oral health care services.

At the multivariable level, the school type did not remain significantly associated with the DMFT because school type is only a proxy indicator of the SES expressed in our model by the income, educational level of the parents and the number of children in the family. However, when the DMFT was modeled with only school type and adolescent oral health perception, school type remained a significant predictor of DMFT; adolescents attending public schools had higher DMFT scores than adolescents attending private schools (p-value: 0.046; Appendix IV). In light of the conceptual framework of the determinants of oral health, it may be argued that factors residing within the public/ private school experience, beyond simply parental income and education can also contribute to dental caries (i.e.: parental and adolescent awareness, peer influence). The assumption on

perception of oral health would entail that a poor child (more likely attending a public school) would not be exposed to oral health as much of a priority as a child from the highest income group (> 3,000,000LL; probably attending a private school) who is more often reminded of the importance and daily practice of oral hygiene.

Regarding the plaque index, none of the socio-demographic variables was found to be significantly associated with plaque formation, except for gender, whereby more plaque was found among males. This finding is in agreement with previous studies (Villalobos-Rodelo et al, 2007; Gopinath et al, 2015) whereby female participants had better scores. The association between gender and dental plaque remained significant even after adjusting for the frequency of tooth brushing. This might be due to the lack of rigorous tooth brushing among males. In our study, we only asked about the frequency of tooth brushing and this may not necessarily translate into thoroughness.

A significant plaque accumulation was also associated with orthodontic treatment whereby adolescents undergoing orthodontics have higher rates of dental plaque compared to those who never had orthodontics and this is due to the increased plaque retention occurring in the presence of fixed orthodontic appliances. This finding is in line with the results reported by Ristic et al, who reported, among a sample of 32 adolescents enrolled in a longitudinal prospective study, an increase in the plaque index reaching its highest levels three months after treatment initiation with fixed appliances (Ristic et al, 2007).

Adolescent's oral health perception was also found significantly associated with plaque when comparing bad to good oral health perception with a higher average plaque index among adolescents perceiving their oral health as bad.

Furthermore, the frequency of teeth brushing was strongly associated with plaque accumulation. The universally accepted recommendation for maintaining good dental and periodontal health is twice-a-day tooth brushing frequency (Loe et al, 2000). Individuals who brush less than twice/ day are not able to remove dental plaque and will have high plaque index scores (Villalobos-Rodelo et al, 2007).

Among nutritional habits, the frequency of Soda intake was significantly associated with dental plaque; this finding is also reported in the Literature (Villalobos-Rodelo et al, 2007). The harmfulness of Soda intake does not reside only in its sugary content, but also in its acidic composition that causes a drop in the PH of the mouth and increases the incidence of dental erosion and dental cavities (Jawale et al, 2012).

## **B. Strengths of the study**

This study is the first update on oral health among adolescents in Lebanon since the last decade and the only study to investigate the association of DMFT and plaque indices with several factors at the child (oral hygiene practices, dietary intake), family (Income, education, smoking...) and community levels (school type, access to preventive care...). The association of oral health and certain variables (such as smoking of both cigarettes and Narguile) has not been investigated before in the Lebanese population.

Prior to data collection, calibration was performed and high levels of reliability and validity were obtained.

The study was carried out on a relatively large sample size (830 adolescents) and was characterized by the rigorous clinical examination that is similar to the examination protocol adopted by the National Health And Nutrition Examination Survey (NHANES).

The response rate at the adolescent level was high: among adolescents whose parents consented on participating in the study, less than 5% of students in both public and private schools refused to participate in the study.

Moreover, the information regarding the adolescent's characteristics, habits and social background were collected via adolescent and parent self-administered questionnaires. The adolescents' questionnaire included questions better answered by the adolescent himself (such as teeth brushing frequency and dietary intake) while the parents' questionnaire inquired about information better defined by the parents.

Lastly, the strength of this study also figured in the statistical analysis that was all performed accounting for clustering effect of schools at all levels and therefore becoming more conservative while making inferences.

### **C. Limitations of the study**

This is a cross-sectional study; therefore, causal relationships between the dependent variables (DMFT and plaque indices) and the independent variables could not be drawn. Furthermore, the study was not conducted on a national scale and consequently, we should be careful in generalizing our results and conclusions.

Moreover, the private schools present in our sample do not represent the very high socio-economic status and the majority of schools have students with middle socio-economic background. This misrepresentation is due to the refusal of private schools that represent higher living standards to participate in our study. This might have altered some of our findings and allowed the detection of larger differences between the two school types and more associations with social background and lifestyle. Besides, if we compare

participants who were examined to those whose parents agreed on filling the parents' questionnaires only, we notice that families with a fewer number of children (less than 3), who have a high monthly family income (> 3 000 000 LL) and who have a high educational level (college/ university) are less likely to allow their children to be examined, most of them claiming that they have their own dentist.

An additional limitation in the study is the self-administered questionnaires. Recall bias might have occurred for questions requiring the memory of the parents and reporting bias such as misreporting, under or over reporting might have also figured.

Despite the use of DMFT and plaque indices to assess oral health in epidemiological studies is well-established in the literature. Despite that, these indices represent some challenging limitations. The DMFT scores do not provide any estimation for treatment needs and gives equal weight to missing, untreated decay or well-restored teeth and do not take into account dental sealants. Also, differentiation between missing teeth may not be accurate because of possible delayed eruption (no x-rays to discern), congenitally missing, extracted due to trauma or for orthodontic treatment. It would be difficult how much these factors might weigh on the accuracy of the final score. Judicious research should be invested in this perspective, either reinforcing the use of the same score or perhaps prompting its modification or even replacement.

The Loe and Silness plaque index scores have a narrow range, extending from 0 to 3. In our comparisons, we detected statistically significant difference between groups that may not necessarily imply a clinically significant difference. Furthermore, the plaque index score might be affected by the timing of the clinical examination; students who brush their

teeth after breakfast and are examined before recess may show less plaque on their teeth; students examined directly after recess may have eaten during their recess.



## CHAPTER VI

### CONCLUSION AND RECOMMENDATIONS

#### **A. Conclusion**

This cross-sectional study aimed at assessing and comparing the DMFT and plaque indices among Lebanese adolescents in public and private schools and investigating the socio-demographic and behavioral factors associated with oral health. This study showed that the burden of dental caries among adolescents is high in Lebanon compared to developed countries and to the majority of the countries of the Eastern Mediterranean region. Furthermore, it shed the light on the existing social and economic disparities in DMFT scores among the Lebanese population. A larger proportion of adolescents in public schools have a lower socio-economic background, particularly a lower monthly family income, lower parental educational level and a larger number of children per family. These adolescents are therefore exposed to more risk factors because of their low SES (less tooth brushing frequency, more soda intake, Narguile smoking and increased exposure to second hand smoke) and at the same time they lack access to care. These factors can lead to a vicious cycle that reinforces social disparities, where disadvantaged populations have a higher risk of being affected by disease and less capability to receive proper care.

Based on our results, the factors that were associated with the DMFT were at the family level (number of children in the family, educational level of the parents, family income) and at the child level (age, gender, orthodontic history and oral health perception).

Our results revealed that the factors associated with plaque index were all at the child's level (gender, orthodontic history, oral health perception, frequency of tooth brushing and soda intake). However, in the current study, many associated factors have not been investigated and some associations may have not been revealed due to the study design and sample selection. More research is needed to explore other factors influencing oral health, particularly those at the community level in order to assess better the oral health status and address the burden of oral diseases more appropriately.

## **B. Recommendations**

Oral health is a basic human right, inseparable from general health and well-being (World Dental Federation, 2014). Reducing the burden of oral disease, particularly among disadvantaged populations in Lebanon, remains an essential and urgent need. It can be achieved through intersectoral collaborative efforts providing every person with his right of having a good oral health at the individual level and reducing the inequalities existing among individuals from different social backgrounds at the community level.

Lebanon is among the countries that have the highest number of dentists worldwide: 14.7 dentistry personnel per 10 000 population (World Health Statistics, 2014). However, the high number of dentists apparently does not translate into a reduction in treatment needs. Lebanese people still suffer from several untreated cavities because, in most of the cases, the cost of dental treatment exceeds their financial capabilities, particularly in the absence of universal public and private dental insurance. This finding emphasizes the need to establish a third party coverage that will improve the individuals' access to care and

provide the needed dental services with affordable prices. In the meantime, given that curative approaches are not available to address the burden of oral diseases in countries with limited financial resources like Lebanon, the optimal immediate coverage for oral diseases resides in prevention.

### ***1. Short term recommendations***

In order to better control and prevent oral diseases, several measures should be taken not only at the national level but also at the community, the family and at the individual's level.

Fluoride dietary supplements and water fluoridation are the most cost effective measures done at the national level in order to prevent dental decays; it was found that in communities with more than 20,000 residents, every \$1 invested in community water fluoridation yields about \$38 in savings each year from fewer cavities treated (Centers for disease control and prevention, 2011). Furthermore, an Australian study, based on data from the national surveillance survey on children aged 5 to 15, found that Australian children living in areas with  $\geq 0.7$  ppm fluoride in the water have significantly lower caries experience and caries prevalence than their same-aged counterparts residing in areas with no or minimal concentrations of fluoride in the water (Armfield, 2010). In Lebanon, a consensus on Fluoridation is not yet established. Water fluoridation is difficult to control given the multiplicity of sources for drinking water, however, salt fluoridation seems to be an appropriate alternative for Lebanon especially after the recent success of salt iodization (Doumit et al, 2000).

In this context, the Ministry of Education and Higher education had started recently a project to deliver fluoride mouth rinses at public schools, one morning/ week for primary schoolchildren. This is a recent initiative therefore its characteristics and benefits cannot be assessed at present.

Another safe and effective way to prevent cavities is through the use of dental sealants that are plastic coatings applied to the chewing surfaces of the posterior teeth, where most decays occur (Centers for disease control and prevention, 2011). However, since at the national level such measure is not practically feasible, non-governmental organizations (NGOs) should play a role in incorporating dental sealants into schools and in primary care centers for affordable prices. Ajjalouna, a Lebanese NGO, had been providing dental sealant services in several public schools in Beirut, however, more community efforts are needed to expand the application of this preventive measure and make it more available and affordable.

Moreover, collaboration between the ministries (ministry of education and higher education and the ministry of health), the Lebanese Dental Association and the non-governmental organization is needed to establish awareness campaigns targeting both parents and children. Reaching the parents and the adolescents is possible through the various means of communication such as TV campaigns and social media blogs particularly targeting the young generation. At the school level, several measures are also needed; many schools do not have a dentist: out of the 9 private schools included in our study, only two had an annual dental visit, as for the public schools they all have a dental visit until the 9<sup>th</sup> grade.

At the same time, based on our results, we can note that a large proportion of adolescents have several untreated decays, even in the schools that have an annual dental check-up visit. Hence it is essential for every school to have a dentist that examines all students without exception. Moreover, the school should ensure the delivery of the referral paper written by the dentist to the parents indicating the urgency of the treatment need in each case and informing parents about accessible and affordable centers of care (if available).

Educational sessions on oral health should be established in all schools especially for young children, because they are at a receptive age that will allow them to develop lifelong healthy behaviors. Several sessions on oral health are available in public schools, they are not part of the academic curriculum but each school is supposed to deliver oral and general health related information to the students during the extra- curricular hours based on the recommendation of the Ministry of Education and Higher Education (MEHE). In this context, the Ministry should follow up thoroughly on this subject and make sure the right information is delivered to all students appropriately. Moreover, the same educational sessions or similar ones should also be available in private schools; this will help spreading oral health related education to a larger population and reduces the inequalities between students from different school types.

Furthermore, dietary intake at schools plays an important role in caries development. The MEHE had indicated a list of food and beverages prohibited in public schools (mainly soda, potato chips and high sugar content food). It is essential for these regulations to be applied, not only in public but also in private schools.

In addition, at the family and at the adolescent levels, the focus should also be on the importance of prevention and early detection of cavities. This requires a thorough parental follow up on the dietary habits and oral hygiene measures of their children in addition to their commitment to regular dental visits (for cleaning, professional application of Fluoride, sealants, restorations...). Unfortunately, many of the parents are unable to do that, not necessarily because they are unaware of their children's need but because of their limited financial resources impeding them from having access to dental services.

Good oral health requires, in addition to all the aforementioned measures, a high sense of responsibility from the part of the adolescent who should be well-informed and convinced of the importance of adequate self-care practices and who should consciously adopt a healthy lifestyle in order to preserve his oral and overall well-being.

## ***2. Long term recommendations***

Currently, dental treatment is covered by some private insurance companies and by the governmental health systems. However, these insurance packages do not cover the preventive measures, such as regular professional cleaning and dental sealants applications. In order to implement such novel procedures, further studies are needed to weigh their cost-effectiveness.

Prospective interventional studies and longitudinal studies are needed to reveal new associations between some variables and dental diseases. Lastly, studies at a national level, covering all the geographic areas, including schools with a higher SES, investigating the prevalence of other oral diseases are needed. The findings of such studies may shed the

light on the real magnitude of socio-economic disparities existing among the Lebanese population.

### ***3. Recommendations for future research***

For future studies, we recommend that appointments with schools, particularly private, should be arranged at the beginning of the school year. Hence, the examination of the participants can be set at the same date of the annual visit of the school's dentist (if present). This will encourage more private schools to participate and will probably increase the response rate of the parents.

## Tables

**Table 1:** Percent distribution of examined and non-examined adolescents by socio-demographic characteristics (according to parental then child consents)

|  |   | <b>Examined<br/>n=830 (87.55%)</b> | <b>Non-examined<br/>n=118 (12.44%)</b> | <b>P-<br/>value</b> |
|--|---|------------------------------------|--|---------------------|
| <b>Age of the adolescent (mean + SD)</b> |   | 14.71 ± 0.06                       | 14.58 ± 0.15                           | 0.738               |
| <b>Gender of the adolescent</b>          | Males   | 355 (42.77%)                       | 52 (44.07)                             | 0.852               |
|  | Females                                       | 475 (57.23%)                       | 66 (55.93)                             |                     |
| <b>Number of children in the family</b>  | ≤ 3   | 543 (69.44%)                       | 90 (83.33%)                            | 0.001               |
|  | >3  | 239 (30.56%)                       | 18 (16.67%)                            |                     |
| <b>family Income (LL)</b>                | ≤ 999 999                                     | 265 (37.32 %)                      | 20 (20.41%)                            | 0.002               |
|  | 1 000 000-3 000 000                           | 297 (41.83%)                       | 32 (32.65%)                            |                     |
|  | >3 000 000                                    | 148 (20.85%)                       | 46 (46.94%)                            |                     |
| <b>Education of informant</b>            | Low<br><i>(Illiterate Primary-Elementary)</i> | 59 (7.43%)                         | 8 (7.02%)                              | 0.000               |
|  | Average<br><i>(Secondary-Intermediate)</i>    | 400 (50.38%)                       | 32 (28.07%)                            |                     |
|  | High<br><i>(College / university)</i>         | 335 (42.19%)                       | 74 (64.91%)                            |                     |
| <b>School type</b>                       | Public  | 393 (90.55%)                       | 41 (9.45%)                             | 0.010               |
|  | Private                                       | 437 (85.02)                        | 77 (14.98%)                            |                     |



**Table 2:** Percent distribution of students aged 12-18 by DMFT and plaque indices and type of school adjusting for the clustering effects of the schools

| <i>Dental Health</i> | <b>School type</b>    |            |            |                        |            |            | <b>P-value</b> |
|----------------------|-----------------------|------------|------------|------------------------|------------|------------|----------------|
|                      | <b>Public (N=392)</b> |            |            | <b>Private (N=437)</b> |            |            |                |
|                      | <b>Mean+SD</b>        | <b>Min</b> | <b>Max</b> | <b>Mean+SD</b>         | <b>Min</b> | <b>Max</b> |                |
| <b>D</b>             | 4.39 ±0.153           | 0          | 18         | 2.41±0.127             | 0          | 14         | 0.012          |
| <b>M</b>             | 0.14±0.022            | 0          | 3          | 0.04±0.015             | 0          | 5          | 0.006          |
| <b>F</b>             | 1.31±0.106            | 0          | 17         | 1.68±0.105             | 0          | 13         | 0.159          |
| <b>DMFT</b>          | 5.83±0.17             | 0          | 20         | 4.08±0.15              | 0          | 19         | 0.026          |
| <b>Average PI</b>    | 1.06±0.025            | 0.08       | 5.33       | 1.03±0.025             | 0.12       | 5.66       | 0.770          |

**Table 3:** Association of socio-demographic characteristics and DMFT index adjusting for the cluster effect of schools

| <i>Socio-demographic characteristics</i> |   | <b>DMFT</b> |             |           |                |
|--|---|-------------|-------------|-----------|----------------|
|  |   | <b>N</b>    | <b>Mean</b> | <b>SD</b> | <b>P-value</b> |
| <b>Age</b>                               |   |             |             |           | 0.001          |
| <b>Gender</b>                            | Males   | 355         | 4.49        | 0,17      | 0.049          |
|  | Females                                       | 474         | 5.23        | 0.16      |                |
| <b>Number of children in the family</b>  | ≤ 3   | 542         | 4.476       | 0.14      | 0.007          |
|  | >3  | 239         | 5.928       | 0.22      |                |
| <b>Educational level of the parents</b>  | Low ( <i>illiterate- Primary-Elementary</i> ) | 59          | 6.69        | 0.44      | 0.000          |
|  | Average ( <i>Intermediate-Secondary</i> )     | 399         | 5.46        | 0.17      |                |

|                              |                                    |     |      |      |       |
|------------------------------|------------------------------------|-----|------|------|-------|
|                              | High ( <i>College-University</i> ) | 335 | 3.84 | 0.18 |       |
| <b>Monthly family income</b> | ≤ 999 999                          | 264 | 5.72 | 0.24 | 0.001 |
|                              | 1 000 000- 3 000 000               | 297 | 5.09 | 0.19 |       |
|                              | ≥3 000 000                         | 148 | 2.99 | 0.25 |       |

**Table 4:** Association of health status characteristics and DMFT index adjusting for the clustering effects of the schools

| <i>Health status characteristics of child</i>         |                | <b>DMFT</b> |             |           |                |
|---|----------------|-------------|-------------|-----------|----------------|
|   |                | <b>N</b>    | <b>Mean</b> | <b>SD</b> | <b>P-value</b> |
| <b>Presence of chronic disease(s)</b>                 | Yes            | 60          | 5.3         | 0.43      | 0.301          |
|   | No             | 732         | 4.83        | 0.12      |                |
| <b>Breathing mode during childhood</b>                | Nose           | 280         | 5.03        | 0.203     | 0.127          |
|   | Mouth          | 67          | 5.2         | 0.421     |                |
|   | Both           | 292         | 4.54        | 0.203     |                |
| <b>Feeding mode (1<sup>st</sup> 6 months of life)</b> | Breast feeding | 291         | 5.23        | 0.207     | 0.000          |
|   | Bottle feeding | 188         | 4.35        | 0.22      |                |
|   | Both           | 307         | 4.80        | 0.203     |                |
| <b>Oral health perception</b>                         | Bad            | 93          | 6.69        | 0.40      | 0.000          |
|   | Average        | 428         | 5.21        | 0.16      |                |
|   | Good           | 283         | 3.83        | 0.19      |                |

**Table 5:** Association of oral hygiene characteristics and DMFT index adjusting for the clustering effect of the schools

| <i>Oral Hygiene characteristics</i> |              | DMFT |      |      |         |
|-------------------------------------|--------------|------|------|------|---------|
|                                     |              | N    | Mean | SD   | P-value |
| <b>Fluoride intake</b>              | No           | 577  | 4.9  | 0.14 | 0.060   |
|                                     | Yes          | 155  | 4.09 | 0.28 |         |
| <b>Frequency of teeth brushing</b>  | Rarely       | 56   | 5.67 | 0.45 | 0.312   |
|                                     | ≤Once/day    | 381  | 4.91 | 0.17 |         |
|                                     | 2-3times/day | 372  | 4.74 | 0.17 |         |
| <b>Previous dental consultation</b> | No           | 57   | 4.38 | 0.46 | 0.315   |
|                                     | Yes          | 754  | 4.93 | 0.12 |         |

**Table 6:** Association of nutritional habits characteristics and DMFT index adjusting for the clustering effect of the schools

| <b>Nutritional habits characteristics</b> |                        | DMFT |      |      |         |
|---|------------------------|------|------|------|---------|
|   |                        | N    | Mean | SD   | P-value |
| <b>Eating behavior</b>                    | 3meals/day             | 265  | 4.62 | 0.2  | 0.230   |
|   | >3 meals/day           | 390  | 5.17 | 0.17 |         |
|   | <3 meals/day           | 86   | 5.06 | 0.42 |         |
| <b>Frequency of fast food consumption</b> | Occasionally/<br>never | 212  | 4.61 | 0.22 | 0.109   |
|   | 1-3 times/week         | 402  | 5.01 | 0.17 |         |
|   | 4-7 times/week         | 186  | 4.9  | 0.24 |         |

|  |                        |     |      |      |       |
|--|------------------------|-----|------|------|-------|
| <b>Frequency of soda intake</b>        | Occasionally/<br>never | 218 | 4.11 | 0.22 | 0.005 |
|  | 1-3 times/week         | 197 | 5.24 | 0.25 |       |
|  | 4-7 times/week         | 379 | 5.15 | 0.17 |       |
| <b>Frequency of sweets consumption</b> | Occasionally/<br>never | 64  | 3.79 | 0.40 | 0.024 |
|  | 1-3 times/week         | 318 | 4.68 | 0.18 |       |
|  | 4-7 times/week         | 417 | 5.25 | 0.17 |       |

**Table 7:** Association of smoking exposure and DMFT index adjusting for the clustering effect of the schools

| <i>Smoking exposure</i>                            |   | <b>DMFT</b> |             |           | <b>P-value</b> |
|--|---|-------------|-------------|-----------|----------------|
|  |   | <b>N</b>    | <b>Mean</b> | <b>SD</b> |                |
| <b>Maternal cigarette smoking during pregnancy</b> | No  | 689         | 4.71        | 0.13      | 0.016          |
|  | Yes   | 91          | 5.54        | 0.35      |                |
| <b>Adolescent smoking status</b>                   | None  | 550         | 4.65        | 0.14      | 0.102          |
|  | Ever smoked ( <i>cigarettes and or Narguile</i> ) | 235         | 5.52        | 0.21      |                |
| <b>Parental smoking status</b>                     | No one smokes                                     | 215         | 4.31        | 0.24      | 0.005          |
|  | Father smokes                                     | 198         | 5           | 0.23      |                |
|  | Mother smokes                                     | 103         | 4.66        | 0.32      |                |
|  | Both smoke  | 259         | 5.3         | 0.204     |                |

**Table 8:** Association of socio-demographic characteristics and plaque index adjusting for the cluster effect of schools

| <i>Socio-demographic characteristics</i> |  | <b>Plaque index</b> |             |           |                |
|--|--|---------------------|-------------|-----------|----------------|
|  |  | <b>N</b>            | <b>Mean</b> | <b>SD</b> | <b>P-value</b> |
| <b>Age</b>                               |  |                     |             |           | 0.971          |
| <b>Gender</b>                            | Males  | 355                 | 1.11        | 0.03      | 0.010          |
|  | Females                                      | 472                 | 0.99        | 0.02      |                |
| <b>Number of children in the family</b>  | ≤ 3  | 542                 | 1.038       | 0.02      | 0.336          |
|  | > 3  | 238                 | 1.076       | 0.03      |                |
| <b>Educational level of the parents</b>  | Low ( <i>illiterate-Primary-Elementary</i> ) | 59                  | 1.22        | 0.09      | 0.159          |
|  | Average ( <i>Intermediate-Secondary</i> )    | 398                 | 1.07        | 0.02      |                |
|  | High ( <i>College-University</i> )           | 334                 | 0.97        | 0.02      |                |
| <b>Monthly family income</b>             | ≤ 999 999                                    | 264                 | 1.12        | 0.04      | 0.249          |
|  | 1 000 000- 3 000 000                         | 296                 | 1.04        | 0.03      |                |
|  | ≥3 000 000                                   | 148                 | 0.93        | 0.04      |                |

**Table 9:** Association of health status characteristics and plaque index adjusting for the clustering effects of the schools

| <i>Health status characteristics of child</i>         |                | <b>Plaque index</b> |             |           |                |
|---|----------------|---------------------|-------------|-----------|----------------|
|   |                | <b>N</b>            | <b>Mean</b> | <b>SD</b> | <b>P-value</b> |
| <b>Presence of chronic disease(s)</b>                 | No             | 730                 | 1.04        | 0.02      | 0.187          |
|   | Yes            | 60                  | 1.12        | 0.05      |                |
| <b>Breathing mode during childhood</b>                | Nose           | 280                 | 1.08        | 0.03      | 0.215          |
|   | Mouth          | 67                  | 1.05        | 0.04      |                |
|   | Both           | 291                 | 1.02        | 0.03      |                |
| <b>Feeding mode (1<sup>st</sup> 6 months of life)</b> | Breast feeding | 291                 | 1.04        | 0.02      | 0.976          |
|   | Bottle feeding | 187                 | 1.04        | 0.03      |                |
|   | Both           | 306                 | 1.03        | 0.03      |                |
| <b>Oral health perception</b>                         | Bad            | 92                  | 1.19        | 0.07      | 0.007          |
|   | Average        | 429                 | 1.07        | 0.02      |                |
|   | Good           | 281                 | 0.95        | 0.03      |                |

**Table 10:** Association of oral hygiene characteristics and plaque index adjusting for the clustering effect of the schools

| <i>Oral Hygiene characteristics</i> |               | <b>Plaque index</b> |             |           |                |
|-------------------------------------|---------------|---------------------|-------------|-----------|----------------|
|                                     |               | <b>N</b>            | <b>Mean</b> | <b>SD</b> | <b>P-value</b> |
| <b>Fluoride intake</b>              | No            | 576                 | 1.06        | 0.02      | 0.071          |
|                                     | Yes           | 154                 | 0.95        | 0.03      |                |
| <b>Frequency of</b>                 | Rarely/ never | 57                  | 1.306       | 0.079     | 0.000          |

|                                     |              |     |       |       |       |
|-------------------------------------|--------------|-----|-------|-------|-------|
| <b>teeth brushing</b>               | ≤Once/day    | 378 | 1.073 | 0.025 |       |
|                                     | 2-3times/day | 372 | 0.984 | 0.026 |       |
| <b>Previous dental consultation</b> | No           | 57  | 1.01  | 0.05  | 0.540 |
|                                     | Yes          | 752 | 1.05  | 0.02  |       |

**Table 11:** Association of nutritional habits characteristics and plaque index adjusting for the clustering effect of the schools

| <i>Nutritional habits characteristics</i> |                     | <b>Plaque index</b> |             |           |                |
|---|---------------------|---------------------|-------------|-----------|----------------|
|   |                     | <b>N</b>            | <b>Mean</b> | <b>SD</b> | <b>P-value</b> |
| <b>Eating behavior</b>                    | 3meals/day          | 264                 | 1.02        | 0.03      | 0.218          |
|   | >3 meals/day        | 391                 | 1.07        | 0.03      |                |
|   | <3 meals/day        | 85                  | 1.07        | 0.04      |                |
| <b>Frequency of fast food consumption</b> | Occasionally/ never | 213                 | 0.98        | 0.03      | 0.009          |
|   | 1-3 times/week      | 399                 | 1.08        | 0.02      |                |
|   | 4-7 times/week      | 186                 | 1.04        | 0.02      |                |
| <b>Frequency of soda intake</b>           | Occasionally/ never | 218                 | 0.93        | 0.03      | 0.001          |
|   | 1-3 times/week      | 196                 | 1.15        | 0.04      |                |
|   | 4-7 times/week      | 378                 | 1.05        | 0.02      |                |
| <b>Frequency of sweets consumption</b>    | Occasionally/ never | 64                  | 0.95        | 0.05      | 0.118          |
|   | 1-3 times/week      | 318                 | 1.03        | 0.02      |                |
|   | 4-7 times/week      | 415                 | 1.08        | 0.02      |                |

**Table 12:** Association of smoking exposure and plaque index adjusting for the clustering effect of the schools

| <i>Smoking exposure</i>                            |               | <b>Plaque index</b> |             |           | <b>P-value</b> |
|--|---------------|---------------------|-------------|-----------|----------------|
|  |               | <b>N</b>            | <b>Mean</b> | <b>SD</b> |                |
| <b>Maternal cigarette smoking during pregnancy</b> | No            | 688                 | 1.09        | 0.05      | 0.326          |
|  | Yes           | 90                  | 1.04        | 0.02      |                |
| <b>Adolescent smoking status</b>                   | Never         | 549                 | 1.03        | 0.02      | 0.263          |
|  | Ever smoked   | 234                 | 1.08        | 0.04      |                |
| <b>Parental smoking status</b>                     | No one smokes | 215                 | 1.05        | 0.03      | 0.554          |
|  | Father smokes | 198                 | 1.02        | 0.04      |                |
|  | Mother smokes | 103                 | 1.05        | 0.06      |                |
|  | Both smoke    | 257                 | 1.07        | 0.03      |                |

**Table 13:** Percent distribution of students aged 12-18 by DMFT index, plaque index and Orthodontic treatment adjusting for the clustering effect of the schools

| <i>Dental Health</i> | <b>Orthodontic treatment</b> |                    |                      | <b>P-value</b> |
|----------------------|------------------------------|--------------------|----------------------|----------------|
|                      | <b>Never</b>                 | <b>Current</b>     | <b>Past</b>          |                |
|                      | <b>n=652, (78.83%)</b>       | <b>n= 91 (11%)</b> | <b>n=84 (10.15%)</b> |                |
|                      | <b>Mean + SD</b>             | <b>Mean + SD</b>   | <b>Mean + SD</b>     |                |
| <b>D</b>             | 3.59±0.12                    | 1.94±0.23          | 2.95±0.28            | 0.000          |
| <b>M</b>             | 0.10±0.01                    | 0.02±0.01          | 0.02±0.01            | 0.032          |
| <b>F</b>             | 1.21±0.07                    | 2.47±0.22          | 2.82±0.32            | 0.001          |
| <b>DMFT</b>          | 4.87 ± 0.13                  | 4.43±0.30          | 5.72±0.42            | 0.018          |
| <b>Average PI</b>    | 1.03±0.02                    | 1.19±0.05          | 0.99±0.05            | 0.004          |



**Table 14:** Percent distribution of students aged 12-18 by socio-demographic characteristics and type of school adjusting for the clustering effect of the schools

| Socio-demographic characteristics |   | School type              |                           | P-value |
|-----------------------------------|---|--------------------------|---------------------------|---------|
|                                   |   | Public n=393<br>(47.34%) | Private n=437<br>(52.65%) |         |
| Age (mean + SD)                   |   | 15.3 ±0.078              | 14.10±0.068               | 0.009   |
| Gender                            | Males                                     | 142 (36.13%)             | 213 (48.74%)              | 0.504   |
|                                   | Females                                   | 251 (63.87%)             | 224 (51.26%)              |         |
| Number of children in the family  | ≤ 3                                       | 226 (59.79%)             | 317 (78.47%)              | 0.000   |
|                                   | >3  | 152 (40.21%)             | 87 (21.53%)               |         |
| Family income (LL)                | ≤ 999 999                                 | 205 (59.42%)             | 60 (16.44%)               | 0.000   |
|                                   | 1 000 000-3 000 000                       | 133 (38.55%)             | 164 (44.93%)              |         |
|                                   | >3 000 000                                | 7 (2.03%)                | 141 (38.63%)              |         |
| Education of informant            | Low ( <i>Illiterate → Elementary</i> )    | 51 (13.49%)              | 8 (1.92%)                 | 0.000   |
|                                   | Average ( <i>Secondary-Intermediate</i> ) | 261 (69.05%)             | 139 (33.41%)              |         |
|                                   | High ( <i>College / university</i> )      | 66 (17.46%)              | 269 (64.66%)              |         |

**Table 15:** Percent distribution of students aged 12-18 by health status characteristics and type of school adjusting for the clustering effect of the schools

| <i>Health status characteristics of the adolescent</i> |                | <b>School type</b>               |          |                                   |          | <b>P-value</b> |
|--|----------------|----------------------------------|----------|-----------------------------------|----------|----------------|
|  |                | <b>Public n=393<br/>(47.34%)</b> |          | <b>Private n=437<br/>(52.65%)</b> |          |                |
|  |                | <b>Frequency</b>                 | <b>%</b> | <b>Frequency</b>                  | <b>%</b> |                |
| <b>Presence of chronic disease(s)</b>                  | No             | 347                              | 92.29    | 386                               | 92.57    | 0.922          |
|  | Yes            | 29                               | 7.71     | 31                                | 7.43     |                |
| <b>Breathing mode during childhood</b>                 | Nose           | 125                              | 42.66    | 156                               | 44.96    | 0.880          |
|  | Mouth          | 31                               | 10.58    | 36                                | 10.37    |                |
|  | Both           | 137                              | 46.76    | 155                               | 44.67    |                |
| <b>Feeding mode (1<sup>st</sup> 6 months)</b>          | Breast feeding | 173                              | 46.76    | 119                               | 28.54    | 0.000          |
|  | Bottle feeding | 81                               | 21.89    | 107                               | 25.66    |                |
|  | Both           | 116                              | 31.35    | 191                               | 45.8     |                |
| <b>Oral health perception</b>                          | Bad            | 58                               | 15.22    | 35                                | 8.25     | 0.000          |
|  | Average        | 217                              | 56.96    | 212                               | 50.00    |                |
|  | Good           | 106                              | 27.82    | 177                               | 41.75    |                |

**Table 16:** Percent distribution of students aged 12-18 by oral hygiene characteristics and type of school adjusting for the clustering effect of the schools

| <i>Oral Hygiene characteristics</i> |               | School type              |       |                           |       | P-value |
|-------------------------------------|---------------|--------------------------|-------|---------------------------|-------|---------|
|                                     |               | Public n=393<br>(47.34%) |       | Private n=437<br>(52.65%) |       |         |
|                                     |               | Frequency                | %     | Frequency                 | %     |         |
| <b>Frequency of teeth brushing</b>  | Rarely/ never | 43                       | 10.91 | 16                        | 3.63  | 0.000   |
|                                     | ≤Once/ day    | 183                      | 46.45 | 200                       | 45.35 |         |
|                                     | 2-3times/day  | 168                      | 42.64 | 225                       | 51.02 |         |
| <b>Fluoride intake</b>              | No            | 287                      | 85.93 | 291                       | 72.93 | 0.033   |
|                                     | Yes           | 47                       | 14.07 | 108                       | 27.07 |         |

**Table 17:** Percent distribution of students aged 12-18 by nutritional habits characteristics and type of school adjusting for the clustering effect of the schools

| <i>Nutritional habits characteristics</i> |                    | School type              |       |                           |       | P-value |
|---|--------------------|--------------------------|-------|---------------------------|-------|---------|
|   |                    | Public n=393<br>(47.34%) |       | Private n=437<br>(52.65%) |       |         |
|   |                    | Frequency                | %     | Frequency                 | %     |         |
| <b>Eating behavior</b>                    | 3 meals/day        | 124                      | 34.16 | 141                       | 37.2  | 0.313   |
|   | >3 meals/ day      | 195                      | 53.72 | 196                       | 51.72 |         |
|   | <3meals/day        | 44                       | 12.12 | 42                        | 11.08 |         |
| <b>Frequency of fast food consumption</b> | Occasionally/never | 91                       | 24.07 | 122                       | 28.84 | 0.115   |
|   | 1-3 times/week     | 190                      | 50.26 | 212                       | 50.12 |         |
|   | 4 to 7 times/week  | 97                       | 25.66 | 89                        | 21.04 |         |
| <b>Frequency</b>                          | Occasionally/never | 66                       | 17.41 | 152                       | 36.54 | 0.000   |

|  |                    |     |       |     |       |       |
|--|--------------------|-----|-------|-----|-------|-------|
| <b>of soda Intake</b>                  | 1-3 times/week     | 108 | 28.5  | 89  | 21.39 |       |
|  | 4-7 times/week     | 205 | 54.09 | 175 | 42.07 |       |
| <b>Frequency of sweets consumption</b> | Occasionally/never | 28  | 7.33  | 36  | 8.61  | 0.721 |
|  | 1-3 times/week     | 150 | 39.27 | 169 | 40.43 |       |
|  | 4-7 times/week     | 204 | 53.40 | 213 | 50.96 |       |

**Table 18:** Percent distribution of students aged 12-18 by smoking exposure and type of school adjusting for the clustering effect of the schools

| <i>Smoking exposure</i>                            |               | School type              |       |                           |       | P-value |
|--|---------------|--------------------------|-------|---------------------------|-------|---------|
|  |               | Public n=393<br>(47.34%) |       | Private n=437<br>(52.65%) |       |         |
|  |               | Frequency                | %     | Frequency                 | %     |         |
| <b>Maternal cigarette smoking during pregnancy</b> | No            | 302                      | 82.51 | 388                       | 93.49 | 0.000   |
|  | Yes           | 64                       | 17.49 | 27                        | 6.51  |         |
| <b>Adolescent smoking status</b>                   | None          | 224                      | 59.73 | 327                       | 79.56 | 0.000   |
|  | Cigarettes    | 14                       | 3.73  | 16                        | 3.89  |         |
|  | Narguile      | 88                       | 23.47 | 39                        | 9.49  |         |
|  | Both          | 49                       | 13.07 | 29                        | 7.06  |         |
| <b>Parental smoking status</b>                     | No one smokes | 71                       | 19.14 | 144                       | 35.56 | 0.001   |
|  | Father smokes | 106                      | 28.57 | 93                        | 22.96 |         |
|  | Mother smokes | 59                       | 15.90 | 44                        | 10.86 |         |
|  | Both smoke    | 135                      | 36.39 | 124                       | 30.62 |         |

**Table 19:** Multiple regression analysis showing associations between DMFT and other variables adjusting for clustering effect of the schools

| <b>DMFT</b>   |                                   | <b>Coef.</b> | <b>Std. Err.</b> | <b>P-value</b> | <b>95% CI</b>    |
|---|-----------------------------------|--------------|------------------|----------------|------------------|
| <b>Age of adolescent</b>  |                                   | 0.443        | 0.097            | 0.000*         | [0.235; 0.652]   |
| <b>Gender (Male)</b>  | Female                            | 0.597        | 0.271            | 0.045*         | [0.015; 1.178]   |
| <b>Number of children in family (<math>\leq 3</math>)</b>                             | > 3                               | 0.963        | 0.329            | 0.011*         | [0.257; 1.670]   |
| <b>Educational level of the parents</b><br>(Low: illiterate $\rightarrow$ elementary) | Average (secondary/ intermediate) | -0.315       | 0.300            | 0.310          | [-0.959; 0.327]  |
|   | High (University/ college)        | -0.687       | 0.287            | 0.031*         | [-1.304; -0.071] |
| <b>Monthly income</b><br>( $\leq 3\ 000\ 000$ )                                       | >3 000 000                        | -1.405       | 0.423            | 0.005*         | [-2.313; -0.496] |
| <b>Orthodontic history</b><br>(Never)   | Current                           | 0.363        | 0.249            | 0.167          | [-0.170; 0.898]  |
|   | Past                              | 1.059        | 0.325            | 0.006*         | [0.360; 1.758]   |
| <b>Oral health perception</b><br>(Bad)  | Average                           | -1.359       | 0.239            | 0.057          | [-2.763; 0.043]  |
|   | Good                              | -2.153       | 0.669            | 0.006*         | [-3.590; -0.717] |
| <b>Frequency of sweets intake</b><br>(Occasionally/ never)                            | 1-3 times/ week                   | -0.351       | 0.239            | 0.164          | [-0.865; 0.162]  |
|   | 4-7 times/ week                   | -0.958       | 0.482            | 0.067          | [-1.992; 0.074]  |
| <b>Maternal</b>   | Yes                               | -0.212       | 0.272            | 0.449          | [-0.797; -       |

|                     |  |       |       |       |                    |
|---------------------|--|-------|-------|-------|--------------------|
| <i>smoking (No)</i> |  |       |       |       | 0.372              |
|                     |  |       |       |       |                    |
| <b>_Cons</b>        |  | 0.547 | 2.060 | 0.794 | [-3.871;<br>4.966] |

*Prob > F = 0.000/ R-squared = 0.240 (Between brackets are the reference category for categorical variables)*

**Table 20:** Multiple regression analysis showing associations between plaque index and other variables adjusting for clustering effect of the schools

| <b>Plaque index</b>                                |                 | <b>Coef.</b> | <b>Std. Err.</b> | <b>P-value</b> | <b>95% CI</b>    |
|--|-----------------|--------------|------------------|----------------|------------------|
| <b>Gender (Male)</b>                               | Female          | -0.080       | 0.037            | 0.050*         | [-0.161; -0.000] |
| <b>Orthodontic history (Never)</b>                 | Current         | 0.251        | 0.054            | 0.000*         | [0.135; 0.368]   |
|  | Past            | 0.004        | 0.041            | 0.920          | [-0.083; 0.092]  |
| <b>Oral health perception (Bad)</b>                | Average         | -0.113       | 0.074            | 0.149          | [-0.272; 0.045]  |
|  | Good            | -0.210       | 0.082            | 0.023*         | [-0.386; -0.033] |
| <b>Fluoride history (No)</b>                       | Yes             | -0.079       | 0.038            | 0.056          | [-0.162; 0.002]  |
| <b>Frequency of teeth brushing (Rarely/ Never)</b> | ≤ Once/ day     | -0.272       | 0.064            | 0.001*         | [-0.409; -0.134] |
|  | 2-3 times/ day  | -0.335       | 0.054            | 0.000*         | [-0.451; -0.219] |
| <b>Frequency of fast food</b>                      | 1-3 times/ week | 0.053        | 0.054            | 0.338          | [-0.062; 0.169]  |

|  |                 |        |       |        |                      |
|--|-----------------|--------|-------|--------|----------------------|
| <b>consumption</b><br>(Occasionally/<br>never)                           | 4-7 times/ week | -0.018 | 0.026 | 0.510  | [-0.075;<br>0.039]   |
| <b>Frequency of<br/>soda<br/>consumption</b><br>(Occasionally/<br>never) | 1-3 times/ week | 0.114  | 0.034 | 0.005* | [0.041;<br>0.187]    |
|  | 4-7 times/ week | -0.075 | 0.028 | 0.019* | [-0.137; -<br>0.014] |
|  |                 |        |       |        |                      |
| <b>_Cons</b>   |                 | 1.549  | 0.140 | 0.000  | [1.249;<br>1.850]    |

*Prob > F = 0.000/ R-squared = 0.107 (Between brackets are the reference category for categorical variables)*

## Appendices



## Appendix I



3. إجابة أبناءكم الطوعية عن استمارة خاصة بهم تستفسر عن صحة فمهم وأسنانهم بما يتعلق بالعناية بنظافتها، بالإضافة الى الاستفار عن عاداتهم الغذائية ومعتقداتهم بما يخص أسنانهم.

- لن يأخذ الاستطلاع من وقتكم أكثر من 15 دقيقة ولستم مجبرين مجبرين بالإجابة عن جميع الأسئلة، حتى بعد توقيع القبول بالمشاركة.
- سوف يتم استدعاء إبنكم/إبنتكم من الصف من أجل إجراء الكشف على الأسنان. سوف يتم التنسيق مع إدارة المدرسة والمعلمين لتحديد الوقت المناسب لذلك، على أن لا يتعارض الفحص مع وقت الإمتحانات أو الحصص الدراسية الأساسية. إذا كان الولد بحاجة الى علاج معين لأسنانه (علاج لتسوس الأسنان أو تقويم الأسنان) سوف يتم إبلاغ الأهل عبر رسالة خطية تُرسل مع ولدهم.
- من إيجابيات مشاركة ابنكم/ابنتكم في هذه الدراسة إمكانية الإكتشاف المبكر لمشاكل صحة الفم بما فيها تسوس الأسنان وسوء الإطباق، ما يمكن المعالجة المبكرة.
- إن مشاركتكم طوعية. اختياركم عدم المشاركة لن ينتج عنه أي ضرر أو عقاب على ابنكم/ابنتكم، ولن يتم التعرض لأي من حقوق أو امتيازات ابنكم/ابنتكم كما ولن تتأثر علاقتكم بالمدرسة أو بالجامعة الأميركية في بيروت.

بعد قراءة وفهم تفاصيل الدراسة، نرجو منكم وضع علامة (صح) في المربع والتوقيع أدناه عند الجزء أو الأجزاء الذي/التي توافقون المشاركة به/بها. نذكركم بأن كل جزء بحاجة الى توقيع منفصل، وأنه بإمكانكم الموافقة على جزء واحد أو اثنين أو جميع الأجزاء.

أوافق على تعبئة الاستمارة الملحقة بهذه الرسالة وبالتالي على استخدام المعلومات التي سوف اشارك بها في الدراسة

التاريخ

التوقيع

اسم الوالد/الوالدة أو الشاهد

أوافق على أن يتم الكشف على أسنان إبني/ إبنتي \_\_\_\_\_ من قبل أطباء الأسنان المذكورين أعلاه وذلك داخل الحرم المدرسي وبالتنسيق مع المدرسة

.....  
.....  
اسم الوالد/الوالدة أو الشاهد .....  
التوقيع .....  
التاريخ .....

أوافق على أن يجيب/ تجيب إبني/ إبنتي \_\_\_\_\_ على الاستمارة الخاصة بالطلاب والتي سوف تتوفر في المدرسة أثناء وجود أطباء الأسنان المختصين

.....  
.....  
اسم الوالد/الوالدة أو الشاهد .....  
التوقيع .....  
التاريخ .....

شكرا سلفا لمساهمتمكم

فريق البحث، يستطيع المساعدة في حال تعذر عليكم تعبئة الاستمارة.

الرجاء الاتصال عند الحاجة ب:

• البروفيسور مونيك شعيا، قسم الوبائيات، كلية العلوم الصحية، الجامعة الاميركية في بيروت، خلوي: [mchaaya@aub.edu.lb](mailto:mchaaya@aub.edu.lb)، بريد الكتروني: 03-458143

- الدكتور كيتي بيطار، قسم تقويم الاسنان، الجامعة الاميركية في بيروت، خلوي: [kb30@aub.edu.lb](mailto:kb30@aub.edu.lb)، بريد الكتروني: 03-414082
- الدكتورة سوزانا المعالي، قسم تقويم الاسنان في الجامعة الاميركية في بيروت، خلوي: [sa152@aub.edu.lb](mailto:sa152@aub.edu.lb)، بريد الكتروني: 71-520428

للاتصال بفريق مستقل عن فريق البحث لأي استفسارات، مخاوف، شكاوى على البحث، استفسارات عن حقوقك وحقوق ابنك/ابنتك، للمزيد من المعلومات أو لمشاركة تجربتكم، الرجاء الإتصال بلجنة الأخلاقيات:

Institutional Review Board (IRB)

Tel: +961-1-3500000 Ext: 5445 or Ext: 5454; Email: [irb@aub.edu.lb](mailto:irb@aub.edu.lb)

الرقم المتسلسل: \_\_\_\_\_

القسم الأول: التعريف

اسم الولد \_\_\_\_\_

اسم المدرسة \_\_\_\_\_

الصف \_\_\_\_\_

عمر الولد في آخر عيد ميلاد \_\_\_\_\_

جنس الولد:

1. ذكر

2. أنثى

11. علاقتك بالولد:

1. الوالدة

2. الاب

3. الجدة

4. أخت

5. عمّة

6. علاقة اخرى، حدد:

SD1. عمر حضرتكم في آخر عيد ميلاد: [\_\_\_\_] سنة

SD2. جنس حضرتكم:

1. ذكر
2. انثى

SD3. الوضع العائلي:

1. متاهل متاهلة
2. مُطلق مُطلقة
3. أرمل أرملة

SD4. أعلى مستوى علمي:

1. أمي
2. كتابة/قراءة
3. ابتدائي
4. متوسط
5. ثانوي
6. كلية/جامعة

SD5. عدد الاولاد في العائلة:

- 1 (1)
- 2 (2)
- 3 (3)
- 4 (4)
- 5 (5) اكثر من 4 اولاد

SD6. ترتيب ولادة الولد المعني في هذه الاستمارة؟

1. البكر
2. الاخير\الاصغر
3. آخر (حدّد).....

**SD7. الدخل الاجمالي الشهري للعائلة :**

1. ما دون ال 500,000 ل.ل
2. بين 500,000 و 999,999 ل.ل
3. بين 1000,000 و 3000,000 ل.ل
4. ما فوق ال 3000,000 ل.ل

**SD8. هل تعمل حالياً؟**

- (1) نعم، دوام كامل
- (2) نعم، دوام جزئي
- (3) ابحت عن عمل
- (4) لا اعمل حالياً
- (5) متقاعد
- (6) ربة منزل

**SD9. في حال كنتم تعملون ، هل تؤمن لكم وظيفتكم دخلاً ثابتاً؟**

- (1) نعم
- (2) لا

**SD10. هل يكفي دخل العائلة لسد احتياجاتكم الأساسية من مأكّل، مشرب أو طبابة؟**

- (1) لا يكفي
- (2) بالكاد يكفي
- (3) يكفي
- (4) يكفي و يزيد

**SD11. هل لدى العائلة أي ضمان صحي؟**

- (1) نعم
- (2) لا (إذا كانت الإجابة لا، انتقل إلى القسم الثالث)

**SD12. في حال كانت الإجابة "نعم"، الرجاء إختيار الاحتمال المناسب:**

- (1) صندوق الضمان الوطني الاجتماعي
- (2) تعاونية موظفي الدولة
- (3) ضمان الجيش
- (4) ضمان قوى الامن الداخلي

- 5) ضمان وزارة الصحة  
6) ضمان خاص

SD13. هل يغطي الضمان الصحي علاج الاسنان؟

- 1) نعم  
2) كلا

القسم الثالث: الوضع الصحي للولد

H1. هل الولد المعني بهذه الأستمارة عانى أو لا يزال يعاني من أي مرض مزمن ؟

1. نعم  
2. كلاً (انتقل الى السؤال H3)

H2. إذا كانت الإجابة بنعم، من أي الأمراض المزمنة التالية عانى أو يعاني منها ؟

1. مرض السكري  
2. أمراض القلب  
3. مشاكل رئوية  
4. أمراض الجهاز الهضمي  
5. سرطان  
6. آخر (حدّد) \_\_\_\_\_

H3. هل يتنفس الولد المعني بهذه الأستمارة في الوقت الحالي من:

1. الأنف  
2. الفم  
3. من الأنف والفم  
4. لا اعرف

H4. في طفولته، هل كان يتنفس في الغالب من:

1. الأنف (انتقل الى السؤال H7)  
2. الفم  
3. من الأنف والفم  
4. لا اعرف (انتقل الى السؤال H7)



H5. إذا كان طفلك يتنفس من فمه، هل خضع للعلاج؟

1. نعم
2. كلاً (انتقل الى السؤال H7)

H6. إذا كانت الإجابة بنعم في أي عمر تم علاج ذلك؟ [\_\_\_\_] سنة

H7. هل كانت الوالدة تُدخن السجائر خلال فترة حملها بالولد المعني في هذه الاستمارة؟

1. نعم
2. كلاً (انتقل الى السؤال H10)
3. لا اعرف (انتقل الى السؤال H10)

H8. خلال أي فصل من الحمل كانت تدخن؟

1. الأول
2. الثاني
3. الثالث
4. كل فترة الحمل
5. لا اعرف

H9. تقريبا كم عدد السجائر يومياً كانت تدخن الأم خلال فترة الحمل؟

1. 1-10
2. 11-20
3. أكثر من 20 سيجارة
4. لا اعرف

H10. هل كانت الوالدة تُدخن الارغيلة خلال فترة حملها بالولد المعني في هذه الاستمارة؟

1. نعم

2. كلا
3. لا اعرف

القسم الرابع: عادات معينة لدى الولد

S1. هل كان الولد المعني بهذه الاستمارة يمص اصبعه، شفته، او اي شيء آخر خلال فترة الرضاعة أو الطفولة؟

1. نعم
2. كلا (انتقل الى القسم الخامس)
3. لا اعرف (انتقل الى القسم الخامس)

S2. إذا نعم، ماذا كان يمص ؟

1. ابهام الصبع
2. الشفة
3. اللهاية الخاصة بالأطفال
4. آخر، حدّد: \_\_\_\_\_

S3. في اي عمر بدأ بدأت هذه العادة ؟ [ ] سنة

S4. في اي عمر، اوقف\اوقفت هذه العادة؟

1. [ ] سنة
2. لم تتوقف هذه العادة بعد

S5. كم كانت مدة فترة ممارسة هذه العادة يوميا/ في اليوم الواحد؟

1. ساعة او اقل
2. أكثر من ساعة وأقل من 3 ساعات
3. أكثر 3 ساعات وأقل من 6 ساعات
4. ست ساعات وما فوق
5. لا أذكر

القسم الخامس: عادات إطعام الولد في الطفولة

F1. كيف تمّ اطعام الولد المعني في هذه الإستمارة خلال أول ستة اشهر من طفولته؟

1. رضاعة
2. القنينة (انتقل الى السؤال F3)
3. كلاهما
4. لا اعرف (انتقل الى القسم السادس)

F2. كم شهراً إستمرت فترة الرضاعة من الثدي ؟

1. أقل من شهرين
2. 2-4 اشهر
3. 3-6 أشهر
4. 4-12 شهر
5. 1-2 سنة
6. اكثر من سنتين
7. لا اتذكّر

F3. كم كانت مدة ارضاعه من القنينة؟

1. 1-5 اشهر
2. ما بين 6 أشهر و سنتين
3. اكثر من سنتين
4. لا اتذكّر

القسم السادس: نمط الاهتمام بصحة الفم الاسنان

OH1. كيف تقيم صحة الأسنان مقارنةً مع غيرها من المشاكل الصحية؟

- (1) نفس الأهمية
- (2) أقل أهمية
- (3) أكثر أهمية

OH2. ما هي الاسباب التي قد تدفعك لاصطحاب أولادكم لزيارة طبيب الأسنان؟

- (1) فحص الاسنان نعم كلا
- (2) تنظيف الاسنان نعم كلا
- (3) تسوس الاسنان نعم كلا
- (4) ألم حاد في الأسنان نعم كلا

- (5) مظهر الأسنان نعم كلا  
(6) حالات أخرى: \_\_\_\_\_

OH3. هل تعتقد ان حالة فم الولد المعني هي؟

1. ممتازة
2. جيّدة
3. عاديّة
4. سيّئة
5. سيّئة جدا

OH4. هل تعرّضت اسنان الولد لمادة الفلوريد من غير معجون الأسنان؟

1. نعم
2. كلا (انتقل ال سؤال OH6)

OH5. إذا نعم، كيف تمّ اخذ الفلوريد ؟

(يمكنكم اختيار أكثر من خيار)

1. بواسطة الماء
2. غسول الفمّ
3. إضافات غذائيّة\حبوب
4. خلال زيارات طبيب الاسنان

OH6. هل سبق أن عاين أخصائي تقويم أسنان الولد المعني في هذه الاستمارة ؟

1. نعم ، في عمر: \_\_\_\_\_ سنة (أول معاينة)
2. كلا

OH7. هل تعتقد ان الولد المعني في هذه الاستمارة بحاجة الى تقويم اسنان في الوقت الحالي؟

1. نعم، إنه بحاجة الآن الى تقويم أسنان
  2. كلا، هو حصل على علاج تقويم أسنان وبالتالي ليس بحاجة له
  3. كلا، هو ليس بحاجة الى علاج تقويم أسنان ولم يحصل عليه سابقا
  4. لا اعرف
- (انتقل ال سؤال OH8)  
(انتقل ال سؤال OH9)  
(انتقل ال القسم السابع)  
(انتقل ال القسم السابع)

OH8. لأيّة اسباب تعتقد أنه بحاجة لتقويم الأسنان ؟

1. أسنان متراكمة فوق بعضها البعض أو غير منتظمة
2. أسنان ناتئة (بارزة الي الخارج)
3. وضع غير طبيعي لأي من الفكين
4. آخر ، حدّد:

OH9. لأيّة اسباب حصل ابنك على علاج تقويم الأسنان ؟

1. اسنان متراكمة فوق بعضها البعض أو غير منتظمة
2. اسنان ناتئة (بارزة الي الخارج)
3. وضع غير طبيعي لأي من الفكين
4. آخر ، حدّد:

#### القسم السابع:الخدمات الصحية لطب الأسنان

DS1. هل سبق أن عاين طبيب اسنان الولد المعني في هذه الاستمارة ؟

1. نعم
2. كلا (انتقل الى سؤال DS6)

DS2. في حال كانت الإجابة "نعم" ، كم مرة أخذتم ولدكم لزيارة طبيب الأسنان خلال الأشهر ال-١٢ الماضية ؟

1. مرة واحدة
2. أكثر من مرة
3. لا اذكر

DS3. متى كانت آخر مرّة خلال الأشهر ال-١٢ الماضية ؟

1. أقل من 3 اشهر
2. 4 الى 6 اشهر
3. اكثر من 6 اشهر
4. لا أذكر

DS4. آخر مرة عاين طبيب اسنان الولد كانت لأيّ سبب من الاسباب التالية؟

1. كشف روتيني نعم كلا
2. تنظيف نعم كلا
3. تسوّس نعم كلا
4. ألم حاد نعم كلا
5. شكل الاسنان نعم كلا
6. آخر, حدّد:

**DS5. الرجاء إختيار الخدمات التي قدمت لولدكم في زيارته الأخيرة لطبيب الأسنان وتحديد مبلغ المال الذي قمتم بدفعه مقابل هذه الخدمات**

| المبلغ     | لا | نعم |   |
|------------|----|-----|---|
| ل.ل. _____ |    |     | 1) فحص روتيني (فحص عادي)  |
| ل.ل. _____ |    |     | 2) رعاية وقائية:<br>* ساد الشقوق sealant، حافظ المسافة، تطبيق الفلورايد |
| ل.ل. _____ |    |     | 3) معالجة سناً واحداً:<br>قلع ضرس، حشوة، حشوة قناة او قطع عصب، تليبيسة  |
| ل.ل. _____ |    |     | 4) تقويم الأسنان  |

\* ساد الشقوق (sealant): هي مادة بلاستيكية تلتصق من قبل طبيب أسنان الأطفال على الأسنان لمنع تجمع بقايا الطعام وبالتالي الوقاية من التسوس.

\* تطبيق الفلورايد: يقوم طبيب الاسنان بتطبيق مادة تحتوي على الفلور على اسنان الطفل للوقاية من التسوس.

\* حافظ المساحة: يقوم طبيب الأسنان بوضع جهاز داخل فم الولد للمحافظة على مساحة سنٍ مقلوع أو مفقود

**DS6. في حال عدم إصطحاب الولد المعني لزيارة طبيب الأسنان في الأشهر الـ ١٢ الأخيرة، ما هي الأسباب؟ يمكنكم إختيار أكثر من إ احتمال واحد:**

- |     |     |   |
|-----|-----|---|
| كلا | نعم | 1. لم يكن بحاجة إلى طبيب أسنان                          |
| كلا | نعم | 2. غلاء تكاليف علاج الأسنان                             |
| كلا | نعم | 3. عدم معرفتكم بوجود عيادة أو مركز أسنان في منطقة سكنكم |
| كلا | نعم | 4. صعوبة وصولكم إلى عيادة أو مركز أسنان                 |
|     |     | 5. أسباب أخرى _____                                     |

**DS7. هل تعلم أن هناك مراكز/عيادات أسنان تقدم خدمات أقل كلفة من عيادات الأسنان الخاصة؟**

- |                                 |
|---------------------------------|
| 1. نعم                          |
| 2. كلا (انتقل الى القسم الثامن) |

**DS8. إذا كانت الإجابة نعم، حدد أسماء المراكز التي تعرفها:** -----

**DS9. في حال كانت الإجابة نعم، كيف علمتم بوجود هذه المراكز؟**

- |                                       |
|---------------------------------------|
| 1. الإعلام                            |
| 2. حملات توعية قامت بها وزارة الصحة   |
| 3. حملات توعية قامت بها المراكز نفسها |
| 4. مدرسة أولادكم                      |
| 5. صديق أو قريب                       |
| 6. غيره: _____                        |

**DS10. في حال كنتم على علم بهذه المراكز، هل تأخذون أولادكم لمعالجة أسنانهم فيها؟**

- |                                |
|--------------------------------|
| 1. نعم (انتقل إلى السؤال DS12) |
|--------------------------------|

2. كلا

DS11. إذا كنتم على علم بوجود هذه المراكز، لكنكم لا تأخذون أولادكم لمعالجة أسنانهم فيها، ما هي الأسباب التي تمنعكم؟

1. تكاليف العلاج مرتفعة (لا يستطيع تحمل الكلفة) كلا نعم
  2. عدم تصنيف صحة الفم كأولوية كلا نعم
  3. لا تؤمن هذه المراكز نوعية علاج جيد كلا نعم
  4. بعد مسافة هذه المراكز عن منزلكم كلا نعم
  5. أسباب أخرى: \_\_\_\_\_
- (انتقل الى القسم الثامن)

DS12. إذا كنتم تأخذون أولادكم لمعالجة أسنانهم في هذه المراكز، منذ متى تفعلون ذلك؟

1. اقل من سنة
2. اكثر من سنة

DS13. هل كنتم تتلقون من هذه المراكز اتصالاً للمراجعة؟

1. نعم
2. كلا

### القسم الثامن: تكاليف علاج الأسنان

DI1. إذا كان لديكم الخيار لأخذ أولادكم إلى احدى الإحتمالات الثلاث التالية، التي تؤمن الخدمات نفسها لمعالجة الأسنان ولكن بتكاليف مختلفة، أي إحتمال تختارون؟ (الرجاء رسم إشارة ✓ في الخانة الفارغة تحت الاحتمال الذي يناسبكم لكل من العلاجات الآتية)

(1) معاينة واحدة

|                 |                             |                          |
|-----------------|-----------------------------|--------------------------|
| مستوصف - مجاناً | مركز علاج جامعي - ٥,٠٠٠ ل.ل | عيادات خاصة - ٣٠,٠٠٠ ل.ل |
|                 |                             |                          |

(2) جلسة تنظيف أسنان واحدة

|                     |                              |                          |
|---------------------|------------------------------|--------------------------|
| مستوصف - ١٠,٠٠٠ ل.ل | مركز علاج جامعي - ١٠,٠٠٠ ل.ل | عيادات خاصة - ٦٥,٠٠٠ ل.ل |
|                     |                              |                          |

(3) حشوة مركبة واحدة

|                     |                              |                          |
|---------------------|------------------------------|--------------------------|
| مستوصف - ١٠,٠٠٠ ل.ل | مركز علاج جامعي - ١٥,٠٠٠ ل.ل | عيادات خاصة - ٦٠,٠٠٠ ل.ل |
|                     |                              |                          |

|  |  |  |
|--|--|--|
|  |  |  |
|--|--|--|

(4) قلع سن واحد

|                    |                              |                          |
|--------------------|------------------------------|--------------------------|
| مستوصف - ٧,٠٠٠ ل.ل | مركز علاج جامعي - ١٥,٠٠٠ ل.ل | عيادات خاصة - ٤٥,٠٠٠ ل.ل |
|                    |                              |                          |

(5) معالجة قناة الجذر الواحدة (قطع عصب)

|                     |                              |                          |
|---------------------|------------------------------|--------------------------|
| مستوصف - ١٥,٠٠٠ ل.ل | مركز علاج جامعي - ٢٥,٠٠٠ ل.ل | عيادات خاصة - ٧٥,٠٠٠ ل.ل |
|                     |                              |                          |

(6) ساد شقوق على ضرس واحد\* (Sealant)

|                              |                          |
|------------------------------|--------------------------|
| مركز علاج جامعي - ١٢,٠٠٠ ل.ل | عيادات خاصة - ٣٠,٠٠٠ ل.ل |
|                              |                          |

(7) جلسة تطبيق فلورايد واحدة\*

|                              |                          |
|------------------------------|--------------------------|
| مركز علاج جامعي - ١٠,٠٠٠ ل.ل | عيادات خاصة - ٤٥,٠٠٠ ل.ل |
|                              |                          |

(8) حافظ المساحة \*

|                               |                           |
|-------------------------------|---------------------------|
| مركز علاج جامعي - ١٥٠,٠٠٠ ل.ل | عيادات خاصة - ٢٢٥,٠٠٠ ل.ل |
|                               |                           |

(9) علاج تقويم الأسنان\*

|                                 |                             |
|---------------------------------|-----------------------------|
| مركز علاج جامعي - ٢,٢٥٠,٠٠٠ ل.ل | عيادات خاصة - ٣,٣٧٥,٠٠٠ ل.ل |
|                                 |                             |

\* الخدمات التالية هي خدمات غير متوفرة في المستوصفات: تطبيق ساد شقوق، تطبيق الفلورايد، حافظ المساحة، علاج تقويم الأسنان

D12. علما ان ارتفاع أقساط ضمان الأسنان يوفر تغطية إضافية لإجراءات طب الأسنان، أي قسط من الأقساط السنوية

التالية (الرسم السنوي المدفوع لشركة الضمان) هو ضمن امكانياتكم ؟

(1) \$١٠٠

(2) \$٢٠٠

(3) \$٣٠٠

(4) \$٤٠٠



- (5) \$٥٠٠  
 (6) اكثر من \$٥٠٠  
 (7) لا استطيع تحمل أي قسط من الأقساط السابقة

**D13.** في ما يلي، مشاريع مختلفة وضعتها شركة ضمان صحي لتغطية علاج أسنان ولدكم. الرجاء إختيار المشروع الذي يناسبكم وذلك بوضع علامة ✓ في المربع الفارغ.

المشروع رقم ١: التغطية الشاملة - مبلغ لا يقل عن \$٥٠٠ سنويا

- تغطية ١٠٠٪ لجميع إجراءات طب الأسنان (الوقائية والإصلاحية)
- تقويم الاسنان: تقوم شركة الضمان بدفع مبلغ يتراوح بين \$١٠٠٠ و \$١٥٠٠ (وذلك لمرة واحدة فحسب)

المشروع رقم ٢: تغطية الأقساط - مبلغ لا يقل عن \$٣٠٠ سنويا

- تغطية ١٠٠٪ للإجراءات الأسنان الوقائية
- المشاركة في دفع تكاليف الإجراءات الإصلاحية للأسنان\*
- تقويم الاسنان: تقوم شركة الضمان بدفع مبلغ يتراوح بين \$٥٠٠ و \$١٠٠٠ (وذلك لمرة واحدة فحسب)

المشروع رقم ٣: تغطية التكاليف الأساسية - مبلغ لا يقل عن \$١٥٠ سنويا

- تغطية ١٠٠٪ للإجراءات الوقائية للأسنان
- المشاركة في دفع تكاليف الإجراءات الإصلاحية للأسنان\*

\*المشاركة في الدفع يعني ان شركة التأمين لا تغطي ١٠٠% لتكاليف بعض الاجراءات ويتوجب عليكم دفع الفرق إلى طبيب الأسنان

لا استطيع تحمل تكلفة أي من المشاريع السابقة

**D14.** في حال كان لديكم ضمان يغطي تكاليف طب الاسنان، هل لديكم مشكلة في اختيار طبيب أسنان من قائمة أطباء الأسنان المتعاقدين مع شركة التأمين، والتي قد لا تشمل طبيب اسنانكم؟

1. نعم
2. كلا

**جزيل الشكر لمشاركتكم**

## Appendix II

الرقم المتسلسل: \_\_\_\_\_

تقييم صحة الفم في المدارس التكميلية والثانوية في لبنان: مقارنة بين المدارس العامة والخاصة

الجامعة الامريكّية في بيروت

الاسئلة الخاصة بالطالب المشارك

القسم الأول: التعريف

الاسم \_\_\_\_\_  
اسم المدرسة \_\_\_\_\_  
الصف \_\_\_\_\_

[ ] سنة

SD1. العمر في آخر عيد ميلاد

SD2. الجنس

3. ذكر

4. انثى

القسم الثاني: نمط الاهتمام بصحة الفم و الاسنان

1. كم مرة تنظف أسنانك في اليوم؟

1. مرّة يوميًا

2. 2- 3 مرّات يوميًا

3. أقلّ من مرّة

4. نادراً

5. ابدا

2. ما هي المواد المستعملة لتنظيف الاسنان؟

(يمكنك اختيار أكثر من خيار)

1. معجون اسنان

2. الخيط

3. غسول فم

4. لا شيء

5. آخر، حدّد:

3. هل سبق أن فحصك اي طبيب اسنان ؟

3. نعم

4. كلا (انتقل الى القسم الثالث)

4. متى كانت آخر مرّة؟

1. شهر أو أقل
2. 1 الى 3 اشهر
3. 4 الى 6 اشهر
4. اكثر من 6 اشهر

5. آخر مرة عاينك طبيب اسنان كانت لأي سبب من الاسباب التالية؟

7. كشف روتيني نعم كلا
8. تنظيف نعم كلا
9. تسوّس نعم كلا
10. ألم حاد نعم كلا
11. مشكلة في شكل الاسنان نعم كلا
12. آخر, حدد: \_\_\_\_\_

القسم الثالث: صحة الفم والحياة العامة

1. هل تعتقد ان حالة فمك الصحيّة هي.....؟

6. ممتازة
7. جيّدة
8. عاديّة
9. سيّئة
10. سيّئة جدا

2. خلال الأشهر الثلاثة الماضية .... هل عانيت من أي من الأعراض الآتية بسبب أسنانك/ فمك:

| (0) أبداً | (1) مرة أو مرتين | (2) بعض الأحيان | (3) غالباً/ كثيراً | (4) كل يوم/ أو تقريباً كل يوم |  |
|-----------|------------------|-----------------|--------------------|-------------------------------|--|
|           |                  |                 |                    |                               | ألم في أسنانك، أو شفتيك، أو فكك، أو فمك؟ |
|           |                  |                 |                    |                               | نزيف باللثة؟                             |
|           |                  |                 |                    |                               | تقرحات في فمك؟                           |

|  |  |  |  |  |   |
|--|--|--|--|--|---|
|  |  |  |  |  | (حمو أو تفرح مؤلم يظهر في الفم وذلك في الشفتين واللسان وعلى جدار الخدين من الداخل، وأحياناً سقف الحلق واللثة) |
|  |  |  |  |  | رائحة نفس غير مستحبة (كريهة)؟   |

| (0) أبداً | (1) مرة أو مرتين | (2) بعض الأحيان | (3) غالباً/ كثيراً | (4) كل يوم/ أو تقريباً كل يوم |   |
|-----------|------------------|-----------------|--------------------|-------------------------------|---|
|           |                  |                 |                    |                               | طعام عالق داخل أسنانك أو بينها؟                                 |
|           |                  |                 |                    |                               | طعام عالق بأعلى فمك؟  |
|           |                  |                 |                    |                               | تنفست من خلال فمك؟  |
|           |                  |                 |                    |                               | استغرقت وقتاً أطول من الآخرين لتناول وجبتك؟                     |
|           |                  |                 |                    |                               | واجهت صعوبات في النوم؟  |
|           |                  |                 |                    |                               | صعوبة في عض أو مضغ أطعمة مثل التفاح، عرنوس الذرة، أو قطع اللحم؟ |
|           |                  |                 |                    |                               | صعوبة في فتح الفم على سعته؟                                     |
|           |                  |                 |                    |                               | صعوبة في نطق أي كلمة؟   |
|           |                  |                 |                    |                               | صعوبة في تناول الأطعمة التي تحبها؟                              |
|           |                  |                 |                    |                               | صعوبة في الشرب بواسطة المصاصة (Chalumeau)؟                      |
|           |                  |                 |                    |                               | صعوبة شرب أو تناول الأطعمة الساخنة أو الباردة؟                  |
|           |                  |                 |                    |                               | سرعة الانفعال أو الإحباط؟                                       |
|           |                  |                 |                    |                               | عدم الثقة في النفس؟   |
|           |                  |                 |                    |                               | الخجل أو الإحراج؟   |
|           |                  |                 |                    |                               | القلق من رأي الآخرين حيال أسنانك؟                               |
|           |                  |                 |                    |                               | القلق بأنك لست جيد المظهر أو مقبول الشكل كالآخرين؟              |
|           |                  |                 |                    |                               | الإنزعاج؟   |
|           |                  |                 |                    |                               | التوتر أو الخوف؟  |

|  |  |  |  |  |                                       |
|--|--|--|--|--|---------------------------------------|
|  |  |  |  |  | القلق بأنك لست بصحة جيدة<br>كالآخرين؟ |
|  |  |  |  |  | القلق بأنك مختلف عن كالأخرين؟         |

| (0) أبداً | (1) مرة أو<br>مرتين | (2) بعض<br>الأحيان | (3) غالباً/ كثيراً | (4) كل يوم/ أو تقريباً<br>كل يوم |  |
|-----------|---------------------|--------------------|--------------------|----------------------------------|--|
|           |                     |                    |                    |                                  | التغيب عن المدرسة بسبب ألم، أو<br>موعد، أو عملية جراحية؟   |
|           |                     |                    |                    |                                  | أي صعوبة في الانتباه في المدرسة؟   |
|           |                     |                    |                    |                                  | أي صعوبة في أداء الواجبات<br>المنزلية؟   |
|           |                     |                    |                    |                                  | عدم الرغبة في الكلام أو القراءة<br>بصوت عال في الصف؟   |
|           |                     |                    |                    |                                  | تجنبت المشاركة في أنشطة مثل<br>الرياضة، أو النوادي، أو التمثيل، أو<br>الموسيقى، أو الرحلات المدرسية؟ |
|           |                     |                    |                    |                                  | واجهت صعوبة في اللعب على آلة<br>نفخ موسيقية؟   |
|           |                     |                    |                    |                                  | تجنبت التحدث مع الطلاب الآخرين؟  |
|           |                     |                    |                    |                                  | تجنبت الإبتسام أو الضحك عندما<br>كنت بصحبة غيرك من الطلاب؟   |
|           |                     |                    |                    |                                  | تجنبت قضاء الوقت مع الطلاب<br>الآخرين؟   |
|           |                     |                    |                    |                                  | تخاصمت مع الطلاب الآخرين أو<br>مع عائلتك؟  |
|           |                     |                    |                    |                                  | أغاظك أو سخر منك الطلاب<br>الآخرون، أو نادوك بألقاب غير<br>محببة؟                                    |
|           |                     |                    |                    |                                  | أشعرك طلاب آخرون بالانعزال أو<br>الوحدة؟   |
|           |                     |                    |                    |                                  | وجه إليك طلاب آخرون أسئلة عن<br>أسنانك، أو شفطيك، أو فكك، أو<br>فمك؟                                 |

## القسم الرابع: تقويم الأسنان

الأسئلة التالية سوف تستفسر عن تقويم الأسنان. ما نعنيه بتقويم الأسنان أي جهاز ثابت أو متحرك يستخدم من قبل أخصائي تقويم الأسنان من أجل صف أسنانك

1. هل سبق أن فحصك أخصائي تقويم أسنان؟

1. نعم
2. كلا (انتقل الى السؤال 8)

2. إذا كانت الإجابة نعم، في أي عمر تقريبا عاينك أخصائي تقويم أسنان لأول مرة؟ [\_\_\_\_] سنة

3. هل سبق أن حصلت على علاج تقويم لأسنانك؟

1. نعم (انتقل ال سؤال 8)
2. لا

4. هل انت حاليا تحت متابعة أخصائي تقويم أسنان؟

1. نعم
2. لا

5. من كان صاحب فكرة أن تحصل على علاج التقويم؟

1. أنا (انتقل الى سؤال 6)
2. أهلي (أمي أو أبي) (انتقل الى سؤال 7)
3. أصدقائي (انتقل ال سؤال 7)
4. طبيب الأسنان (انتقل الى سؤال 7)
5. أخصائي التقويم (انتقل الى سؤال 7)
6. آخر، حدد: \_\_\_\_\_

6. لماذا كنت تظن أنك بحاجة لتقويم اسنانك؟

1. صعوبة في نطق بعض الأحرف والكلمات
2. صعوبة في المضغ والأكل

3. أوجاع في الفك أو الاسنان
  4. لتحسين منظر أسناني/ابتسامتي
  5. معظم أصدقائي/ زملائي حصلوا على علاج تقويم
  6. آخر، حدد:
- 

7. هل تعتقد أن قرار حصولك على علاج التقويم كان الاختيار الصحيح؟

1. نعم، السبب: \_\_\_\_\_ . (انتقل الى القسم الخامس)
2. لا، السبب: \_\_\_\_\_ . (انتقل الى القسم الخامس)
3. لا أعرف (انتقل الى القسم الخامس)

8. هل تعتقد أنك بحاجة لعلاج التقويم؟

1. نعم
2. لا (انتقل الى القسم الخامس)
3. لا أعرف (انتقل الى القسم الخامس)

97. لماذا تعتقد أنك بحاجة لعلاج التقويم؟

1. صعوبة في نطق بعض الأحرف والكلمات
  2. صعوبة في المضغ والأكل
  3. وضع غير طبيعي لأي من الفكّين
  4. اسنان متراكمة فوق بعضها البعض
  5. اسنان نائثة
  6. لتحسين منظر أسناني/ابتسامتي
  7. معظم أصدقائي/ زملائي حصلوا على علاج تقويم
  8. أهلي (أمي أو أبي) ينصحوني بذلك
  9. طبيب الأسنان / أخصائي التقويم ينصحني بذلك
  10. آخر، حدد:
- 

10. لماذا لم تحصل على علاج التقويم على الرغم من أنك تعتقد أنك بحاجة له؟

1. ليس لدي الوقت لذلك بسبب متطلبات المدرسة



2. أهلي لا يعتقدون أنني بحاجة الى علاج
3. طبيب الأسنان / أخصائي التقويم لا يعتقد أنني بحاجة الى علاج
4. لا أحبذ فكرة وجود أجهزة ظاهرة على أسناني يستطيع أصدقائي/ زملائي رؤيتها
5. علاج تقويم الأسنان مكلف جدا

### القسم الخامس: العادات و الخصائص الغذائية

#### 1. كم مرة تتناول الوجبات السريعة عادةً؟

1. يوميًا
2. من مرة الى 3 مرات اسبوعيًا
3. من 4 الى 6 مرات اسبوعيًا
4. في المناسبات
5. ابدا

#### 2. كم مرة تستهلك مادة الصودا عادةً؟ بيبسي، كوكاكولا وغيرها؟

1. أكثر من مرة يوميًا
2. مرة يوم
3. أقل من المعدل اليومي. عدّة مرات اسبوعيًا
4. في المناسبات
5. ابدا

#### 3. كم مرة تستهلك الحلويات (كالشوكولا و السكاكر)؟

1. أكثر من مرة يوميًا
2. مرة يوم
3. أقل من المعدل اليومي. عدّة مرات اسبوعيًا
4. في المناسبات
5. ابدا

4. هل جربت التدخين, لو مرة في حياتك؟

1. نعم (سجائر فقط)
2. نعم (الترجييلة فقط)
3. نعم (سجائر و نرجيلة)
4. كلا (انتقل الى السؤال 8)

5. كم كان عمرك حين دخنت أول مرة؟

1. حدد العمر: سنة [\_\_\_\_\_]
2. لا أعرف/ لا أتذكر

6. خلال الشهر الماضي، ما هو عدد السجائر التي دخنتها؟

1. أقل من 5
2. 5-10
3. 10-25
4. أكثر من 25
5. أبداً
6. لا أعرف/ لا أتذكر

7. خلال الشهر الماضي، كم مرة دخنت النرجيلة؟

1. 1-5 مرات
2. 5-10
3. 10-25
4. أكثر من 25
5. يومياً
6. أبداً
7. لا أعرف/ لا أتذكر

8. هل يدخن أحد والديك (سجائر أو نرجيلة)؟

1. نعم، الأب
2. نعم، الأم
3. نعم، الأم و الأب
4. كلا، لا الأم و لا الأب (انتقل الى النهاية)

9. إذا كان أحد والديك من المدخنين (سجائر و نرجيلة), حدد المكان الذي غالبا ما يدخنون فيه؟

1. داخل غرف المنزل
2. على الشرفة
3. خارج المنزل فقط

جزيل الشكر لمشاركتم

## Appendix III

## SBS Child/Adolescent Assent Form

### AUB Social & Behavioral Sciences Assent to Participate in Research

**Study Title:** تقييم صحة الفم في المدارس التكميلية والثانوية في لبنان: مقارنة بين المدارس العامة والخاصة

**Researcher:** كيتي بيطار، سوزانا المعالي

**Purpose:**

إننا نحاول درس كل ما يتعلق بأسنانك وفمك: نظافة أسنانك ووجود التسوس بها وأيضا إذا كنت بحاجة الى تقويم أسنان. اذا قررت المشاركة فإنك ستكون ضمن دراسة تقوم بها البروفيسور مونيك شعيا من الجامعة الأميركية في بيروت لفحص العلاقة بين صحة فمك وطريقتك لتنظيف أسنانك وعاداتك وغداؤك. سوف ندرس أيضا إذا كانت هناك اختلافات بصحة الفم بين طلاب المدارس الخاصة والعامة.

قد سمح لنا والديك أن تشارك بهذه الدراسة.

تتكون هذه الدراسة من جزئين:

1. فحص للفم والأسنان لن تتجاوز مدته عن ال-10 دقائق. إذا وافقت على أن يتم فحصك، فكل ما هو مطلوب منكم هو فتح فمك كي نستطيع فحص اسنانك. لن يكون هناك أي ألم او خطر خلال المعاينة. وفي حال الحاجة للمعالجة، فسوف يتم اعلامك واعلام والديك. سوف نتمكن من معرفة حالة وصحة اسنانكم والتأكد إذا ما كنتم بحاجة لعلاج، وهذا يسمح لك على الحصول على العلاج اللازم.
2. الإجابة على أسئلة في استمارة. إذا وافقت على الإجابة على الأسئلة في الاستمارة، فكل ما هو مطلوب منك هو 5-10 دقائق من وقتك للإجابة على بعض الأسئلة عن صحة فمك وأسنانك بما يتعلق بالعناية بنظافة اسنانك بالإضافة الى عاداتك الغذائية.

لست مجبراً على المشاركة في هذه الدراسة. إذا قررت أن لا تشارك لن تحصل على أي عقاب ولن تخسر أي من حقوقك في المدرسة. كما وإنك لن تحصل على أي مكافآت مقابل السماح لنا بفحصك أو مقابل إجابتك على الأسئلة. يمكنك الموافقة على أي من جزئي الدراسة، وإذا وافقت على المشاركة في جزء واحد أنت لست مجبراً أن تشارك بالجزء الثاني. يمكنك التوقف عن المشاركة في هذه الدراسة ساعة تشاء. يمكنك التوقف عن اجابة الأسئلة ساعة تشاء. يمكنك رفض الاجابة عن كلّ الاسئلة، حتى بعد توقيع القبول بالمشاركة. لن يرى احد أجوبتك غير فريق البحث. ستحصل كل استمارة على رقم تسلسل ولن يستخدم اسمك في هذه الدراسة. كل الإستمارات سوف تخزن في مكان مغلق وآمن.

للسؤال عن الدراسة يمكنك الاتصال ب:

- البروفيسور مونيك شعيا، قسم الوبائيات، كلية العلوم الصحية، الجامعة الاميركية في بيروت، خلوي: 03-458143، بريد الكتروني: [mchaaya@aub.edu.lb](mailto:mchaaya@aub.edu.lb)
- الدكتور كيتي بيطار، قسم تقويم الاسنان، الجامعة الاميركية في بيروت، خلوي: 03-414082، بريد الكتروني: [kb30@aub.edu.lb](mailto:kb30@aub.edu.lb)
- الدكتور سوزانا المعالي، قسم تقويم الاسنان في الجامعة الاميركية في بيروت، خلوي: 71-520428، بريد الكتروني: [sa152@aub.edu.lb](mailto:sa152@aub.edu.lb)

للاتصال بفريق مستقل عن فريق البحث لأي استفسارات، أو مخاوف، أو شكاوى على البحث، أو استفسارات عن حقوق المدرسة أو الطلاب وأهاليهم، أو للمزيد من المعلومات، أو لمشاركة تجربتكم، الرجاء الإتصال بلجنة الأخلاقيات:

Institutional Review Board (IRB)

Tel: +961-1-3500000 Ext: 5445 or Ext: 5454; Email: [irb@aub.edu.lb](mailto:irb@aub.edu.lb)

### **Signing the assent form**

لقد قرأت (أو شخص قد قرأ لي) هذه الورقة و فهمت مضمونها.

**القسم -2-**  
الموافقة على تعبئة الاستمارة

.....  
التوقيع أو اسم الفرد

..... AM/PM

**القسم -1-**  
الموافقة على فحص الأسنان والفم

.....  
التوقيع أو اسم الفرد

..... AM/PM

**Investigator/Research Staff**

لقد أوضحت للمشارك قبل طلب التوقيع أعلاه. لا توجد فراغات في هذه الوثيقة. وقد سلمت نسخة من هذا النموذج إلى المشاركين أو ممثله / ممثله.

\_\_\_\_\_ اسم الشخص الحاصل على موافقة

\_\_\_\_\_ توقيع الشخص الحاصل على موافقة

AM/PM

\_\_\_\_\_ التاريخ والوقت

**This form must be accompanied by an IRB approved parental permission form signed by a parent/guardian.**

Appendix IV

| <b>DMFT</b>                            |         | <b>Coef.</b> | <b>Std. Err.</b> | <b>P-value</b> | <b>95% CI</b>    |
|--|---------|--------------|------------------|----------------|------------------|
| <i>School type</i><br>(Private)        | Public  | 1.423        | 0.652            | 0.046*         | [0.032; 2.814]   |
| <i>Oral health perception</i><br>(Bad) | Average | -1.316       | 0.553            | 0.031*         | [-2.495; -0.137] |
|  | Good    | -2.506       | 0.401            | 0.000*         | [-3.363; -1.650] |
|  |         |              |                  |                |                  |
| <i>_Cons</i>                           |         | 5.811        | 0.796            | 0.000          | [4.113; 7.509]   |

*Prob > F = 0.000/ R-squared = 0.110 (Between brackets are the reference category for categorical variables)*



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