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Global burden of dental condition among children in nine countries participating in an international oral health promotion programme, 2012–2013

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The Live.Learn.Laugh. phase 2 programme is a unique global partnership between FDI World Dental Federation and Unilever Oral Care which aims to provide measurable improvement of oral health on a global scale through encouraging twice-daily brushing with a fluoride toothpaste. It was based on international recommendations using the principles of health promotion within school for the implementation of preventive health strategies. This paper is an overview of the dental caries condition of children from 2012 to 2013 in nine countries included in four World Health Organisation (WHO) regions. A cross-sectional study was conducted in each country before the implementation of health-promotion measures focused on twice-daily toothbrushing with fluoride toothpaste. The sample was based on stratified sampling according to the WHO pathfinder recommendations. From a total of 7,949 children examined, there were 517 children (1–2 years of age), 1,667 preschool children (3–5 years of age) and 5,789 schoolchildren (6–13 years of age). The prevalence and severity of primary dental caries, early childhood caries and temporary dental caries were described using decayed, filled teeth (dft), permanent decayed, missing, filled teeth (DMFT) indices and the significant caries index (SCI). The major findings were a high prevalence of caries, identification of high-risk groups and inequality in the distribution of the severity of dental conditions. Aggregated data from this overview should provide justification for implementing an oral health programme. The main point is the need to retain and expand the community fluoridation programme as an effective preventive measure. At the individual level, the aggregated data identify the need for more targeted efforts to reach children early – especially among specific high-risk groups.

Key words: *Oral health, child, dental caries, epidemiology, international programmes, school health services*

INTRODUCTION

Child health in many low- and middle-income countries lags behind international goals and affects children's education, well-being and general development[1]. Oral diseases were highly prevalent in 2010, affecting 3.9 billion people. The impact of the current situation on health, quality of life and other societal costs is high. Untreated caries in permanent teeth was the most prevalent condition evaluated for the 2010 Global Burden of Disease Study, with a global prevalence of 35% for all ages combined[2]. Oral conditions combined accounted for 15 million disability-adjusted life years (DALYs) globally [1.9% of all years lost due to disability (YLDs); 0.6% of all DALYs], implying an average health loss of 224 years per 100,000 population[3].

Tooth decay has historically been considered the most important oral health problem worldwide and is, for the most part, entirely preventable. Individuals are susceptible to this disease throughout their lifetime. Dental caries is the most common cause of disturbances of normal functions in the oral cavity and results from a lack of implementation of known preventive and curative measures[4]. To avoid pain and discomfort, decayed primary teeth need to be restored, particularly molars in children 6–8 years of age[5]. Retention of primary molars until they fall out normally – usually at around 10–12 years of age – allows adequate dental arch space for the eruption of succeeding permanent premolars and avoids the tipping forward of the first permanent molars. Carious permanent teeth should be repaired promptly to keep fillings small and conserve as much natural tooth as possible. Minimal intervention dentistry for managing dental caries has an essential role to play in reducing severity of the impact of caries[6].

Minimal intervention dentistry is a prerequisite for the meaningful ranking of community needs and the development of intervention programmes with which

to address them. Good oral health is dependent on establishing the key behaviours of toothbrushing with fluoride toothpaste and controlling sugar snacking. Primary schools pose a unique opportunity for intervention and provide a potential setting in which these behavioural interventions can support children to develop independent and habitual healthy behaviours[7,8].

Current research also indicates that children from low-income countries have a higher risk of caries, quality-of-life problems and more unmet dental-treatment needs than their higher-income counterparts[9]. A concern among public health policy makers is that some special groups are disadvantaged in terms of untreated diseases and less-desirable patterns of dental care. In view of the prevalence of risk factors, inadequate access to and affordability of preventive and curative oral health services, oral diseases have a growing impact on the health and well-being of people in the World Health Organisation (WHO), Western Pacific Region (WPRO), South-East Asia Region (SEARO) and Eastern Mediterranean Region (EMRO) – particularly on vulnerable and marginalised populations[10].

The goal of the Live.Learn.Laugh. (LLL) phase 2 partnership programme was to investigate oral health behaviour and attitudes from 2012 to 2013 as part of a controlled trial to evaluate the effects of a 1-year oral health education and caries-prevention programme implemented mainly in preschools and schools.

Oral health promotion attempts to reduce the incidence or prevalence of caries in the population. At the end of the process, evaluation should provide information about the programme, to measure the programme's effectiveness or contribution between different programme types and to demonstrate the programme's value. Details regarding the aims, methodologies and findings from the global LLL partnership programme are reported in other paper within this supplement.

The aim of this paper was to assess the dental caries condition in nine specific countries – Cambodia, Greece, India, Indonesia, Kenya, the Philippines, Morocco, Myanmar and Vietnam – as measured in the LLL phase 2 partnership projects as part of the baseline examination.

MATERIALS AND METHODS

Data were collected, before interventions, from regional or local oral health surveys or in specific communities including cross-sectional surveys. The number of schools supplying information in each country varied from 2 (in Vietnam) to 22 (in India). The sample was based on stratified sampling according to urban and rural backgrounds, and schools were chosen according to WHO pathfinder recommendations. The sample in these studies mainly consisted of two groups derived from a multi-site examination: preschool children; and schoolchildren. From a total of 7,949 children examined, there were 1,667 preschool children (3–5 years of age) and 5,789 schoolchildren (6–13 years of age).

The study methodology was compounded of interviews with children examined and clinical examination. As part of the LLL phase 2 programme, there were two elements to the global survey: (i) a face-to-face interview to collect information on the respondent's oral health behaviour, attitudes and opinions; and (ii) a clinical examination to collect baseline data of the occurrence of dental caries in nine countries. A total of 15,514 dental examinations had been carried out in the clinical project by the end of 2013 (*Table 1*).

The studies were specifically based on the decayed, filled teeth (dft)/Decayed, Missing, Filled teeth (DMFT) indexes, following the recommendations of the WHO[11]. Data were collected only at the tooth level. Caries recordings were obtained following WHO criteria for epidemiological studies. Caries was defined as caries into dentine. Enamel lesions were regarded as sound surfaces. For the caries assessments, all tooth surfaces were examined. Every defect in the tooth was tested with a probe. Decayed, filled and extracted/missing (as a result of caries in permanent teeth) teeth were recorded in a modified WHO Oral Health Assessment Form.

DMFT (for permanent dentition) and dft (for primary dentition) describe the number, or the prevalence, of caries in an individual. DMFT and dft are used to express the caries experience numerically and are obtained by calculating the number of decayed (D, d), missing (M) and filled (F, f) teeth (T). Natural daylight was used for all clinical examinations. The number of examiners involved in clinical registrations varied among countries. The oral survey included oral examination conducted by calibrated dentists. Altogether, four global workshops were organised during phase 2, in Brazil (2010), the Philippines (2011), Turkey (2012) and Greece (2013). These workshops gathered the national project leaders with the global partnership core

Table 1 Age (years) characteristics according to country, 2012–2013

Country	*n*	Age, years(mean ± SD)	Q1; Q2; Q3
Morocco	600	2.7 ± 1.3	1; 2; 4
Cambodia	1,199	6.0 ± 0.0	6; 6; 6
Greece	560	2.7 ± 0.6	2; 3; 3
Indonesia	1,617	10.8 ± 0.4	11; 11; 11
Kenya	3,609	7.4 ± 4.1	6; 7; 8
Myanmar	600	6.5 ± 0.5	6; 7; 7
Vietnam	1,036	n.a.*	–
India	5,711	25.6 ± 11.6	16; 23; 34
The Philippines	582	4.1 ± 0.8	4; 4; 5

Mean age at first quartile (Q1), second quartile (Q2) and third quartile (Q3).
*6–12 years of age.

team and regional coordinators appointed by FDI, to provide the project leaders with guidance and to address project implementation, methodology and evaluation. In Greece (2013), the workshop provided data analysis from baseline (T0) to date and one-on-one discussion with FDI Regional Coordinators on the progress and evaluation of their individual project. Some project leaders conducting clinical evaluation within their projects requested some support to calibrate the dental team involved in the clinical evaluation and data collection. In such cases, T0 calibration workshops – Kenya (2011) and Vietnam (2012) – were organised with participation of FDI Regional Coordinators with expertise in this field to provide national project leaders with support and technical guidance. The intra-examiner agreement was not estimated. The inter-examiner agreement of DMFT and dft scores was measured by applying the kappa index. A *k* value of 0.7 (Kenya) for interexaminer agreement was considered satisfactory.

As part of the overall evaluation of global outcomes for the partnership projects in LLL phase 2, indicators were selected to address the question 'How will you know that the partnership objective has been achieved?' This paper only presents data for dental caries. Clinical forms collected the following additional information: year of examination; gender; date of birth; school identification; and area of residency. Furthermore, information collected from all children receiving dental check-ups in primary care settings included, but was not limited to: mean dft/DMFT; decayed, filled surfaces (dfs)/Decayed, Missing, Filled Surfaces (DMFS); caries increment; filled teeth; early carious lesions; and gingivitis. The following indicators were selected to provide a better understanding of oral health outcomes related to caries:

- DMFT describes the severity of dental caries in an individual. It is calculated by summing the number of decayed (D), missing (M) and filled (F) teeth and expresses the individual's dental caries experience until the day of examination. The sum of all the DMFT values divided by the total number of individuals in the sample provides the mean DMFT for the population
- dft describes the severity of primary dental caries
- Early childhood caries (ECC) is defined as the presence of one or more decayed, missing or filled tooth surfaces in any primary tooth in a child ≤ 71 months of age[12]. The earliest form of prevention can be achieved by educating parents and primary caregivers about ECC.
- The significant caries (SiC) index was introduced in 2000 to bring attention to individuals with the highest caries values in each population[13]. The SiC was calculated as follows:
  1. Individuals in the population (sample) were sorted according to their DMFT values.
  2. One-third of the population with the highest caries scores was selected.
  3. The mean DMFT for this subgroup was calculated. This value is the SiC index.
- 'Untreated caries prevalence' is the proportion of those with untreated decay into dentine, used to assess mean levels of untreated dental caries and help estimate treatment requirements in children.
- 'No obvious decay experience' is the proportion of those examined with a value of zero for DMFT, used to assess overall levels of oral health and monitor trends over time and to measure the effectiveness of measures to limit decay to early stages.

Analysis

Data from individual projects were centralised at the FDI Head Office in Geneva. The main results were presented through tables and figures. A series of descriptive analyses was conducted. The distribution of caries according to quartiles is described. Relative risk (RR) consists of a ratio between rates of each class variable and an arbitrary reference value. Major sources of information are the WHO oral health country/area profile programme, ministries of health and scientific reports from population studies on oral health carried out in various countries. Anonymity, confidentiality and security of data were ensured by FDI, on behalf of the global partnership LLL phase 2.

RESULTS

Prevalence and severity of primary dental caries

The prevalence and severity of primary dental caries are described in *Table 2*. In the sample, 34.7% of the children had no observable clinical signs of caries (dft = 0). As expected, this percentage decreased with increasing age: 89.1% of 2-year-old children were caries-free, but only 27.3% of children ≥ 8 years of age were caries free. The mean dft of the sample was 3.72. The lowest mean dft was seen in 1- and 2-year-old children (dft = 0.72). As expected, the mean dft among children increased with age. The greatest contribution to the dft index was untreated caries, which was 3.51 in the global sample and represented 94.3% of dft. Untreated caries varied from 47% in 1- and 2-year-old children to 97% in the group of children > 8 years of age.

In *Figure 1*, the relationship between deciduous caries prevalence (dft > 0) and dft is underlined. We can see that, with increasing dft, the prevalence of caries also increases. Two relevant indicators, derived from the same data but with different interpretations and implications for health services, are the mean dft and

Table 2 Primary dental caries [decayed, filled teeth (dft)] at baseline examination

Country	Age (years)	*n**	d–f	dft (mean ± SD)	% Distribution of dft (0; 1; 2; >2)
Morocco	1–2	328	0.28–0.33	0.61 ± 2.29	91; 0; 2; 7
Morocco	3–5	272	2.18–2.83	5.01 ± 5.52	40; 0; 6; 54
Cambodia	6	1,199	6.05–0.02	6.07 ± 5.19	29; 2; 4; 65
Greece	1–2	165	0.45–0.48	0.93 ± 2.89	86; 0; 3; 11
Greece	3–4	352	0.77–0.87	1.64 ± 3.84	78; 0; 3; 19
Kenya	4–5	486	2.19–0.02	2.21 ± 2.68	40; 13; 11; 36
Kenya	6–7	1,722	2.04–0.02	2.07 ± 2.48	39; 16; 11; 33
Kenya	8–10	1,320	2.12–0.02	2.14 ± 2.50	37; 15; 13; 34
Myanmar	6–7	534	4.16–0.18	4.34 ± 3.36	11; 11; 13; 65
Vietnam	6–12	1,035	3.44–0.38	3.82 ± 3.38	20; 11; 10; 58
India	8–10	103	1.10–0.54	1.64 ± 0.76	0; 51; 35; 14
Philippines	3–5	557	12.03–0.00	12.03 ± 5.18	2; 1; 3; 94

*Sample size within each country, after excluding those older than 11 years of age and those with no deciduous dentition data. For Vietnam there are no detailed age data.
d, decayed; f, filled.

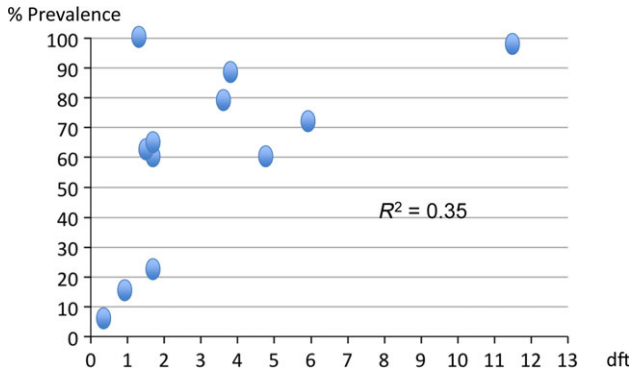

Figure 1. Scatterplot between caries prevalence on deciduous teeth [decayed, filled teeth (dft) > 0] and mean dft at country level.

dft > 0. The first relates to the extent of the disease and the latter to the prevalence of the disease. At the country level (n = 12) adjusted R^2 is 0.35 (i.e. 35% of the variability in mean dft depends on the prevalence of the disease). This latter figure should be taken with caution because it is an ecological correlation. Although this figure (35%) could be considered high, one should bear in mind that the complementary figure (i.e. 65%) indicates that a large amount of mean dft variability depends on factors other than dft prevalence.

Early childhood caries

In the total sample of 2,160, 1- to 5-year-old children examined, the prevalence of ECC was 52.3% with a mean dft of 8.90 (*Table 3*). The prevalence of ECC varies across countries. The lowest prevalence was found in Greece (19.3%) and the highest in the Philippines (98.0%). Regarding the mean dft, the lowest value in the ECC subsample was found in Kenya (3.68) and the highest in the Philippines (12.27). The value of untreated caries in the ECC sample was 7.78 and represented 87.4% of dft.

Figure 2 compared dft in the global sample with dft in the ECC sample, according to country. dft in the ECC population was two- to five times greater than the dft in the corresponding overall population. The percentage of children without ECC ranged from 19.3 to 98.0. The exception was in the Philippines, where the dft was the same in the ECC population and the overall population. This analysis gives us real insight into the problem of caries. If we take the example of Morocco, we can see that the overall dft is 2.6. But if we calculate the average rate among those children with at least one lesion, the value increases to 8.14. This means that the problem of decay is a real problem for those with the disease and the average dft index may mask the reality of this problem if corrective measures are not taken.

Prevalence and severity of permanent dental caries

The percentage of children with DMFT = 0 at 6 years of age was 73%, and, as expected, this decreased with age (*Table 4*). Only 48% of 11- to 13-year-old children had no observable clinical signs of caries. The mean DMFT index was 0.56 for 6-year-old children

Table 3 Early childhood caries (ECC) analysis

Country	Age (years)	*n*	No. in ECC sample	% with ECC	Decayed teeth (dt) in ECC sample	Filled teeth (ft) in ECC sample	Mean decayed, filled teeth (dft) in ECC sample
Morocco	1–5	600	192	32.00	3.56	4.58	8.14
Greece	1–4	517	100	19.30	3.45	3.85	7.30
Kenya	4–5	486	292	60.00	3.64	0.04	3.68
The Philippines	3–5	557	546	98.00	12.27	0.00	12.27

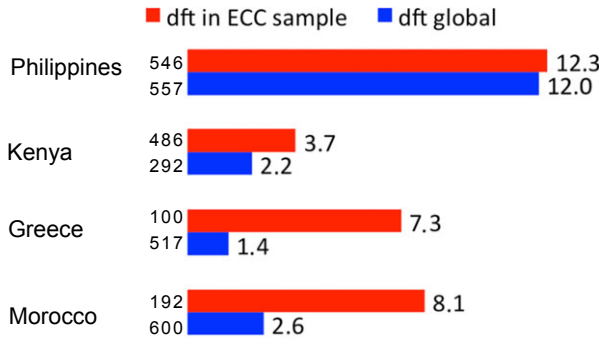

Figure 2. Comparsion between decayed, filled teeth (dft) in the global sample and dft in children with early childhood caries (ECC). The values at the left of the bars are the sample number and the values at the right of the bars are the dft.

and 1.17 for 11- to 13-year-olds. The greatest contribution to the DMFT index was untreated caries. At 6 years of age, the decayed component was 0.47 (84% of DMFT). We only found 12 missing permanent teeth in 3,512 children. The filled component was 0.09, which represents 16% of dental caries with restorative treatment.

In 11- to 13-year-old age groups, untreated caries was 1.09 (93% of DMFT). The missing component was 0.07 and, from 1,242 children, only 12 teeth received restorative treatment. Depending on the age and country, between 3 and 15% of children accumulate 50% of the pathology of the entire group and are the high-risk subjects. The SiC index in children at 6 years of age varied from 0.53 to 2.76. For 11- to 13-year-old groups, the SiC index was 2.76. This would mean that, for a third of the population, the problem of decay is much more important than what apparently follows from the simple reading of the DMFT index. The SiC indices were nearly three times as high as the respective DMFT values.

DISCUSSION

Study design and methodology

The research presented in this paper can be classified as an ecological study[14] as it undertakes to investigate aggregated data. Ecological studies use measured values for population groups rather than for individuals. In them, a description and analysis are related to the mean exposure and the prevalence in geopolitical units is considered. They have a lower cost, simplicity and an easy analytical process in relation to the ethical aspects. It is obvious that a random sample would have been preferable for obtaining an unbiased estimate of caries experience. This study did not intend to produce representative results for the entire child population participating in the LLL phase 2 partnership project throughout the country. That would have required a complex sampling procedure, a much larger set up, an exponentially higher budget and a huge management structure. Nevertheless, the various socio-demographic and health-related parameters of the study sample were very similar to those reported in other large-scale, regional or national child surveys. The WHO pathfinder approach, as a sample methodology, was adopted and great care was taken to use the same methodology in all surveys.

According to WHO, if the oral health of children 12 years of age is the object of several epidemiological studies conducted around the world[11,14], it is because children leave primary school at this age. In our studies, priority was given to younger schoolchildren to evaluate, as baseline, the severity of lesions on primary teeth and first molars. The lack of a database with information on tooth decay of five- to seven-year-old children does not favour the presentation of an epidemiological scenario of oral health, especially in the WPRO, SEARO and African (AFRO) regions. If easy access to the data publicly available enables the analysis by the researchers favouring the transformation of data into decision-making information, information such as that produced by the global public–private partnership LLL phase 2, may serve to guide policy goals for oral health according to the different realities observed[15].

Besides being restricted to countries that are part of the regional offices of WHO, some countries had no data available on oral health. Another factor was wide variations in the years to disseminate the studies. Few studies were observed from 1973 to 2008 in young children. This range of many years makes comparisons very weak and outdated. However, this

Table 4 Prevalence and severity of permanent dental caries

Country	Age (years)	*n**	D; M; F	DMFT (Mean ± SD)	% distribution of DMFT (0; 1; 2; >2)	Q1; Q2; Q3	% with 50% lesions	SiC
Cambodia	6	1,199	0.79; 0.01; 0.26	1.06 ± 1.35	53; 12; 18; 16	0; 0; 2	14.6	2.76 ± 0.87
Indonesia	11–13	1,242	1.09; 0.07; 0.01	1.17 ± 1.47	48; 15; 22; 15	0; 1; 2	15.5	2.83 ± 1.29
Kenya	5–7	2,099	0.32; 0.00; 0.00	0.32 ± 0.84	83; 9; 4; 4	0; 0; 0	4.7	0.96 ± 1.22
Myanmar	6–7	214	0.15; 0.00; 0.03	0.18 ± 0.59	89; 7; 3; 1	0; 0; 0	3.3	0.53 ± 0.92
Vietnam	6–13	1,035	0.60; 0.00; 0.00	0.60 ± 1.09	70; 13; 9; 8	0; 0; 1	8.6	1.80 ± 1.19

DMFT: first quartile (Q1), second quartile (Q2) and third quartile (Q3).
*Sample size within each country, after excluding those older than 13 years of age and those with no permanent dentition data.
D, decayed; DMFT, Decayed, Missing, Filled Teeth; F, filled; M, missing; SiC, significant caries index.

evidence should be that the countries and regions where data are more outdated pay greater attention to the epidemiological diagnosis of the oral health of their populations. At least in the field of oral health, there has been no comprehensive evaluation of all the published survey results. A few evaluations in the last decade have set out to examine characteristics of a sample of dental survey results; however, the value of these evaluations is limited[16].

Oral data

This paper outlines the baseline assessment of the specific target populations participating in projects as part of the global partnership LLL phase 2 and provides information on the situation from 2012 to 2013. Clinical data collection was part of a longitudinal project to assess the health-promotion impact for school programmes on oral health in the nine countries investigated. Health promotion is the process of implementing a range of interventions, including promoting healthy behaviours, creating supportive environments and encouraging healthy public policies, enabling people to increase control over, and to improve, their health. Our information should serve to guide policy goals for oral health according to the different situations in different sociocultural countries, and different age groups observed before, during and after the intervention and make recommendations on actions that should result from the evaluation, and share results in formats that are tailored to specific audience needs/preferences. Evaluation in this project should answer two questions:

- What is making the situation better and what is making it worse?
- What possible solutions, interventions and actions can organisations implement to deal with the observed situation at the end of the process?

The existence of information about the DMFT and dft indexes for most WHO member states legitimises this indicator as a measure universally accepted and used for global comparisons. Quantitative tools include analytical tools and learning resources for population health assessment and surveillance. These tools are meant to help epidemiologists, analysts, researchers and other health professionals in analysing public health data or generating statistical reports[17]. However, the lack of other oral health indicators limits its interpretation of its characteristics and consequences. Cross-sectional trends in the percentage of caries-free children and mean dmf counts reported in this paper might potentially be biased as a result of the use of restorative and adhesive materials. It is not unlikely that the use of tooth-colour-matching adhesive materials has increased the chance of misdiagnosis and, consequently, of underestimating the F component of the dft/DMFT counts and hence overestimating the percentage of caries-free children.

In the developed world, caries appears to be neither as common nor of the same order of severity as in developing countries. Over the past few decades, the burden of oral disease and the needs of populations have changed rapidly in developed countries, and oral health systems are required to adjust to the transition process. Global problems still persist in developing regions. The RR for dental caries according to WHO regions is, respectively, 0.81 in AFRO, 0.9 in WPRO and SEARO, 0.95 in EMRO, 1.10 in Europe (EURO) and 1.14 in the Americas (AMRO). In 2007, WHO reported that 60–90% of schoolchildren worldwide have dental caries[15]. Traditional dental care remains a significant economic burden for many countries, where 5–10% of public health expenditure relates to oral health[18].

At present, the oral health profile of SEARO, AFRO and WPRO is not homogeneous across countries. Thus, oral diseases known to exist in each community need to be individually assessed in terms of the basic epidemiological criteria of prevalence and severity. Moreover, it is noteworthy that this global ecological analysis, taking the countries as units of analysis, assuming homogeneous areas, also has large heterogeneities in local realities.

In comparing these results with those from previous surveys, account must be taken of the methodologies and protocols used. The oral health status of 6- and 12-year-old Filipino children was assessed in a representative national sample of 2,030, 6-year-old children in WHO Basic Methods; 97% of 6-year-old children had caries (mean dmft = 8.4) and 20% reported pain when examined[19]. The National Oral Health Survey of Vietnam in 1999 underlined that caries experience was high in children (dft = 8.9 in children at 6 years of age) but moderate in adults. Caries experience was present mostly as untreated decay[20]. The authors concluded that the oral health of Vietnamese children was characterised by a high level of dental caries with variation among socio-economic groups. It suggests the need for a population oral health programme that includes measures to target high-need children[21]. In Greece, the SiC index value for the 5-year-old age groups was 5.01[22]. The WHO Regional Office for South-East Asia Report (2008) formulating oral health strategy provides the most recent oral health strategy-related data for South-East Asia[23].

Even if there is a consistency between the results found in our report and those described in the literature, we must remain cautious about interpretations, especially because the main objective of our results are part of a logical prospective, not retrospective and/or comparative, analysis. Over the lifetime of the

surveys, there are two methodologically distinct periods and the results from one cannot be directly compared with the other. Although the absolute levels of decay are not comparable across the full timeline of these surveys, for the reasons highlighted above, the general trends give an indication of what has been happening over time. However, this scenario is quite out of date as a result of the analysis of old data. There is strong evidence that this pattern is altered with marked reduction in caries experience in children and young adults in developed countries. Other factors are helping to reverse this scenario within the context of a globalised world. Increased access to foods and the exclusive and selective oral health services offered are changing the global profile of caries. Up-to-date studies are needed to evaluate such changes.

Policy tools

The findings of the situational assessment can contribute to the development of human resource policies and strategies to strengthen the capacity of health systems to deliver efficient and effective services. The development of oral health-promotion programmes for best practices in targeted countries focuses on implementing community-based demonstration projects for oral health promotion, with special reference to poor and disadvantaged population groups and on the development of methods and tools to analyse the processes, and outcomes of oral health-promotion interventions as part of national health programmes should be encouraged[10,24]. Hence, improving oral hygiene in early childhood requires that mothers' own toothbrushing habits and their infant's oral cleaning skills are improved[25]. Infant feeding practices were also found to be poor in South-East Asian countries such as Taiwan[26], Myanmar[27] and Korea[28], with increased occurrence of between-meal snacks, sweetened solution in nursing bottles and sweets. Many studies have concluded that parents are in definite need of advice on feeding and oral hygiene practices[29]. Prevention is the key for ECC and can be successfully achieved by knowledgeable and efficacious caregivers[30].

The findings from this study should aid in two ways. At the community level, the study strongly points to the importance of retaining and expanding the community fluoridation programme as an effective preventive measure. The 'whole-population' approach is appropriate for the prevention of oral diseases and applying it is the only way to reduce the burden of these diseases and the cost of oral care[31]. The use of fluoride toothpaste is the primary intervention for the prevention of caries[32].

At the individual level, the study identifies the need for more targeted efforts to reach children early, with special attention paid to specific high-risk groups[33]. This indication is caused by an intensely unequal distribution of caries. Oral health-care discussions are often complicated by the non-proportional distribution of the burden of the preventable disease called dental caries. First, in a balanced view, the advantages and disadvantages of the 'high-risk' strategy seek to protect susceptible individuals and the 'population' approach has been considered[34]. This led to the conclusion that the 'high-risk' strategy was an interim phase, only needed as long as the underlying causes of a disease were not yet clear or could not be controlled[6,35]. However, sealants are effective in preventing or controlling caries in high-risk children[36]. All of the above call for immediate intervention with comprehensive preventive programmes and better geographical targeting of the dental services at a national level, including targeted prevention of pit and fissure sealants on posterior permanent molars[37]. Second is the idea of monitoring not only the average values, but also their distributions, which tries to correct the effect on the measurement of a disease with high inequality in its distribution. And, third, there is no establishment of absolute values because they must adapt to local conditions regarding the availability of databases, priorities, current levels of prevalence and severity, socio-economic status, available resources and characteristics of health systems[33]. Cultural practices specific to the region can be one of the obstacles to improvement in attitudes and oral health practices among the public. Hence, culturally appropriate and targeted strategies aimed at these modifiable practices need to be wisely promoted so that the oral health burden carried by these children can be reduced[38,39].

Conflict of interest

Denis Bourgeois and Juan Carlos Llodra have received consultancy payments from FDI World Dental Federation.

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