## MODELLING THE NEED FOR PREVENTIVE ORAL CARE

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#### ABSTRACT

Descriptive analysis of data from the 2013 Child Dental Health Survey involving multi-stage random sample of 1,526 five-year old and 1,313 fifteen-year old children was done to categorise children based on their caries risk which might be low, medium or high, in order to assess the needs pattern for dental care based on risk level to model the level of preventive care for this age group. The volume of evidence-informed preventative care was calculated based on their risk level. Analysis showed 62% (n=964) of five year old and 83% (n=1,087) of fifteen year olds were considered medium or high risk for dental caries. The findings were then extrapolated to the total population of five and fifteen year olds in England. Nationally the level of fluoride varishings and fissure sealants for age group being evaluated amounts to 4.3 million and 2.5 million applications annually respectively. Extent of caries risk is considerably high in British children and requires immediate preventive action.

Key Words: Caries, preventive care, Pits and Fissure Sealants, behavioural risk factors

#### INTRODUCTION

The Child Dental Health survey (CDH) commissioned by the Health and Social Care Information Centre (HSCIC) reports vital information regarding multiple oral health conditions experienced by children in the UK. It provides substantial data highlighting the oral health behaviours and dental decay of five and fifteen children old English children<sup>1</sup>.

The oral health of English children has improved since the last CDH survey, which is understood to be, in part, due to the increased use of fluoridated toothpastes and fluoride varnish application by dentists. In addition to this, messages about proper tooth brushing techniques may have reached a significantly high percentage of the younger population to have had this effect<sup>2</sup>. Nevertheless, with 49% and 62% five and fifteen year old suffering from decay experience respectively, there is continuing need for preventive care, to not only improve the oral health and consequently the quality of life of these children but also to minimise the financial constraints posed by curative dental treatment on the healthcare services<sup>1</sup>.

With 88% of five-year old and 82% of fifteen- year old English children using dental services, preventative care can be provided to a vast majority of children, thereby reducing the risk of caries by modelling a pre-

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ventive plan based on their caries risk level<sup>1</sup>. Correctly diagnosing the lesions is the first step in caries risk assessment and therefore, in managing the risk. Diagnosis of dental decay refers to the determination of not only the presence but also the degree and the activity of the lesions. Caries activity is an amalgamation of three primary factors: clinical appearance of the lesions, how the lesion progresses and most importantly past caries experience. Additionally, it includes behavioural factors such as sugar consumption and oral hygiene behaviour which can accelerate or decelerate the caries process<sup>3</sup> along with the socio-economic statusof these children<sup>4</sup>, play a vital role in risk assessment.

Consumption of sugars is considred one of the most essential risk factors for cariesa ctivty and progression. Dental caries incidence in Kenyan children has increased in the recent years due to an increase in the nationwide consumption of sugars and the condition is predominantly associated with tooth loss both in adults as well as children<sup>5</sup>. Furthemore, Poor oral hygiene hastens the development of dental caries in the presence of fermentable sugars. Research evidence indicates that premature tooth loss is associated with dental caries not only due to excessive consumption of sugary foods and beverages but also sub-optimal oral hygiene habits<sup>6</sup>. Tooth decay is both biologically determined and socially impacted. Social inequality in oral health is seen both, between nations and within populations residing in the same country. Evidence from different studies indicates that the socioeconomic status is an important indicator of social standing of individuals in the society and children belonging from low social classes tend to be at a higher risk of suffering from tooth decay than those who belong higher up in the social gradient<sup>7</sup>.

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The evaluation of decay activity involves assessing the factors which influence the pathogenesis of the condition along with the clinical picture of the lesions by means of the International Caries Detection and Assessment System (ICDAS)<sup>8</sup>. This system comprises of six codes which aid in identifying the extent of the lesions; from initial visual changes in the enamel surface to established decay extending into the dentine<sup>8,9,10</sup>. High levels of precision and reproducibility associated with ICDAS make it ideal for the detection and assessment of caries activity in both permanent<sup>11,12,13,14</sup> and primary teeth to aid in treatment planning<sup>15,16</sup>.

Data from clinical examination, past caries experience and patient factors collectively help in determining the risk level of children who are then provided with appropriate care. The Delivering Better Oral Health evidence-based tool-kit contains evidence based guidelines on how to manage children at different levels of risk by means of advice and professional intervention on the use and application of fluoridated substances<sup>17</sup>. Additionally there have been updates in relation to diet which are not yet reflected in the guidance. Professional intervention not requiring patient compliance tends to fare better. Several studies emphasize the impact of fluoride varnishes and fissure sealants in reducing caries<sup>18</sup>. Application of fluoride varnish is hence, is both a cost-effective and beneficial means of reducing the caries risk without burdening the system financially<sup>19</sup>.

The rationale of this study lies in the fact that prevention of carious lesions and inhibition of the progression of dental decay is a newer, more acceptable strategy as compared to the treatment of established disease. Treatment not only has a negative impact on the quality of life of children but also puts a heavy economic burden on the health care services<sup>20</sup>. According to an NHS report, prevention of dental disease is the first step for any patient by means of assessing risk and managing them<sup>21</sup>. This factor is further highlighted by another NHS report which focuses on how prevention is essential in not only reducing the burden of dental caries in English children but is also vital in maintaining the economic prosperity of the country because as the severity of the disease increases, so does the cost of treating it<sup>22</sup>. It spares children ill effects of established dental decay as the progress is inhibited at an earlier stage before tooth decay becomes severe.

The aim of this study was to examine the pattern of need for dental care based on caries risk levels, model the level of contemporary preventive care required for five and fifteen year old English school children and consider the implications for dental care. Furthermore this study can be used as a means of assessing the need for preventative care of children in Pakistan as the caries prevalence of young Pakistani children from low socio-economic backgrounds is 71% according to a report<sup>23</sup>. It is therefore considered as big of a public health problem in Pakistan as it is in the United Kingdom and therefore the use of preventative tools can be applied successfully in th form country resulting in a decrease in the prevalence of caries in the country.

The research objectives are as follows:

- To examine the pattern of dental caries in English children by measuring tooth decay on the basis of ICDAS codes, reported health behaviours which include frequency of tooth brushing and consumption of sugar sweetened beverages and deprivation level of the children measured using the England Index of Multiple Quintile based on the home postcodes of the children.
- To group children according to their risk status based on the aforementioned variables into low, medium and high risk.

To use this knowledge to structure contemporary preventive primary care for all the caries levels separately using contemporary evidence from DBOH.

### METHODOLOGY

The study involved secondary analysis of the data derived from the Children's Dental Health Survey 2013; a cross-sectional survey based on the national representative sample of five and fifteen year old children studying at state and independent schools in England. There were 1,526 five-year old and 1,313 fifteen-year old English children who took part in the survey, all of whom underwent clinical examination. The questionnaire response rate for parents of younger children was 45% while the self-completion questionnaire for older children was 99%. It is hypothesized that the respne rate for the youngr age group is low due to the requirement of informed written consent for clinical examination from the parents. This sample size was calculated during the primary analysis which was done when this survey was conducted. The sample was divided between children aged 5 and 15 on 31 August 2013 so that approximately 2,500 dental examinations would be achieved in each age cohort. The 31 August cut off ensured that the children were of a comparable age to those involved in the previous rounds of the survey.

Schools with more than 30% of children eligible for free school meals were defined as

'deprived'. 'Deprived' schools were oversampled relative to those that were classified as not

'deprived', so that children in deprived schools would make up approximately a third (33%) of the overall sample of children. This was to ensure that there was a sufficient sample size for analysis by measures of relative deprivation. The proportion of children eligible for free school meals is a school-level indicator that has been shown to be very highly correlated

with the socio-economic status of the children and their parents.

The outcome variable of this study was caries risk level for the two age cohorts labelled low, medium and high, based on four primary variables; absence or presence of any clinical decay experience at enamel and dentine levels based on ICDAS codes<sup>8</sup>, or al hygiene behaviour, dietary behaviour and deprivation level of the children based on home postcodes. For clinical decay experience ICDAS score 0 denotes no evidence of clinical decay experience, either at enamel or dentine level, ICDAS score 1 and 2 as those showing visual caries at enamel level and ICDAS score 3 to 6 as decay extending into the dentine. The range of inter examiner kappa value for enamel caries lay between 0.814 and 0.928 while for enamel and dentine it ranged from 0.592 to 0.8569. The oral hygiene behaviour assessed was the frequency of daily tooth brushing; twice or more per day and once or less per day Dietary behaviour taken into consideration was the frequency of daily consumption of sugar sweetened beverages; consumption of drinks three times or more per day and consumption twice a day or less. The socio-economic status was based on 2010 England Index of Multiple Deprivation quintiles<sup>24</sup>, which was derived from home postcodes available in the data set, were collapsed into three categories. Those who belonged to category 0 were least deprived, category 1 were moderately deprived and category 2 were most deprived.

Data were analysed using the Statistical Software for Social Sciences (SPSS version 22)<sup>25</sup>. In order to produce nationally representative estimates, all analyses involved consideration of the complex survey design and sample weights. For this purpose variable 'eweight' clinical examination weight), 'ppweight'(pupil questionnaire weight) and 'prweight'(parent questionnaire weight) were used to ensure that the final weights would total to the 2012/13 school population totals for age groups within each region<sup>26</sup>.

#### RESULTS

The results for the risk levels for five-year old children are presented in Figure 1 while the results for fifteen- year olds are presented in Figure 2. After taking all the factors into consideration, 36.8% were at low risk for dental caries, 23.8% were assessed to be at medium risk and 39.4% were considered to be at high risk for dental caries.

According to the 2011 census<sup>28</sup>, there are approximately 700,000 five-year old and 800,000 fifteen-year old children in England. The survey being a national representative of the total population as per the age groups, allows us to extrapolate the results to the whole population. 2,60,000 five year old children may be understood to be low risk, 1,68,000 medium and 2,76,000 high. For fifteen year olds, 1,38,000 are at low risk for dental caries, 2,80,000 medium and 3,84,000 are at high. Table 2 shows all the prevention based care required for the total population of five and fifteen year old English children.

#### DISCUSSION

The results for clinical caries experience, reported health behaviours and social status in the study, highlight the volume of five and fifteen year old children in England who are at risk for dental caries, despite the oral health improving in the past years.

With 23.8% and 39.4% of five year old at medium and high risk for caries respectively and 34.9% and 47.9% of fifteen year old children at medium and high risk

TABLE 1: MANAGEMENT STRATEGIES FOR FIVE AND FIFTEEN YEAR OLD ENGLISH CHILDREN BASED ON THEIR RISK STATUS

Risk Sta- tus	Management for five year old En- glish children	five year old English children from CDH survey n= 1526	Total pop- ulation of five year old chil- dren in England n≈ 700,000	Management for fifteen year old English chil- dren from CDH survey	fifteen year old English children from CDH survey n=1313	Total population of fifteen year old children in England n≈ 800,000
Low	i, Advice on use of 1,000 ppm fluoride toothpaste	> 500	≥ 260,000	i, Advice on use of 1,350-1,500 ppm fluoride toothpaste	≥200	≥ 130,000
	ii, No. of dental check-ups required per child	= 1	= 1	ii, No. of dental check-ups required per child	= 1	= 1
	iii, No. of fluoride varnishes required	> 1000	≥ 500,000	iii, No. of fluoride varnishes required	≥ 400	≥ 260,000

**Preventive oral care** 

	i, Advice on use of 1,350-1,500 ppm fluoride toothpaste	> 350	≥ 170,000	i, Advice on use of 1,350-1,500 ppm fluoride toothpaste and 0.05 NaF- of fluoride rinse	≥ 450	= 280,000
Medi- um	ii, No. of dental check-ups required per child (NICE, 2004)	= 2	= 2	ii, No. of dental check-ups required per child	= 2	= 2
	iii, No. of fluoride varnishes required	> 700	≥ 300,000	iii, No. of fluoride varnishes required	≥ 900	= 560,000
				iv, No. of fissure sealants required	≥ 2000	1.2 million
	i, Advice on use of 1,350-1,500 ppm fluoride toothpaste	>600	≥ 275,000	i, Advice on use of 28,00 ppm fluoride toothpaste and 0.05 NaF- of fluo- ride rinse	≥ 600	≥ 400,000
High	ii, No. of dental check-ups required per child	= 4	= 4	ii, No. of dental check-ups required per child	= 4	= 4
	iii, No. of fluoride varnishes required	< 2400	≥ 1,100,000	iii, No. of fluoride varnishes required	≥ 2400	≥ 16,00,000
				iv, No. of fissure sealants required	≥ 2000	$\geq$ 1.3 mil- lion

# TABLE 1: TOTAL NUMBER OF PREVENTION-BASED TREATMENTS REQUIRED FOR THE TOTAL POPULATION OF FIVE AND FIFTEEN YEAR OLDS IN ENGLAND

	Care Required Provided 2014/15 (Primary Care Do- main and Centre, 2015)		
Types of treatment	Five year olds	Fifteen year olds	All Children
Professional advice	700,000	800,000	8 million
Fluoride varnish application	1.9 million	2.4 million	3.4 million
Fissure sealants	NA	2.5 million	2.3 million
No. of check ups	1.7 million	2.3 million	8.0 million

respectively, there is a continuing need to put prevention based care into action to reduce the load of the disease and arrest the severity of the condition. Clinicians who assess caries risk based on past dental caries alone, will miss children at greater risk because of their health behaviours and social status and this most notable in five year olds. There have been past studies which have addressed the risk factors and prevalence of the condition in detail; however this is the first study of its type which provides comprehensive set of management bearing in mind the risk level of each child. This study

can therefore, allow healthcare services to understand how individual preventive care can be provided to each child based on his/her risk status in order to improve their quality of life. Preventive care can be delivered by means of dental care professionals (DCPs) in line with the General Dental Council scope of practice<sup>29</sup>.

The results of this study should be interpreted bearing in mind that there were missing values, especially for five year olds as their parents did not complete the questionnaires. Moreover, examinations took place in a school setting. Drying of teeth and absence of evidence



i, ICDAS score 0= sound tooth

ii, ICDAS score 1 and 2= early stage decay (visual enamel decay)

- iii, ICDAS score 3 and 4= established decay (enamel cavity)
- iv, ICDAS score 5 and 6= severe decay (cavity at dentine level)

See https://www.icdas.org/. v, Optimal oral hygiene=brush teeth twice or more per day vi, Optimal oral hygiene: The response rate by parents in completing the questionnaire was 45%. Only 672 valid responses were noted for the frequency of tooth brushing with 854 missing values. viii, Least, moderately and most: There were 59 children whose home postcode was not available.





i, ICDAS score 0= sound tooth

ii, ICDAS score 1 and 2= early stage decay (visual enamel decay) iii, ICDAS score 3 and 4= established decay (enamel cavity)

iv, ICDAS score 5 and 6= severe decay (cavity at dentine level) See https://www.icdas.org/.

v, Optimal oral hygiene=brush teeth twice or more per day

vi, Healthy dietary habits=consume sugar-sweetened beverages twice or less per day vii, Optimal oral hygiene:\*: The response rate of children in completing the questionnaire was 99%. However there were 399 valid responses for the question regarding the frequency of tooth brushing(HSCIC, 2015).

viii, Healthy dietary habits: 98% response rate for the question addressing the frequency of consumption of sugar sweetened beverages. 1288 valid responses and 25 missing values(HSCIC, 2015). ix, Least, moderately and most deprived: There were 53 children whose home postcode was not available (HSCIC, 2015).



from radiographs and other diagnostic aids required to identify caries at different levels was not as precise as it would have been in a clinical setting leading to an underestimation of the risk for dental caries based on clinical examinations. Furthermore, self-reported questionnaires are at risk of bias giving false results<sup>30</sup>. Altogether this represents an under-estimation of risk in the study findings.

The Health and Social Care Information Centre reported that in 2016/17 a total of 4.2 million courses of treatment (CoT) of fluoride varnishes were delivered to English children and 2.8 million CoT of fissure sealants, being the second most common dental treatment, was provided to children below the age of eighteen years<sup>31</sup>, which means only 1,60,000 5 year olds and 1,65,000 15 year olds underwent fluoride varnish application while there were only 97,000 CoT for fissure sealants for older children. The results from the study shows an imbalance between the amount of care required and that delivered. This study can help healthcare officials in formulating policies to address this imbalance in order to reduce the burden of the disease. And it is important to note that much of this care could be delivered by the wider dental team<sup>32,33</sup>.

Evidence shows the caries-inhibiting effect of fluoride varnishes both on permanent as well as primary teeth making it an effective caries preventative agent<sup>34</sup>. Moreover, pits and fissure sealants have been shown to reduce caries incidence up to 48 months as opposed to surfaces which have no sealants applied to them<sup>35</sup>.

It is, nonetheless important to bear in mind that as well as social inequalities in oral health, inequalities are also apparent across the social spectrum for dental attendance. Dental visits are higher amongst children belonging from higher social class as compared to those from low social classes<sup>4</sup>. Children from socially deprived groups are more likely to attend 'when in trouble' than their counterparts in higher social groups<sup>1</sup>. Visits to the dentists are centred on the time when dental caries shows an aggressive pattern, well beyond the scope of prevention based care for the latter group<sup>36</sup>. Policies based on prevention therefore, will be challenging when targeting this group and need careful planning and implementation to achive better oral health.

#### CONCLUSION

This study set out to identify the risk status for dental caries of five and fifteen year olds in England based on clinical decay experience, oral hygiene behaviours, dietary behaviours and social status for the purpose of providing them with the necessary and most appropriate preventative treatment to reduce their risk in the future. Consideration of health behaviours and social factors highlights more children at risk than merely consideration of clinical decay. The study highlights the extent of caries risk present amongst children and young people and the imbalance between the care delivered and that required to achive better oral health. It is time for dental care authorities to make prevention rather than treatment their pivotal point of concern to reduce both the severity of the condition and financial burden on the healthcare system.

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1	Amna Ali:	Selection of the topic, design and literature review, wrote article.
2	Rai Tariq Masood:	Data cleaning, entry and analysis.
3	Adnan Hafeez:	Revision and approval of the final version.