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ORIGINAL ARTICLE

Caries and background factors in Swedish 4-year-old children with special reference to immigrant status

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Abstract

Objective. This study assesses the prevalence of caries and some background factors in 4-year-old children in the city of Umeå, northern Sweden, and compares this with data from earlier studies to reveal changes over time. ***Materials and methods.*** Children from the catchment areas of three Public Dental Health Service clinics in Umeå ($n = 224$) born during the third quarter of 2008 were invited to undergo a clinical dental examination. Decayed surfaces (including both dentine and enamel, except for enamel lesions on buccal and lingual surfaces), missing and filled surfaces (dmfs) were recorded using the same methods and criteria as in a series of earlier studies performed between 1980–2007. Background data were collected in a case-history and a questionnaire. ***Results.*** The proportion of children with caries significantly decreased from 2007 (38%) to 2012 (22%) ($p < 0.05$). In addition, the distribution of dmfs differed significantly between these years ($p < 0.05$). More immigrant children had caries (42%) than non-immigrant children (15%) ($p < 0.05$). For children with caries, there were no significant changes in the distribution of dmfs between 1980–2012 ($p > 0.05$). An immigrant background was associated with a lower frequency of tooth brushing and a higher intake of ice cream, sweets and chocolate drinks ($p < 0.05$). ***Conclusion.*** Although the proportion of children with caries declined between 2007–2012, this decline was limited to non-immigrant children. Since 1980 the distribution of dmfs remained unchanged among children with caries. More research on interventions for changing oral health behaviours is needed, specifically for immigrant children.

Key Words: *caries, children, immigrants, polarization*

Introduction

Despite the declining prevalence, dental caries in pre-school-aged children remains a public health challenge in many countries [1]. Left untreated, dental caries can negatively affect children and their parents [2–4]. Important aetiological factors may occur during the child's first year of life and include maternal influence on bacterial acquisition, whereas colonization is mediated by oral health behaviours and feeding [5,6]. Socioeconomic factors are important risk indicators for caries during the pre-school age [7]. Caries during pre-school ages is associated with a higher susceptibility to subsequent caries both in the primary and permanent dentition [8]. Healthy teeth in children depend on lifestyle factors such as promoting tooth brushing and limiting the intake of sugary snacks. Consequently, research on contributing factors for caries in infants have mainly focused on oral hygiene, social factors and dietary factors [9–12]. Oral hygiene, together with use of fluorides and restriction of the frequency of sugar intake, constitutes the basic elements for prevention of dental caries [13]. Sugar intake and oral hygiene may interact; if there is a balance of good habits such as favourable oral hygiene and bad habits as a cariogenic diet, the development of caries may be controlled [14,15].

In Umeå, a city in northern Sweden, a series of cross-sectional studies have been conducted since 1967 using the same methods and criteria [16]. Between 2002–2007, there was a change in the distribution of caries with a concurrent decreased intake of sugary snacks and increased frequency of tooth-brushing. The distribution was clearly skewed with a polarization towards a higher prevalence of

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caries in immigrant children. This corroborated results from a recent study in Norway, where the prevalence of caries in 5-year-olds was strongly associated with factors such as socioeconomic status, dental behaviour and parental attitudes [11], indicating that the real high risk group is non-western children whose parents are immigrants and have a low level of education. Contributing factors may change over time because of life-style changes. Up-to-date knowledge about the possible changes in prevalence and contributing factors will, therefore, help to form the basis for the preventive approach in child dentistry.

The present study assesses the prevalence of caries and contributing factors in 4-year-old children in Umeå using the same methods and criteria as used in earlier studies and compares with data collected between 1980–2007 to reveal changes over time.

Material and methods

The subjects were children born during the third quarter of 2008 and who lived in the catchment areas of three public dental health service clinics in Umeå (n = 224). The areas were the same as those in the earlier studies [16]. The number of children examined was proportional to the total number of children in the respective clinic. Parents of the children received a letter informing them that participation in the study was voluntary and 208 families agreed to participate (93%). Five children were excluded because they were unwilling to undergo a thorough dental examination. Thus, 203 children were included in the analysis. The examinations were carried out between September and December 2012 at the dental clinic where the child registered and were performed as a part of the regular dental examination of 4-year-olds within the regular, complete and free dental care offered to children aged 3–19 years.

Clinical examinations

The dental examinations were carried out by four experienced paediatric dentists (CK, CSB, KW and PH) using a mirror and probe. Bitewing radiographs were used when approximal surfaces were unavailable for visual inspection. The examiners were calibrated on the diagnostic criteria before the start of the study. KW and PH were calibrated to examiners who had been involved in the study in 2007 (CK, CP, CSB and EB). CSB had been involved in all studies since 1980 and EB had been involved in 1997, 2002 and 2007 studies. Nine children were examined for the calibration, which was performed until joint agreement on the criteria for caries was reached. The opinion of the examiners who had been involved in the earlier studies constituted the gold standard.

Decayed, missing and filled surfaces (dmfs) were recorded using the same methods and criteria as in the earlier studies. The criteria for caries were those described by Koch [17]. Initial caries was defined as a chalky white spot without a breakdown in enamel surface. The dmfs score included all carious lesions in enamel and dentine except enamel caries on buccal and lingual surfaces. A molar extracted because of caries was counted as three missing surfaces and an extracted incisor was counted as two missing surfaces.

As in the previous studies, a case history outlining frequency of tooth brushing, the use of fluoride toothpaste and/or fluoride supplements, general health, medication and country of birth was obtained from the accompanying parent. If at least one parent was born outside of Sweden and had a native language other than Swedish, the child was classified as an immigrant child.

Questionnaire

As in the previous studies, the accompanying parent was asked to complete a questionnaire about the frequency of consumption of 10 sugary snacks and drinking habits. The intake frequencies of each product were scored into the following categories: never; one intake per month; two intakes per month; one intake per week; two–three intakes per week; one intake per day; two–three intakes per day; and four or more intakes per day.

Statistical methods

The data were analysed using PASW statistics software (version 20.0, Chicago, IL). The Pearson chi-square test was used to compare the number of children with caries in sub-groups. The non-parametric Mann-Whitney U-test was used to compare the distribution of dmfs between 2007–2012. The Kruskal-Wallis test was used for multiple comparisons of dmfs. A p-value of < 0.05 was considered statistically significant.

Results

Prevalence of caries

The proportion of children with caries in 2012 (22%) was statistically significantly lower ($p < 0.05$) than in 2007 (38%). Similarly, the distribution of dmfs differed statistically significantly between these years ($p < 0.05$) (Table 1, Figure 1). More immigrant children had caries ($p < 0.01$) than non-immigrant children (58% vs 15%). The distribution of dmfs scores also had a statistically significant difference ($p < 0.01$) between immigrant and non-immigrant children (Figure 2). The proportion of children with caries gradually decreased among non-immigrant

Table I. Four-year-old children with caries (%) and dmfs in 1980, 1987, 1992, 1997, 2002, 2007 and 2012 in Umeå.

Year	1980	1987	1992	1997	2002	2007	2012
n	93	126	163	205	182	218	203
Immigrants, %	—	—	—	10	9	16	16
Children with caries, %	50	42	44	46	46	38 *	22
Immigrants %				55	88 **	59 **	58 **
Non-immigrants %				45	41 **	32 **	15
Children with caries (dmfs)							
Mean ± SD	4.0 ± 3.1	4.8 ± 4.7	4.4 ± 4.2	4.2 ± 3.6	4.4 ± 4.2	3.4 ± 3.7	3.8 ± 3.8
Median	3	3	3	3	3	2	3
Range	1–13	1–15	1–15	1–19	1–21	1–24	1–18

—, not recorded.
Statistically significant difference for children with caries (%) between 2007–2012 and for immigrant children with caries (%) between 2002–2007 and for non-immigrants between 2002–2007 and between 2007–2012. *$p < 0.05$, **$p < 0.01$.

children between 2002–2007 and between 2007–2012 ($p < 0.01$). A similar decrease was noted for immigrant children between 2002–2007 ($p < 0.01$), but not between 2007–2012 ($p > 0.05$). For children with caries, there was no statistically significant change in the distribution of dmfs between 1980–2012 or between any of the years ($p > 0.05$).

Background factors

The proportion of immigrant children (16%) was not significantly different from that observed in 2007. In 12% of the children, a medical condition was reported, asthma and allergies being the most common. The non-immigrant children had a significantly higher prevalence ($p < 0.01$) of asthma or allergies than immigrant children had (12.3% vs 3%).

In 2012, 67% of the children received help with tooth brushing according to recommendations (twice a day), 22% received help once a day and 11% seldom or irregularly received help; there were no significant differences compared to 2007 ($p > 0.05$). Compared to caries-free children, children with caries had a less frequent tooth brushing ($p < 0.01$) (Figure 3). Immigrant background was associated with a statistically significantly lower frequency of tooth brushing ($p < 0.05$) (Figure 4). All parents reported use of fluoridated toothpaste.

For children with caries a statistically significantly higher intake was reported for ice cream ($p < 0.05$),

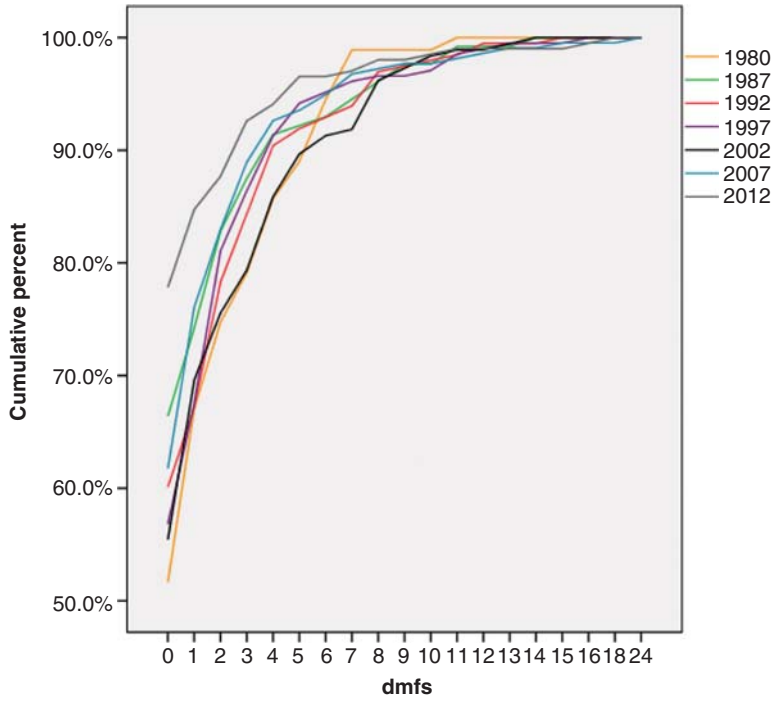

Figure 1. The cumulative frequency distribution of dmfs in 4-year-old children in Umeå in 1980, 1987, 1992, 1997, 2002, 2007 and 2012.

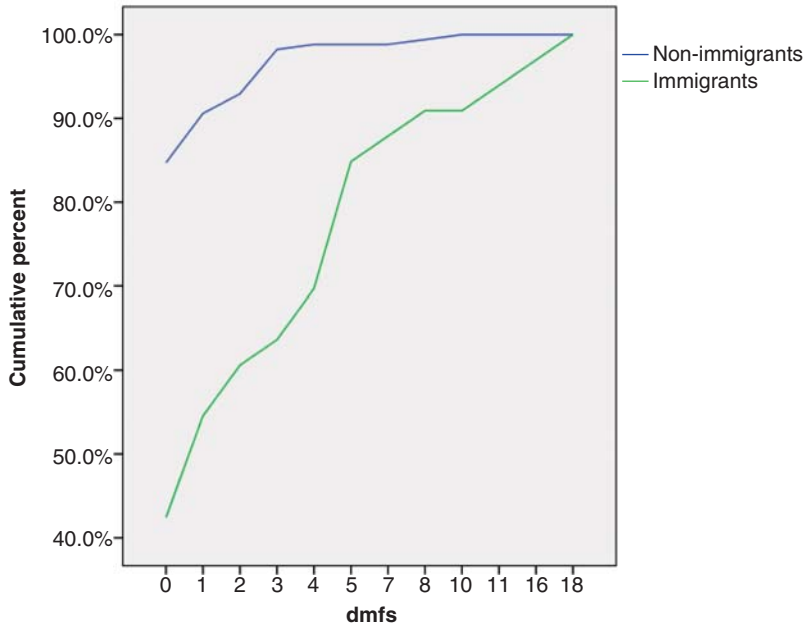

Figure 2. The cumulative distribution frequency of dmfs in immigrant and non-immigrant 4-year-old children in Umeå 2012 ($p < 0.01$).

marmalade and jam ($p < 0.05$) and sweets ($p < 0.01$) (Figure 5). The immigrant children had a significantly higher intake of ice cream, sweets and chocolate drinks ($p < 0.05$). Eighteen per cent of immigrant children consumed ice cream three or more times per week compared with 5% of non-immigrant children. Thirty per cent of immigrant children consumed sweets three or more times per week compared with 10% of non-immigrant children. For chocolate drinks, the corresponding figures were 36% and 10% for immigrant children and non-immigrant children, respectively. With regard to sugar added to food, buns, cakes and biscuits, a higher proportion of parents of immigrant children stated no intake compared to parents of non-immigrant children ($p < 0.05$). Drinking at night was significantly ($p < 0.05$) more common in immigrant children than in non-immigrant children (21% and 8%, respectively).

Discussion

The caries prevalence had an obvious decline between 2007–2012, but this decline was limited to non-

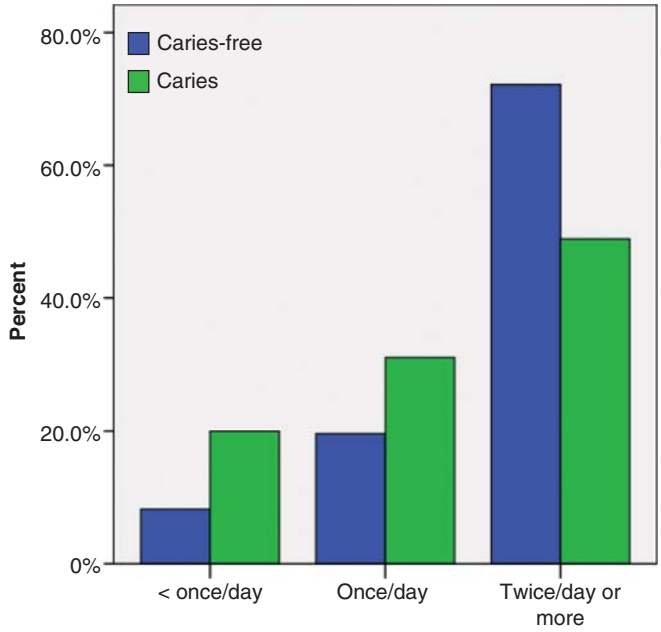

Figure 3. Reported frequency of tooth brushing in children with caries and caries-free children ($p < 0.01$).

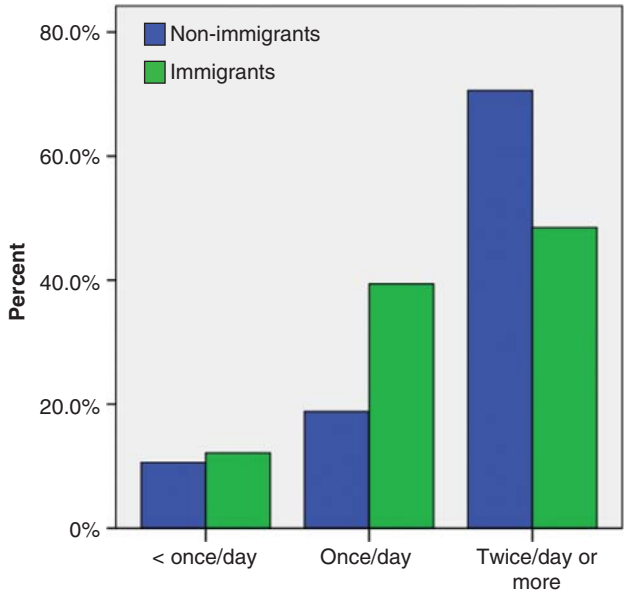

Figure 4. Reported frequency of tooth brushing in immigrant and non-immigrant 4-year-old children ($p < 0.05$).

immigrant children. Noteworthy, for those children with caries, the distribution of dmfs has remained unchanged for 32 years and the prevalence of caries among immigrant and non-immigrant children continues to differ. Comparing the population-wide prevalence of caries may, therefore, give a false picture of the distribution of the disease.

A strength of the comparisons with earlier studies in this series is that the caries criteria, methods for recording caries and collection of background data have been the same in all the studies. Caries included enamel caries except for initial lesions on buccal and lingual surfaces. In small children with inadequate oral hygiene soon after tooth eruption enamel caries may develop near the gingival margin at buccal and lingual surfaces,

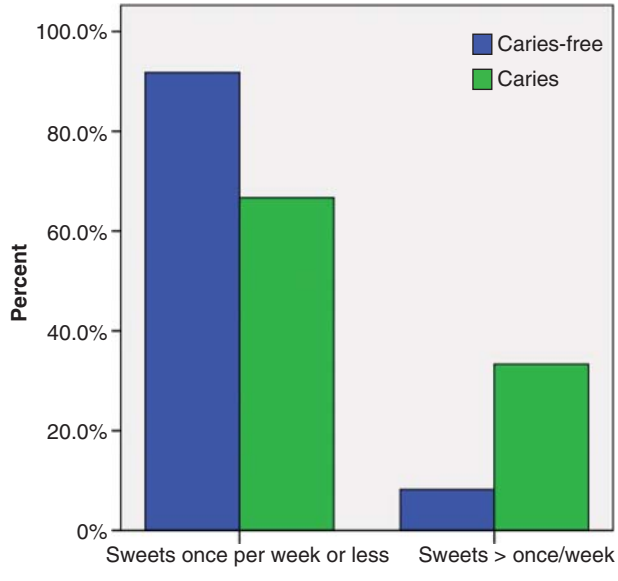

Figure 5. Reported intake of sweets for children with caries and caries-free children ($p < 0.01$).

but as the tooth continues to erupt these lesions often remineralize while the white colour remains. To avoid an over-registration of such lesions they have not been included in the analysis in these studies.

In Sweden, all children are offered regular, comprehensive dental care free of charge up to the age of 20. With an obvious skewed distribution of dental caries in children in such a system, the importance of careful allocation of resources for dental care to those most in need is clear. To meet this demand efforts are made to identify children at risk for dental caries as early as possible in order to maintain healthy teeth. With the obvious decline in the prevalence of caries among Swedish children, these efforts seem successful. However, encouraging good oral health behaviour among immigrant families remains a challenge.

Particularly intake of sweets discriminated children with caries from caries-free children. This difference indicated that the Swedish concept with Saturday's sweets which has been advocated for many years to minimize the consumption of candies should be encouraged. Based on the evidence from the daily use of fluoridated toothpaste, increased frequency of tooth brushing has been advocated to prevent caries [18]. In 4-year-olds it was clear that caries was associated with a lower frequency of tooth brushing with parental assistance. The significantly lower frequency of tooth brushing among immigrant children may, therefore, help to explain the increased prevalence of caries compared with non-immigrant children. A study from Denmark reported that, despite the comprehensive public dental care, large differences in dental health were found between families with Danish and non-Danish backgrounds. A change in the preventive strategies including peer-based education on tooth brushing habits was proposed to meet these needs [19]. Interestingly, a national nursery tooth brushing programme in Scotland was associated with a reduction in caries in 5-year-old children and a change in the inequality in the distribution of dental caries [20].

Caries early in life is a complex problem and may need complex intervention [21]. Increased knowledge of parental factors may improve our understanding of unhealthy behaviour and poor oral health in children. In a study on the familial and cultural perceptions and beliefs of oral hygiene and dietary habits among ethnically and socio-economically diverse groups from 17 countries, the way parents perceived their ability to control tooth brushing and snacking habits in their children was the most significant predictor of favourable habits [22]. A systematic literature review on parental influence and the development of dental caries in children aged 0–6 years concluded that knowledge about parents' beliefs, attitudes and knowledge could help to increase understanding of unhealthy oral health behaviour and favourable factors that could be used to develop evidence-based

interventions for children at high risk [23]. After a review of the aetiological factors of early childhood caries, it was suggested that the causes are best explored using a combination of quantitative and qualitative research [6]. A qualitative research approach may provide a better understanding of why current preventive approaches are not successful in this group of children. Few studies have explored parental attitudes, knowledge and beliefs as well as the possible pathways between individual, familial, community and socio-cultural contexts. Parents from socio-economically deprived areas were interviewed with respect to the tooth brushing habits of their children [24]. The stability of daily routines, the perceived immediacy of the benefits of tooth brushing and opinions of how often other parents brush their children's teeth appeared as the most important factors. Interviews were also used to study behavioural determinants among parents with regard to brushing the teeth of pre-school-aged children [25]. Parents who brushed twice a day were more likely to hold high self-standards for brushing, whereas parents who brushed their children's teeth less than twice daily were more likely to hold false beliefs about the benefits of brushing twice daily. These parents also reported little normative pressure or social support for the behaviour and had lower self-standards, described more external constraints and offered fewer ideas to overcome barriers. Activities that support parental skills in caring for their children's teeth are, therefore, important. The evaluation of interventions that aim to change oral health behaviours in children and their parents based on behavioural therapy is also desired [26].

In conclusion, the proportion of children with caries declined between 2007–2012, but this decline was limited to non-immigrant children. For children with caries the distribution of dmfs has remained unchanged since 1980. Future research on interventions for changing oral health behaviours is desired, specifically for immigrant children.

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