Community Dental Health (2010) **27,** 94–101
Received 7 March 2008; Accepted 1 November 2008

doi:10.1922/CDH_2424Christensen08

Oral health in children in Denmark under different public dental health care schemes

L.B. Christensen[1], P.E. Petersen[1] and B. Hede[2]

[1]*University of Copenhagen, Faculty of Health Science, School of Dentistry, Department for Community Dentistry and Graduate Studies,Denmark;* [2]*The City of Copenhagen, Department for Special Care Dentistry.*

Purpose: To describe and analyse oral health of children and adolescents under two types of dental health care schemes under the Public Dental Health Service in Denmark, and to analyse possible influence of socio-economic and socio-cultural factors. ***Methods:*** Data on children's oral health status was obtained from public oral health registers and were pooled with data from questionnaires sent to parents of the children and adolescents. The study comprised individuals aged 5, 12 and 15, in total 2168 persons, randomly drawn from four municipalities with dental care provided by salaried dentists in public dental clinics and three municipalities with dental care provided by dentists in private practice. 70% of the parents completed a questionnaire including questions on socio-economic and socio-cultural background, lifestyle-related factors, self assessment of parents' oral- and general health. After the data were merged, the final study population represented 60% of the original target population. ***Results:*** The mean caries experience (DMFS+dmfs) was 2.2 and further analysis of caries experience in each age group showed no variations in relation to type of provider of dental care. However, multiple dummy regression analyses demonstrated that low education, poor general health, foreign citizenship and smoking habits of the parents were important determinants for high level of caries in their children. ***Conclusion:*** Occurrence of dental caries as well as changes over time in levels of dental caries of Danish children did not vary by scheme of Public Dental Health Service, i.e. whether dental health care was provided by public employed dentists or by private practitioners. However, social inequalities still relate to caries experience in children and adolescents. Adjustment of preventive oral health activities strategy seems to be needed.

Keywords: Caries experience, dental care provider, lifestyle, schoolchildren, socio-cultural factors, socio-economic factors.

Introduction

In Denmark, the Public Dental Health Service (PDHS) offers systematic dental care to children and adolescents. According to the Danish Act on Dental Care for Children (passed in 1972 and revised in 1986 and 2001), all children and adolescents are entitled to dental care under PDHS free of charge. The Danish authorities have detailed in directives and guidelines how to accomplish the aim of the act, i.e. offers of regular dental examinations, comprehensive treatment and preventive care. The PDHS system is organized at the municipal level in two different ways. In most municipalities, dental care is organized as a school-based service provided by public salaried dentists employed in public dental clinics. In the remaining municipalities, contracts were made with dentists in private practice to deliver dental health care service for children and adolescents based on fee-per-item in accordance with a payment scheme. In 1980 the PDHS system for children and adolescents in Denmark was evaluated and compared with other oral health care systems by an international team. The team reported a lower level of caries experience among children in municipalities with public employed dentists than in municipalities with dental care for children provided in private dental clinics (Davies *et al*., 1982). These figures confirmed results from an earlier local report made by the Danish health authorities. At present, the PDHS system is attended by nearly 100% of the target group, and about ten percent are covered by PDHS in private practice.
With the establishment of PDHS in 1972, a recording system was introduced for evaluation of the PDHS and for the surveillance of oral health of children (Helm, 1973). During the last decades, the prevalence of caries among children and adolescents has decreased markedly in most Western countries including Denmark (Petersen, 2003) , and a steady increase in the number of children without caries has been observed. On the other hand, a skewed distribution of dental caries, which was found at the end of the 1980s (Petersen, 1992), was still present at the end of 1990s (Poulsen and Scheutz, 1999) meaning that more and more children were free of caries while a limited number still had considerable caries experience. This trend parallels the situation in several other industrialized countries (Petersen, 2003). Moreover, the existence of a social gradient in relation to dental caries has been found under various dental health care systems across countries worldwide, as measured by the association between dental caries and socio-economic status (Petersen, 2005). Such a social gradient for caries was found earlier in Denmark among six-year-old children (Petersen, 1992) and schoolchildren (Poulsen, 1987). Studies from other countries showed associations between caries in children and their parents' socio-economic status (Faggiano *et al*., 1999; Adam *et al*., 2005; Enjary *et al*., 2006) which is in agreement with the two Danish reports. In Denmark,

Correspondence to: Dr. Lisa Bøge Christensen, University of Copenhagen, Faculty of Health Science, School of Dentistry, Department for Community Dentistry and Graduate Studies, Noerre Alle 20, DK 2200. E-mail: LBCH@sund.ku.dk

no current information has been published concerning possible association between caries among children and the type of provider of dental care. The present study aimed to describe and analyse the dental health of children and adolescents under two types of dental health care schemes under the PDHS. Furthermore, to analyse the influence of socio-economic, socio-cultural and lifestyle factors on oral health in these population groups.

Study population and method

Cluster sampling was used for identification of participants. The clusters were municipalities selected for the purpose of representing various geographical areas of the country, various degrees of urbanization and different types of dental care providers under PDHS (Figure 1). Eight municipalities were selected for the study, four municipalities with PDHS organized through public clinics and four municipalities delivering dental care service in private dental clinics. One municipality with PDHS organized in private dental clinics was excluded from the study due to lack of reported data. The mean concentration of fluoride in the drinking water varied from 0.1-0.2 ppm (parts per million) in the municipality with the lowest level to 0.3-1.9 ppm in the municipality with the highest level. From each municipality, almost equal-sized cohorts of children born in 1989, 1992 and 1999 were randomly selected. The size of each of the seven cohorts was approximately 300, 50 boys and 50 girls in each of the three age groups. For practical reasons, one municipality included all children from each year of birth in the study. Hence, at the time of data collection the children were 5, 12 and 15 years of age respectively. Such a sample design is calculated to permit the identification of differences between geographical areas and between different socio-economic groups . The sampling procedure was carried out by the government agency for civil registration numbers, and the sample comprised 2,168 children. Data on caries experience DMF-S and dmf-s (decayed, missing and filled surfaces in permanent and primary dentition respectively) were obtained from nationally aggregated data collected in databases established and administered by the National Board of Health in 1972 (Helm, 1973). The recording system is based upon a relatively simple coding methodology and standardized criteria for clinical registration that provides information on DMF-S and dmf-s indices, at regional as well as national levels. The criteria for caries agree with standards set by WHO for presence of initial and manifest caries (WHO, 1997). In the present study caries occurrence was recorded at the cavity level. Furthermore, caries severity zones were recorded as follows: Zone 1, no cavitated caries; Zone 2 caries experience in fissures and pits; Zone 3, caries experience on approximal sur-

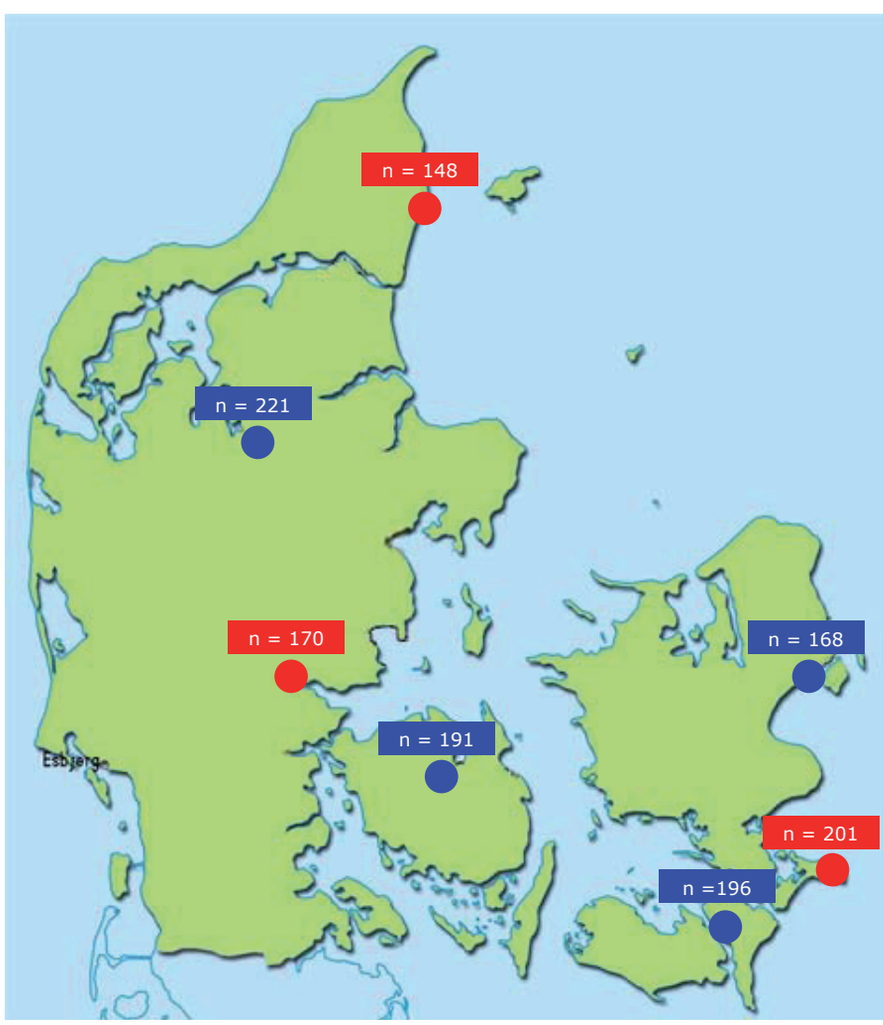

Figure 1. *Distribution of municipalities and participants of the study*

faces; and zone 4 caries experience in smooth surfaces. As for treatment methods, no specific standards have been set by the Danish health authorities. The results of the present report are presented by the sum of DMF-S and dmf-s. This type of measurement reflects the total disease burden and the need for preventive interventions i.e. the extent of the public health problem.

According to directives from the health authorities, registration of data on oral health by 5, 12 and 15 years of age is mandatory. In the present study, the number of reported data was obtained from 80% of the study population. Information on socio-economic and socio-cultural factors, health and health behaviour of the family was obtained through postal questionnaires sent to the parents of the children. The respondents were asked about citizenship, number of years in school, smoking habits and family income level. In the present report, the income level is reported in EURO intervals, which may seem odd. This is because income level was originally reported in Danish currency on an ordinary scale. In order to obtain information on the respondents' perception and feelings about their general and oral health, questions on self-assessment included four answering categories: very good, good, fairly good and poor. Twelve questionnaires were never sent because the children were orphans. Six questionnaires never reached the respondents because of errors in the identification numbers or unknown addresses. Seventy percent of the parents completed and returned the questionnaires.

Data on caries experience were merged with the questionnaire data for analysis by means of SPSS (Statistical Programme for the Social Sciences). After the data were merged, the final study population represented 60% of the original target population. Distribution of the study population in relation to various characteristics is shown in Table 1.

Table 1. Percentage of the study population, children and their parents (respondents) in relation to various characteristics.

		n	%
Age group of children	5 years	443	34
	12 years	444	34
	15 years	408	32
Gender of the children	Boys	633	49
	Girls	662	51
Citizenship (respondent/parents)	Danish	1229	95
	Not Danish	64	5
Municipality	Odense	191	15
	Viborg	221	17
	Rødovre	168	13
	Nykøbing F	196	15
	Sæby	148	11
	Hedensted	170	13
	Møn	201	16
Organization of dental care	Public clinics	776	60
	Private dental practice	519	40
Family income	<26.665 EUR	122	10
	26.666-53.332 EUR	291	23
	53.333-79.998 EUR	502	40
	79.999+ EUR	339	27
Level of education (respondent/parents)	9 years in school or less	130	10
	10 years in school	456	36
	11-12 years in school (graduates)	700	54
Smoking habits (respondent/parents)	Smoking	352	27
	Not smoking	940	73
Self-assessment of general health (respondent/parents)	Very good/good	1200	93
	Less good	71	5
	Poor	21	2
Self-assessment of oral health (respondent/parents)	Very good/good	815	63
	Less good	382	30
	Poor	97	7

Results

The caries prevalence among the 5, 12 and 15-year-olds was found to be 26%, 54% and 64% respectively. No differences were found in caries experience between boys and girls. However, it was calculated that 70% of the total amount of caries experience was found in 16% of the study population. The total mean caries experience (DMFS+dmfs) was 2.1 in children attending dentists in private practice versus 2.2 among children attending public clinics. Analyses of caries among children whose parents did not complete and return the questionnaires showed a somewhat higher mean (3.5 DMFS+dmfs). Table 2 illustrates the level of caries experience (DMFS+dmfs) among Danish children aged 5, 12 and 15. Almost no differences were seen between the two types of provision of dental care (Table 2). Irrespective of dental care scheme, almost equal values were found for untreated caries (the DS+ds component), and for missing and filled surfaces (MS+ms and FS+fs components). In general, the amount of untreated caries and total caries experience increased with increasing age, and missing surfaces due to caries were most prominent in the younger age group. In addition, when comparing the two dental health care schemes, no differences were found between the number of children in the caries severity zones. About one third of the children were found in zones 3 and 4, i.e. approximal caries and caries on smooth surfaces. Approximately half of the total study population was caries free (DMFS+dmfs=0) (Table 3), and the distribution of children in each of the three age groups according to five categories of number of surfaces with caries experience (DMFS+dmfs) showed equal figures within the two types of dental care schemes (Table 3). Comparing DMFS+dmfs among the children in the seven municipalities, some variation was found across dental health care schemes (Table 4). The range of DMFS+dmfs in the municipalities was 1.3 with a maximum value of 2.8 and a minimum value of 1.5 (Table 4). Table 4 also indicates the number of waterworks and the interval of fluoride concentration in the drinking water in each municipality. Table 5 demonstrates that caries experience among the children varied with parent citizenship. Moreover, the level of caries experience was highest among children whose parents had low levels of education and low family income (Table 5). In addition, the children's caries experience was highest where parents considered their own general health and their own oral health as poor, and in families where parents smoked (Table 5). Table 6 presents the results of multivariate regression analyses. These analyses show that caries amount and caries risk increased with increasing age. Foreign citizenship, low educational level and poor health of parents represent statistically significant differences; some variations were also seen between geographical areas. The odds of dental caries experience were 1.3 times higher among children with smoking parents (Table 6).

Discussion

The present data were obtained from seven municipalities, three with private practitioners as PDHS dental care providers and four with employed public dentists as PDHS providers. Within each municipality random samples of children from three age groups were drawn. One municipality included all children in the relevant age groups due to the small number of inhabitants. Data regarding oral health were based on the Danish standardized recording system for oral health, and data were obtained from data bases systematically stored and administered by Danish health authorities (Helm, 1973). Comparing the two dental care schemes of PDHS, external validity was considered satisfactory. The response rate among parents was 70%. In general, 99% of all Danish children attend the PDHS either in public clinics or in private practices. One municipality was excluded from the study as the mandatory reporting of caries to the health authorities had only been partially fulfilled. Clinical data were available for 80% of the study population. Missing data from one-fifth of the total study population may have caused some selection bias; however, the most likely reason for the missing data is extended intervals of dental examination to more than one year for children and adolescents with no caries incidence for years. Consequently, no data were available on these "healthy" children during the study period**.** This may indicate that the mean figures for caries in the present results are too pessimistic. On the other hand, analysis of caries experience in the group whose parents did not respond to the questionnaire showed somewhat higher levels of caries experience than in the children of the respondents.

The present study showed that the differences in caries experience which were demonstrated 30 years ago, depending on type of dental care provider, seem to have disappeared along with the general reduction in caries experience among children and adolescents. No differences were found in the present study between the two types of dental health care schemes under PDHS.
The Danish PDHS system was launched in 1972 based on preventive and curative principles. The system is free of charge, and it has a very high attendance rate (99%). Since 1972 caries among children and adolescents has declined markedly (Schwarz and Hansen., 1979; Poulsen and Scheutz, 1999), a trend which has been seen in many other industrialized countries during the same period (Petersen, 2003). Among 15-year-old Danes, mean DMFS was reduced from 6.7 in 1988 to 3.3 in 2001. Compared to other Western European countries, Denmark and the Netherlands had the lowest level of caries experience (at tooth level) among 12-year-olds in 2000 (0.9 and 0.8 respectively) (Downer *et al*., 2005), whereas Greece had the highest level, 2.2 DMFT. Denmark is also among the European countries with the lowest level of caries experience among 5-year-old children (Downer *et al*., 2005).
Improvement of the oral health of children and adolescents in Denmark has been ascribed to various factors such as school-based preventive programs, use of fluorides, improved oral hygiene, improved living conditions, an improved general lifestyle and better health-related behaviour (Helm and Helm, 1990; Petersen, 1992). However, as documented previously, along with this amelioration of dental health, a polarization of caries together with a clear social gradient was found in the late 1980s (Petersen, 1992).

Table 2. Mean caries experience (DMFS+dmfs) in relation to age group and dental care provider scheme.

Age		*Public dental clinics*					*Private dental clinics*				
		n	*Mean*	*SEM*	*95% CI*		*n*	*Mean*	*SEM*	*95% CI*	
					Lower	*Upper*				*Lower*	*Upper*
5 years	DMFS+dmfs	276	1.2	0.3	0.7	1.8	167	1.2	0.3	0.6	1.8
12 years	DMFS+dmfs	261	2.6	0.3	2.1	3.1	183	2.3	0.3	1.8	2.7
15 years	DMFS+dmfs	239	2.8	0.3	2.4	3.3	169	2.8	0.3	2.2	3.4

Table 3. Distribution (%) of the study population in relation to caries experience (DMFS+dmfs), age group, and dental care provider scheme.

Age		*Public dental clinics* *%*	*Private dental clinics* *%*
5 years	No caries experience	75	72
	1-2 DMFS+dmfs	15	16
	3-4 DMFS+dmfs	4	6
	5-9 DMFS+dmfs	4	3
	≧ 10 DMFS+dmfs	2	3
		100	100
12 years	No caries experience	45	47
	1-2 DMFS+dmfs	24	21
	3-4 DMFS+dmfs *	9	18
	5-9 DMFS+dmfs *	15	7
	≧ 10 DMFS+dmfs	7	7
		100	100
15 years	No caries experience	35	38
	1-2 DMFS+dmfs	26	25
	3-4 DMFS+dmfs	14	13
	5-9 DMFS+dmfs	20	18
	≧ 10 DMFS+dmfs	5	6
		100	100
All	No caries experience	52	52
	1-2 DMFS+dmfs	21	21
	3-4 DMFS+dmfs	9	13
	5-9 DMFS+dmfs	13	9
	≧ 10 DMFS+dmfs	5	5
		100	100

Table 4. Mean caries experience (DMFS+dmfs) of the total study population, number of waterworks and fluoride concentration (ppm= parts per million) in relation to geographical area.

	*Mean DMFS+dmfs**	*SEM*	*CI 95%*	*No of waterworks*	*Fluoride concentration ppm*
Møn #	1.5	0.2	1.1-1.9	27	0.3-1.9
Rødovre ##	1.7	0.2	1.3-2.2	4	0.5-0.7
Odense ##	2.1	0.3	1.5-2.8	27	0.1-0.6
Hedensted #	2.2	0.3	1.6-2.6	21	0.1-0.3
Viborg ##	2.3	0.2	1.8-2.8	21	0.1-0.3
Nykøbing Falster #	2.5	0.4	1.8-3.2	15	0.2-0.8
Sæby #	2.8	0.4	2.0-3.6	8	0.1-0.2

* $p < 0.05$
\# Dental care provided by dentists in private dental practice
\## Dental care provided by public employed dentists

Table 5. Mean caries experience (DMFS+dmfs) of the study population in relation to various socio cultural, socio economic, and lifestyle factors and selfassessment of health of the parents (respondents).

	n	*Mean*	*SEM*	*95% CI*	*p*
Citizenship					<0.001
Danish	1229	2.0	0.5	1.8-2.2	
Not Danish	64	4.7	1,8	2.6-6.8	
Educational level, years in school (parents/respondents)					<0.001
9 years or less	130	3.8	0.5	2.8-4.7	
10 years	456	2.4	0.2	2.0-2.7	
11-12 years (graduate high school)	700	1.7	0.1	1.4-2.0	
Family income level					<0.01
<26.665 EUR	122	2.6	0.5	1.6-3.5	
26.666-53.332 EUR	291	2.6	0.3	2.1-3.1	
53.333-79.998 EUR	502	2.1	0.2	1.7-2.5	
79.999+ EUR	339	1.6	0.2	1.3-1.9	
Selfassessment of general health (parents/respondent)					<0.001
Very good/good	1200	2.1	0.1	1.8-2.3	
Less good	71	2.8	0.6	1.6-3.9	
poor	21	6.7	2.2	1.9-11.3	
Selfassessment of oral health (parents/respondent)					<0.01
Very good/good	815	1.8	0.1	1.6-2.1	
Less good	382	2.5	0.2	2.0-3.0	
poor	97	3.0	0.5	2.1-4.0	
Smoking habits (parents/respondents)					<0.001
Smoking habits	352	2.8	0.2	2.2-3.6	
Not smoking	940	1.9	0.1	1.7-2.2	

In the present study the mean level of caries was found to be very low, although two out of three 15-year-old children had caries experience. Some geographical variations were seen irrespective of public dental health care scheme; additional analyses of economic and social differences at the municipal level did not show relations to children's caries level. As the content of fluoride in drinking water varies among as well as within municipalities, it cannot be ascertained, at the individual level, whether differences in dental caries depend on exposure to fluoride in drinking water. Such variations in fluoride content in drinking water apply to almost all Danish municipalities, though the variations in general are rather small. However, the pattern of fluoride concentration intervals in drinking water in the seven municipalities involved in the present study, slightly indicate a pattern that might be related to the average caries experience (Table 4). Such a relation at the population level has been observed earlier (Ekstrand *et al*., 2003). Looking at geographical area as proxy variable for fluoride in drinking water, the regression analyses in Table 6 shows that fluoride in drinking water might contribute to the explanation of variation in caries experience. Children whose parents did not have Danish citizenship had relatively more caries than children with Danish parents. This is in accordance with earlier studies from Denmark as well as from other countries (Sundby and Petersen, 2003; Adam *et al*., 2005; Conway *et al*., 2007). Associations between children's oral health and parents' educational level and family income were demonstrated in an earlier Danish study on six-year-old children (Petersen, 1992); the present study shows that associations of this type still exist. Approximately one fifth of the study population had more than five DMFS+dmfs or caries on approximal and/or smooth surfaces. A similar pattern of polarization of caries and caries experience was found in a Finnish study (Vehkalahti *et al*., 1997), and results of Swedish studies have shown that the socio-economic level of a family and earlier caries experience were the two most important determinants for caries incidence among children (Kallestal and Wall, 2002). Results from other European countries also point at social deprivation as an important determinant for caries (Faggiano *et al*., 1999; Enjary *et al*., 2006; Conway *et al*., 2007). It seems that in spite of the general reduction in caries which has taken place in many western countries during the last decades, social inequality still relates to caries experience, even under dental care systems such as the Danish system, where the system is free of charge, has a high attendance rate and oral disease prevention is given high priority.

Table 6. Multivariat dummy regression analysis (linear) of caries experience (DMFS+dmfs) and logistic regression analysis of odds for having caries experience.

Independant variable	*Dummy variable*	*DMFS+dmfs Regression coeffiicient*	*DMSF+dmfs >0 Odds ratio*
Age group	5 years		
	12 years	1.26 ***	3.47 ***
	15 years	1.54 ***	5.07 ***
Parents' self-assessment of their own oral heath	Very good/good		
	Less good	0.19	1.22
	Poor	0.16	1.21
Parents's self-assessment of own general health	Very good/good		
	Less good	0.41	0.98
	Poor	3.61 ***	3.68 *
Parents' citizenship	Danish		
	Not Danish	1.96 ***	2.19 **
Parents' educational level, years in school	11-12 years (graduates)		
	10 years	0.41	1.20
	9 years or less	1.59 ***	1.51 *
Parents's smoking habits, are regular smokers	Smoking		
	Not smoking	0.65 **	1.35 *
Region	Møn		
	Rødovre	0.31	1.34
	Hedensted	0.90 *	2.61 ***
	Odense	0.73	1.52 *
	Viborg	1.01 **	2.14 ***
	Nykøbing F	1.09 **	1.88 **
	Sæby	1.39 ***	2.11 **

Dummy regression : intercept -0.25, * $p<0.05$ ** $p<0.01$ *** $p< 0.001$

In conclusion, the present study indicates that occurrence of dental caries as well as changes over time in levels of dental caries of Danish children did not vary by scheme of PDHS, i.e. whether dental health care was provided by a public employed dentists or by private practitioners. It is anticipated that the public programme based on the outreach principles of PDHS will continue to be most appropriate for reducing inequity in oral health among children and adolescents. However, adjustment of preventive oral health activities strategy is needed. A strategy with broad oral health promotion activities and geographically oriented preventive programmes in high caries risk communities is also proposed (Enjary *et al*., 2006; Pine, 2007).

Acknowledgement

The study was financially supported by the Danish National Association of Public Health Dentistry.

References

Adam C, Eid A, Riordan PJ, Wolikow M, Cohen F. (2005): Caries experience in the primary dentition among French 6-year-olds between 1991 and 2000. *Community Dentistry and Oral Epidemiology* **33**, 333-340.

Conway DI, Quarrell I, McCall DR, Gilmour H, Bedi R, Macpherson LM. (2007): Dental caries in 5-year-old children attending multi-ethnic schools in Greater Glasgow--the impact of ethnic background and levels of deprivation. *Community Dental Health* **24,** 161-165.

Davies GN, Downer MC, Holloway PJ. (1982): An Evaluation of Danish Child Oral Health Care Service. Danish Dental Association, Copenhagen.

Downer MC, Drugan CS, Blinkhorn AS. (2005): Dental caries experience of British children in an international context. *Community Dental Health* **22,** 86-93.

Ekstrand KR, Christiansen ME, Qvist V. (2003): Influence of different variables on the inter-municipality variation in caries experience in Danish adolescents. *Caries Research* **37,** 130-141.

Enjary C, Tubert-Jeannin S, Manevy R, Roger-Leroi V, Riordan PJ. (2006): Dental status and measures of deprivation in Clermont-Ferrand, France. *Community Dentistry and Oral Epidemiology* **34,** 363-371.

Faggiano F, Stanislao FD, Lemma P, Renga G. (1999): Role of social class in caries occurrence in 12 year olds in Turin, Italy. *European Journal of Public Health* **9**, 109-113.

Helm S. (1973): Recording system for the Danish Child Dental Health Services. *Community Dentistry and Oral Epidemiology* **1,** 3-8.

Helm S and Helm T. (1990): Caries among Danish schoolchildren in birth-cohorts 1950-78. *Community Dentistry and Oral Epidemiology* **18,** 66-69.

Källestål C and Wall S. (2002): Socio-economic effect on caries. Incidence data among Swedish 12-14-year-olds. *Community Dentistry and Oral Epidemiology* **30,** 108-114.

Petersen PE. (1992): Oral health behavior of 6-year-old Danish children. *Acta Odontologica Scandinavica* **50,** 57-64.

Petersen PE. (2003): The World Oral Health Report 2003: continuous improvement of oral health in the 21st century--the approach of the WHO Global Oral Health Programme. *Community Dentistry and Oral Epidemiology* **31 Suppl 1**, 3-23.

Petersen PE. (2005): Sociobehavioural risk factors in dental caries - international perspectives. *Community Dentistry and Oral Epidemiology* **33**, 274-279.

Pine CM. (2007): Designing school programmes to be effective vehicles for changing oral hygiene behaviour. *International Dental Journal* **57**, 377-381.

Poulsen S and Scheutz F. (1999): Dental caries in Danish children and adolescents 1988-1997. *Community Dental Health* **16**, 166-170.

Poulsen VJ. (1987): Caries risk children in the Danish child dental service. *Scandinavian Journal of Primary Health Care* **5**, 169-175.

Schwarz E and Hansen ER. (1979): Caries experience of Danish children evaluated by the child dental health recording system. *Community Dentistry and Oral Epidemiology* **7**, 107-114.

Sundby A and Petersen PE. (2003): Oral health status in relation to ethnicity of children in the Municipality of Copenhagen, Denmark. *International Journal of Pediatric Dentistry* **13**, 150-157.

Vehkalahti M, Tarkkonen L, Varsio S, Heikkila P. (1997): Decrease in and polarization of dental caries occurrence among child and youth populations, 1976-1993. *Caries Research* **31**, 161-165.

World Health Organization (1997): *Oral Health Surveys. Basic methods. 4th edition.* Geneva: World Health Organization.