Caries experience in disabled pre-school children

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Storhaug K. Caries experience in disabled pre-school children. Acta Odontol Scand 1985;43:241–248. Oslo. ISSN 0001–6357.

The parents of 436 disabled pre-school children were interviewed about habits and problems relevant to dental health. The children, who represented 10 different disabling conditions, were examined and dmft registered. The purpose was to study the relationship between different background variables and caries experience. The dmft score was analyzed in accordance with several sociocultural, medical, and habitual variables, using a multiple classification analysis (MCA). The number of daily carbohydrate intakes, duration of use of nursing bottle, family income, and diagnosis were the variables with the strongest association with dmft. Children with congenital heart disease, asthma, and cystic fibrosis had a considerably higher adjusted dmft than the other diagnostic groups. The proportion of children with caries experience was higher in the present survey than in groups of Norwegian children of corresponding age. □ *Behavior; carbohydrates; dmft; handicapped*

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Numerous studies have reported on the caries experience of non-institutionalized disabled pre-school children (1–12). Most of the studies have been made on children with cerebral palsy or mental retardation, and most have been carried out in English-speaking countries. Studies on variations in caries experience among *different* diagnostic groups are few, and none have tried to explain the differences between groups.

It is generally reported and accepted that social factors, undesirable feeding patterns, oral hygiene habits, use of fluorides, and sweetened medicines may influence the dental health of pre-school children (13–20). However, detailed analyses of the relationship between such factors and the caries experience of disabled pre-school children seem not to have been carried out.

The purpose of the present study was to report the caries experience of different groups of chronically ill and disabled pre-school children living at home and to study the relationship between several background variables and caries experience.

Materials and methods

Place of examination

Frambu Health Center, situated near Oslo, is an information and treatment center for families with disabled members. The center offers fortnightly courses to families with disabled children living at home. Families come from all over Norway to attend such courses, which are financed by the Social Insurance Institution (21).

The survey group

All disabled children aged 1–6 years, 185 girls and 251 boys, who attended the center during the calendar years 1976, 1977, and 1978 were included in the survey. The families came from all regions of the country. Urban and rural areas were evenly represented.

The children represented 10 different disabling conditions. Distribution of children by age and diagnostic groups is shown in Table 1.

Table 1. Distribution of the survey population in accordance with age and diagnostic groups (for abbreviations, see Table 4)

	Diagnosis										
Age	AA	CP	CHD	CF	EP	HEM	JRA	MR	MMC	OI	Total
1	1	7	5	6	1	7	1	5	8	0	41
2	6	13	11	4	3	6	8	14	4	1	70
3	6	13	8	3	8	6	8	18	4	0	74
4	11	10	6	3	13	2	13	20	9	2	89
5	13	9	9	7	11	3	8	16	8	0	84
6	10	4	7	4	3	5	13	27	5	0	78
Total	47	56	46	27	39	29	51	100	38	3	436

Background information

The children's parents were interviewed by the author or a trained assistant, and a pre-coded questionnaire was completed. The interviews lasted 40–45 min and contained questions concerning income, education, profession, and marital status of parents. For the disabled child toothbrushing routines and difficulties, dietary habits, eating problems, dental visits, and barriers for such visits were recorded, as was the use of fluorides and sweetened medicines, duration of use of nursing bottle, and breast feeding.

Family income was categorized into low (< 60,000 NKR/year), medium (60,000–100,000 NKR/year), and high > 100,000 NKR/year). Mother's education was divided into four categories: primary school only (7 years), secondary school lower level (8–9 years), secondary school higher level (10–12 years), and higher education (> 12 years). Father's profession was categorized as 1) academic and executive work; 2) inspectional, supervisory, and other non-manual professions; 3) unskilled labor; 4) irrelevant (when there was no contact with or support from father). Education and marital status of the parents compared well with the national average of parents with pre-school children, whereas the average income of the survey families was lower (22).

The interviews showed that most of the children brushed their teeth alone or with a little help, some did not brush regularly at all, whereas 42% of the children had their teeth brushed by the parents at least once daily. Almost half of the parents (44%) reported problems with toothbrushing, such as lack of cooperation or difficulties associated with rinsing, spitting, or opening the mouth.

Consumption of carbohydrate-containing foods or beverages 8 to 11 times per day was reported by 31%, whereas 10% had more than 11 carbohydrate intakes daily. Eating problems like difficulties in chewing, retention of food in the mouth, rumination, and so forth were reported in 37% of the children.

Barriers for dental visits were as follows: long distance to clinic, transport problems, economic hindrances, or difficulties with cooperation from the child. Such problems were reported by 20% of the families. According to the parents, 69% of the children were given fluorides in tablet form or in toothpaste daily. Almost one third of the children were regular users of sugar-containing drugs.

Prolonged use of nursing bottle (after the age of 12 months) was reported in 41%, and 24% had continued using nursing bottle after 18 months of age. One fifth of the mothers reported to have breast-fed their disabled child for more than 4 months.

The percentage distribution in accordance with diagnosis of some of the data obtained during the interviews is shown in Table 2. This table shows considerable variation among some diagnostic groups concerning background variables with possible relevance to caries.

Table 2. Percentage distribution of children in accordance with some characteristics with relevance to dental health in different diagnostic groups (for abbreviations, see Table 4)

	Diagnostic groups									
	AA (n = 47)	CP (n = 56)	CHD (n = 46)	CF (n = 27)	EP (n = 39)	HEM (n = 29)	JRA (n = 51)	MR (n = 100)	MMC (n = 38)	Total* (n = 433)
Hypoplastic teeth	9	16	7	0	10	7	6	23	13	13
Nursing bottle after 12 months	34	45	44	33	54	28	45	43	37	41
Intake of carbohydrates > 7 times per day	73	25	35	59	43	45	65	24	16	41
Regular intake of sugar-containing drugs	57	14	59	70	10	14	14	15	32	28
Eating problems	11	55	28	4	39	10	53	55	24	37
Saliva-reducing drugs	75	2	0	0	5	0	14	5	0	12
Problems in brushing teeth	28	43	39	26	56	28	51	56	42	44
Use fluorides regularly	64	79	61	67	59	76	57	82	61	69
None or irregular dental visits	28	57	52	67	51	55	57	50	68	53
Former dental treatment in general anesthesia	0	9	13	4	13	10	2	15	8	9

* Osteogenesis imperfecta (OI) patients were not included owing to the small number of children (3) with this diagnosis.

Clinical examination

The children's teeth were examined in Frambu's dental department with sharp probes and plane mouth mirrors. Teeth were recorded as hypoplastic when there were irregularities in the enamel which were clearly visible and/or extensive discoloration. Decayed, missing, and filled teeth (dmft) were recorded by means of WHO criteria (23). When permanent teeth were present, mainly in 6-year-olds, caries in those teeth were included in the dmft count. Filled teeth with decay were recorded as decayed only. Bitewing radiographs were used for detecting approximal surface caries in practically all children aged 3 years and over.

In inter-group comparisons patients with oesteogenesis imperfecta have been excluded because there were only three patients with this diagnosis in the survey population (Table 1).

Statistical analyses

To compare caries experience between subgroups, a multiple classification analysis, MCA (24), was used to adjust for differences in age distribution and other background variables. In this analysis the unadjusted mean shows the mean of each category of an independent variable without adjusting for other independent variables included in the analysis, whereas the adjusted mean gives an estimate of what the mean would have been if the group had been exactly like the total population in its distribution over all the other independent variables. The R^2 gives the percentage of the total variance explained by all the variables included in the analysis. The coefficient *eta* shows the bivariate correlation between the dependent and each of the independent variables, whereas the *beta* coefficient shows the correlation when the effect of the other variables included in the analysis has been taken into account. The effect of each independent variable in terms of beta was tested for statistical significance by means of a one-way analysis of variance in accordance with the following formula (24):

$$F = \frac{SS_{v_i}}{c_i - 1} \frac{SS_{tot} - SS_{v_i}}{n - c_i}$$

where SS_{vi} = sum of squares based on unadjusted or adjusted deviations for predictor v_i, c_i = number of categories of predictor v_i, and SS_{tot} = total sum of squares.

Table 3. Mean dmft* and the separate components according to age in the survey group

Age, years	dt	mt	ft	dmft
1 (n = 41)	0.0	0.0	0.0	0.0
2 (n = 70)	1.0	0.0	0.0	1.0
3 (n = 74)	3.6	0.1	0.3	4.0
4 (n = 89)	5.7	0.4	0.8	6.9
5* (n = 84)	7.8	0.4	2.2	10.4
6* (n = 78)	8.7	0.7	2.6	12.0
Total (n = 436)	5.0	0.3	1.1	6.4

* Caries in permanent teeth included when present.

Results

Mean dmft in accordance with age is shown in Table 3, whereas Table 4 gives the mean dmft in the different diagnostic groups and the adjusted dmft when the selected independent variables are accounted for. By means of MCA the dmft score was analyzed with regard to several sociocultural, medical, and habit-related variables. The least influential variables were removed in the final analysis, in which 15 different independent variables were included (Table 5). Next to age, the number of daily carbohydrate intakes, use of nursing bottle, family income, and diagnosis were the variables with the strongest direct effect on caries experience in terms of beta. The adjusted mean dmft in relation to frequency of daily carbohydrate intake shows that the relationship to caries is mainly due to children with very high consumption of carbohydrates (>11 intakes per day) (Table 6).

The children who had used the nursing bottle for more than 18 months also had a high adjusted mean dmft compared with those who had stopped earlier (Table 7). The

Table 4. Unadjusted and adjusted mean dmft* according to diagnosis in the survey group (MCA)

		Unadjusted				Adjusted
		dt	mt	ft	dmft	dmft
Asthma (AA)	(n = 47)	8.2	0.5	1.5	10.2	9.0
Cerebral palsy (CP)	(n = 56)	3.0	0.2	0.8	4.0	5.8
Cong. heart disease (CHD)	(n = 46)	7.4	0.5	1.0	8.9	10.0
Cystic fibrosis (CF)	(n = 27)	5.5	0.3	1.1	6.9	8.6
Epilepsy (EP)	(n = 39)	6.1	0.6	0.4	7.1	4.5
Hemophilia (HEM)	(n = 29)	1.5	0.0	0.8	2.3	5.8
Juvenile arthritis (JRA)	(n = 51)	4.2	0.1	1.5	5.8	6.4
Mental retardation (MR)	(n = 100)	4.4	0.3	1.4	6.1	4.6
Spina bifida (MMC)	(n = 38)	3.9	0.2	0.8	4.9	5.9
Total	(n = 433)	4.9	0.3	1.1	6.3	

* Caries in permanent teeth included when present. Osteogenesis imperfecta (OI) not included.

least important variables included in the final MCA were regular use of sweetened medicines and fluorides. All variables included in the analysis explained 26% of the variance in dmft.

Table 5. Effect of selected independent variables included in the MCA on dmft* (n = 436)

	Eta	Beta
Age	0.35	0.30**
Daily carbohydrate intake	0.28	0.16**
Nursing bottle	0.24	0.15**
Family income	0.19	0.15**
Diagnosis	0.17	0.15
Mother's education	0.22	0.12
Father's profession	0.15	0.12
Chewing problems	0.14	0.09
Brushing problems	0.14	0.08
Barriers for dental visits	0.22	0.07
Who brushes teeth	0.18	0.07
Hypoplastic teeth	0.10	0.07
Length of breast feeding	0.03	0.04
Sweetened medicines	0.09	0.03
Use of fluorides	0.08	0.00

* Caries in permanent teeth included when present.
** Statistically significant, $p < 0.05$. $R^2 = 26\%$.

Discussion

Practically all children in Norway with certain rare disorders (cystic fibrosis, hemophilia, and spina bifida) had attended a Frambu course during the survey period of 3 years. The caries experience of these groups thus reflects the reality of all preschool children with the same diagnosis. The representativeness of the other groups is less certain. There is, however, no reason to assume that the selection criteria used at Frambu would have favored children with a caries picture different from other children with the same chronic condition. This

Table 6. Adjusted mean dmft* in accordance with frequency of daily carbohydrate intake in the survey population (MCA)

Reported frequency of daily carbohydrate intakes	Adjusted mean dmft
< 7 (n = 256)	5.5
8–11 (n = 131)	6.4
12 + (n = 42)	12.5

* Caries in permanent teeth included when present.

Table 7. Adjusted mean dmft* in accordance with duration of use of nursing bottle in the survey group (MCA)

Length of bottle use	Adjusted mean dmft
< 18 months (n = 329)	5.4
≥ 18 months (n = 105)	9.7

* Caries in permanent teeth included when present.

assumption is supported by the distribution of the study group with regard to residence, education, and marital status of the parents (22).

During the period this survey was carried out Norwegian pre-school children did not receive free dental services everwhere in the country. Patients with hemophilia had, and still have, the legal right to free dental treatment. The legislation was introduced at a time when bleeding after tooth extraction still was a serious complication for hemophiliacs. The medical specialists at the National Institute for Hemophiliacs recommend dental visits four times a year from the age of 2 years. Thus tooth extraction is a rare event in these patients. Some dental procedures are also free for patients with cerebral palsy and epilepsy, and more recently the new Act on Dental Health Service (25) ensures free dental treatment for all mentally retarded persons regardless of age.

The results of the present survey indicate that there is absence of empirical basis for giving preferential treatment to pre-school children in those particular diagnostic groups and not to others with chronic illness or disability. The caries experience of some of the other groups included in this survey indicates that they may also need special attention from the dental health profession.

The independent variables included in the MCA explained 26% of the variance in caries experience. This type of survey rarely explains more. Thus many questions remain unanswered. Disturbances in tooth development, changes in salivary flow and composition, and other factors that have not been included in the present study may be of importance.

Among the included variables, eating habits played an important role for the development of caries in the disabled children, as has already been shown in healthy children (13–16, 20). It seems conceivable that many children included in this survey had developed eating habits that could have been avoided by early counseling from health nurses or dental health personnel (17). The eating problems and toothbrushing difficulties reported by many parents might also have been reduced by early and frequent professional assistance.

The influence of socioeconomic conditions on caries experience has been reported in several other surveys on healthy pre-school children (13–16). As mentioned earlier, the income of the families in the present survey was lower than the national average, although the educational level of parents was not. This may partly be explained by the fact that the percentage of mothers gainfully employed outside the home was lower than average (22). Furthermore, a considerable under-consumption of available social insurance and welfare benefits among the families participating in this study has been reported (22). Family income turned out to be one of the more important variables, according to the MCA (Table 5). Thus, an increased consumption of available benefits may be beneficial for the general well-being of the families and for their children's dental health.

The differences in caries experience among the various diagnostic groups (Table 4) should be taken into account when planning services and selecting risk groups. Berger (26) has shown that school children with congenital heart disease have more caries than healthy children. The present study shows that this group together with asthma and cystic fibrosis children had more caries than other chronically ill pre-school children (adjusted rates). Considering the medical hazards of dental disease and treatment in heart-disease children (bacteremia, endocarditis), special attention at an early age to prevent dental disease should be considered for this group.

Regular consumption of sugar-containing medication seemed to be of minor impor-

tance compared with the other independent variables included in the analysis. Other reports have suggested that sweetened medication may be responsible for caries in chronically ill children (18, 19, 27). The manner in which the question was formed in the present survey, however, only gave information on regular use of sweetened drugs. Duration and frequency of use were not accounted for, and more detailed information might have given different results for this variable.

A similar problem arose concerning use of fluorides. Regular users were singled out, but information as to how long the children had been given fluorides regularly was not available. This may explain why use of fluorides was so weakly related to caries experience according to the MCA. Yet, 20% of those who did not use fluorides regularly had more than 10 dmft, compared with 10% of the regular users.

To assess whether the disabled children in this survey had more or less caries experience than other Norwegian children, the percentage of caries-free children in two of the age groups in the Frambu survey was compared with available Norwegian data. A survey of 3-year-olds from the Stavanger area, made in 1976–77 and 1978–79 showed that 71% and 81% of the children, respectively, were caries-free at the age of 3 years (28), whereas only 54% of the 3-year-olds examined at Frambu (1976–78) were without caries experience.

A national survey of 5-year-old children carried out by the Public Dental Services in 1980 showed that 41% were caries-free (29) compared with 25% of the same age group at Frambu (1976–78). Although there will be differences in diagnostic level among different surveys concerning the criteria for caries-free children, the proportion of disabled pre-school children with caries experience still seemed to be higher in the present survey than that of corresponding age groups of Norwegian children.

In summary, the most important factors for the development of caries in this group of disabled pre-school children were, in addition to age and diagnosis, daily carbohydrate intake, prolonged use of nursing bottle, and family income. These three factors may be influenced by early assistance to families with disabled children from the Public Health Services.

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Received for publication 22 January 1985