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Ich bedanke mich bei den unten aufgeführten Kolleginnen und Kollegen für ihre wertvolle Mitarbeit, die sie in den vergangenen zwei Jahren geleistet haben.

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Dental knowledge and attitude toward school dental-health programs among parents of kindergarten children in Winterthur

KEYWORDS
caries,
school dental-health program,
socioeconomic status

SUMMARY

The current study investigated the attitudes and knowledge regarding diet and oral hygiene of parents with kindergarten children. The parents' statements were evaluated in terms of their socioeconomic background and were compared with the annual clinical examination of the children. The objective of the study was to assess the effectiveness of the school dental-health program and adapt it to today's societal needs. Of those who participated in the interview, 61% were Swiss, 16% were from former Yugoslavia or Turkey, and 12% each from the EU or other countries. Of the children examined, 39% already had caries, and 18% of those showed more than two lesions. The parents' knowledge correlated with the severity of the child's caries as well as with the parents' income, country of origin, and education. There was a correlation between the child's dental decay and lower income, as well as lower education and non-Swiss nationality of the parents. Parents with higher income and better education more often participated in the pre-school's preventive program. Parents from former Yugoslavia or Turkey participated less frequently than parents from other countries. The study demonstrated that parents who especially needed instruction and prophylaxis are contacted too late or not at all through the dental-health program at kindergarten and that new approaches to prevention should be implemented to more effectively reach the parents.

Introduction

School dental-health programs have a long tradition in Switzerland, and they may have contributed decisively to the strong caries decline in school children (Sigron 2009; Steiner et al. 2010). For some time now, both international and Swiss studies have shown a polarization of caries prevalence (Wendt et al. 1992; Menghini et al. 2003a) and recommend a more risk-oriented prevention strategy, also in school dental-health programs. For this reason, diverse studies have been carried out in the city of Winterthur with the aim of acquiring evidence and establishing a basis for a best-practice approach (Klein 2007; Leisebach 2011; Lipowsky-Flaig 2013; Schifko & Roth 2013). The present study is one of them.

In Winterthur, the first contact with a school dental-health program takes place at kindergarten at the age of 4 or 5 years. The school-based program includes an annual obligatory exam by the school dentist in the school's dental clinic or practice and prophylaxis instruction at pre-school. School dental-care instructors lead these lessons, in which toothbrushing exercises with high fluoridated gel are performed and both children and parents are informed about healthy eating habits. Based on the nutritional and oral hygiene knowledge and habits of the parents, the purpose of the present study was to evaluate the efficacy of the school dental-health program in relation to socioeconomic status. In addition, the children's caries prevalence was compared with the parents' responses. The results are in-tended to serve as a basis for adapting the preventive interventions in school dental-health programs and re-examining the time point at which they begin.

Materials and Methods

The study population consisted of children from kindergartens in the city of Winterthur, Switzerland, who were registered for the annual school exam at the school dental clinic in the 2003/2004 school year, and who were at least 5 but no more than 6 years old. Using computerized randomization, 200 children and their parents were selected for the study. Of the parents who were contacted, approximately half (n=96) gave their written consent and voluntarily participated in the interview at the school dental clinic; findings from the annual school examination were available for 85 of their children. The Canton of Zürich Ethics Commission reviewed the concept of the study and determined that submission was not necessary. All interviews were conducted by the same person. The questionnaire was divided into the following four sections:

1. **General opinion on school dental-health program:** general questions on the school dental-health program and specifically about dental-health education in kindergarten
2. **Habits:** questions on nutritional and oral hygiene habits
3. **Knowledge:** questions on parents' knowledge about dental health, and questions to determine the source of this knowledge
4. **Demographic information**

Statistical significance was determined using Pearson's chi-square test (Pearson 1947); the level of significance was set at 5%. Statistical analysis was performed using SAS© V9.2 (SAS Institute INC., Cary, NC, USA).

Results

General opinion on school dental-health program

The general questions on the value of school dental-health programs revealed that almost 99% of the parents agreed that the prophylaxis program at kindergartens and schools was important. 72% of the parents had attended the prophylaxis programs at their children's kindergartens. Two-thirds of the parents had come in contact with school dental-health programs during their own childhood, and just as many still helped their children to brush their teeth. Somewhat more than 60% were also of the opinion that their child benefitted from the lessons and brushed her/his teeth better afterwards. In terms of diet, the results were less positive; not quite 36% thought that their child was more likely to eat a healthy mid-morning snack due to dental prophylaxis lessons (Fig. 1).

Habits

Of the parents interviewed, almost 72% reported regular visits to the dentist themselves. In general, parents judged the influence of their own oral hygiene on that of their children to be great. 85% of parents and children alike brush their teeth two or three times a day. All children brushed their teeth with a manual toothbrush, and almost one-third additionally used an electric toothbrush. Nearly 90% of the children did not use dental floss. Just 2% of the parents reported flossing their children's teeth daily.

Knowledge

Two-thirds of the parents indicated that their child had learned the most about toothbrushing and a dentally sound diet from the parents themselves. For one-fourth of the parents, the most important teacher in terms of toothbrushing is the school dental-health instructor, who is also the most important person in terms of diet for one-fifth of the parents. The kindergarten teacher also plays an important role (for 8% of the parents the most important role) in conveying what is bad for the teeth, while her role in transferring toothbrushing skills is not important. Two-thirds of the parents confirmed placing importance on a dentally healthy diet for their children. In general, the questions on knowledge about caries and its prevention were answered very well (Tab. I).

Demographic information

In 84% of the cases, the mother participated in the interview. Of the participating children, 53% were female and 47% were

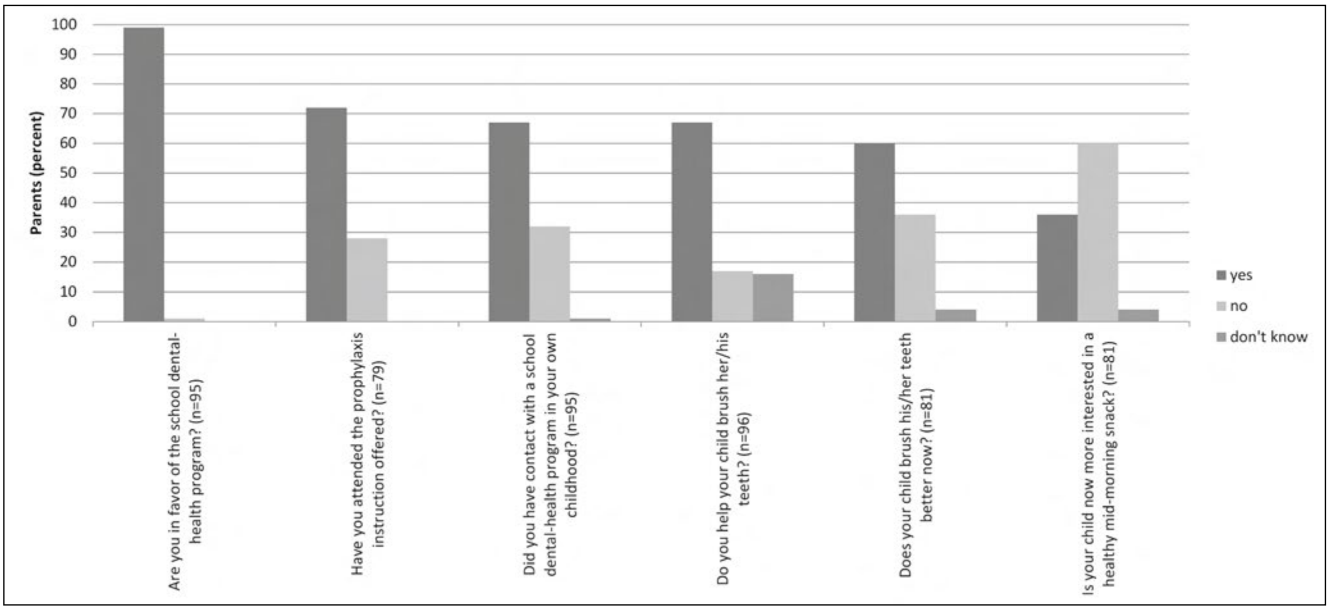

Fig. 1 General questions on school dental-health programs

Tab. I Questions on caries knowledge

	yes	no	Don't know
Caries is prevented by a dentally healthy diet.	99	1	0
Caries is prevented by small, frequent meals.	8	86	6
Caries is prevented by regular, thorough oral hygiene.	99	1	0
Caries is prevented by making sure bacteria are not transferred to the child's oral cavity.	60	33	7
Caries is prevented by regular dental check-ups.	99	1	0
Caries is prevented by fluoride toothpastes.	90	1	9
Caries is prevented by chewing gum with whitening agents.	6	81	13
Caries is prevented by oral hygiene products.	91	5	4
Caries is prevented by not brushing teeth after consuming acidic drinks.	43	42	15
Caries is preventable	79	17	4

Values in percent

male. 61% of those interviewed were Swiss, and almost 16% of the parents were from former Yugoslavia and Turkey. About 12% of the parents came from the EU. The remaining 12% were from other countries. The findings from the obligatory school exams showed that 61% of the children had no caries, 21% had 1–2 carious lesions, and 18% had a high incidence of over 2 lesions.

Correlations

The number of points achieved for questions on dental-health knowledge were compared with the following socioeconomic factors: country of origin, income, and education. The knowledge of Swiss parents, 100% of whom achieved at least 11 of 19 possible points and thus good to excellent scores, differed statistically significantly from that of parents from former Yugoslavia and Turkey, 40% of whom achieved poor scores, i.e., fewer than 11 points. After evaluation of the overall distribution, the cut-off point at 11 points was considered expedient and therefore set at this level. Similarly, 18% of parents from the EU and 58% from other countries achieved fewer than 11 knowledge points. Parents' behavior in terms of regular visits to the dentist differed significantly and depended on income ($p=0.04$), country of origin ($p=0.01$), and education ($p=0.04$). Parents who had a monthly income of over 6,000 francs, who were born in Switzerland, and who had a post-secondary school education more regularly attended dental appointments than parents who were from other countries, who had a smaller income, and only a basic education. Further, parents with a

Tab. II Correlation of socioeconomic factors with knowledge, visits to the dentist, participation in prophylaxis instruction, dentally healthy diet, caries belief, and child's caries incidence

	Knowledge points				Visits to the dentist		
	≤10	11–16	>16	p	Yes	No	p
Income	n = 89			*	n = 88		*
≤6,000 Fr.	26	58	16		65	35	
>6,000 Fr.	4	55	41		84	16	
Country of origin	n = 96			*	n = 95		*
Switzerland	0	64	36		84	16	
Former Yugoslavia/Turkey	40	53	7		53	47	
EU	18	46	36		60	40	
other	58	42	0		50	50	
Education	n = 96			*	n = 95		*
Primary school/secondary school, some trade school	56	44	0		50	50	
Completed trade school, higher vocational education	7	54	39		80	20	
Academic-track high school diploma, degree from university of applied sciences or university	5	76	19		71	29	

Values in percent
* : $p<0.05$

Tab. III Correlation of knowledge, participation in prophylaxis instruction, and parents' experience with school dental-health programs with child's caries incidence

	Caries incidence			
	Caries-free	1–2 lesions	>2 lesions	p
Knowledge points	n = 85			*
≤10	31	15	54	
11–16	63	21	16	
>16	74	26	0	
Participation in prophylaxis instruction	n = 77			
Yes	70	16	14	
No	46	27	27	
Parents had school dental-health program during childhood	n = 83			*
Yes	70	28	2	
No	45	10	45	

Values in percent
* : p < 0.05

higher income paid significantly more attention to a dentally healthy diet than did parents with a lower income (Tab. II). No significant difference in frequency of toothbrushing was found. However, the correlation between parents' knowledge and their children's caries incidence was also statistically significant. The better the parents' knowledge, the greater was the chance that their children were caries-free (Tab. III). The correlation between parents' income and participation in prophylaxis instruction did not differ statistically significantly, but a tendency was evident ($p=0.07$). The same was true of the correlation with country of origin ($p=0.07$) and education ($p=0.11$) (Tab. II). However, more parents of caries-free children tended to participate in prophylaxis instruction than did parents of children with caries ($p=0.11$) (Tab. III). The answer to the question on caries avoidability was clearly dependent on the parents' country of origin ($p=0.01$). Swiss parents left no doubt that caries could be prevented (Tab. II).

A similarly strong association was found between children's caries incidence and their parents' country of origin and education ($p<0.01$). A certain relationship was also observed between a child's caries incidence and the parents' income, but this was not significant ($p=0.07$) (Tab. II).

Participation in prophylaxis instruction			**Dentally healthy diet**			**Caries preventable?**				**Caries incidence**			
Yes	No	p	Yes	No	p	Yes	No	Don't know	p	Caries free	1–2 lesions	>2 lesions	p
n = 81			n = 86		*					n = 79			
55	45		53	47						52	20	28	
74	26		78	22						69	23	8	
n = 87						n = 93			*	n = 85			*
74	26					86	14	0		72	24	4	
53	47					77	15	8		43	0	57	
75	25					73	9	18		70	30	0	
36	64					45.5	45.5	9		27	27	46	
n = 87										n = 85			*
44	56									31	6	63	
71	29									66	24	10	
71	29									72	28	0	

Discussion

Almost all participating parents found the school dental-health program worthwhile, and two-thirds had had contact with the same during their own childhood. Not surprisingly, most of these two-thirds were Swiss rather than immigrant parents.

Apparently, dental prophylaxis instruction in kindergarten was chiefly effective in conveying knowledge about the toothbrushing technique, and less effective in terms of a dentally sound diet. 63% of the parents reported having learned something about toothbrushing techniques themselves, and 32% about healthy nutrition. In contrast, Klein (2007) found that only half of the interviewed parents of late secondary school children had learned about toothbrushing techniques from their children and just 16% had learned about nutrition. It is conceivable that the better knowledge of kindergarten children's parents was based on their direct participation in prophylaxis instruction. Two-thirds of the parents regularly helped their children to brush their teeth, but 16% of the parents never helped their children perform oral hygiene. However, parental assistance in daily oral hygiene measures is recommended up to the age of 8 years. A study from the USA showed that children become able to brush their teeth as well as adults only after reaching the age of 10 years (Unkel et al. 1995). Parents are nevertheless aware of functioning as role models in terms of brushing habits, as demonstrated by their assessment of the influence their own oral hygiene has on that of their child. 85% of parents and children alike brushed their teeth two or three times a day. A Finnish study confirmed that parents' oral hygiene does in fact influence the child's. Eleven- to twelve-year-old children who had poor oral hygiene habits and whose parents judged their own oral health to be poor exhibited a greater number of active initial lesions (Poutanen et al. 2007). In the present study, all children's teeth were cleaned with a manual toothbrush, but 30% also used an electric toothbrush. A systematic review (Deery et al. 2004) demonstrated that with the exception of rotating/oscillating electric toothbrushes, there is no significant difference in plaque-removal efficacy between electric and manual toothbrushes. The fact that use of dental floss among children of this age was rare was expected. Two-thirds of the parents see themselves as the most important source of knowledge about toothbrushing and nutrition. This was followed by 25% and 20% of the parents who considered the school dental-health instructor to be an important source of knowledge about toothbrushing and a healthy diet, respectively. The kindergarten teacher also plays an important role, but more in terms of diet than oral hygiene. This can almost certainly be explained by the daily "inspection" of the child's mid-morning snack; in contrast, toothbrushing in kindergarten usually takes place only after special between-meal snacks. Questions on caries knowledge were generally answered very well: fundamental concepts such as a dentally sound diet, good oral hygiene, regular dental check-ups, use of oral-hygiene products, and fluoridated toothpaste were each classified as caries prophylactic by over 90% of the parents. Questions that were somewhat more complex and demanded knowledge synthesis were answered less well and more often with the "don't know" option. The thematic overlap of caries and erosion was ultimately too difficult for many. The fact that 17% of those interviewed thought caries could not be prevented at all reflects ignorance on the one hand and insufficient translation of available theoretical knowledge into action on the other, as well as a certain frustration arising from personal experience. The study by Kronenberg & Jungo (1998), in which young adults were interviewed at the end of their school career, found that 15% of them thought caries was inevitable or couldn't answer the question.

The group of study participants consisted of 61% Swiss and 39% other nationalities. In 2003, the proportion of immigrants in Winterthur's population was only 23% on average, meaning that the participation of immigrant parents in this study was higher than their proportion of the population, but representative for making use of the public-service obligatory dental examination of children in Winterthur. At the time of the exam, 61% of the children were caries-free, 21% had 1–2 lesions, and the remaining 18% had more than two lesions. These figures correspond well with those reported by Menghini et al. (2003a), except for the lower proportion of caries-free children in that study (55%). The voluntary nature of the study and thus reduced representativity could explain this. It is a cause for concern that so many 5-year-olds already had caries and many of these even more than 2 lesions; this should provide the impulse for further and especially earlier prophylactic interventions, as has already been recommended (Menghini et al. 2003b).

The finding that lower-income parents knew considerably less about dental health than did the more prosperous (Tab. II) agrees with results from an English study, in which interviews with parents of small children also showed that less well-off parents knew less about oral health and had worse habits than did parents with higher incomes (Williams et al. 2002).

A similar relationship was found in this study in terms of education, although it must be mentioned that parents who had learned a trade or had a higher vocational education showed better results than those who graduated from academic-track high school, a university of applied sciences, or a university. Although about the same number of persons in both groups scored in the lowest third of points possible, a markedly higher proportion of parents in the educational group "trade/higher vocational education" achieved more than 16 of 19 possible points. An interpretation of this result would be highly speculative. The correlation between dental-health knowledge and education was also confirmed in a study by Klein (2007). Evaluating the knowledge questions by country of origin showed that Swiss parents knew much more than parents from former Yugoslavia and Turkey. The distribution in the EU group (15 members) was relatively equal, which could be explained by potentially great differences among countries in the EU. However, these results should be interpreted with caution, because the number of participants in the "EU" and "other countries" groups was too small. The interesting comparison between parents' knowledge and children's caries incidence demonstrated that the distribution of parents of caries-free children was the same as for parents of children with only 1 or 2 lesions. A pronounced knowledge decline was observed only in parents of children with more than 2 lesions.

In comparing the participation of parents in prophylaxis instruction, no statistically significant differences were found between groups, although certain tendencies were apparent. From the fact that higher-income parents from Switzerland or the EU participated more often than lower-income parents from former Yugoslavia, Turkey, or other countries, it may be concluded that inadequate integration and/or lack of Swiss-German language skills kept these parents from participating in dental health-care instruction. The participation rate in prophylaxis instruction among the interviewed parents was somewhat higher than among the total population of parents of kindergarten children. In total, about 60% of parents take part in the offered prophylaxis lessons. Furthermore, this type of school dental-health program does not exist in many countries and is thus not well established in parents' awareness. Immigrant families often have much more pressing problems to deal with daily, which means participation in instruction is not their top priority.

The evaluation according to knowledge status and children's caries incidence shows that participation in prophylaxis instruction may also tend to be a question of health awareness or health literacy. As opposed to knowledge comparison, it is interesting that parents from the group with only 1 or 2 lesions also participated in lessons less often, not just the parents of highly caries-active children. Thus, the parents most in need of instruction were the ones who did not participate. Parents (chiefly immigrants) who themselves had not experienced school dental-health programs much less frequently had caries-free children and twice as often had children with many lesions.

Evaluation by the criterion "dentally healthy diet" showed a significant correlation only with income. A relation with country of origin, education, and particularly children's caries incidence was expected but not confirmed. In contrast, a study from the USA found that children with a lower socioeconomic status consumed more soft drinks and instant beverages (Hamasha et al. 2006). Yet it remains speculative whether *dentally healthy* was taken to mean *generally healthy* (e.g., groceries purchased at a health food store are "healthy" but often cariogenic), or whether a correlation between income and a dentally healthy diet actually exists. It is even more disappointing that the actual benefit of prophylaxis instruction about nutrition was found to be so slight, because the potential for benefit from that setting is great.

Regarding the question of whether caries is preventable, the current authors were less interested in a scientifically correct answer than in what parents thought about it. 80% of those interviewed thought caries is avoidable. If the answer was evaluated according to the family's country of origin, it was found that Swiss parents most often (86%) believed caries to be preventable, followed by parents from former Yugoslavia and Turkey (77%) as well as EU countries (73%). Only parents from countries other than these much less frequently (45.5%) believed caries to be preventable. Comparing these results with those of Klein (2007) shows that more immigrant parents of kindergarten children than of secondary school graduates thought caries to be avoidable. An unambiguous interpretation of this difference is difficult, especially because at the time the study was conducted, the prevention program for healthy deciduous teeth could not yet have shown any effect (Menghini & Steiner 2003c).

Finally, the results of the annual school dental exam were compared with the socioeconomic parameters. The statistically significant difference in caries incidence according to country of origin and education corresponds to results from many other studies. It is noteworthy that children from the Balkan region either had no caries or a high caries incidence; none of these children belonged to the group with just 1 or 2 lesions. A study by Menghini et al. (2003a) in Winterthur with children the same age as those in the present study found the mean dmft of Swiss children to be 1.7 in 2001. In contrast, children from former Yugoslavia and Albania had a mean dmft of 7.84. In addition, 65% of these children had a high caries incidence (dmft ≥5). Another study by Menghini et al. of 2-year-olds in the city of Zürich demonstrated that children whose mother was not born in Switzerland had considerably higher caries prevalence than those whose mother was born in Switzerland (17.4% versus 5%) (Menghini et al. 2008). In the present study, only findings from the annual school dental exam were evaluated; a standardized dmft index was not recorded because the study's focus was on the interviews.

Children whose parents had a better education and/or a higher income had fewer carious lesions. These results also agree with those of many other studies. However, due to the study design (study population too small, no stratification by children's caries incidence, possibly also volunteer bias), the results of this study must be interpreted with caution and the statistical analyses be considered explorative. Thus, no regression analyses to calculate collinearity were performed, nor were Bonferroni corrections. Language problems were usually avoided thanks to interpreting by other family members accompanying the parents, so that questionnaire comprehension was judged to be "very good" or "good" in 80% of the participants.

In an Australian study, various social factors were also examined in relation to Early Childhood Caries (ECC). Low income of the parents was associated with a higher caries risk, which also depended on country of origin (Hallett & Rourke 2003). Similarly, a study from Sweden showed that country of origin is a decisive factor in caries development; the examination of 3-year-olds found that 50% of the immigrant children already had caries, while only 20% of the Swedish-born children did (Wendt et al. 1992). Unfortunately, the socioeconomic variables in the present study were also correlated with the availability/accessibility of the parents, that is, with their non-participation in the dental-health program. This makes it quite clear that in addition to or instead of voluntary participation in instruction offered by the school dental-health program, new risk-based and early-contact caries prophylactic programs are necessary for pre-school children and their families. This is especially important because caries in kindergarten-age children has often progressed much too far to be stopped by fluoridation and changes in dietary and oral hygiene habits. Besides cooperation between dental professionals and pediatricians as well as community children's services (mother/father counseling), there is certainly untapped potential in daycare centers, where children brush their teeth under supervision or have their teeth brushed, and where emphasis can be placed on a dentally healthy diet. In addition, a motivational system could promote acceptance of regular dental check-ups and timely prophylactic measures in early childhood. Several studies have shown that fluoride is still one essential pillar of therapeutic caries prophylaxis, and that especially fluoride varnishes produce good results. Compared to primary prevention, consisting of toothbrushing with fluoride toothpaste (500 ppm) and four impulses with nutritional counseling and instruction in/motivation for oral hygiene, application of fluoride varnishes such as Fluoridin N5 (Voco) or Duraphat (Colgate) yielded much better results. Compared to groups in which fluoride varnish was used, the number f healthy tooth surfaces in 2- to 4-year-olds decreased by a factor of 8 in the group receiving only basic prophylaxis (Borutta et al. 2006).

Conclusions

Caries prevalence in these 5-year-old children was correlated with the country of origin, education, and income of their parents. The knowledge questions showed that although certain fundamental knowledge is present, the translation into action in daily life is often inadequate. One major problem is reaching those parents who are in greatest need of instruction/information yet do not attend the prophylaxis instruction offered by the school dental-health program; it has been proven that such programs start too late for kindergarten-age children with high caries risk. Pediatricians' offices, community services for pre-school children, daycare centers, etc. offer a good platform for reaching parents and children, and are now increasingly becoming involved in counseling families on/helping families implement healthy nutrition and good oral hygiene. In addition, however, regular dental check-ups for pre-school children should become standard policy.

Caries-preventive and health-promoting measures at school are beneficial. Nevertheless, in the interest of deriving the greatest possible benefit from the public resources used, redistribution should be examined and future studies should focus on this aspect. This was demonstrated by the results of the present study as well as others conducted in Winterthur, although caution must be used in their interpretation.

Résumé

La présente étude s'est interrogée sur les habitudes et les connaissances de parents d'enfants en âge d'école enfantine concernant l'alimentation et l'hygiène buccale. Leurs témoignages ont été évalués selon le statut socio-économique et ont été comparés avec le contrôle dentaire scolaire annuel des enfants. Les résultats devaient permettre l'évaluation du service dentaire scolaire et l'adaptation de ce dernier aux besoins sociaux d'aujourd'hui. Ont participé à l'interview 61% de Suisses, 16% provenant de l'ex-Yougoslavie ou de la Turquie, 12% de la CE et 12% d'autres pays. 39% des enfants présentaient des caries lors du contrôle annuel, dont 18% avaient plus de deux lésions. Le savoir des parents était en corrélation avec le nombre de caries chez l'enfant, de même que le revenu, l'origine et la formation professionnelle. La présence de caries corrélait avec un bas revenu, une mauvaise formation professionnelle et une origine étrangère. Les parents avec un revenu plus élevé et une meilleure formation s'intéressaient plus souvent aux leçons de prophylaxie données à l'école enfantine. Les parents provenant de l'ex-Yougoslavie et de la Turquie participèrent moins souvent aux cours proposés que les personnes interrogées venant d'autres pays. Ce travail montre que surtout les parents, alors qu'ils auraient besoin d'informations en prophylaxie via les cours donnés à l'école enfantine, ne sont pas ou trop tard joignables. Il faut donc trouver de nouvelles méthodes d'information pour que la prévention soit perceptible à tous les parents.

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