Relevance of social and behavioral factors in the evaluation of dental health care for school children

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An interdisciplinary strategy based on a theoretical model for studying dental health was used to analyze the relevance of social and behavioral factors in the evaluation of dental health care for school children. The study comprised pupils who, after a total period of 5 years, differed in their experience with preventive regimens applying different principles of dental prevention. In 1979–80 social and behavioral data were collected by means of a postal questionnaire from altogether 234 pupils, aged 15–16 years, from two school areas. Clinical data, comprising scores for prevalence of plaque, gingivitis, and caries, were available from examinations in 1974, 1978, and 1979. The analysis of factors influencing the subjects' oral status demonstrated that material factors—the parents' education and employment, type of housing, and line of education—and physical factors—sex and prevalence of plaque, gingivitis, and caries at base line—all were of significance for the results obtained. No significant influence of home care climate (social/political factors), dental knowledge and attitudes, general foresightedness or carelessness (mental factors), or tooth-cleaning and sweet-eating habits (action factors) was found. Social and behavioral factors of significance exerted their influence regardless of the type and scope of the dental health care provided. Gingival health was far more a consequence of the professional tooth-cleaning regimen than dependent on the social and behavioral factors tested. No superior effect on caries status was demonstrated for any of the preventive regimens tested. □ *Caries; gingivitis; interdisciplinary analyses; plaque; school children*

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Besides being dependent on the type and scope of the preventive regimens provided for young people in their early and middle teens, the results indicate an influence of both the professional and personal contribution on the effects achieved (1). This is in accordance with several studies and reports that have concerned mechanisms of behavioral influence and factors in the social environment influencing the individual's dental status and dental health (for example, see Refs. 2–11). It seems, however, that these are factors whose significance is hard to interpret and on the basis of which it appears to be difficult to design modern dental health strategies (12).

In an attempt to study determinants of dental health, an interdisciplinary approach to health and welfare studies (13) was further developed for the identification of factors presumed to influence the individual's dental health (14). This approach is also in accordance with the view that similar mechanisms underlie the individual's preventive behavior with regard to both general and dental health (2, 9). By utilizing this interdisciplinary strategy, several individual social and behavioral factors were shown to be relevant in the evaluation of different preventive regimens provided for young people in their late teens (3, 15). It therefore appeared of interest to analyze whether similar factors were of relevance in younger age groups (1, 16).

The purpose of this presentation is to review the results of a series of interdisciplinary studies of the influence of social and behavioral factors in the evaluation of dental prevention for school children (17).

Materials and methods

The study population

The population in this series of studies comprised school children for whom complete clinical data on oral hygiene and gingival and caries status were available from annual examinations in 1974 (base line; Table 1), 1978, and 1979 and who in 1979–80 agreed to have their social and behavioral characteristics investigated. They numbered in all 119 pupils, aged 15–16 years, in the 8th and 9th grades at the Munkhagen school and 115 pupils of the same ages and grades at the Österberga school.

Clinical data

The clinical data are based on the scores for prevalence of plaque, gingivitis, and caries in these school children (1, 16). During the period 1974–78, they had participated in a dental health care program with either professional tooth-cleaning plus fluoride mouth-rinsing every 3rd week (experimental group, Munkhagen) or only fluoride mouth-rinsing every 2nd week (comparison group, Österberga; Fig. 1). During 1978–79, approximately half of the children at both schools had received professional tooth-cleaning plus fluoride mouth-rinsing every 3rd week in accordance with previous routines, and the other half had received fluoride varnish (Duraphat®) treatment every 6 months (Fig. 1).

Social and behavioral data

The social and behavioral data, intended to describe the social and behavioral factors of the individuals, were collected by means of coded postal questionnaires containing 41 questions, 40 of them with multiple-choice answers provided. Those subjects who did not answer the questionnaire despite three reminders were regarded as drop-outs (8.5% at Munkhagen and 14.8% at Österberga). They did not differ systematically from the studied groups with respect to sex, age, or clinical data.

Interdisciplinary analyses

The interdisciplinary analyses were carried out utilizing the theoretical model that had previously been designed for studies of dental health (3, 14). This model contains general frames and individual components (Fig. 2). In this study only the individual components were studied—that is, material, social/political, physical, mental, and action factors—and the analysis was restricted to the following aspects:

Among material factors, those comprising the socio-economic status of the respondents and their parents.

Among social factors, those describing the primary (family) group with regard to attitudes and behavior concerning the personal care and health of their teeth. Among political factors, those providing a picture of the

Table 1. Prevalence ($\bar{x}$; SEM) of plaque, gingivitis, and caries at base line in 1974 in 119 pupils of an experimental group (Munkhagen) and 115 pupils of a comparison group (Österberga). The plaque and gingivitis scores are based on recordings of all first molars and incisors, for a total of 48 surfaces (maximum score), whereas the DF-S scores for caries prevalence include examination of all permanent teeth except third molars

Variables at base line 1974		Groups		
		Exp. (M)	*P*	Comp. (Ö)
Plaque prev.	$\bar{x}$	30.9	<0.01	34.2
	SEM	±0.9		±0.9
Gingivitis prev.	$\bar{x}$	19.7	NS	18.7
	SEM	±0.9		±0.9
Caries prev.	$\bar{x}$	7.2	NS	6.6
	SEM	±0.4		±0.4

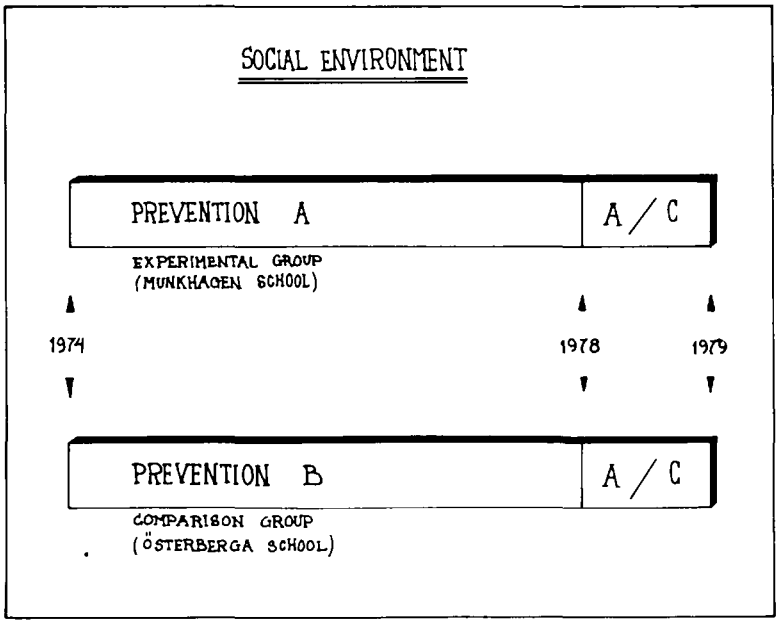

Fig. 1. Design of the trial in accordance with different types of dental prevention. The social and behavioral data are tested against clinical data obtained in 1978 and 1979. Base-line data from 1974 are used to describe earlier dental status. Prevention A = professional tooth-cleaning plus fluoride mouth-rinsing every 3rd week; Prevention B = fluoride mouth-rinsing every 2nd week; Prevention C = fluoride varnish (Duraphat®) treatment every 6 months.

individual's general participation and activity in the life of the community.

Among physical factors, sex, age, and earlier dental status, such as the prevalence of plaque, gingivitis, and caries at base line.

Among mental factors, dental knowledge and attitudes, and factors intended to describe personality traits, such as foresightedness or carelessness.

Among action factors, modes of behavior in relation to dental status and dental health, such as oral hygiene and dietary habits.

To make the data more manageable, variables that were theoretically and conceptually associated and which, in linkage analyses, turned out to be highly correlated, were combined into indices. The socio-economic index (material factors) included variables concerning the parents' occupation and education. A home care climate index (social/political factors) was arrived at by asking questions about the respondents' opinion of their parents' dental health and status and the care of their teeth. Variables relating to the respondents' assumptions about the cause and prevention of dental caries and periodontal disease were combined into a dental knowledge index (mental factors). A dental awareness index (mental factors) was constructed from the answers to questions about the respondents' attitudes concerning their own teeth and their daily care of them, thereby indicating the subjects' sense of personal responsibility for maintenance of dental health. The respondents' general attitudes to punctuality and truancy were combined into a carelessness index (mental factors). The variables for prevalence of plaque, gingivitis, and caries at base line in 1974 (physical factors) formed traditional indices for the description of earlier dental status. An index of tooth-cleaning habits (action factors) was composed of variables concerning daily tooth-brushing frequency and use of further aids to tooth-cleaning apart from brushing.

Because of weak associations between the answers, two areas were represented by one variable each instead of indices. Thus foresightedness (mental factors) was tested by a 'planning ahead' question. For dietary habits (action factors) 'intake of sweets' was used as an action of particular interest at these ages.

All indices and single questions were dichotomized into low and high values, and

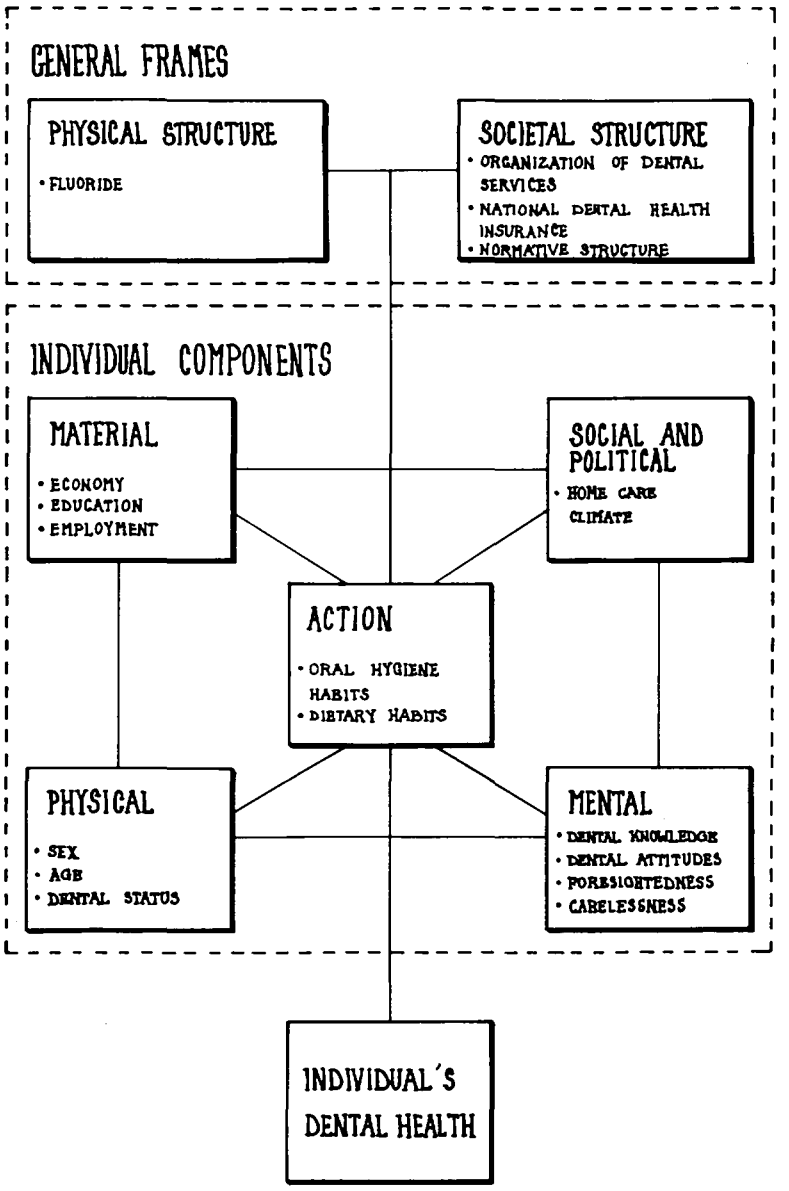

Fig. 2. Theoretical model for interdisciplinary studies of dental health (3, 14). Only social and behavioral factors of the individuals were studied. The variables tested are listed within the various boxes.

subgrouped accordingly, to serve as control variables in the testing of the respondents' clinical data in 1978 and 1979. The influence on these data of social and behavioral factors of the individuals was tested similarly in both years, primarily to give information about the significance of such an influence. Indirect information concerning the comparative clinical efficacy of the preventive regimens tested was also obtained. The quantity of clinical data from these years made testing of data from 1980 (approximately half of the subjects) superfluous.

Statistical analysis

The correlation analysis of variables for index construction was carried out by using linkage analysis with gamma coefficient. By

Table 2. Prevalence of gingivitis in accordance with control variable, studied group, and year. Experimental and comparison groups in 1978; the Munkhagen (M) and Österberga (Ö) schools in 1979. Maximum score, 48. Mean ($\bar{x}$) and standard error of the mean (SEM)

		Gingivitis prevalence					
Control variable		Exp. 78	*P*	Comp. 78	M 79	*P*	Ö 79
Sex							
Boys	$\bar{x}$	8.8	<0.01	26.9	11.4	<0.05	17.1
	SEM	±1.4		±1.7	±1.5		±1.8
	P	<0.05		<0.01	<0.05		<0.01
Girls	$\bar{x}$	5.5	<0.01	15.7	7.5	NS	10.3
	SEM	±1.2		±1.6	±1.3		±1.3
Socio-economic index							
Low	$\bar{x}$	8.4	<0.01	24.4	11.3	<0.01	17.8
	SEM	±1.3		±1.8	±1.5		±1.8
	P	<0.05		<0.05	<0.05		<0.05
High	$\bar{x}$	5.1	<0.01	19.1	6.6	<0.05	10.3
	SEM	±1.2		±1.7	±1.2		±1.4
Plaque prevalence in 1974							
High (35–48)	$\bar{x}$	9.6	<0.01	24.8	12.6	NS	16.6
	SEM	±1.6		±1.6	±1.8		±1.7
	P	<0.01		<0.01	<0.01		<0.01
Low (0–34)	$\bar{x}$	5.0	<0.01	17.5	6.8	<0.05	10.5
	SEM	±0.9		±1.9	±1.1		±1.4
Gingivitis prevalence in 1974							
High (21–48)	$\bar{x}$	9.2	<0.01	26.7	12.0	<0.05	17.8
	SEM	±1.5		±1.6	±1.7		±1.7
	P	<0.05		<0.01	<0.01		<0.01
Low (0–20)	$\bar{x}$	5.0	<0.01	15.8	6.7	NS	9.3
	SEM	±0.9		±1.7	±1.1		±1.4

taking into account a third variable, the control variable consisting of dichotomized indices or single questions, comparisons were made between and within the studied groups. Significance testing was performed by chi-square testing and by the use of Student's *t* test.

Results

The interdisciplinary analyses of the clinical and social and behavioral data gave the following results.

□ The gingival status in 1978 was best in girls and in groups of individuals with a high socio-economic index and rather good earlier oral hygiene and gingival status (Table 2). For these control variables there were significant differences between the two subgroups of both the experimental and the comparison group. The differences were most pronounced in the comparison group. Moreover, each of the subgroups of the experimental group showed significantly better gingival conditions than corresponding subgroups of the comparison group.

In 1979 there were still significant differences between the two subgroups in each of the schools. However, there were no longer exclusively significant differences between corresponding subgroups, owing to a minor increase of the mean values at Munkhagen and a major decrease at Österberga. These changes were independent of the subgrouping of the individuals.

Table 3. Prevalence of caries (DF-S) according to control variable, studied group, and year. Experimental and comparison groups in 1978; the Munkhagen (M) and Österberga (Ö) schools in 1979. Mean ($\bar{x}$) and standard error of the mean (SEM)

		Caries prevalence					
Control variable		Exp. 78	*P*	Comp. 78	M 79	*P*	Ö 79
Socio-economic index							
Low	$\bar{x}$	17.1	NS	17.6	20.3	NS	20.9
	SEM	±1.2		±1.2	±1.4		±1.3
	P	<0.05		<0.01	<0.01		<0.01
High	$\bar{x}$	13.7	NS	13.3	15.3	NS	15.3
	SEM	±1.3		±1.1	±1.2		±1.2
Type of accommodation							
Low	$\bar{x}$	16.9	NS	17.3	20.0	NS	20.6
	SEM	±1.1		±1.0	±1.2		±1.2
	P	<0.05		<0.01	<0.05		<0.01
High	$\bar{x}$	13.5	NS	13.1	15.1	NS	14.9
	SEM	±1.6		±1.2	±1.6		±1.3
Line of education							
Low	$\bar{x}$	17.8	NS	18.7	20.9	NS	22.2
	SEM	±1.1		±1.1	±1.2		±1.3
	P	<0.01		<0.01	<0.01		<0.01
High	$\bar{x}$	12.3	NS	12.4	13.9	NS	14.3
	SEM	±1.4		±1.1	±1.5		±1.5
Caries prevalence in 1974							
High (≥7 DF-S)	$\bar{x}$	20.9	NS	19.4	24.2	NS	22.3
	SEM	±1.2		±1.0	±1.3		±1.1
	P	<0.01		<0.01	<0.01		<0.01
Low (≤6 DF-S)	$\bar{x}$	9.8	NS	10.6	11.5	NS	12.8
	SEM	±0.8		±1.0	±0.9		±1.1

□ The caries status in 1978 was best in groups of individuals with a high socio-economic status and low earlier caries prevalence (Table 3). In this context, high socio-economic status comprises the variables for high socio-economic index (the parents' occupation and theoretically oriented education), high level of accommodation (detached housing), and high line of education (theoretical study orientation). For these control variables, there were significant differences between the two subgroups of both the experimental and the comparison group. No significant differences in these respects were found between any of the corresponding subgroups.

In 1979 there were still significant differences between the two subgroups at both the Munkhagen and Österberga schools. As in 1978, no significant differences were found between any of the corresponding subgroups of the two schools.

□ Neither gingival status nor caries status in 1978 was markedly affected by variables chosen to express the individual's home care climate, dental knowledge and dental awareness, foresightedness or carelessness, or dietary or oral hygiene habits (Table 4). Only one significant difference between the two subgroups of the experimental and comparison groups was found: in the comparison group, individuals with a low dental awareness index had significantly poorer gingival conditions than those with a high index. Likewise, in 1979 the only significant differ-

Table 4. Control variable with significant (*P* value) and non-significant (NS) differences in the prevalence of gingivitis and caries in accordance with studied group and year. Experimental and comparison groups in 1978; the Munkhagen (M) and Österberga (Ö) schools in 1979

		Gingivitis prevalence						Caries prevalence					
Control variable		Exp. 78	*P*	Comp. 78	M 79	*P*	Ö 79	Exp. 78	*P*	Comp. 78	M 79	*P*	Ö 79
Opinion of father's care of his teeth (home care climate)													
Low	*P*	NS	<0.01	NS	NS	<0.05	NS	NS	NS	NS	NS	NS	NS
High			<0.01			NS			NS			NS	
Dental knowledge index													
Low	*P*	NS	<0.01	NS	NS	<0.01	NS	NS	NS	NS	NS	NS	NS
High			<0.01			NS			NS			NS	
Dental awareness index													
Low	*P*	NS	<0.05	<0.05	NS	<0.05	NS	NS	NS	NS	NS	NS	NS
High			<0.01			<0.05			NS			NS	
Carelessness index													
High	*P*	NS	<0.01	NS	NS	<0.01	NS	NS	NS	NS	NS	NS	<0.05
Low			<0.01			NS			NS			NS	
Planning ahead (foresightedness)													
Low	*P*	NS	<0.01	NS	NS	<0.01	NS	NS	NS	NS	NS	NS	NS
High			<0.01			NS			NS			NS	
Intake of sweets (dietary habits)													
High	*P*	NS	<0.01	NS	NS	<0.01	NS	NS	NS	NS	NS	NS	NS
Low			<0.01			NS			NS			NS	
Tooth-cleaning index (oral hygiene habits)													
Low	*P*	NS	<0.01	NS	NS	<0.01	NS	NS	NS	NS	NS	NS	NS
High			<0.01			<0.01			NS			NS	

ence between the subgroups was that the Österberga school individuals with a high carelessness index had significantly poorer caries status than those with a low index.

However, in 1978 significant differences were demonstrated between the subgroups of the same category with regard to the control variables tested (Table 4), the individuals belonging to the comparison group showing the poorest gingival conditions regardless of the variable tested. In 1979 these significant differences remained for those having a low opinion of their father's care of his teeth, low dental knowledge, low dental awareness, low foresightedness, low tooth-cleaning, high carelessness, and high intake of sweets between meals. The gingival status was also still significantly better in those with high dental awareness and tooth-cleaning at Munkhagen than in corresponding individuals at Österberga (Table 4).

□ Professional tooth-cleaning plus fluoride mouth-rinsing carried out every 3rd week had a significant effect on gingival status, far greater than was expressed by the social and behavioral factors tested as control variables (Table 2). Professional tooth-cleaning plus fluoride mouth-rinsing every 3rd week and fluoride mouth-rinsing every 2nd week showed equivalent effects on caries status in corresponding groups of individuals (Table 3).

□ Social and behavioral factors of relevance on the group level exerted their influence regardless of the type and extent of dental health care provided and of the subjects' previous experience with dental prevention (Tables 1–4).

Discussion

The most important results obtained in a series of interdisciplinary studies of the relevance of social and behavioral factors in the evaluation of dental prevention provided for school children are presented (17). The findings confirm some of the results from a corresponding study in young people in their late teens (3) but also point to differences in these respects between various age groups. It seems appropriate in a discussion of the present findings to comment on the scientific approach used for studies of this kind.

The interdisciplinary strategy constitutes a useful approach for identifying, surveying, and systematizing factors presumed to influence the individual's dental health (3). For several of the variables chosen to express the social and behavioral factors, generally accepted measures had not been fully elaborated at the time of the investigation, in contrast to the clinical factors, for which standardized and calibrated measures were available and had been used for years (1, 15, 16).

The results are therefore subject to some uncertainty as to the validity and reliability of the variables used as indicators of relevant aspects of the social and behavioral factors studied. Although these problems are shared with other studies in the medical and dental fields based on answers to questionnaires (18), the possibility of shortcomings for this reason has to be considered. However, most of the social and behavioral variables used had been developed and tested with the present or similar design in a previous study of older teenagers (3). In addition, the principles used for index construction should guarantee the reliability of the measures and also constitute support for the assumption of validity.

The respondents' social and behavioral factors were measured only once, at the end of the trial. The conclusions are therefore based on the assumption that the individuals' social conditions, such as the family structure and their school attendance, were fairly stable during the period of the trial. The results of the interdisciplinary analyses are based on two separate clinical recordings, in connection with partly different preventive regimens in 1974–78 and 1978–79, on which the conclusions are based. It is thereby possible to obtain information about (i) the stability or instability of the dental health behavior, which, depending on the subject's experience with dental prevention, may have developed before or during the trial, and (ii) the importance of the preventive meas-

ures for the achieved clinical effects when the results are related to individual social and behavioral factors of the respondents.

Testing of these aspects revealed interesting divergences compared with older teenagers (3). In the former but not in the present study several of the social/political, mental, and action factors influenced the clinical results. The reason for this discrepancy may be that social and behavioral factors of this kind, such as foresightedness, carelessness, and dental awareness, have not reached such a level of development and maturation in individuals of younger ages as they have in the late teens. Also, the preventive regimens may in themselves have resulted in a low level of personal responsibility among the participating school children. Furthermore, the influence of commercially available sweets in these school areas is strong, and negative sweet-eating habits may readily develop among the school children. Finally, another approach to dental health education also encompassing non-professional sources, for instance parents, teachers, and other 'key persons' (6, 8, 9, 19), might have resulted in clinical effects superior to those achieved here.

Despite this, a fairly good level of dental health behavior was achieved by applying the principles of professional tooth-cleaning. The maintenance process was also evidently dependent on the mechanisms underlying long-term preventive behavioral influence (2, 6, 7, 10, 11), although these are known to be complex (5, 7). At the ages studied, these mechanisms appeared to be associated with the individual's material and physical factors, which are known to be parent-dependent. Dental health care programs for school children should accordingly be designed so that the parents' cooperation is achieved (9).

Preventive strategies designed to increase school children's dental knowledge and dental awareness (attitudes) or change their sweet-eating or tooth-cleaning habits are generally accepted among dental health workers (20–22). However, there seems to be some overconfidence as to their general usefulness, and they would probably benefit from an increased interest in the professional and the personal sense of responsibility for the outcome of the preventive regimens (9).

Thus, this interdisciplinary analysis of the effects of dental prevention for school children indicates that the most relevant social and behavioral factors for the results at these ages are the material and physical factors of the individuals. It should be noted that these are factors that may interact. However, owing to limitations imposed by the size and special character of the material, the interdisciplinary analysis was chiefly made by studying one individual factor at a time.

Finally, we believe that this interdisciplinary strategy, based on a theoretical model for studies of general and dental health (3, 13, 14), is a useful scientific tool in the evaluation of dental health care programs. This may be of interest if preventive regimens, in addition to effectiveness, are also to be evaluated in terms of efficiency, appropriateness, and adequacy (23, 24).

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