

Oral health of representative samples of Germans examined in 1989 and 1992

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Abstract – This paper presents selected results of two recent representative cross-sectional studies of oral health in the German population, conducted by the IDZ (Institute of German Dentists) for the old Federal States (the former Federal Republic of Germany) in 1989 ($n=1741$) and the new Federal States (the former German Democratic Republic) in 1992 ($n=1519$). Each epidemiological study reported both clinical and sociological data. The following average DMFT values were determined: for the children aged 8/9 yr: 1.4; for the adolescents aged 13/14 yr: 4.9; for the adults aged 35–44 yr: 16.1; and for the adults aged 45–54 yr: 17.9. These are the overall averages for “Germany West” and “Germany East” combined. The overall results for periodontal health in adults were as follows: CPITN 0: 4.9%; CPITN 1: 11.2%; CPITN 2: 24.6%; CPITN 3: 42.7%; and CPITN 4: 16.6% for the adults aged 35–44 yr and CPITN 0: 2.4%; CPITN 1: 8.1%; CPITN 2: 20.4%; CPITN 3: 46.8%; and CPITN 4: 22.3% for the adults aged 45–54 yr. The following average tooth loss figures were calculated for Germany as a whole: age group 35–44 yr: 3.9 missing teeth; age group 45–54 yr: 7.7 missing teeth. In addition, all the morbidity data determined have been analysed for statistical significance in the comparison between “West” and “East” Germany. The prevalences presented are also differentiated according to the socioeconomic status (SES) of the subjects, with the lower social strata as a whole showing higher morbidity prevalences. Comparisons show that caries has declined significantly among children and adolescents in Germany in the last 10–15 yr. Finally, the authors recommend the inclusion of qualitative research techniques when studying the differential causation of the inverse correlation between oral morbidity and social status.

Key words: CPITN; DMFT; dental health; differential morbidity; methods; national survey; periodontal health; tooth loss; social epidemiology

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The available statistics on oral epidemiology in Germany in the last two decades have been based mainly on a large number of local studies, each with different methodology and sampling, with the aim of determining the prevalences of caries morbidity in specific population groups.

The most important of these studies for the territory of the old Federal Republic (West Germany between 1948 and 1990) were the two nationwide surveys of dental patients by PATZ & NAUJOKS (1)

in 1978 and NAUJOKS & HÜLLEBRAND (2) in 1983, as well as the representative survey of the population of the Hanover region (Metro and Nonmetro) conducted in 1973 as a part of the WHO ICS I study (3). The WHO study in fact covered a large number of clinical variables in addition to caries and also had a socio-dental orientation.

A considerable number of epidemiological surveys have also been carried out in the territory of the former German Democratic Republic (GDR) in the

last 20–30 yr, providing information on oral morbidity and its variation over time (4). These studies, too, predominantly documented the epidemiology of caries among specific population groups in different regions and urban municipalities of the former GDR, but they also included complete surveys accompanying mass screenings of entire school years, which formed part of the system of stomatological care in operation in the former GDR at the time (5, 6). The WHO ICS I study (3), in which the Leip-

zig region (Metro and Nonmetro) of the former GDR took part in 1978, is again relevant here.

The situation of oral epidemiology statistics for Germany as a whole, i.e. "West" and "East" together, was as follows: although a number of studies had been devoted primarily to caries morbidity since the beginning of the 1970s, there was no comprehensive survey of the oral health status of the German population that was both representative of that population and covered the entire Federal Republic. Against this research background, it seemed appropriate to organize and conduct a representative survey along the above lines, in order to fill the gaps in our knowledge. For this reason, after a number of preliminary projects, the IDZ (Institute of German Dentists) conducted two representative cross-sectional studies of the oral health of the German resident population, the first, dating from 1989, covering the old Federal States ("West") and the second, 2 yr after the reunification of "West Germany" and "East Germany", in 1992, being devoted to the new Federal States ("East"). The data recorded have already been published in German (7, 8).

The following research objectives were chosen: a) determination of the prevalences of dental caries and periodontitis and of dental prosthetic status; b) description of differences regarding the morbidity figures determined for West and East Germany; c) determination of the sociodemographic distribution patterns of the clinical variables; d) placement of the current morbidity figures (dental caries) in a time comparison with the data determined for West and East Germany in earlier cross-sectional studies.

Material and methods

The methodology of both IDZ studies was that of a cross-sectional survey (9, 10), since the principal object of the research process was a general descriptive presentation.

The 1989 primary study in West Germany and the 1992 supplementary study in East Germany both comprised stratified random samples of the German resident population in four age groups: children aged 8/9 yr, adolescents aged 13/14 yr and adults in the age groups 35–44 yr and 45–54 yr. The first sampling step

consisted in studies of cluster samples stratified by Federal State and by community category, while in the second step individual subjects were sampled at random from the communities selected using data obtained from the population registration offices. The age cohorts were selected according to international criteria (11, 12).

Table 1 presents sample size and the number of participants from East and West Germany according to age rates of the address material constituting these samples. The participation rates averaged 67% for the West German random sample and 77% for the East German random sample. A sociodemographic analysis of the final net samples based on the official attribute distributions in the resident population of Germany as a whole (13, 14) revealed only slight discrepancies (between 2 and 5 percentage points), so that sociodemographic weighting of the sample data material proved unnecessary.

The survey instruments used for the relevant IDZ studies – some of them developed specifically for the purpose – were described in a separate English-language publication in 1992 (15). For this reason, it will suffice to note that the data for caries and periodontitis were recorded by means of the accepted international index systems (DMFT, DMFS, CPITN, PBI). Caries was diagnosed (DMFT, DMFS) on the basis of full examinations using a hand mirror, a sharp probe and an inspection lamp, but without X-rays. Periodontal diagnosis comprised the following steps: a) visual examination of dental calculus; b) assessment of gingival condition (PBI) using the WHO probe; c) recording of the CPITN (index teeth) and d) determina-

tion of loss of attachment (recording in the first and fourth quadrants; age group 8/9 yr not being examined).

The sociological survey section, which is also documented in (15), was developed by the IDZ using the relevant literature in the field of empirical social and health research in Germany (16, 17). Whereas the social survey part of the study in West Germany took the form of interviews conducted by professional interviewers, this system was modified for the study in East Germany, which used a shortened version of the questionnaire. Both IDZ studies were carried out with the assistance of a private social research institute.

In the West German study, the clinical data were recorded by a network (canvassed in each case in communities selected for the study) of dental practitioners ($N=80$) working in their own practices, all of whom were required to attend a 1-day theoretical and practical training course, conducted by the senior dental calibrators, on the system of recording used in the research project. The senior dental calibrators themselves were recruited from the dental departments of several German universities (those of Göttingen, Regensburg and Würzburg), which had been approached for assistance with the project because of their extensive experience of research in the field of oral epidemiology. This group of senior dental calibrators also drew up the diagnostic criteria and data recording manual for the research project (15) in accordance with the WHO/FDI criteria for the diagnosis of dental caries and periodontal diseases.

In the East German study, the clinical data were recorded by two specially

Table 1. Gross data base¹ and final net utilization in "Germany West" in 1989 and "Germany East" in 1992

Age (yr)	Gross		Net	
	West	East	West	East
8/9	524	478	443	388
13/14	525	488	452	400
35–54	1544	1014	868	731
Total	2593	1980	1763	1519

¹ Gross figures corrected for exclusions due to factors with neutral quality impact (e.g. change of address, illness, wrong address).

Table 2. Correlation coefficients (r) between project calibrators and project dentists for DMFT and CPITN in "West Germany" in 1989 and "East Germany" in 1992

Index system $n=$	Product-moment correlation	
	West 75 (r)	East 80 (r)
DMFT	0.984	0.984
D/T	0.744	0.875
M/T	0.993	0.977
F/T	0.977	0.964
CPITN (max. value)	0.650	0.851
CPITN (mean value)	0.798	0.941

Table 3. Caries-free dentition: percentages in "West Germany" in 1989 and "East Germany" in 1992

Age (yr)	West		East	
	n	(%)	n	(%)
8/9	443	42.4	388	51.0
13/14	452	12.4	400	16.0
35-54	868	0.6	731	0.0

trained project teams (each consisting of a dentist and a recording assistant), working in a Dentomobile in each of the selected survey municipalities in succession. The personnel had undergone a whole day's theoretical and practical training by the senior dental calibrators prior to the commencement of the project.

To ensure and verify that the data were of the quality required, reliability studies were carried out by the participating project dentists during the fieldwork. Table 2 sets out the concordance rates (product-moment correlations) obtained for the DMFT and CPITN data between the project dental calibrators and the actual project dentists in the random sample checks carried out (West: $n=75$ subjects; East: $n=80$ subjects). The results were as follows: a) higher rates of concordance were obtained in caries diagnosis than for the CPITN; b) when the two methods ("fixed-location system" of project data recording using a network of practice-

based dentists versus "mobile system" with project teams operating from the Dentomobile) were compared, the calibration level was found to be almost identical in the case of caries, whereas the "mobile data-recording system" proved to be significantly superior in the case of the periodontitis data.

The statistical evaluation of the complete data comprised a) tabulations of all individual variables in the dental and sociological parts of the survey and b) bivariate cross-tabulations covering selected groups of parameters. The following statistical techniques were used for data differentiation: the *t*-test of differences in mean values for independent random samples, the chi-square test of differences in the incidence of selected variables; and the Wilcoxon-test as a non-parametric method for additional corroboration of the interpretation of the data.

Results

Prevalence of caries – The percentages of caries-free persons in West and East Germany are presented in Table 3. The average DMFT values for the different age cohorts are set out in Table 4; both the *t*-test and the Wilcoxon-test show that the DMFT figures for West and East differ highly significantly ($P<0.001$) from each other. Furthermore, the lower social strata as a whole exhibited higher rates of caries experience than the upper

Table 4. Mean DMFT values and standard deviations (SD) in "West Germany" in 1989 and "East Germany" in 1992

Age (yr)	Overall ¹ ($n=3282$)		West ($n=1763$)		East ($n=1519$)	
	DMFT	SD	DMFT	SD	DMFT	SD
8/9	1.4	1.64	1.5	1.73	1.1	1.32
13/14	4.9	4.00	5.1	4.07	4.3	3.70
35-54	16.9	5.95	17.5	5.91	14.5	5.49

¹ Overall figure weighted in accordance with the proportionate relative populations of West and East Germany.

Table 5. Caries prevalence (DMFT) by socio-economic status (SES) in "West Germany" in 1989 and "East Germany" in 1992

Age (yr)	SES High		SES Medium		SES Low	
	$(n=530)$		$(n=1050)$		$(n=1595)$	
	West	East	West	East	West	East
8/9	1.0	1.0	1.3	1.0	2.1	1.1
13/14	2.9	3.6	5.1	4.3	6.1	4.9
35-54	16.6	13.9	17.7	13.8	17.6	15.9

Table 6. Distribution of degrees of severity of periodontitis (maxima) in "West Germany" in 1989 and "East Germany" in 1992

Age groups	Overall ¹ (%)	West (%)	East (%)
35-44 ($n=815$)			
Degree 0	4.9	6.1	0.0
Degree 1	11.2	12.1	7.4
Degree 2	24.6	25.8	19.8
Degree 3	42.7	40.7	50.8
Degree 4	16.6	15.3	21.7
45-54 ($n=784$)			
Degree 0	2.4	2.8	0.5
Degree 1	8.1	9.0	4.4
Degree 2	20.4	20.2	19.9
Degree 3	46.8	47.6	41.4
Degree 4	22.3	20.5	28.6

¹ Overall figure weighted in accordance with the proportionate relative populations of West and East Germany.

strata (Table 5) – especially in the group of children and adolescents. To facilitate understanding of the DMFT results, it should be added that the prevalence of dental caries is very unequally distributed, with a comparatively small group of persons accounting for most of the dental caries. This phenomenon of caries polarization is illustrated by the statistics for Germany as follows (figures for East Germany in parentheses): in the group of children, 28% (31%) have some 71% (83%) of all DMF teeth; 21% (22%) of the adolescent group account for approximately 46% (50%) of all DMF teeth; while in the adult group 40% (22%) have about 53% (34%) of all DMF teeth. This social medicine finding of caries polarization seems to us to be highly

Table 7. Prevalence of tooth loss and prosthetic status in "West Germany" in 1989 and "East Germany" in 1992

Age groups	Overall ¹	West	East
35-44 ($n=815$)			
Missing teeth	3.9	3.8	4.5*
Replaced teeth	2.2	2.3	1.8***
Non-replaced teeth	1.8	1.5	2.9***
45-54 ($n=784$)			
Missing teeth	7.7	7.5	8.5*
Replaced teeth	5.7	5.8	5.6
Non-replaced teeth	2.0	1.7	3.1***

¹ Overall figure weighted in accordance with the proportionate relative populations of West and East Germany.

* $P<0.05$.
*** $P<0.001$.

Table 8. Tooth loss and prosthetic replacements by socio-economic status (SES) in "West Germany" in 1989 and "East Germany" in 1992 in adults aged 35–54 yr

Variables	SES High		SES Medium		SES Low	
	West	East	West	East	West	East
n=	114	130	441	348	305	253
Missing teeth	2.7	5.0	5.1	5.3	7.4	9.3
replaced	1.7	2.8	3.6	2.4	5.5	5.7
not replaced	1.0	2.2	1.5	2.9	2.0	3.6

relevant to prevention and treatment, particularly as disproportionately large numbers of children and adolescents from the lower social strata are affected by this morbidity pattern.

Prevalence of periodontitis – Severe forms of this disease (CPITN \geq 6 mm) were observed in 17% (West) and 25% (East) of adults in the age group 35–54 years (Table 6); the difference between these two proportions is shown by the chi-square test to be highly significant ($P<0.001$).

Quantitative analysis of the data recorded by social status shows that, as in the case of caries, the severe forms of periodontitis in particular were diagnosed appreciably more frequently in the lower status groups of society than in subjects from the higher strata: 12.3% in higher strata vs. 21.0% in lower status groups in the West German random sample and 19.2% in higher strata vs. 34.0% in lower status groups in the East German study; all these values are referred to the recorded percentages (maxima) with a CPITN of 4.

Tooth loss and prosthetic replacements – Table 7 shows the average number of missing, replaced and non-replaced teeth in the 35–54-yr-old German population. When the "West" and "East" distributions are compared by the Wilcoxon-test, significant ($P<0.05$) to highly significant ($P<0.001$) differences between the measured variables are observed. More detailed analyses of the data show that tooth loss has been treated in West Germany much more often with fixed prostheses than in East Germany, where removable dentures are more common. The social gradient again proves significant for tooth loss, with both the extent of tooth loss and the extent of replacement showing specific distributions for each social level (Table 8). According to the two IDZ studies, the proportions of subjects completely edentulous in both arches in the group of

Germans aged 35–54 yr are 1.2% for "West" (1989) and 2.7% for "East" (1992).

Discussion

The results of the two recent IDZ studies of oral health in Germany set out here are confined to certain parameters selected from the overall data recorded. In particular, considerations of space preclude a presentation and critique of the various individual results on oral health attitudes and behavior (with particular reference to oral and dental hygiene, eating/drinking habits, the use of dental services and fluoride application) among the German population and their structural correlations with the dental variables recorded in the studies. These results have been presented in other publications (7, 8). The discussion of the findings therefore is limited to just two groups of problems.

As in many other European countries, caries prevalence would appear to have declined in Germany during the last 10–15 yr. Thus comparison of the present caries data for West Germany with the corresponding results of major studies dating from 1973 (3) and 1983 (2) shows an (almost) continuous decline in the prevalence of caries among children and adolescents in West Germany. The average DMFT value for 8/9-yr-old children fell from 3.3 in 1973 to 2.2 in 1983 and to 1.5 in 1989. In the adolescent group, the average DMFT values are 8.8 in 1973, 8.8 in 1983 and 5.1 in 1989. Caries values in the group of adults aged 35–54 yr, by contrast, have changed only slightly, with the 1973 DMFT value of 18.7 falling to 18.5 in 1983 and 17.5 in 1989. Concerning the variation of caries prevalence in West Germany, however, it should be borne in mind that the comparative studies of 1973 and 1983 were not based on random sample models representative of the population and

covering the whole of the then Federal Republic; the comparative figures should therefore be interpreted more in terms of a general statistical trend.

Analysis of the variation of caries prevalence in East Germany (the territory of the former German Democratic Republic) reveals (19) that caries has declined among 8/9-yr-old children (DMFT 1.5 in 1979 and 0.7 in 1989) and 13/14-yr-old adolescents (DMFT 4.9 in 1979 and 3.6 in 1989). Here again, the reservation must be made that the caries data for the former GDR originated from individual studies conducted in urban/rural areas and that the prevalence of caries on the whole depended strongly on the extent of fluoridation measures (mainly fluoridation of drinking water). For instance, whereas caries declined significantly in adolescents over the period 1959–1989 in cities whose drinking water was fluoridated, its prevalence tended to increase slightly over this period in towns without drinking water fluoridation (4, 18).

However, in all the above analyses and comparisons of caries experience and its variation with time in West and East Germany, there is the methodological and epidemiological proviso that the comparative data are sometimes based on widely differing random sample models (see above), and it is also not always possible to reconstruct to what extent the diagnostic criteria for caries were identical. Again, the results will have been influenced by the magnitude of interexaminer variability. Since the methodological problems of determining the prevalence of periodontal disease in a survey are even more difficult to solve than those of caries diagnosis (see above), a comparative analysis of the CPITN data between "East" and "West" and of their variation in time will not be undertaken here.

The clinical data recorded on the forms of pathology covered by the studies show a consistent significant correlation with the subjects' socioeconomic status. This correlation between morbidity patterns and social status is not in principle specific to the dental field (19) but is also found to apply to a large number of other diseases and health problems in the sphere of medicine in general (20–22). For this reason, the main challenge of research today is not so much a matter of statistical demon-

stration of these correlations between specific morbidity structures and specific social strata, as the achievement of an appropriate understanding of the relevant causes. In this connection it is vital to avoid exaggerated or over-hasty extrapolations (23) of causes from the macro level to the micro level; attention must be concentrated on the crucial question of how structural characteristics of a social system (in this case, the social stratification of a society) are actually manifested in people's behavior (in this case, health-related behavior).

The key to a full understanding of this important question of the "manifestation" of the macro level of society in the micro level of the individual surely lies in an exact analysis on the meso level – that is, in empirical investigation of the actual life contexts in which conditions determined by the social structure impact on the health-related behavior of individuals. For instance, it is important to bear in mind the close connection between the subjective locus of health and disease control and general experiences concerning the controllability of events (24), the latter in turn no doubt being intimately bound up with everyday family life (25–27) and professional role playing. Against this problem background, it seems to us urgently necessary to take appreciably more account of the aspect of social epidemiology in our studies, in dentistry as in other fields, supplementing it by qualitative research approaches using problem-related samples in which over-hasty standardization of recording is avoided and which are directed towards the consistent empirical identification of correlations (28); CROUCHER'S (29) contribution on periodontal health awareness, using the technique of in-depth interviews, is in our view a highly successful example of this form of research. By means of a methodological combination of quantitative and – deliberately problem-driven – qualitative research design in the field of epidemiology, it would surely also be possible to throw more light on the causes of the converse correlation, between social status and oral and dental pathology. There is, in our view, a considerable need for research on this point.

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