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Prevalence of periodontal disease and treatment demands based on a German dental survey (DMS IV)

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Abstract

Aim: We assessed the prevalence and extent of periodontitis in Germany. Furthermore, region- and gender-specific differences in periodontal disease prevalence were evaluated.

Material and Methods: The fourth German Dental Health Survey is a national cross-sectional survey conducted in 2005. Nine hundred and twenty-five adults (35–44 years) and 1040 seniors (65–74 years) were examined. The survey comprised social- and health-related interviews and dental examinations. Probing depth (PD) and clinical attachment loss (CAL) were assessed at three sites at 12 index teeth.

Results: Prevalence of CAL $\geqslant$ 3 mm was found in 95.0% in adults and 99.2% in seniors with 68.7% and 91.4% of teeth being affected, respectively. PD $\geqslant$ 4 mm was prevalent in 76.9% and 87.7% in both age groups, respectively. According to the CDC definition considering mesiobuccal and distolingual sites, prevalence of periodontitis was 70.9% and 87.4% in both age cohorts, with one-fourth and one-half presenting severe forms, respectively. Periodontal prevalence was significantly higher in male subjects and East German subjects.

Conclusions: Periodontitis was highly prevalent in German adults. To reduce periodontal burden, treatment of periodontal diseases and continuous maintenance should become an integral part in dental practice. Furthermore, health recommendations should be implemented at the community, professional, and individual level.

Keywords: clinical attachment loss; periodontal disease; prevalence; probing depth; treatment needs

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In Europe, national representative data on prevalence and extent of periodontal destruction are rare. A recently published article gave a comprehensive summary of the prevalence of periodontal health in Europe based on data gathered before 2000 (Sheiham & Netuveli 2002). Within the last decade, only few studies provided a comprehensive view on prevalence and extent of periodontal diseases (Kelly et al. 2000, Skudutyte et al. 2001, Menghini et al. 2002, Krustrup & Erik Petersen 2006, Skudutyte-Rysstad et al. 2007, Hugoson et al. 2008, Suominen-Taipale et al. 2008, Hermann et al. 2009), covering only a small fraction of all European countries. Periodontal diseases were least prevalent in Sweden (Hugoson et al. 2008) and Switzerland (Menghini et al. 2002). In contrast, 82% of 35–44-year-old subjects and 95% of 65–74-year-old subjects in Lithuania presented at least moderate probing depths (PDs) (Skudutyte et al. 2001).

The dramatic change of political, economic, and social conditions in Germany in the last two decades relevantly changed socioeconomic and environmental risk factors of oral health. Thus, it can be expected that oral and periodontal health have changed, too. To date, nationally representative and comprehensive data for Germany are lacking. Previously published studies did not provide sufficient information

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on prevalence and extent of periodontal diseases (Mengel et al. 1993, Micheelis & Reich 1999). Only the regional Study of Health in Pomerania (SHIP) provided a comprehensive assessment of periodontal status in West Pomerania, a region in the very north east of Germany (Holtfreter et al. 2009). Prevalence of severe periodontitis ranked among the highest in Europe. Generalized attachment loss was common, especially in older age cohorts, while severe PDs mostly occurred locally (Holtfreter et al. 2009).

Evaluations of periodontal disease burden are highly complicated by the ongoing discussion of a globally accepted case definition for periodontitis (Albandar 2007, Page & Eke 2007, Savage et al. 2009). The choice of different index systems as well as differences in the interpretation with respect to clinical and epidemiological aspects varies between studies (Burt & Eklund 2005) and aggravates an objective evaluation of periodontal treatment needs (Holm & Martinsson 1998, Page & Eke 2007). In a recent publication a classification for periodontitis combining attachment loss and PD values was proposed (Page & Eke 2007), which may provide a tool for health planners to report the disease burden in an easy communicable way.

After the publication of the fourth German national survey of oral health (DMS IV) (Micheelis & Schiffner 2006), a discussion ensued among German health authorities, asking how large the periodontal disease burden would be, whether there is an under-treatment of periodontal disease, and how this situation could be changed. To address these issues, the prevalence of periodontitis and its treatment needs have to be assessed in the first step. In a subsequent step, the number of individuals undergoing periodontal treatment has to be enumerated and then periodontal treatment efficacy can be estimated. Finally, decisions to modify strategic health care plans could be conceptualized, if under-treatment is paramount and treatment fails to reach a notable public effect (Burt & Eklund 2005).

Here, we concentrate on aspects of prevalence and extent of periodontal diseases and attempt to estimate its treatment needs in Germany. Thus, we aim (i) to assess the prevalence and extent of attachment loss and PD values considering different severity thresholds, (ii) to report region and gender specific periodontal disease prevalence, and (iii) to describe the prevalence of moderate and severe periodontitis according to the CDC-AAP definition considering mesiobuccal and distobuccal sites (Page & Eke 2007) based on the fourth national dental survey (DMS IV) in Germany.

Material and Methods

The fourth German Dental Health Survey (DMS IV) is a cross-sectional survey in all German Federal counties conducted by the Institute of German Dentists (IDZ) in 2005 (Micheelis & Schiffner 2006). A stratified multistage probability design of the civilian non-institutionalized German population in two age cohorts (adults aged 35–44 years and seniors aged 65–74 years) was applied. Subgroups in East Germany were oversampled to allow better precision in estimates. Study subjects were selected randomly according to German population registries in a total of 90 municipalities (sample points), which in turn constituted a cluster random sample based on region and degree of urbanization. Overall, 3960 subjects aged 35–44 and 65–74 years were sampled. According to several reasons (22 had died, 154 had moved away, 142 had severe medical problems) 318 subjects were removed resulting in 3642 objects being invited. The net random sample included 925 adults and 1040 seniors corresponding to a response rate of 52.1% for adults and 55.7% for seniors. In part, low response rates may have resulted from study conditions, because examiners were present at each sample point for only 2 days, and thus flexibility of examination appointments was restricted. This could have substantially influenced study response.

To determine effects of non-response, a short basic questionnaire, comprising questions about the subjective awareness of oral health, reasons for visiting the dentist, the kind of dental prostheses, graduation level, gender, and others, was sent to 1,372 non-responders. Three hundred and forty-two adults and 359 seniors responded. Based on this basic questionnaire, a comparison of responders and non-responders revealed, that adult responders were more often female (49.4% *versus* 45.3%), had less often a good or very good subjective oral health (40.6% *versus* 53.2%), and were more often regularly visiting the dentist compared with adult non-responders (76.1% *versus* 64.9%). Senior responders were more often male (46.2% *versus* 42.1%), had less often a good or very good subjective oral health (36.5% *versus* 41.8%). A comparable percentage of senior responders and non-responders reported to have regular dental check-ups (72.2% *versus* 70.9%).

Sociodemographic and behavioural variables

Examinations comprised a social- and health-related interview and dental examinations. The social- and health-related interview was used to gain information on behavioural and sociodemographic characteristics. Based on the German school system, school education level was categorized as low (<10 years), medium (10 years), and high (>10 years). Cigarette smoking was assessed and categorized as never, former, and current smoking. The number of cigarettes smoked per day was categorized as <10, 10–20, and >20.

Furthermore, the dental questionnaire provided information about oral health behaviour. Oral hygiene was defined as good, if teeth were brushed twice a day for at least 2 min. and otherwise as insufficient. Utilization of dental services was defined as regular if dental check-ups were made at least once a year. Irregular utilization was defined as having dental check-ups less than once a year or visiting the dentist only in case of dental discomfort or never.

Oral examination and periodontal disease definitions

Of the 925 adults and 1040 seniors receiving an oral examination, nine adults (1.0%) and 240 seniors (23.1%) were edentulous. Two adults and three seniors refused periodontal examination. Thus, periodontal parameters were available in 914 adults and 797 seniors.

Clinical attachment loss (CAL) and PD were assessed at midbuccal, mesiobuccal and distolingual sites at 12 index teeth (17, 16, 11, 24, 26, 27, 47, 46, 44, 31, 36, 37; two-digit notation according to the FDI World Dental federation). These measurements were recorded with a WHO periodontal probe (PCP 11.5 WHO probe, M+W Dental, Büdingen, Germany). The number of teeth present was counted excluding wisdom teeth.

Periodontal recordings were performed by three calibrated study dentists, who were trained by a professional periodontist. Validity and reliability examinations were done during the field period at the beginning, during, and at the end of the study in 14 subjects. Field-specific dental experts served as a gold standard. Inter-rater agreement was good with a κ value of 0.94 for CPI recordings on subject level. For attachment loss values inter-rater correlation coefficients (ICC) between the three study dentists and the professional dentist were 0.74, 0.79, and 0.94, respectively. 84.1%, 95.1%, and 100% of attachment loss values were measured within a range of ± 2 mm compared with the professional dentist (Pihlstrom 1992).

Prevalence of a given condition, e.g. attachment loss $\geqslant 3$ mm, was defined as the percentage of subjects having at least one site with that condition. Extent was defined as the percentage of teeth displaying that condition. Periodontal conditions were evaluated in all subjects. Edentulous subjects were excluded from analyses due to missing periodontal measurements.

The Community Periodontal Index (CPI) was recorded in sextants according to WHO guidelines (WHO 1997). Recording was conducted if two or more teeth (not considering root rests) were present. The highest value according to the CPI scale (0–4) was recorded. Overall, the CPI was recorded in 904 adults and 786 seniors.

To provide comparability with SHIP (Holtfreter et al. 2009), individuals were further classified according to the CDC-AAP case definition proposed by the CDC Working Group (Page & Eke 2007). Accordingly, distobuccal and mesiobuccal sites were evaluated. To provide comparability with other studies having included less sites, e.g., NHANES (Dye et al. 2007), we additionally determined the prevalence of moderate and severe periodontitis based on mesiobuccal sites only. Severe periodontitis is defined as at least two sites with attachment loss $\geqslant 6$ mm (not on same tooth) and at least one site with PD $\geqslant 5$ mm. At least two sites with attachment loss $\geqslant 4$ mm (not on same tooth) or at least two sites with PD $\geqslant 5$ mm indicate a moderate periodontitis. If neither moderate nor severe periodontitis applies, mild or no periodontitis was recorded.

Statistical methods

Continuous data are displayed as mean and standard deviation; categorical values are presented as percentages. Data were presented for the total population, and stratified according to gender and residence (West or East Germany).

To compare distributions of periodontal variables between groups, chi square tests were applied. To detect differences in the extent of periodontal disease between groups Mann–Whitney *U* tests were applied. *p* values were corrected with Bonferroni's adjustment for multiple testing. Statistical analyses were performed with STATA 10.0 (Stata Corp LP, College Station, TX, USA) and R 2.9.1 (free shareware, http://www.r-project.org).

Sampling weights were used to produce unbiased total variance estimates. Sample weights adjusted for different probabilities of subject selection with reference to the base population in Germany, accounting for differences in gender, age, region, and city size class.

Results

Study population

On average, adults were 40 years old and 44% were male, see Table 1. Seniors were 69 years old with 48% being male. Educational level was high in 32.5% of adults and 20.2% of seniors. Of adults and seniors, 35.1% and 6.7% of subjects were smokers, respectively. On average, subjects in both age groups had 25 and 14 teeth, respectively.

Table 1. Basic characteristics for adults (35–44 years) and seniors (65–74 years) with periodontal recordings according to region

	Germany		West Germany		East Germany	
	adults ($N = 914$)	seniors ($N = 797$)	adults ($N = 606$)	seniors ($N = 697$)	adults ($N = 308$)	seniors ($N = 343$)
Age (years)	39.6 ± 2.8	68.6 ± 2.7	39.6 ± 2.8	68.7 ± 2.7	39.8 ± 2.9	68.6 ± 2.7
Male gender (%)	44.0	48.3	44.2	48.7	43.5	47.5
School education (%)						
< 10 years	21.6	60.2	27.3	59.9	10.2	60.8
10 years	46.0	19.6	37.2	22.6	63.3	13.5
> 10 years	32.5	20.2	35.5	17.5	26.6**	25.8**
Smoking status (%)						
Never smoker	45.0	62.3	46.2	60.4	42.6	66.2
Former smoker	20.0	31.0	20.9	31.9	18.0	29.2
Current smoker	35.1	6.7	32.9	7.7	39.3	4.6
Number of cigarettes per day (%)†						
< 10	38.1	46.7	37.9	40.3	38.4	65.2
10–20	44.7	44.4	44.2	47.8	45.6	34.8
> 20	17.2	8.9	18.0	11.9	16.0	-
Number of teeth (in all subjects)	25.1 ± 4.1	13.6 ± 9.8	25.4 ± 3.9	14.1 ± 9.8	24.7 ± 4.2**	12.5 ± 9.5*
Edentulism (in all subjects) (%)	1.0	23.1	0.8	23.0	1.3	23.3
Good oral hygiene (%)‡	32.1	22.1	35.3	22.4	25.7**	21.5
Regular utilization of dental services (%)§	88.4	88.8	86.1	86.2	92.8**	94.1**

Data are presented as mean ± standard deviation or as percentages. *$p < 0.01$, **$p < 0.001$, for comparisons of variables between East *versus* West Germany, χ^2 test or Mann–Whitney *U*-test as appropriate.

†Data refer to current smokers.

‡Tooth brushing at least two times a day after meal for at least 2 min.

§Regular dental check-ups (at least once a year).

Comparing the distribution of sociodemographic variables, East and West Germans differed significantly with regard to school education and the number of teeth ($p<0.05$). In East Germany the percentage of highly educated adults (26.6%) and seniors (25.8) was relevantly lower compared with adults and seniors living in West Germany (35.5% and 17.5%, respectively). East German adults and seniors had less teeth, worse oral hygiene habits, but more often regularly visited the dental office than West Germans ($p<0.05$).

Prevalence and extent of attachment loss

In adults, CAL $\geqslant$3 mm was prevalent in 95.0% with 68.7% of index teeth being affected, see Table 2. Severe CAL ($\geqslant$5 mm) was recorded in 62.4% of adults and 21.6% of teeth were affected. 99.2% of all seniors had at least on site with CAL$\geqslant$3 mm with almost all index teeth being affected (91.4%). Severe CAL was prevalent in 89.1% of seniors; the according extent equalled 55.7% of index teeth.

Regarding gender and region, a similar picture was found in both age groups. Looking at severe thresholds of CAL (e.g. $\geqslant$6 mm), males had a significantly higher prevalence (seniors: 83.7% *versus* 69.5%, $p<0.05$) and a markedly higher extent (adults: 13.2% *versus* 10.1%; seniors: 44.7% *versus* 36.3% of examined teeth; $p<0.05$) than females. For certain thresholds, East German adults were significantly more affected than West German adults ($p<0.05$). For example, CAL$\geqslant$6 mm was prevalent in 50.8% of adults from East Germany, with 16.4% of index teeth being affected. For West German adults the according numbers were much lower: 37.9% and 10.6%. The same applied for seniors.

Prevalence and extent of PD

Moderate PD ($\geqslant$4 mm) was prevalent in 76.9% of adults with 34.0% of teeth being affected (Table 2). Especially for higher thresholds, prevalences decreased more rapidly than prevalences of attachment loss. The prevalence of at least one site with PD$\geqslant$6 mm was 20.5%, with 4.9% of teeth being severely affected. In seniors moderate PD ($\geqslant$4 mm) occurred in 87.7% of seniors. 54.0% of teeth displayed this condition. Severe PD was prevalent in 38.3% of seniors with 12.6% of teeth being affected.

Partly, males presented higher extent values compared with women ($p<0.05$). Differences in extent of PD (for moderate thresholds) with regard to region were statistically significant in adults ($p<0.05$), but negligible in seniors. In East German adults severe PDs occurred more generalized than in West Germans.

Percentage of periodontally affected sites

To evaluate the extent of periodontitis, the percentage of affected sites (at a maximum of 36 sites) was enumerated, see Fig. 1. Results for the extent contrasted those for the prevalence of periodontitis. At site-specific levels the percentage of affected sites was evaluated for varying thresholds for CAL and PD, separately for adults and seniors. Seldom, all sites were severely affected regarding PD and attachment loss (PD$\geqslant$6 mm or CAL$\geqslant$5 mm). For adults, moderate CAL occurring at a high percentage of sites was common, for example, 69.1% of adults presented moderate or severe CAL ($\geqslant$3 mm) on at

Table 2. Percentage of subjects and the extent on tooth level for attachment loss and probing depth by gender and region

	All subjects		Females		Males		West Germany		East Germany	
	% (SE)	mean (SE)	% (SE)	mean (SE)	% (SE)	mean (SE)	% (SE)	mean (SE)	% (SE)	mean (SE)
35–44-year-old subjects										
CAL										
$\geqslant$2 mm	98.5 (0.4)	90.0 (0.8)	98.0 (0.7)	88.1 (1.1)	99.0 (0.5)	91.8 (1.1)	98.3 (0.5)	89.2 (0.9)	99.5 (0.4)	93.6 (1.0)*
$\geqslant$3 mm	95.0 (0.8)	68.7 (1.1)	94.2 (1.1)	65.2 (1.5)	95.7 (1.1)	72.2 (1.6)**	94.2 (1.0)	66.9 (1.3)	98.6 (0.7)	77.0 (1.6)**
$\geqslant$4 mm	83.8 (1.3)	44.5 (1.1)	82.0 (1.8)	40.6 (1.5)	85.7 (1.9)	48.2 (1.7)**	82.2 (1.6)	42.5 (1.3)	91.4 (1.6)**	53.1 (1.9)**
$\geqslant$5 mm	62.4 (1.7)	21.6 (0.9)	59.2 (2.3)	19.4 (1.2)	65.4 (2.6)	23.6 (1.4)	60.9 (2.0)	20.3 (1.1)	69.0 (2.7)	27.2 (1.8)
$\geqslant$6 mm	40.3 (1.8)	11.7 (0.7)	35.3 (2.3)	10.1 (0.9)	44.1 (2.7)	13.2 (1.1)*	37.9 (2.0)	10.6 (0.8)	50.8 (3.0)*	16.4 (1.6)*
PD										
$\geqslant$2 mm	99.8 (0.2)	93.6 (0.5)	99.5 (0.3)	92.8 (0.8)	100 (0)	94.4 (0.7)	99.7 (0.2)	93.5 (0.6)	100.0 (0)	94.1 (0.9)
$\geqslant$3 mm	96.3 (0.7)	65.0 (1.1)	95.7 (0.9)	61.6 (1.4)	96.9 (1.0)	68.3 (1.6)**	96.0 (0.8)	63.6 (1.2)	97.7 (0.8)	71.0 (1.7)**
$\geqslant$4 mm	76.9 (1.5)	34.0 (1.1)	71.9 (2.2)	31.0 (1.4)	81.8 (2.1)*	36.9 (1.6)*	76.0 (1.8)	32.1 (1.2)	81.0 (2.4)	42.4 (2.0)**
$\geqslant$5 mm	38.7 (1.7)	10.5 (0.6)	36.1 (2.3)	9.9 (0.9)	41.3 (2.6)	11.0 (0.9)	37.1 (2.0)	9.4 (0.7)	45.9 (3.0)	15.3 (1.4)*
$\geqslant$6 mm	20.5 (1.4)	4.9 (0.4)	19.2 (1.8)	4.7 (0.6)	21.8 (2.1)	5.2 (0.6)	18.8 (1.6)	4.4 (0.5)	28.3 (2.7)	7.2 (1.0)
65–74-year-old subjects										
CAL										
$\geqslant$2 mm	100.0 (0)	98.7 (0.2)	100.0 (0)	98.2 (0.4)	100.0 (0)	99.3 (0.2)	100.0 (0)	98.7 (0.2)	100.0 (0)	98.6 (0.4)
$\geqslant$3 mm	99.2 (0.4)	91.4 (0.7)	98.9 (0.6)	89.9 (1.0)	99.6 (0.4)	93.1 (0.8)	99.1 (0.4)	90.9 (0.8)	99.5 (0.5)	93.6 (1.0)
$\geqslant$4 mm	96.9 (0.7)	78.1 (1.0)	95.4 (1.1)	74.6 (1.5)	98.5 (0.7)	81.9 (1.3)	96.8 (0.8)	76.8 (1.2)	97.4 (1.1)	83.2 (1.6)*
$\geqslant$5 mm	89.1 (1.2)	55.7 (1.2)	85.2 (1.9)	51.6 (1.8)	93.4 (1.4)*	60.2 (1.7)	88.0 (1.4)	52.9 (1.4)	93.6 (1.7)	66.5 (2.1)**
$\geqslant$6 mm	76.3 (1.6)	40.3 (1.3)	69.5 (2.4)	36.3 (1.7)	83.7 (2.0)**	44.7 (1.8)*	74.1 (1.9)	37.8 (1.5)	84.7 (2.4)*	50.1 (2.2)**
PD										
$\geqslant$2 mm	99.9 (0.1)	96.5 (0.4)	100.0 (0)	95.9 (0.6)	99.7 (0.3)	97.0 (0.5)	99.8 (0.2)	96.7 (0.4)	100.0 (0)	95.6 (0.8)
$\geqslant$3 mm	97.5 (0.6)	77.7 (1.0)	96.6 (0.9)	75.3 (1.4)	98.4 (0.7)	80.2 (1.3)	97.4 (0.7)	77.7 (1.2)	97.7 (0.9)	77.4 (1.7)
$\geqslant$4 mm	87.7 (1.2)	54.0 (1.2)	83.2 (2.0)	49.9 (1.7)	92.6 (1.3)*	58.5 (1.7)	88.6 (1.4)	54.5 (1.4)	84.2 (2.4)	51.9 (2.2)
$\geqslant$5 mm	58.1 (1.8)	23.4 (1.0)	54.1 (2.6)	20.4 (1.3)	62.5 (2.6)	26.7 (1.6)	57.3 (2.2)	23.0 (1.2)	61.3 (3.1)	24.9 (1.8)
$\geqslant$6 mm	38.3 (1.8)	12.6 (0.8)	33.7 (2.4)	10.7 (1.0)	43.2 (2.7)	14.7 (1.3)	38.0 (2.1)	12.5 (0.9)	39.3 (3.1)	13.0 (1.5)

CAL, clinical attachment loss; PD, probing depth.
*$p<0.05$, **$p<0.01$, χ^2 test or Mann–Whitney *U*-test as appropriate.

least 30% of sites. On average, 47.3% of sites had CAL ⩾ 3 mm, and 12.0% of sites were severely affected (CAL ⩾ 5 mm). For PD, the decrease of percentile curves was most pronounced for cut-offs 4 and 5 mm, whereas the percentage of adults with a minimum of sites with PD ⩾ 5 or 6 mm was similar (see Fig. 1b). On average, 16.9% of sites were at least moderately affected, while only 2.1% of sites had PD values ⩾ 6 mm.

For seniors, the cut-off-dependent decrease of the percentage of seniors with affected sites (Fig. 1c and d) was comparable to that of adults (Fig. 1a and b). The percentage of seniors presenting ⩾ 3/4/5 mm attachment loss in ⩾ 30% of examined sites was generally high and, in ascending order of cut-off values, 94.3%, 81.6%, and 53.6% (Fig. 1c). On average, CAL ⩾ 3 mm and CAL ⩾ 5 mm were recorded at 76.9% and 38.9% of sites, respectively. Regarding PD, 4.2% of seniors had severe PD values (⩾ 6 mm) on at least 30% of sites. A generalized occurrence of severe PDs was rarely observed in seniors. Mean percentage of affected sites with PD ⩾ 4 mm was 27.4%. On average, 5.3% of sites were severely affected (PD ⩾ 6 mm).

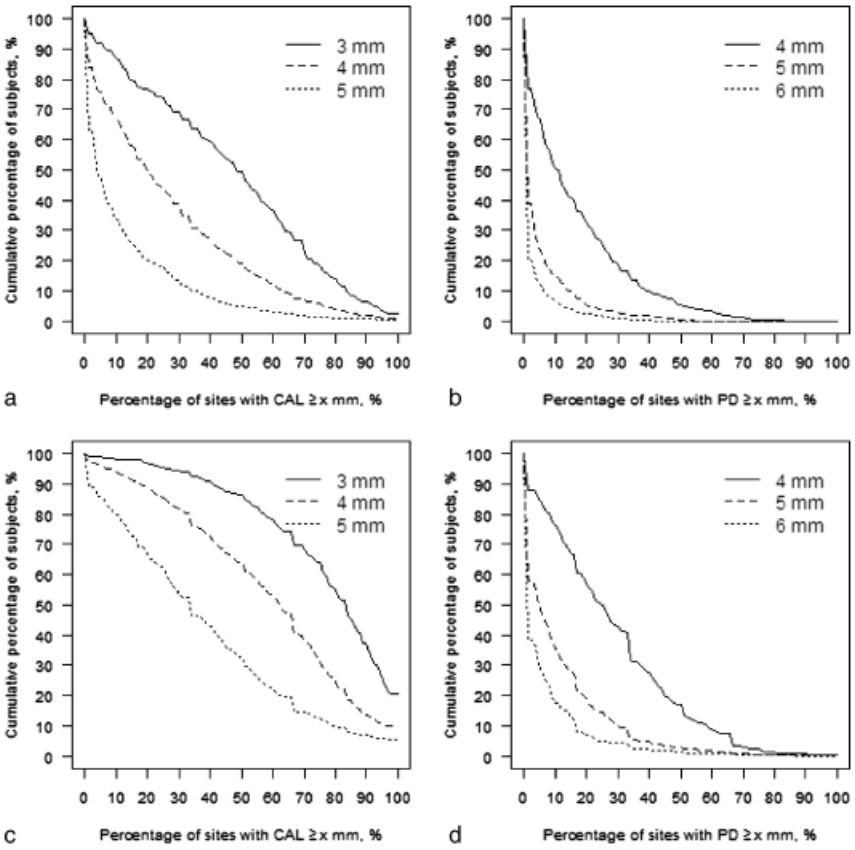

Fig. 1. Extent of clinical attachment loss (CAL) and probing depth (PD) in adults (a, b) and seniors (c, d). Lines represent the cumulative percentage of subjects (*y*-axis) with, e.g., CAL ⩾ 3 mm in at least 30% of examined sites (*x*-axis).

Prevalence of periodontal disease according to CPI and CDC-AAP classifications

Focussing on higher CPI categories (see Table 3) moderate periodontal pockets (4–5 mm) were recorded in 52.7% of adults and in 48.9% of seniors. Severe PDs (⩾ 6 mm) occurred in 20.5% of the younger and 39.8% of the older age cohort.

The frequency distribution of CPI categories differed significantly between females and males within both age cohorts ($p < 0.01$). Considering region-specific differences, CPI categories showed a different distribution in East and West Germany for adults ($p < 0.05$), while for seniors differences were negligible. In East Germany CPI grade 3 and 4 were prevalent in 50.5% and 27.8% compared to 53.2% and 18.9% in West Germany, respectively.

In contrast, an analysis of periodontal data according to the CDC-AAP definition resulted in overall 17.4% of adults and 41.9% of seniors having severe periodontitis with loss of attachment ⩾ 4 mm and concomitant PD ⩾ 5 mm, respectively (Table 4). 53.5% and 45.5% of subjects in both age groups had moderate forms of periodontal disease. Males showed a statistically significant tendency towards a higher percentage of severe periodontitis than females (adults: 20.5 *versus* 14.2, $p < 0.001$; seniors: 48.3 *versus* 36.1, $p < 0.001$). Further, the distribution of CDC-AAP categories differed signifi-

Table 3. Percentage distribution of subjects classified according to the Community Periodontal Index (CPI), stratified by gender and region

	Total	Females	Males	West Germany	East Germany
35–44 years					
N	903	508	395	599	304
Grade 0	0.5 (0.2)	0.5 (0.3)	0.6 (0.5)	0.4 (0.3)	1.3 (0.8)
Grade 1	11.8 (1.1)	15.7 (1.8)	8.0 (1.5)	12.6 (1.4)	8.1 (1.6)
Grade 2	14.4 (1.2)	16.6 (1.8)	12.4 (1.8)	14.9 (1.5)	12.3 (2.0)
Grade 3	52.7 (1.7)	48.2 (2.4)	57.2 (2.7)	53.2 (2.1)	50.5 (3.0)
Grade 4	20.5 (1.3)	19.1 (1.8)	21.8 (2.2)**	18.9 (1.6)	27.8 (2.7)*
65–74 years					
N	780	404	376	523	257
Grade 0	1.4 (0.5)	2.1 (0.8)	0.7 (0.5)	1.5 (0.6)	1.2 (0.7)
Grade 1	4.0 (0.7)	6.1 (1.2)	1.9 (0.6)	3.8 (0.8)	4.9 (1.3)
Grade 2	6.8 (1.0)	8.0 (1.5)	5.4 (1.2)	6.3 (1.1)	8.5 (1.9)
Grade 3	48.0 (1.9)	49.2 (2.6)	46.7 (2.7)	49.0 (2.2)	44.1 (3.2)
Grade 4	39.8 (1.8)	34.6 (2.5)	45.4 (2.7)**	39.4 (2.2)	41.3 (3.2)

Percentages with standard errors in brackets are presented.
*$p < 0.05$, **$p < 0.01$, χ^2 test comparing CPI distributions with regard to gender and region.

Table 4. Percentage distribution of subjects classified according to the CDC-AAP definition (Page & Eke 2007), stratified by gender and region

	Total	Females	Males	West Germany	East Germany
35–44 years					
N	914	512	402	606	308
CDC-AAP definition (mesiobuccal and distolingual site)					
No. or mild	29.1 (1.6)	34.4 (2.3)	24.0 (2.3)	30.9 (1.9)	21.2 (2.4)
Moderate	53.5 (1.8)	51.4 (2.4)	55.5 (2.7)	52.8 (2.1)	56.7 (3.0)
Severe	17.4 (1.3)	14.2 (1.6)	20.5 (2.1)**	16.3 (1.5)	22.1 (2.5)*
CDC-AAP definition (mesiobuccal site)					
No. or mild	46.8 (1.8)	51.2 (2.4)	42.6 (2.7)	48.4 (2.1)	39.6 (2.9)
Moderate	45.4 (1.8)	41.1 (2.4)	49.4 (2.7)	44.7 (2.1)	48.2 (3.0)
Severe	7.8 (0.9)	7.7 (1.2)	8.0 (1.4)*	6.8 (1.0)	12.2 (2.0)*
65–74 years					
N	797	412	385	536	261
CDC-AAP definition (mesiobuccal and distolingual site)					
No. or mild	12.5 (1.2)	16.2 (1.9)	8.5 (1.5)	12.4 (1.4)	13.0 (2.3)
Moderate	45.5 (1.9)	47.6 (2.6)	43.2 (2.7)	46.8 (2.2)	40.5 (3.1)
Severe	41.9 (1.8)	36.1 (2.5)	48.3 (2.7)**	40.8 (2.2)	46.5 (3.2)
CDC-AAP definition (mesiobuccal site)					
No. or mild	23.8 (1.6)	29.2 (2.4)	17.8 (2.1)	24.7 (1.9)	19.9 (2.6)
Moderate	54.3 (1.9)	53.8 (2.6)	54.8 (2.7)	54.3 (2.2)	54.3 (3.2)
Severe	22.0 (1.5)	17.0 (1.9)	27.4 (2.4)**	21.0 (1.8)	25.8 (2.8)

Percentages with standard errors in brackets are presented.
*$p < 0.05$, **$p < 0.001$, χ^2 test comparing distributions of periodontal categories with regard to gender and region.

cantly with regard to region: in adults, severe periodontitis was more prevalent in East Germans (22.1%) than in West Germans (16.3%). Similar proportions were found in seniors.

Restricted to mesiobuccal sites only, total prevalences of severe periodontitis were approximately halved (17.4% *versus* 7.8% in 35–44-year-olds, and 41.9% *versus* 21.9% in 65–74-year-olds). Differences emphasize the effect of underlying periodontal sites on CDC-AAP prevalence values.

Interpolation of age strata

Summarizing previous results periodontal disease prevalence exhibited a clear age gradient such that severe disease prevalence increased with increasing age. The prevalence of severe or moderate periodontitis according to different classification systems was extrapolated to the German population ($N = 44{,}684{,}900$; age 35–74 years) using information from population registries for the year 2005 (Federal Statistical Office 2007). Assuming an age-dependent linear increase of periodontal disease prevalence according to the recent CDC-AAP classification, moderate and severe periodontitis was prevalent in 50% and 28.2% of the adult dentate population 35–74 years of age, respectively. Estimating that about 40 million individuals of the German population are dentate, about 31.3 million dentate subjects exhibited periodontal treatment needs.

Discussion

Epidemiological assessment of periodontal disease burden on the basis of the present DMS IV data is complex, since yet no epidemiological definition for periodontitis has been widely accepted (Page & Eke 2007, Savage et al. 2009). Additionally, comparison with published studies is complicated due to different definitions for periodontitis, methodological, and recording disparities (Papapanou 1999, Albandar & Rams 2002, Kingman & Albandar 2002; Papapanou & Lindhe 2008). Thus, it seems reasonable to conservatively estimate disease prevalence in Germany.

The DMS IV study presents a representative sample of the German population aged 35–44 and 65–74 years. Adding up prevalences for moderate and severe periodontitis resulted in comparable values for both index systems (for adults: CPI 73.2%, CDC-AAP: 70.9%; for seniors: CPI 87.8%, CDC-AAP: 87.4%, Tables 3 and 4). But on the individual level, agreement of both classifications was insufficient for both adults (73.8%) and seniors (69.2%). These discrepancies demonstrate impressively, that health authority's questions about actual periodontal burden cannot easily be answered. In addition, it is obvious that indices using maximum values do inevitably lead to an overestimation of periodontal treatment needs (Baelum & Papapanou 1996). Most often, only few teeth/sites were moderately or severely affected, while generalized periodontitis occurred seldom, see Table 2 and Fig. 1.

Further, it should be kept in mind that due to only middle study response results might be biased. Comparison of responders and non-responders revealed that in adults, prevalence of periodontitis may have been underestimated due to a higher percentage of females. In seniors, periodontal prevalence might be overestimated due to a higher percentage of male seniors participating in the study. For adults and seniors, the high percentage of subjects reporting regular dental check-ups may balance the lower percentage of subjects having a good subjective oral health regarding non-response bias.

Regional differences in periodontal health

In this study, prevalence and extent of attachment loss and PD was relevantly higher for East German adults compared with West Germans. Discrepancies between East and West Germany can partly be attributed to differences in dental health services, prevention strategies, and oral health behaviour: a lower percentage of East German adults reported good oral hygiene. However, East German adults more often reported to have regular dental check-ups compared to West Germans.

For seniors, region-specific differences were only found for extent values of attachment loss. Actual inflammatory disease severity assessed by PD was comparable for both regions. For both regions, the percentage of seniors reporting good oral hygiene was comparable, while the percentage of seniors having declared regular dental check-ups was significantly higher in East Germany.

Not only in periodontal diseases, but also in cardiovascular mortality rates an unequal distribution of disease burden between East and West Germans was observed. In the year 2000, cardiovascular disease mortality in the 25–74-year-old German population was 321.5 per 100,000 in men and 141.8 per

100,000 in women in the study region of SHIP; the corresponding values for the region around Munich in West Germany were 278.4 per 100,000 in men and 116.0 per 100,000 in women (Meisinger et al. 2006). Whether these differences in periodontal disease burden or cardio- and cerebrovascular mortality are related to differences in both biological or lifestyle components or former political system differences, is beyond the scope of this analysis. Similar observations have been described for blood pressure (Meisinger et al. 2006).

Gender differences in periodontal health

In this study, male gender was related to increased periodontal destruction in both age cohorts, see Tables 2–4. This concurs with other studies (Albandar et al. 1999, Kelly et al. 2000, Krustrup & Erik Petersen 2006, Bourgeois et al. 2007, Suominen-Taipale et al. 2008). The fact that women had substantially less documented periodontal disease might be due to differences in periodontal risk factors, sociocultural determinants, or differences in dental and general health behaviour. Smoking patterns, for example, were different across genders, favouring males (ever smokers: 59.5% *versus* 52.5% in adults and 61.4% *versus* 35.9% in seniors). In addition, men are more often diabetic (Rathmann et al. 2006). Diabetics are at higher risk for periodontal diseases (Borrell & Papapanou 2005, Kaur et al. 2009). Further, the gender differential observed in this study might be due to decreased number of teeth in females, especially in seniors (13.1 *versus* 14.7), and thus decreased number of teeth at risk for periodontal diseases. However, tooth extraction does not necessarily inhibit the onset of periodontitis on residual teeth (Holtfreter et al. 2009).

Placement of Germany in the European setting

For Europe, only few national representative data for periodontal disease within the last decade are available. Further, comparison with a French study was limited due to restriction to subjects with at least six teeth, leading to an underestimation of periodontal disease prevalence and extent (Bourgeois et al. 2007). In this study, prevalence of severe PDs (PD $\geqslant$ 6 mm) was considerably higher compared with other European studies (Kelly et al. 2000, Skudutyte et al. 2001, Menghini et al. 2002, Yolov 2002, Szoke & Petersen 2004, Krustrup & Erik Petersen 2006, Skudutyte-Rysstad et al. 2007, Hugoson et al. 2008, Suominen-Taipale et al. 2008, Hermann et al. 2009). For listed studies, prevalences of PD $\geqslant$ 6 mm ranged between 1.6% and 8.1% for adults and between 2.2% and 31% for seniors. Prevalences were lowest in Sweden (Hugoson et al. 2008) and highest in Finland (Suominen-Taipale et al. 2008) and Norway (Skudutyte-Rysstad et al. 2007). Only for Lithuania reported prevalences even overtop prevalences reported for DMS (Skudutyte et al. 2001).

Regarding attachment loss prevalences, recent epidemiological studies are rare for Europe (Kelly et al. 2000, Menghini et al. 2002, Krustrup & Erik Petersen 2006). For reviewed studies, prevalence of moderate or severe attachment loss ($\geqslant$ 4 mm) ranged between 20% and 42% for adults and between 63.1% and 85% for seniors, with lowest and highest prevalences being reported for Denmark (Krustrup & Erik Petersen 2006) and the United Kingdom (Kelly et al. 2000), respectively. Conclusively, attachment loss was consistently less prevalent compared with DMS (adults: 83.8%, seniors: 96.9%).

Recently, the CDC working group has published a case definition for periodontitis, which considers attachment loss and PD values at different levels (Page & Eke 2007). In this study, prevalence of severe periodontitis according to the CDC-AAP definition was 22.1% for adults and 46.5% for East German seniors. This concurs with CDC-AAP prevalences from SHIP (Holtfreter et al. 2009). For the United States, prevalence of periodontitis ranged between 5.0% in the youngest and 10.7% in the oldest age group (Dye et al. 2007). For Australian adults similarly low prevalence values were reported (Do et al. 2008). Thus, prevalence of periodontitis in Germany evaluated according to the CDC-AAP definition ranked highest.

Importantly, one has to emanate from enhanced discrepancies between studies due to different recording protocols. Utilization of partial recording protocols implicates a biased estimation of prevalences and extent (Susin et al. 2005, Kingman et al. 2008). Among different compositions of teeth, index teeth have a comparatively high percentage of molars and mandibular incisors, which are periodontally more affected compared to other teeth (Albandar et al. 1999). Thus, evaluation of index teeth is associated with an underestimation of prevalence values (Susin et al. 2005, Beck et al. 2006), whereas extent, measured as the percentage of affected teeth, overestimated real values (Beck et al. 2006, Vettore et al. 2007). Finally, the selection of three instead of six sites per tooth leads to an additional underestimation. This site-related inflation is smallest for partial recordings including mesiobuccal, midbuccal and distolingual sites (Susin et al. 2005, Kingman et al. 2008). This effect on site level was also observable when CDC-AAP prevalences were calculated with a varying number of sites per tooth. Based on distolingual and mesiobuccal sites, prevalences for severe periodontitis were doubled compared with prevalences based on mesiobuccal sites.

Nevertheless, in view of the different partial recording protocols applied in the reviewed studies, it can be assumed that bias of prevalence estimates was highest if index teeth were examined (Susin et al. 2005, Beck et al. 2006). Thus, the top ranking of DMS among European studies would not change considerably.

Under-treatment of periodontal diseases

To roughly estimate the prevalence of periodontitis beyond sampled age cohorts (i.e. in subjects aged 45–64 years) we assumed a linear increase of disease prevalence with age. Thus for subjects between 45 and 64 years, in whom periodontitis mostly contributes to the overall burden of oral diseases (Albandar et al. 1999, Holtfreter et al. 2009), estimated prevalences were possibly underestimated. According to the recent CDC-AAP definition at least 31.3 million dentate subjects aged 35–74 years were estimated to have moderate or severe periodontitis. Contrasting the number of 31.3 million subjects with periodontal treatment needs with the number of about 893,200 periodontally treated patients per year [only state-insured patients, data on periodontal treatments in privately insured adults ($\sim$ 13.9% of adults) are not available] [Federal Association of Fund Dentists (KZBV) 2007], one has to emanate from a considerable under-treatment.

In summary, periodontal diseases are highly prevalent in the German population with considerable discrepancies with regard to region and gender. In con-

trast to subjective treatment demands, objective periodontal treatment needs are comparably high in the German population. A decade ago Eaton concluded that ''although a range of organisations can promote improvements in professional awareness in periodontal disease, unless simultaneous efforts are made to improve the awareness of the general public to periodontal diseases, it is difficult to see how there can be an improvement in the periodontal health of the population'' (Eaton 1998). Obviously, this conclusion seems to be valid ten years later in Germany.

References

Albandar, J. M. (2007) Periodontal disease surveillance. *Journal of Periodontology* **78**, 1179–1181.

Albandar, J. M., Brunelle, J. A. & Kingman, A. (1999) Destructive periodontal disease in adults 30 years of age and older in the United States, 1988–1994. *Journal of Periodontology* **70**, 13–29.

Albandar, J. M. & Rams, T. E. (2002) Global epidemiology of periodontal diseases: an overview. *Periodontology 2000* **29**, 7–10.

Baelum, V. & Papapanou, P. N. (1996) CPITN and the epidemiology of periodontal disease. *Community Dentistry and Oral Epidemiology* **24**, 367–368.

Beck, J. D., Caplan, D. J., Preisser, J. S. & Moss, K. (2006) Reducing the bias of probing depth and attachment level estimates using random partial-mouth recording. *Community Dentistry and Oral Epidemiology* **34**, 1–10.

Borrell, L. N. & Papapanou, P. N. (2005) Analytical epidemiology of periodontitis. *Journal of Clinical Periodontology* **32** Suppl 6, 132–158.

Bourgeois, D., Bouchard, P. & Mattout, C. (2007) Epidemiology of periodontal status in dentate adults in France, 2002–2003. *Journal of Periodontal Research* **42**, 219–227.

Burt, A. B. & Eklund, S. A. (2005) *Dentistry, Dental Practice and Community*. Tokyo: W.B. Saunders Company.

Do, L. G., Slade, G. D., Roberts-Thomson, K. F. & Sanderson, A. E. (2008) Smoking-attributable periodontal disease in the Australian adult population. *Journal of Clinical Periodontology* **35**, 398–404.

Dye, B. A., Tan, S., Smith, V., Lewis, B. G., Barker, L. K., Thornton-Evans, G., Eke, P. I., Beltran-Aguilar, E. D., Horowitz, A. M. & Li, C. H. (2007) Trends in oral health status: United States, 1988–1994 and 1999–2004. *Vital Health Statistics* **11**, 1–92.

Eaton, K. A. (1998) Awareness of periodontal diseases: the professional and the civil servant. *International Dental Journal* **48**, 248–255.

Federal Association of Fund Dentists (KZBV) (2007) *Jahrbuch 2007. Statistische Basisdaten zur vertragszahnärztlichen Versorgung*. K ö ln: Kassenzahnärztliche Bundesvereinigung (KZBV).

Federal Statistical Office (2007) *Statistical Yearbook 2007 for the Federal Republic of Germany*, p. 734. Wiesbaden: Federal Statistical Office.

Hermann, P., Gera, I., Borbely, J., Fejerdy, P. & Madlena, M. (2009) Periodontal health of an adult population in Hungary: findings of a national survey. *Journal of Clinical Periodontology* **36**, 449–457.

Holm, G. & Martinsson, T. (1998) The Swedish National Dental Insurance's periodontal diagnosis. Used on an individual level. *Swedish Dental Journal* **22**, 77–84.

Holtfreter, B., Schwahn, C., Biffar, R. & Kocher, T. (2009) Epidemiology of periodontal diseases in the Study of Health in Pomerania. *Journal of Clinical Periodontology* **36**, 114–123.

Hugoson, A., Sjodin, B. & Norderyd, O. (2008) Trends over 30 years, 1973–2003, in the prevalence and severity of periodontal disease. *Journal of Clinical Periodontology* **35**, 405–414.

Kaur, G., Holtfreter, B., Rathmann, W. G., Schwahn, C., Wallaschofski, H., Schipf, S., Nauck, M. & Kocher, T. (2009) Association between type 1 and type 2 diabetes with periodontal disease and tooth loss. *Journal of Clinical Periodontology* **36**, 765–774.

Kelly, M., Steele, J., Nuttall, N., Bradnock, G., Morris, J., Nunn, J., Pine, C., Pitts, N., Treasure, E. & White, D. (2000) *Adult Dental Health Survey- Oral Health in the United Kingdom 1998*. London: Office for National Statistics.

Kingman, A. & Albandar, J. M. (2002) Methodological aspects of epidemiological studies of periodontal diseases. *Periodontology 2000* **29**, 11–30.

Kingman, A., Susin, C. & Albandar, J. M. (2008) Effect of partial recording protocols on severity estimates of periodontal disease. *Journal of Clinical Periodontology* **35**, 659–667.

Krustrup, U. & Erik Petersen, P. (2006) Periodontal conditions in 35–44 and 65–74-year-old adults in Denmark. *Acta Odontologica Scandinavica* **64**, 65–73.

Meisinger, C., Heier, M., Volzke, H., Lowel, H., Mitusch, R., Hense, H. W. & Ludemann, J. (2006) Regional disparities of hypertension prevalence and management within Germany. *Journal of Hypertension* **24**, 293–299.

Mengel, R., Koch, H., Pfeifer, C. & Flores-de-Jacoby, L. (1993) Periodontal health of the population in eastern Germany (former GDR). *Journal of Clinical Periodontology* **20**, 752–755.

Menghini, G., Steiner, M., Helfenstein, U., Imfeld, C., Brodowski, D., Hoyer, C., Hofmann, B., Furrer, R. & Imfeld, T. (2002) [Dental health of adults in the Zurich Canton]. *Schweizer Monatsschrift fur Zahnmedizin* **112**, 708–717.

Micheelis, W. & Reich, E. (1999) *Dritte Deutsche Mundgesundheitsstudie (DMS III). Ergebnisse, Trends und Problemanalysen auf der Grundlage bevölkerungsrepräsentativer Stichproben in Deutschland 1997*. Köln: Deutscher Zahnärzte Verlag.

Micheelis, W. & Schiffner, U. (2006) *Vierte Deutsche Mundgesundheitsstudie (DMS IV). Neue Ergebnisse zu oralen Erkrankungsprävalenzen, Risikogruppen und zum zahnärztlichen Versorgungsgrad in Deutschland 2005*. Köln: Deutscher Zahnärzte Verlag.

Page, R. C. & Eke, P. I. (2007) Case definitions for use in population-based surveillance of periodontitis. *Journal of Periodontology* **78**, 1387–1399.

Papapanou, P. & Lindhe, J. (2008) Epidemiology of periodontal diseases. In Lindhe, J., Lang, N. P. & Karring, T. (eds). *Clinical Periodontology and Implant Dentistry*, 5th edition, pp. 129–179. Oxford: Oxford Blackwell Scientific Publication Ltd.

Papapanou, P. N. (1999) Epidemiology of periodontal diseases: an update. *Journal International Academic Periodontology* **1**, 110–116.

Pihlstrom, B. L. (1992) Measurement of attachment level in clinical trials: probing methods. *Journal of Periodontology* **63**, 1072–1077.

Rathmann, W., Haastert, B., Giani, G., Koenig, W., Imhof, A., Herder, C., Holle, R. & Mielck, A. (2006) Is inflammation a causal chain between low socioeconomic status and type 2 diabetes? Results from the KORA survey 2000. *European Journal of Epidemiology* **21**, 55–60.

Savage, A., Eaton, K. A., Moles, D. R. & Needleman, I. (2009) A systematic review of definitions of periodontitis and methods that have been used to identify this disease. *Journal of Clinical Periodontology* **36**, 458–467.

Sheiham, A. & Netuveli, G. S. (2002) Periodontal diseases in Europe. *Periodontology 2000* **29**, 104–121.

Skudutyte, R., Aleksejunienė, J. & Eriksen, H. (2001) Periodontal Conditions among Lithuanian Adults. *Acta Medica Lituanica* **1**, 57–62.

Skudutyte-Rysstad, R., Eriksen, H. M. & Hansen, B. F. (2007) Trends in periodontal health among 35-year-olds in Oslo, 1973–2003. *Journal of Clinical Periodontology* **34**, 867–872.

Suominen-Taipale, L., Nordblad, A., Vehkalahti, M. & Aromaa, A. (2008) *Oral Health in the Finnish adult population. Health 2000 Survey*. Helsinki: National Public Health Institute.

Susin, C., Kingman, A. & Albandar, J. M. (2005) Effect of partial recording protocols on estimates of prevalence of periodontal disease. *Journal of Periodontology* **76**, 262–267.

Szoke, J. & Petersen, P. E. (2004) [State of oral health of adults and the elderly in Hungary]. *Fogorv Sz* **97**, 219–229.

Vettore, M. V., Lamarca Gde, A., Leao, A. T., Sheiham, A. & Leal Mdo, C. (2007) Partial recording protocols for periodontal disease

assessment in epidemiological surveys. *Cadernos de Saude Publica* **23**, 33–42.
WHO (1997) *Oral Health Surveys. Basic Methods*. Genf: World Health Organization.
Yolov, T. (2002) Periodontal condition and treatment needs (CPITN) in the Bulgarian population aged over 60 years. *International Dental Journal* **52**, 255–260.

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Clinical Relevance

Scientific rationale for the study: Prevalence of periodontitis was evaluated in 35–44- and 65–74-year-old subjects in a national German sample.
Principal findings: Prevalence of periodontitis according to the CDC-AAP definition was high with 53.5% and 17.4% of adults and 45.5% and 41.9% of seniors being moderately or severely affected. Adults living in East Germany presented a more pronounced periodontal breakdown than West Germans.
Practical implications: To reduce under-treatment of periodontitis, clinical assessment and management should be integrated in dental practice. Furthermore, health recommendations should be implemented at the community, professional, and individual level.