

# Need and demand for dental treatment

A comparison between an evaluation based on an epidemiologic study of 35-, 50-, and 65-year-olds and performed dental treatment of matched age groups

Anders Wänman and Lage Wigren

Department of Clinical Oral Physiology, Umeå University, Umeå, and Public Dental Health, Skellefteå, Sweden

Wänman A, Wigren L. Need and demand for treatment. A comparison between an evaluation based on an epidemiologic study of 35-, 50-, and 65-year-olds and performed dental treatment of matched age groups. *Acta Odontol Scand* 1995;53:318–324.

The aim of this study was to compare the results of the level of treatment need as judged from a sample drawn from the general population aged 35, 50, and 65 years with treatments performed in 1992 and 1993 on patients of matched ages. Both the sample and the patients lived in Västerbotten in the northern part of Sweden. In all three age groups there was a significantly higher frequency of restorative treatment performed than the professionally assessed need in the epidemiologic sample. In all ages examined, treatment aimed at rehabilitation of temporomandibular disorders was performed statistically significantly ( $p < 0.001$ ) less frequently than the evaluated need in the population. A similar result was found for dentures among 65-year-olds. The results may reflect dental care paradigms favoring operations on single teeth rather than treatments aimed at functional rehabilitation on a broader sense. □ *Epidemiology; occlusal rehabilitation; temporomandibular joint syndrome; treatment needs*

Anders Wänman, Department of Clinical Oral Physiology, Umeå University, S-901 87 Umeå, Sweden

To evaluate the need and demand for treatment in the population is a complicated task that probably has little prospect of success. Many factors, not directly related to the actual disease for which treatment can be offered, will interfere, such as cost, know-how, culture, equipment, manpower, and prognosis of treatment (1–4). Consequently, the dental care produced depends on an interaction between need and demand for treatment and available resources.

Most recent studies on the need and demand for dental treatment have been performed on specific populations such as the elderly (5–8), institutionalized/handicapped (9–11), or refugees (12–13), and they have in general reported high normative needs in these populations. Few studies have estimated the treatment need in the general population and related the results to the dental treatment that is received. In one epidemiologic study of adults, however, the sample did receive more than twice as many restorations as was predicted (14), whereas only 10% of those with a predicted need for removable dentures received indicated treatment (15). A Swedish study (16) that related the estimated treatment needs in 1970 and 1980 to the consumption of treatment during the period 1974–1979 came to a similar result. In an elderly Swedish population (17) restorative measures formed 6% of the registered need but 22% of the treatment received, whereas the opposite situation was found for removable prosthetics.

The insurance system for dental care in Sweden, launched in 1973, has contributed to the current

situation, in which almost every resident in Sweden has access to regular dental care (18). The level of costs, met by the insurance scheme, is not evenly distributed over the country. Dental care in the more densely populated southern Sweden costs on average twice as much per patient as for those who live in the north (19). A similar pattern with the highest consumption of dental care in the most densely populated areas has also been found in Norway (20). These regional differences may be due to differing needs and demands in the populations but are more likely to be dependent on variations in manpower between regions in combination with an insurance system based on 'a fee for service'. We may be approaching a paradigmatic shift in Swedish dental care with a system based on capitalism instead of fee for service. This shift will probably influence the level of treatment offered, since the dentist's opinion will be the factor with the greatest influence on the judgement of whether treatment is regarded as necessary (3, 20).

In 1990 an epidemiologic study on oral health among adults was carried out. The need for dental care was evaluated on the basis of a random sample of 35-, 50-, and 65-year-olds living in the county of Västerbotten, Sweden. The results of that study have been presented elsewhere (19). The aim of this study was to compare the results of the level of treatment need as judged in a subsample from the general population with the amount of treatment performed in 1992 and 1993 on patients 35, 50, and 65 years of

Table 1. Total number of subjects aged 35, 50, and 65 years living in Västerbotten, Sweden, in 1990 (population), number of subjects from the sample selected at random (sample), and the number of the participants who reported that they received their dental care from the Public Dental Health Service in the county (subsample). Total number of patients aged 35, 50, and 65 years receiving dental care at the Public Dental Health service in Västerbotten in 1992 and 1993, respectively

	35 years	50 years	65 years
Population 1990	3588	2746	2717
Sample	345	271	284
Subsample	160	90	108
Patients 1992	899	612	405
Patients 1993	1021	702	478

age at the Public Dental Care Service in Västerbotten, Sweden.

## Materials and methods

The epidemiologic study was performed in 1990 on a sample from the population of 35-, 50-, and 65-year-olds living in Västerbotten, Sweden—a total of 9051 subjects. The population was stratified into those living on the coast and in the inland region. It was decided that both strata would consist of 450 subjects, who were then selected at random proportional to the demography of each region. Thus, in total 900 subjects were included in the study. Of the sample 79.4% participated in both the questionnaire and in the clinical examination, 10.9% only answered the questionnaire, 3.1% were interviewed by telephone, 1.6% had died, and 4.6% could not be reached or did not want to participate. In the present study only those who reported that they had received dental care from the Public Dental Health Service were analyzed (subsample). Since the sample was stratified in regions, the figures have been weighted for the total region. The population, the sample, and the subsample analyzed in this study are presented in Table 1.

The examination included a questionnaire with 45 items concerning demography, general health, medication, use of tobacco, dental care, oral symptoms, headaches, and chewing function. The questions were generally to be answered with a yes or no. After the questionnaire had been filled out, a clinical examination was performed. At this, tooth mortality, restorations, and fixed and removable prostheses were registered. Caries was registered in accordance with the criteria described by Koch (21). The intermaxillary relations were registered in accordance with a modified Eichner classification (22). The community periodontal index of treatment needs (23) was noted for all teeth. Signs of temporomandibular disorders (TMD) were registered to calculate the anamnestic (AI) and clinical dys-

Table 2. Percentage of agreement and Cohen's kappa for the variables included in the measurement of precision between one standard examiner and the other five examiners

Variable	Percentage agreement	Cohen's kappa
TMD (20 measurements)	81.3–87.3	0.58–0.67
CPI	53.8–71.9	0.36–0.62
CP13 and CP14	74.4–89.7	0.58–0.82
Probing depth (m + b)	90.6–95.3	0.87–0.94
Attachment level (mb,b)	79.6–92.2	0.69–0.88
DFS	92.3–98.7	0.91–0.97

TMD = temporomandibular disorders; CPI = community periodontal index.

function (DI) indices in accordance with Helkimo (24). The status of the oral mucosa was noted, and a clinical diagnosis was stated on the basis of the criteria described by Axell (25). The examinations were performed by six dentists, all trained for acceptable precision in the methods used in the clinical examination at three occasions. Totally, 15 patients were examined to test precision (Table 2). The summarized results of the epidemiologic study are presented in Table 3.

On the basis of the results of the clinical examination the dentist evaluated the dental treatment need (normative need) for each subject. In this evaluation no consideration was taken of the subject's financial situation or of whether the subject wanted treatment. The following levels of treatment need were evaluated:

Table 3. Percentage distribution of the oral health status among 35-, 50-, and 65-year-olds in Västerbotten, Sweden

	35 years	50 years	65 years
No. of teeth*	28	23	16
Edentulous	0	10	33
DFT	17	18	12
DT	1	1	1
CPI			
0	27	23	21
1	40	35	32
2	20	20	21
3	11	17	19
4	2	5	7
AI			
0	57	59	67
1	28	26	21
2	15	15	12
DI			
0	45	46	30
1	38	41	48
2	15	12	19
3	2	1	3
Healthy oral mucosa	73	73	50

CPI = community periodontal index; AI = anamnestic index; DI = dysfunction index.

\* Edentulous subjects excluded.

*Need due to carious lesions:* 1) No need; 2) prevention guidance/topic fluorides; 3) restorative therapy on a few teeth; 4) restorative therapy on several teeth, endodontic treatment; 5) need for referral/consultant.

*Need owing to periodontal status:* 1) No need; 2) prevention guidance; 3) scaling and/or rootplaning on a few teeth; 4) scaling and/or rootplaning on several teeth; 5) need for referral/consultant.

*Need for removable denture:* 1) No need; 2) adjustment of existing removable denture; 3) need for treatment with removable denture; 4) need for referral/consultant.

*Need for fixed partial denture:* 1) No need; 2) fixed partial denture up to four units; 3) fixed partial denture more than four units; 4) need for referral/consultant.

*Need owing to TMD:* 1) No need; 2) selective grinding; 3) splint therapy; 4) need for referral/consultant.

*Need for oral surgery:* 1) No need; 2) dentoalveolar surgery; 3) referral for orthognathic surgery; 4) referral for implantation; 5) referral for oral mucosal analysis.

To compare the result of these evaluations on the basis of the general population, with the dental treatment actually performed on patients of matched ages from the same county, all treatment measures performed in 1992 and 1993 by the Public Dental Health Service in Västerbotten were sampled. In 1992 there were 899 patients aged 35 years, 612 aged 50 years, and 405 aged 65 years. In 1993 the respective numbers were 1021, 702, and 478.

The Swedish insurance system for dental care provides several codes referring specifically to treatment measures, with a related fee. There are eight major groupings for measures carried out by dentists, one for dental hygienists, and one for dental assistants. The eight groups for dental care measures performed by dentists are as follows:

1. Counseling/examination procedures (codes 101–108). Code 102 includes examination.

2. Prophylactic treatment (codes 201 and 202). Code

Table 4. Percentage distribution of evaluated need for dental treatment among 35-, 50-, and 65-year-olds in the county of Västerbotten, Sweden, in 1990 and percentage distribution of treatment performed among 35-, 50-, and 65-year old patients in the Public Dental Health Service, Västerbotten, in 1992 and 1993. Figures adjusted to the nearest whole number except for figures of 0.5% or less

	35-year-olds			50-year-olds			65-year-olds		
	Percentage of population in need of treatment, 1990	Percentage of patients receiving treatment		Percentage of population in need of treatment, 1990	Percentage of patients receiving treatment		Percentage of population in need of treatment, 1990	Percentage of patients receiving treatment	
		1992	1993		1992	1993		1992	1993
No restorative treatment	52	37	40	60	32	32	65	41	41
Minor restorative treatment	45	48	46	36	50	50	28	43	46
Restorative treatment several teeth/ endodontic treatment	3	15	13	4	18	18	7	16	13
No periodontal treatment	25	59	60	18	50	51	51	56	59
Minor periodontal treatment	72	31	32	62	35	36	37	33	30
Significant periodontal treatment	3	10	9	20	15	13	12	11	11
Referral/consultant	–	NA	NA	–	NA	NA	–	NA	NA
No need for removable dentures	100	100	100	90	97	97	72	84	87
Adjustment	–	–	–	3	1	2	8	7	7
Need for removable dentures	0.2	–	–	3	2	2	19	9	6
Referral/consultant	–	NA	NA	4	NA	NA	0.4	NA	NA
No need for fixed dentures	95	97	97	93	86	87	91	88	87
Fixed partial dentures up to 4 units	3	3	3	6	13	12	8	11	12
Fixed partial dentures >4 units	2	–	–	1	1	1	1	1	1
Referral/consultant	–	NA	NA	–	NA	NA	–	NA	NA
No need for therapy owing to TMD	74	96	97	86	95	97	93	98	99
Selective grinding	19	3	3	9	4	2	2	1	1
Splint therapy	7	1	1	5	0.5	1	4	0.2	–
Referral/consultant	–	NA	NA	–	NA	NA	1	NA	NA
No oral surgery	99	97	98	97	94	96	96	94	95
Dentoalveolar surgery	0.5	3	2	3	6	4	–	6	5
Orthognathic surgery	–	NA	NA	–	NA	NA	–	NA	NA
Implantation	0.2	NA	NA	–	NA	NA	1	NA	NA
Oral mucosal analysis	0.2	NA	NA	–	NA	NA	3	NA	NA

NA = not available.

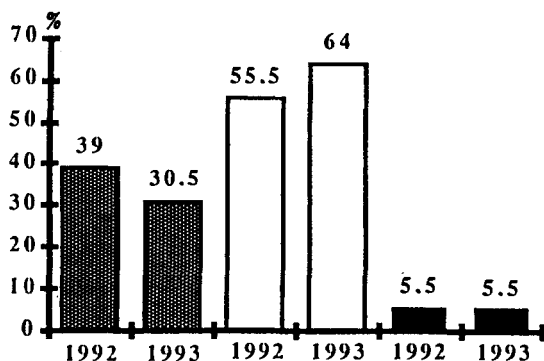


Fig. 1. Percentage distribution of restorative treatment measures performed—up to three dental fillings by the Public Dental Health Service, Västerbotten, Sweden, in 1992 and 1993. Stippled bars = amalgam fillings (codes 501–506); open bars = silicate, composite, or glass ionomer cements (codes 507–508); black bars = miscellaneous (codes 509–510).

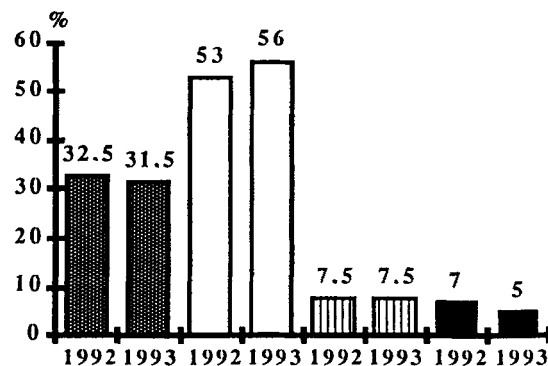


Fig. 2. Percentage distribution of restorative treatment measures performed—more than three dental fillings and endodontic treatment by the Public Dental Health Service, Västerbotten, Sweden, in 1992 and 1993. Filled bars = amalgam fillings (codes 501–506); open bars = silicate, composite, or glass ionomer cements (codes 507–508); stippled bars = endodontic treatment (codes 401–403 or 405); and black bars = miscellaneous (codes 509–510).

202 includes scaling, polishing, and treatment with topic fluorides.

3. Oral surgery and extractions (codes 301–304). Code 303 includes operative measures for impacted teeth, operative measures related to periodontal disease, and biopsy.

4. Endodontic treatments (codes 401–407).

5. Restorative treatments (codes 501–510). Codes 501–506 include different types of amalgam fillings and codes 507–508 composite, silicate, or glass ionomer cement fillings.

6. Fixed prosthesis (codes 601–615).

7. Removable prosthesis (codes 701–711).

8. Other treatments (codes 801–809). Code 803 includes selective grinding, and code 806 bite splints.

Dental hygienist code 251 includes information and instruction in dental hygiene; code 253 includes scaling and root planing.

The following criteria were used to match the previously presented levels of treatment need. The basic criterion was a registered examination during the year (code 102).

*Restorative/endodontic treatment:* 1) No treatment; 2) not more than three restorative therapy measures (codes 501–510 and not 401–403 or 405); 3) four or more restorative therapy measures or endodontic treatment (codes 501–510 and/or 401–403 or 405).

*Periodontal treatment:* 1) No treatment; 2) minor treatment (code 201 or 251 or 202 15–30 min or 253 ≤ 30 min); 3) significant periodontal treatment (code 202 or 253 > 30 min).

*Removable dentures:* 1) No treatment; 2) adjustment of existing removable dentures (codes 707–710); 3) treatment with removable dentures (codes 701–706).

*Fixed partial dentures:* 1) No treatment; 2) fixed partial dentures up to four units (codes 601–615 and not code

104); 3) fixed partial dentures more than four units (codes 601–615 and code 104).

*Treatment owing to TMD:* 1) No need; 2) selective grinding (code 803 but not 806); 3) splint therapy (code 806).

*Oral surgery:* 1) No surgery; 2) surgery (code 303).

#### Statistical methods

Differences in the distribution of need for dental care/performed treatment between sample and patients have been tested with chi-square. If the expected number of cases was too small, Fisher's exact test (two-tailed) was used. The level of statistically significant difference used was  $p < 0.05$ .

#### Results

The distribution of dental treatment need and performed dental care among 35-, 50-, and 65-year-olds is presented in Table 4. There were no statistically significant differences within each age group in the distribution of treatment measures performed in 1992 and 1993. In all three age groups there was a statistically significantly ( $p < 0.001$ ) higher frequency of performed restorative treatment than the professionally assessed need in the epidemiologic study in 1990. The difference was most marked among 65-year-olds, of whom 35% needed treatment according to the evaluation of the epidemiologic subsample, and about 58% of 65-year-old patients in 1992 and 1993 actually received some restorative dental treatment. More than 50% of the measures that had been performed were composite, glass ionomer cements, or silicate fillings (Figs. 1 and 2).

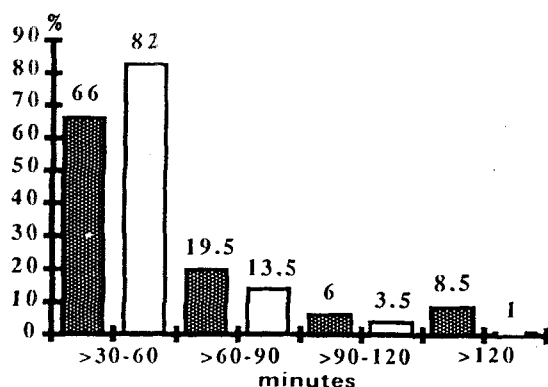


Fig. 3. Percentage distribution of time used for periodontal treatment in minutes in 1992 (stippled bars) and in 1993 (open bars) for 35-, 50-, and 65-year-old patients by the Public Dental Health Service, Västerbotten, Sweden. Time includes charged time for both dentist and dental hygienist.

The periodontal treatment that had been performed among 65-year-olds in 1992 and 1993 was close to the distribution of periodontal treatment need evaluated in the epidemiologic subsample (Table 4). The differences found between the sample and the patients for 35- and 50-year-olds with regard to periodontal treatment were found in the group with 'minor time-consuming' treatments. Between 1992 and 1993 there seems to have been a slight shift in time used for 'significant' periodontal treatment (Fig. 3), since 14.5% of the measures took more than 90 min in 1992 compared with 4.5% in 1993. The distribution of scaling measures between dentist and dental hygienist was almost equal, but the latter group had on average used more treatment time (42 min versus 24 min).

Almost identical figures were found for prosthetic treatments among the 35-year-old subsample and the 35-year-old patients. Among the 65-year-old group there was a highly significant ( $p < 0.001$ ) difference between the evaluated need for removable dentures and what had actually been performed. Whereas 19% of the 65-year-olds were judged to have a need for new dentures, only 6–8.5% of the 65-year-old patients had received this treatment. Of these, about 60% were complete dentures and 40% partial dentures. A reverse relationship was found for the need versus performed treatment for single crowns, in which more such treatment had been done than the evaluated need, but this was not statistically significant, however.

Treatments aimed at rehabilitation of TMD were for all ages performed to a statistically significantly ( $p < 0.001$ ) lower extent than the evaluated need in the population. The need for splint therapy was judged to be between 4% and 7% of the population, and this treatment had been given to 0.6% of the patients.

Table 5. Mean cost, in Swedish crowns, and corresponding mean time based on cost/hour on the basis of the insurance payment for dental care, for dental care by the Public Dental Health Service, Västerbotten, Sweden, among 35-, 50-, and 65-year old patients in 1992 and 1993

Age, years	Mean cost, 1992	Mean cost, 1993
35	965 (93 min)	890 (81 min)
50	1846 (179 min)	1551 (142 min)
65	1879 (182 min)	1676 (153 min)

## Discussion

In this study we have tried to evaluate the treatment need from two points of view. The first was on the basis of a professional assessment based on a clinical examination of the general population made by independent dentists, in the sense that their only consideration was the subject's oral status: the second was the treatments performed among people of matched ages from the same county. Since it was only possible to sample measures performed by the Public Dental Health Service, we excluded in this analysis all patients from the epidemiologic sample who had received dental care at private clinics and also all those who did not have any regular dental care, to only analyze subjects drawn from the general population who received dental care at the Public Dental Health Service and patients who received dental care at the same service. There were, however, actually only small differences in evaluated treatment need between the extracted subsample and the total sample (19).

In general terms there was agreement between the evaluated treatment need and the performed dental treatments in all three age groups. The least difference was found among the 35-year-olds, probably related to the fact that this age group had almost complete dentition (Table 3) and, in general, few lesions connected with their teeth. Among the older age groups the difference found between the performed treatments and the evaluated treatment need for restorative filling therapy and for removable dentures was in accordance with previous reports (14–17) and may well reflect a difference between need and demand for treatment. People may not demand new dentures even though there may be a need for renewal (5), and, on the other hand, people may demand new composite fillings even though the old fillings function acceptably. The longevity of composite is shorter than of amalgam (26), which may provide a complementary explanation for the extent of such therapy, as may new demands from patients as a result of the public debate in Sweden concerning the hazards of amalgam. In the epidemiologic survey (19), however, few composite fillings were found in the premolar and molar regions, and only

5% claimed that they had changed one or more amalgam fillings because of fear of the material. In a previous study (27) it was reported that two-thirds of the restorative cost was spent on restoring tooth surfaces that had previously been filled. Despite this, 46% of the restorative need identified by the survey remained unmet 3 years after the study (14).

Among the 35- and 50-year olds 75–82% needed periodontal treatment. This result is similar to the periodontal treatment need found in a Dutch population (28). The lower need among the 65-year olds (49%) is related to the fact that one-third had complete dentures.

The lower percentage of 'minor or less time-consuming' periodontal treatments among the patients than among the epidemiologic subsample may be related to the fact that we excluded all treatment measures in code 202 taking up to 15 min, to avoid interference with measures related to filling therapy such as polishing. The result may also indicate that minor periodontal disorders in younger people can be overlooked because of the generally good conditions in the mouth at these ages.

The treatment levels as a result of TMD have in various studies ranged from a few percentages up to 20–30% (29). In a general overview of TMD (29) Carlsson concluded that probably around 5% of the population has a need for treatment. The results of the adult epidemiologic subsample were in line with this estimation, even though 55–70% of the population had signs of TMD (Table 3). The low number of measures, among the patient group in this study, for rehabilitation of TMD may be a result of insufficient examinations and uncertainty about correct diagnosis among clinicians. In a nationwide evaluation of the use of the dental insurance system performed in 1991, including all payments in the month of April, splint therapy was carried out in 0.57% of the population (30). The trend found—that is, that restorative treatments were commoner compared with the evaluation of treatment need, whereas treatments related to the function of the jaws such as removable dentures and rehabilitation of TMD were less common—may in part reflect dental care paradigms and education curricula favoring operations on the single teeth rather than treatments aimed at a rehabilitation of function in a broader sense. There is a potential risk that disorders that are 'undertreated' in an insurance system based on a fee for service will be even more neglected in a capitation system.

In a comparison of a time estimate for dental treatment, on the basis of an epidemiologic study of the same age cohorts in Österbotten, Finland (31), both the estimate of treatment need in the epidemiologic study from Västerbotten, Sweden, and the results of treatment time of the patient sample study from the same county, it was shown that much less time was needed for dental treatment among the Swedish age cohorts. The difference was most marked among 35-year-olds, for whom 298 min was the time estimate for dental treatment in

Finland (31), 93 and 81 min for the patient sample from Västerbotten, Sweden, in 1992 and 1993, respectively, and 88 min according to the estimate from the epidemiologic study of the population in Västerbotten in 1990 (19). The Finnish population in all age cohorts had fewer teeth, more dentures, and more decayed teeth (32) which may explain some of the differences. Among the 65-year-olds the difference between the samples for treatment time was less. The time estimate of the 65-year-olds in the Finnish population was 191 min, the treatment time related to mean cost (Table 5) among the patient sample 182 and 153 min, respectively, and the mean time estimate for the Swedish epidemiologic sample in 1990 was 132 min. In a study from Norway the average treatment time in 1978 was 78 min and in 1983 84 min (20). The highest treatment time was found among 50-year-olds (110 min) and the lowest among 20- to 29-year-olds (65 min). The author further estimated that the average treatment time for dental visitors in the year 2000 in Norway will be 1 h (20).

The validity of professional assessments of treatment needs may be questioned and disputed. According to this and previous studies (14–17), these estimates based on epidemiologic surveys have not been good predictors of the amount and type of treatment that actually have been performed in the population. The consistent and interesting result of these studies (14–17) was that significantly more restorative treatments and significantly less treatments with removable dentures had been performed than the predicted need despite differences in examiners, populations, and the fact that these studies had been done in the 1970s, 1980s, and 1990s. Since the insurance system may influence the level of treatment offered, it would be interesting to study a population that receives its dental care in a system based on capitation. The result found in this study that composite and glass ionomer cement filling dominated as a substitute for lost tooth substance may in relation to their shorter longevity (26) influence the need for restorative treatment prospectively even more. A large number of patients with pain related to TMD do not receive the indicated treatment. Further education to increase the basic understanding and management of these disorders seems important, since treatment has been found to be effective in reducing pain, dysfunction, and sick leave (33, 34).

*Acknowledgements.*—We wish to express our gratitude to Mrs Eva Westman for her help, skillfulness, and service in supporting us with data from the Public Dental Health data file. The study was supported by grants from the Swedish Dental Society and the Public Dental Health Service in Västerbotten.

## References

1. Lous I. The need-demand problem in patients with oro-mandibular functional disorders. *J Oral Rehabil* 1977;4:51–4.
2. Sheiham A, Maizels JE, Cushing AM. The concept of need in dental care. *Int Dent J* 1982;32:265–70.

3. Sundberg H. Tandvården inför 90-talet. Behovsrelaterad planering och styrning av tandvården. Göteborg. In: Holst D, Rise J, editors. Epidemiologi i tandvården. Göteborg: The Nordic School of Public Health, 1986:43–54.
4. Kirkegaard E. Befolkningens odontologiske behandlingsbehov. Odontologi 92. Copenhagen: Munksgaard, 1992.
5. Tobias B. Dental aspects of an elderly population. Age Ageing 1988;17:103–10.
6. Drake CW, Beck JD, Graves RC. Dental treatment needs in an elderly population. J. Public Health Dent 1991;51:205–11.
7. Dental needs of elderly in residential care in Newcastle-upon-Tyne and the role of formal carers. Community Dent Oral Epidemiol 1992;20:106–11.
8. Cautley AJ, Rodda JC, Treasure ET, Spears GF. The oral health and attitudes to dental treatment of a dentate elderly population in Mosgiel, Dunedin. NZ Dent J 1992;88:138–43.
9. Harrison A, Huggett R, Watson CJ, Beck CB. A survey of complete denture prosthetics for the elderly, handicapped and difficult patients. Br Dent J 1992;172:51–6.
10. Stuck AE, Chappuis C, Flury H, Lang NP. Dental treatment needs in an elderly population referred to a geriatric hospital in Switzerland. Community Dent Oral Epidemiol 1989;17:267–72.
11. Karkazis HC, Kossioni AE. Oral health status, treatment needs and demands of an elderly institutionalised population in Athens. Eur J Prosthodont Restor Dent 1993;1:157–63.
12. Widström E, Nilsson B. Dental health and perceived treatment needs of Finnish immigrants in Sweden. Scand J Soc Med 1984;12:129–36.
13. Zimmerman M, Bornstein R, Martinsson T. An estimation of dental treatment needs in two groups of refugees in Sweden. Acta Odontol Scand 1990;48:175–82.
14. Nuttall NM. Capability of a national epidemiological survey to predict general dental service treatment. Community Dent Oral Epidemiol 1983;11:296–301.
15. Eddie S, Elderton RJ. Comparison of dental status determined in an epidemiological survey with prosthetic treatment received. Community Dent Oral Epidemiol 1983;11:271–7.
16. Lavstedt S, Henrikson C-O, Bolin A, Jonsson BG. Tandtillstånd och behov av tandvård hos en normalpopulation. En longitudinell epidemiologisk studie. Stockholm: Delegationen för social forskning, 1982. Rapport 1982:7.
17. Palmqvist S. Treatment needed and received in an elderly Swedish county population. Gerodontology 1988;4:272–6.
18. Håkansson R. Tandvårdsvanor och tandstatus bland vuxna i Sverige 1974–1985. Jämförande tvärsnitts- och longitudinella undersökningar [thesis]. Malmö: Lunds universitet, 1991.
19. Wigren L, Wänman A, Sjöström S, Lundgren P. Tillståndet i mun och käkar bland Västerbottens vuxna befolkning. En rapport baserad på en epidemiologisk undersökning genomförd 1990 bland ett urval av 35-, 50- och 65-åringar. Umeå: Västerbottens läns landsting, 1993.
20. Rise J. Behov for tannpleie blant voksne i dag og om 20 år, belyst ved samfunnsodontologiske metoder. Nor Tannlegeforen Tid 1986;96:165–71.
21. Koch G. Effect of sodium fluoride in dentrifice and mouthwash on incidence of dental caries in school-children. Odontol Rev 1967;18 Suppl 12.
22. Österberg T, Landt H. Index för bettstatus, för epidemiologiska studier och kliniskt bruk. Tandlakartidningen 1976;68:1216–23.
23. Ainamo J, Barmes D, Beagrie G, Cutress T, Martin J, Sardo-Infirri J. Development of the World Health Organization (WHO) community periodontal index of treatment needs (CPITN). Int Dent J 1982;32:281–91.
24. Helkimo M. Studies on function and dysfunction of the masticatory system. II Index for anamnestic and clinical dysfunction and occlusal state. Acta Odontol Scand 1971;29:423–37.
25. Axell T. A prevalence study of oral mucosal lesions in an adult Swedish population [thesis]. Odontol Rev 1976;27 Suppl 36.
26. Mjör IA. Long term cost of restorative therapy using different materials. Scand Dent J Res 1992;100:60–5.
27. Elderton RJ, Nuttall NM, Eddie S, Davies JA. Dental health services research in Scotland: a review of some 5-year results. Community Dent Oral Epidemiol 1985;13:249–52.
28. Karsten RH, Truin GJ, Burgersdijk RCW, Kalsbeck H, Hof MA van't, Mulder J. Periodontal treatment need of Dutch 15–74-year-old population. Community Dent Oral Epidemiol 1992;20:310–1.
29. Carlsson GE. Har halva befolkningen bettfysiologiska besvär? Odontologi 91. Copenhagen: Munksgaard, 1991.
30. Uppföljning av tandvårdstaxan. Stockholm: Riksförsäkringsverket avser 1993:2.
31. Tervonen T, Virtanen K, Raustia A, Ainamo J. Time estimates for dental treatment in four age cohorts of an adult population. J Public Health Dent 1988;48:208–13.
32. Tervonen T. Dental treatment needs of adults in Ostrobothnia, Finland [thesis]. Oulu: University of Oulu, 1988.
33. Wedel A, Carlsson GE. Sick-leave in patients with functional disturbances of the masticatory system. Swed Dent J 1987;11:53–9.
34. Kirveskari A, Alanen P. Effect of occlusal treatments on sick-leave in TMJ dysfunction patients with head and neck symptoms. Community Dent Oral Epidemiol 1984;12:78–81.

Received for publication 21 June 1994

Accepted 12 January 1995