Acta Odontologica Scandinavica. 2016; 74: 134–141

informa
healthcare

ORIGINAL ARTICLE

Factors associated with clinical decision-making in relation to treatment need for temporomandibular disorders

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Abstract

Objective. The aim of this study was to analyze dentist's clinical decision-making related to treatment need for temporomandibular disorders (TMD) in an adult population. ***Materials and methods.*** The study population comprised 779 randomly selected 35, 50, 65 and 75 year old individuals living in the county of Västerbotten, Sweden. The participants filled out a questionnaire and were examined clinically according to a structured protocol. The four examiners (two men, two women) were experienced dentists and were calibrated before the start of the study. After examination they individually assessed the need of treatment owing to TMD. ***Results.*** In total, 15% of the study population was considered to have a treatment need owing to TMD. The highest estimate was noted for 35 and 50 years old women and the lowest for 65 and 75 years old men. Overall, 21% of the women and 8% of the men were considered to have a treatment need owing to TMD, with statistically significant differences between men and women for the 35 and 50 years old groups. Inter-individual variations in dentists' decisions were observed. In a multivariate analysis, female gender, signs and symptoms of TMD pain, signs and symptoms of TMD dysfunction and smoking were associated with estimated treatment need. ***Conclusions.*** The prevalence of estimated treatment need owing to TMD was fairly high, but the dentists' clinical decision-making process showed large inter-individual variability. The observation calls for further research on the factors affecting the decision-making process in care providers.

Key Words: *Clinical decision-making, craniomandibular disorder, gender, orofacial pain, treatment need*

Introduction

The term 'treatment need' can be sub-divided in 'normative need', based on a professional judgment, 'perceived need', which refers to the individual's perceptions of being deviant from normal conditions, and 'expressed demand' defined as a perceived need converted into action (utilization of services or request for information) by a person in need of assistance [1]. Healthcare utilization is predominantly determined by a combination of the individual's perceived need and demand [2], the judged normative need and access to treatment [3]. Normative treatment need and demand are, thus, not merely related to the presence of a condition, *per se*. In dentistry, a variety of factors including dental attitudes [4], financial resources [5], type of dental problems [5], pain conditions [6], the possibility of favorable treatment outcome and accessibility of services [7] influence demand for dental treatment among patients. For the dentist, factors such as gender [8,9], age [10], knowledge and experience [8–10] seem to significantly influence the clinical decision-making and choice of treatment.

Temporomandibular disorder (TMD) is a condition associated with impaired jaw function, pain in the jaw joint and jaw muscles and associated headaches. Symptoms related to TMD affect the individual's quality-of-life [11], which together with co-morbidities with other pain conditions may cause the patient to seek care from a wide range of healthcare providers [12]. In several population-based studies, biological patient characteristics such as age and gender have emerged as important factors associated with seeking care behaviour related to orofacial pain conditions [3,13]. Patients with TMD have significantly higher mean healthcare costs compared to controls and a minority of these TMD cases accounted for more than 40% of the total dental and healthcare costs of those included in the

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(Received 13 January 2015; accepted 11 June 2015)

ISSN 0001-6357 print/ISSN 1502-3850 online
DOI: 10.3109/00016357.2015.1063159

study-population (i.e. more clinical and dental visits, outpatients visits, radiographic procedures and pharmaceutical dispensing) [13].

Estimates of treatment need for TMD in the general population vary, reflecting variations in prevalence of signs and symptoms indicative of TMD in different studies. In an earlier review based on studies on adult populations, the estimates varied from 1.5–30% [14] and, in a more recent review with a meta-analysis, the mean estimate was 16% [15]. An accurate assessment of treatment need for TMD may be somewhere between estimated treatment need and patient demand [16]. The difference in dentist's professional assessment of treatment need is considerable in different fields of clinical dentistry. Studies have shown different choices of operative interventions related to different diagnoses and gender of the dentists [17], higher frequency of prosthodontic treatments executed by male dentists than female dentists [9] and differences in caries diagnostics and risk assessment strategies between male and female dentists [18]. Whether there are other factors, aside from the presence of signs and symptoms of TMD, involved in dentists clinical decision of treatment need owing to TMD has not been studied, to the best of our knowledge.

The aim of this study was to analyze the prevalence of estimated treatment need owing to TMD in an adult population and to analyze which factors posed significant influence on the dentist's estimated treatment need. The hypotheses were:

1) Socio-demographic characteristics, general and oral health factors and behavioral factors would influence decisions regarding treatment need.
2) Presence of signs and symptoms of TMD would influence decisions regarding treatment need.

Materials and methods

This cross-sectional study was based on 11,324 individuals, aged 35, 50, 65 and 75 years old, residing in the county of Västerbotten, Sweden, in September 2002. The study populations were stratified by region – inland and coastal areas. From each of the strata 600 individuals, 150 in each age group were randomly selected. From the total of 1200 individuals, 987 individuals retuned a filled-out questionnaire (response rate 82%) and 779 participated in a clinical examination (response rate 65%). In the cross-sectional analysis, information was used from the questionnaire regarding symptoms indicative of TMD, headaches, socio-demographic factors, behavioral factors and general and oral state of health; and from the clinical examination regarding signs indicative of TMD, treatment need owing to TMD and other dental and oral disorders (i.e. decayed teeth, periodontitis, partial or complete edentulousness and malocclusion).

From September 2002 to February 2003, clinical examinations were performed in public dental clinics by four calibrated examination teams that each consisted of one dentist and one chair side assistant. Two dentists were men and two were women (mean age = 48.3, SD = 3.1) and their individual clinical experience was ~ 25 years. The examinations included evaluations of temporomandibular joint (TMJ) function, number of muscles painful to palpation, TMJ pain during jaw movements as well as pain to palpation, maximal jaw opening, dental status, occlusal supporting zones (Eichner index), periodontal pocket depth and a soft tissue examination. Details of the clinical examination have been presented in previous papers [19,20]. The examiners were instructed to consider the treatment need owing to TMD for each individual as well as for other dental and oral conditions based on the outcome of the examination and his/her clinical experience and judgment. Approximately 200 individuals were examined by each examiner.

Statistical method

The data analysis was done with STATA statistical software version 10. The analysis was based on 779 individuals who participated in the clinical examination. Due to minor variations in missing data the included numbers of individuals in the regression analysis varied. The dependent variable was treatment need owing to TMD and was dichotomized in (i) no need for treatment; or (ii) one or more of the following treatments: advice to avoid jaw clenching behavior or advice in jaw exercises or minor occlusal adjustments used in connection to traumatizing occlusion, or splint therapy or referral to TMD specialist for a more comprehensive examination. All prevalence figures in the age-groups were adjusted based on the proportion of individuals living in the respective regions in the county and the prevalence of the total sample was also weighed in proportion to the age distribution in Västerbotten County for the year 2002. The operational definition of dependent variables and demographic characteristics of study participants are presented in Table I. Logistic regression analysis was used to estimate factors associated with treatment need for TMD among the adult population. After applying univariate analysis for each of the included independent variables, all factors significantly associated with the dependent variable were added into a multivariate model. The results are presented as odds ratios (OR) with 95% confidence interval (CI). A p-value less than 0.05 was considered statistically significant.

Results

For the total population 15% were considered to have a treatment need owing to TMD; corresponding

Table I. Description of dependent and independent variables. The reference used for independent variables in the regression analysis is specified first. Non-weighted figures presented in the table.

Dependent variable	Definition		Sample, *n* (%)	
Treatment need owing to TMD	No need for treatment	No	679	(88)
	Yes, advice or minor occlusal adjustment, or bite splint therapy, or referral to TMD specialist	Yes	92	(12)
Independent variables				
Frequent pain in the jaw-face-head region	Reported jaw/face pain or jaw tiredness or headache; ≥ once a week	No	604	(80)
		Yes	152	(20)
Frequent jaw dysfunction	Reported TMJ locking or TMJ sounds or difficulty to open the jaw wide; ≥ once a week	No	659	(85)
		Yes	97	(15)
TMD pain signs	Registered jaw muscle pain to palpation or TMJ pain to palpation or pain on jaw movements	No	427	(55)
		Yes	351	(45)
TMD dysfunction signs	Registered TMJ sounds or jaw opening <40 mm	No	589	(76)
		Yes	189	(24)
Age	75 years		176	(22)
	65 years		199	(26)
	50 years		190	(25)
	35 years		214	(27)
Gender	Male		409	(52)
	Female		370	(48)
Region	Inland		399	(51)
	Coast		380	(49)
Education	Elementary		324	(43)
	High school		285	(38)
	University		150	(19)
Living condition	With Other		605	(80)
	Alone		151	(20)
Employment status	Working		336	(44)
	Not working		424	(56)
Income	Level of income per month in Swedish Crowns (SEK) (year 2002)	≥15,000	365	(50)
		<15,000	370	(50)
Financial resources	Able to obtain 14,000 SEK within a week	Yes	480	(65)
		No	258	(35)
Self-perceived general state of health during the last year (General health)	Good		557	(74)
	Moderate		119	(16)
	Poor		82	(10)
History of general arthritis		No	688	(93)
		Yes	50	(7)
Regular use of prescribed medicine		No	413	(53)
		Yes	366	(47)
Current smoking		No	672	(91)
		Yes	85	(9)
Current using of snuff		No	608	(83)
		Yes	122	(17)
Self-perceived oral health the last year	Good		548	(72)
	Moderate		149	(17)
	Poor		63	(11)
Oral hygiene Tooth brush	Brushing teeth ≥ daily		728	(97)
	Brushing teeth < daily		25	(3)

Table I. (*Continued*).

Dependent variable	Definition	Sample, *n* (%)	
Oral hygiene Proximal cleaning	> once a week	348	(48)
	≤ once a week	378	(52)
Regular dental healthcare	≤ 2 years between examinations	567	(78)
	> 2 years between examinations	163	(22)
Chewing capacity of hard food	No problem	632	(83)
	With caution	131	(17)
Dental status	≥ 24 teeth	450	(58)
	1-23 teeth	262	(34)
	0 teeth	67	(8)
Occlusal supporting zones	A	466	(60)
	B	175	(22)
	C	138	(18)
Need for treatment owing to decade teeth	No operative treatment or advice or fluoride therapy	338	(48)
	Fillings or/and extraction or endodontic treatment and need for more investigation	433	(52)
Need for periodontal treatment	No operative therapy or instructions in tooth hygiene	192	(25)
	Periodontal treatment or referral to specialist	579	(75)
Need for partial fixed prosthesis	No treatment	668	(87)
	Need for partial fixed prosthesis or referral to specialist	103	(13)
Need for removable prosthesis	No treatment	661	(86)
	Adjustment or new dentures or referral to specialist	110	(14)
Need for dental implant	No treatment	735	(95)
	Need for dental implant	36	(5)
Need for orthodontic treatment	No treatment	767	(99)
	Referral to specialist	4	(1)
Need for oral surgery	No treatment	726	(94)
	Need for biopsy, surgery, oral medicine or referral to specialist	45	(6)

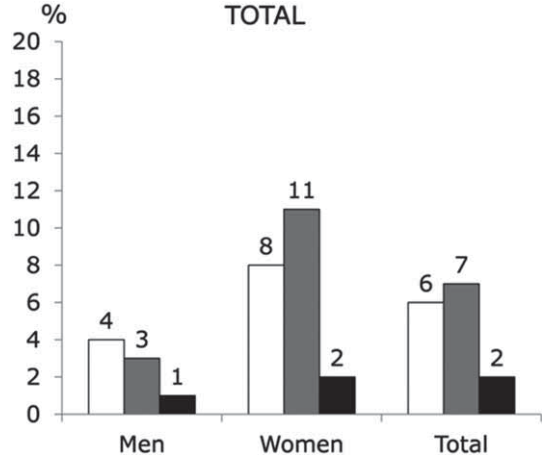

Figure 1. Percentage distributions of weighted prevalence of treatment need owing to temporomandibular disorders in an adult population, based on examination of 35, 50, 65 and 75 year olds. Treatment need owing to TMD was categorized into: need for advice such as avoid tooth clenching behavior, jaw exercises or minor adjustments in connection to traumatizing occlusion (open bar); need of advice and a bite-splint (grey bar); need of referral to specialist on TMD for a more comprehensive examination (black bar).

values were 21% for women and 8% for men (Figure 1). The gender difference was significantly different ($p < 0.05$) for the 35 and 50 year olds. The highest estimate was found for 35 and 50 years old women and the lowest estimate among the 65 and 75 years old men (Figure 2). When considering only the more significant treatment need estimates (i.e. need for splint therapy or referral), the need for the total sample was 8% (13% of the women and 4% of the men) (Figure 1). The inter-individual estimate of the dentists showed considerable variations (2–21%). Two of the four dentists estimated the treatment need at ~ 2% (1.8% and 2.5%, unadjusted prevalence) and the other two dentists estimated the treatment need each at 21% (21.1% and 21.2%, unadjusted prevalence).

Univariate and multivariate models for treatment need owing to TMD are presented in Table II. In the univariate analysis, 35 and 50 year olds, female gender, living in the coastal region, high school or university education, reported bad general state of health, current smoking, reported pain in the jaw–face–head region, presence of TMD pain signs and presence of

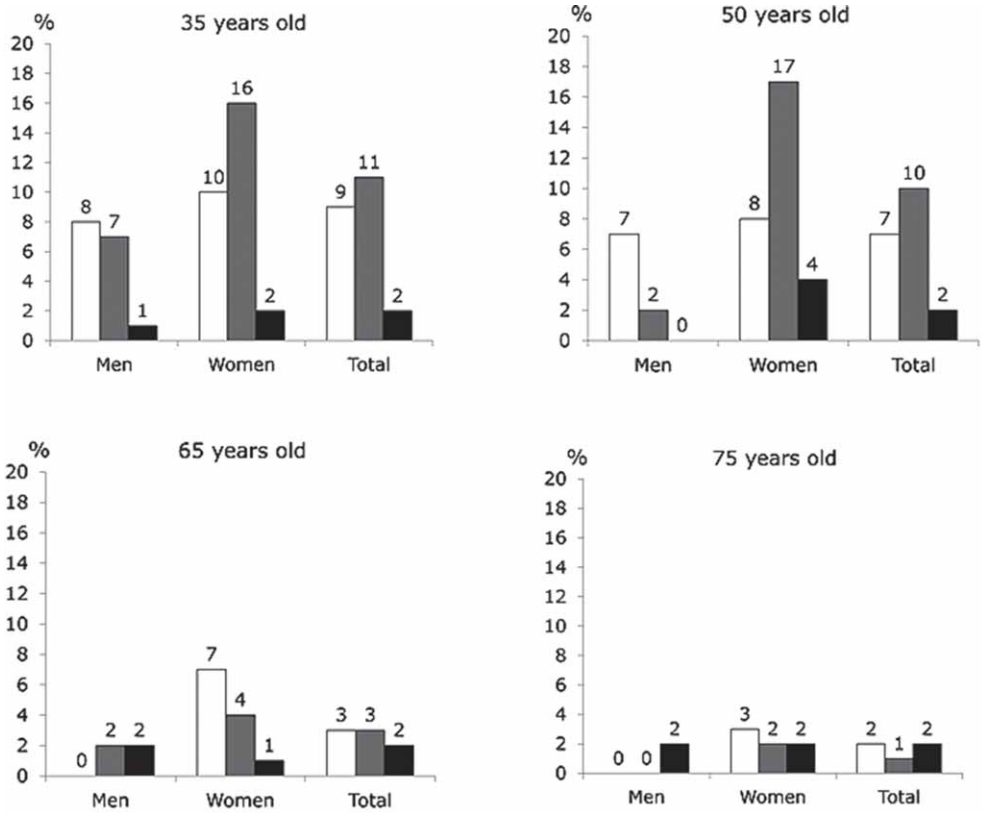

Figure 2. Percentage distributions of prevalence of treatment need owing to temporomandibular disorders in 35, 50, 65 and 75 year olds. Treatment need owing to TMD was categorized into: need for advice such as to avoid tooth clenching behavior, jaw exercises or minor adjustments in connection to traumatizing occlusion (open bar); need of advice and a bite-splint (grey bar); need of referral to specialist on TMD for a more comprehensive examination (black bar).

jaw dysfunction symptoms and signs, emerged as significantly associated factors to treatment need. Presence of a reduced dental status, i.e. number of teeth less than 24 or fewer occlusal supporting zones (occlusal supporting zone B and occlusal supportive zone C), were associated with a lower treatment need owing to TMD. In the multivariate model, female gender, living in the coastal region, current smoking, reported frequent pain in the jaw–face–head region, registered signs of TMD pain, presence of TMD dysfunction symptoms and registered TMD dysfunction signs influenced the estimated treatment need significantly. No significant association between the treatment need due to TMD and the estimated treatment need related to other oral and dental conditions was found.

Discussion

The main finding from this study was that some expected factors such as the presence of signs and symptoms of pain in the jaw-face-head region an some unexpected factors such as smoking and reduced dental support emerged as significantly important factors in the clinical decision-making process of treatment need due to pain and dysfunction in the jaw-face-head region. The estimated treatment need owing to TMD differed considerably between the experienced and calibrated examiners, despite no statistically significant difference in prevalence of symptoms indicative of TMD among those they examined.

The estimated treatment needs thus differed considerably between the individual dentists in the present study, but they were still within the range of previous studies [14] and the calculated weighted mean value was close to the mean value based on a previous meta-analysis [15]. The estimated mean prevalence of a more significant treatment need owing to TMD was in line with a previous population based study [21], which concluded that 4.5% of men and 13.5% of women had an active TMD treatment need (compared to 4% and 13% in this sample). The large discrepancies observed between estimated treatment for TMD in the population and the related traceable treatments performed in the dental healthcare [22], also highlighted by the Swedish National Board of Health and Welfare [23], are puzzling and constitute a gap of knowledge. While estimates of treatment need based on surveys normally fall within the range 5–15%, the traceable treatments performed in dental healthcare in Sweden are approximately one-tenth of these estimates [23]. The present findings point to large inter-individual discrepancies among dentists in clinical decision-making related to TMD. The results of the study cannot, however, determine which of the

Table II. Univariate and multivariate model for treatment need owing to temporomandibular disorders in an adult population. No treatment need vs need of advice or minor occlusal adjustment in connection to traumatizing occlusion or bite splint or referral.

Independent factors	*n*	Treatment need Univariate model OR (CI)	Treatment need Multivariate model OR (CI)
Age-group	771		
75		Ref	Ref
65		1.6 (0.6–3.9)	1.5 (0.5–4.5)
50		*4.0 (1.9–9.3)*	2.2 (0.6–7.6)
35		*4.6 (2.1–10.2)*	2.7 (0.8–9.8)
Gender	771		
Man		Ref	Ref
Woman		*2.7 (1.7–4.4)*	*2.1 (1.2–3.7)*
Region	771		
Inland		Ref	
Coast		*1.6 (1.1–2.6)*	*1.8 (1.1–3.3)*
Education	751		
Elementary		Ref	
High school		*2.2 (1.3–3.8)*	0.7 (0.4–1.5)
University		*2.6 (1.4–4.7)*	0.5 (0.2–1.2)
Living condition	749		
With other		Ref	
Alone		0.9 (0.5–1.6)	
Employed	752		
Yes		Ref	
No		0.6 (0.4–0.99)	
Income	728		
≥ 15,000 SEK		Ref	
< 15,000 SEK		1.1 (0.7–1.7)	
Recourses	731		
Own saving		Ref	
No saving		1.4 (0.9–2.2)	
General health	751		
Good		Ref	Ref
Moderate		1.7 (0.9–3.0)	1.5 (0.7–3.0)
Bad		2.6 (1.5–4.8)	1.4 (0.6–3.1)
General Arthritis	731		
No		Ref	
Yes		1.3 (0.6–2.9)	
Use of Medicine	771		
No		Ref	
Yes		1.0 (0.6–1.5)	
Smoking	749		
No		Ref	Ref
Yes		*3.0 (1.7–5.2)*	*2.9 (1.4–5.9)*
Using Snuff	722		
No		Ref	
Yes		1.0 (0.6–1.9)	
Oral Health	753		
Good		Ref	
Moderate		1.5 (0.9–2.5)	
Bad		1.4 (0.7–3.0)	
Oral Hygiene	721		
≥ Daily brushing		Ref	
< daily brushing		—	
Proximal cleaning	719		
≥ weekly		Ref	
< weekly		1.1 (0.7–1.7)	
Dental care	727		
≥ 2 years		Ref	
< 2 years		0.6 (0.3–1.1)	
Chewing	755		
Yes		Ref	
Careful-no		1.1 (0.6–1.9)	
Dental status	771		
Teeth ≥ 24		Ref	
1–23 teeth		*0.3 (0.2–0.6)*	0.6 (0.2–1.9)
No teeth		*0.2 (0.1–0.7)*	0.5 (0.05–6.5)
Occlusal supporting zones	735		
A		Ref	
B		*0.4 (0.2–0.7)*	1.0 (0.3–3.6)
C		*0.2 (0.1–0.5)*	0.4 (0.1–2.7)
Pain in the jaw–face–head	749		
No		Ref	Ref
Yes		*4.3 (2.7–6.9)*	*2.1 (1.2–4.1)*
Pain signs	771		
No		Ref	
Yes		*3.4 (2.1–5.5)*	*2.1 (1.2–3.6)*
Dysfunction symptoms	749		
No		Ref	Ref
Yes		*6.2 (3.7–10.3)*	*2.9 (1.5–5.6)*
Dysfunction signs	771		
No		Ref	Ref
Yes		*3.3 (2.1–5.2)*	*2.8 (1.5–5.2)*

Italic style represents significant odd ratios.
OR = Odds ratio; CI = 95% confidence interval.

estimates should be regarded the 'true value', i.e. the 2% level estimated by two of the dentists or the 21% level estimated by the other two dentists. This observed difference in assessment of the treatment need following the examination may partly be

explained by differences in attitudes, as well as in the interactions between dentist and patient [8,9].

In a previous multivariate analysis of the same sample we found that the general state of health and gender of the patient were two factors significantly related to presence of signs or symptoms indicative of craniomandibular disorders [24]. Both of these factors were also significantly related to the estimated treatment need in the univariate analysis, but only gender remained in the multivariate model. These results were in line with a previous study which reported that the strongest predictive factor to TMD treatment need was diagnostic sub-groups [21] that are generated from the presence of signs and symptoms indicative of TMD. In a Sami population, duration of jaw pain, severity of impaired jaw opening and neck pain were all factors significantly linked to self-reported impact on daily life activities related to TMD in women [25]. Taken all together these results thus indicate that it is the subject's signs and symptoms that are main determinants in the treatment decision process. Several studies indicate that TMD dysfunction symptoms (i.e. TMJ sounds, TMJ locking or impaired jaw opening capacity), at least in the adult population, are less disabling compared to pain conditions in the jaw–head region [11,25,26]. In the present study, however, these signs and symptoms remained as significant factors related to treatment need in the multivariate analysis.

Smoking was related to nearly a three-fold higher odds ratio of treatment need owing to TMD. The result may seem to be in conflict with previous studies which did not indicate a significant relationship between smoking and TMD [27–29]. In a previous analysis of this study population [24], no significant difference between smokers and non-smokers was observed for presence of TMD signs and symptoms, supporting previous results. On the other hand, several studies have found a relationship between smoking and bruxism [27,30,31]. Therefore, one interpretation might be that our present results mirror a higher degree of tooth wear in smokers compared to non-smokers, which may have been a factor involved in the clinical decision process. One factor which could further influence the decision-making may be a general higher awareness among the dentists of smoking as a significant risk factor related to both impaired general health and dental problems.

The prevalence of TMD symptoms was significantly lower in the 65 and 75 year olds compared to the 35, and 50 year olds [19] which is in agreement with epidemiological studies showing that signs and symptoms of TMDs increase in adolescence, with a peak in middle-aged groups and gradually decreases after the age of retirement [32–35]. The indication of a lower prevalence of treatment need owing to TMD related to fewer occlusal supporting zones may be interpreted as a factor confounded by age. A clinical study on patients indicated two age peaks for patient demand of TMD treatment, one in the 30–35 years old age range and the other in the 50–55 years old range [36]. This finding indicates that the individuals in their middle-age period might be more affected by TMD symptoms. It was thus not surprising that age emerged as a significant factor related to TMD treatment need in the univariate analyses of this sample. The fact that age did not remain as a significant factor in the multivariate model indicates that age in itself was not a factor that influenced the decision-making. In a study among 65+ year olds, behavioral, social, and health factors influenced dentists' decisions when determining treatment needs of older persons [37]. The relatively lower treatment need related to TMD among elderly, however, deserves to be scrutinized further.

Strengths and limitations

In the present study, participants were randomly selected to ensure representativeness of the population under study. Different independent variables, partly from the subjects under study and partly related to the dentists, were applied to evaluate their relative impact on the assessed treatment need owing to TMD. Population variables included different factors such as socioeconomic status, living conditions, general health, oral status and symptoms of TMD. The variables related to the dentist were gender and clinically registered signs of TMD. For the patients, the participation rate was high in the questionnaire (82%) and moderate in the clinical examination (65%). Since the study had a cross-sectional design, it cannot identify causal associations. Some factors that might have had some effect on treatment need owing to TMD were not included in the analyses, since they were not included in the questionnaire (parafunctional habits) or in the clinical examination (tooth wear). The study population was examined from autumn 2002 to spring 2003 and for specific age groups. The results regarding treatment need should, thus, be mirrored to studies done for a similar time period and among similar age groups. Even though some time has passed since the data were gathered, we consider the results contemporarily relevant and of interest regarding possible factors underpinning clinical decision-making for presence of signs and symptoms indicative of TMD.

Conclusion

The study shows that a significant proportion of the adult population has a need of treatment related to TMD. The results present some new perspectives regarding decision-making processes related to TMD. The observation that the examiners' estimations varied considerably warrants further scrutiny.

***Declaration of interest*:** The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

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