INTRODUCTION

The concept of need

One of the greatest challenges facing health care systems internationally is meeting the health needs of their populations with the available resources. Defining and assessing need is a critical element of the planning process, and many definitions of need have been proposed (Daly et al., 2002).

Sometimes need is defined in terms of treatment required as for example, in the definition by Matthew (1971): “a need for medical care exists when an individual has an illness or disability for which there is an effective and acceptable treatment or cure”.

Bradshaw (1972) proposed taxonomy of need which provides a definition of the differing concepts of need. Here he defines “normative need” as an expert's or professional’s, administrator’s or social scientist’s definition of need in a given situation. “Felt need” is equated with “want”, expressed as a lay person’s own assessment of his or her requirement for health care. “Expressed need” or demand is felt need converted into action, by seeking assistance, either by use of services or request for information. “Comparative need” is assessed by comparing the health care received by different people with similar characteristics. If some and not others have received care, then there is a comparative need in those not receiving it.

Donabedian (1973) describes need as a state of client that creates a requirement for care and therefore represents a potential for service. Cooper (1975) stated that “a state of health assessed as in need of treatment by a medical practitioner”. Additionally, Carr and Wolfe (1979) described another aspect of need which they term as “unmet need”. This is the difference, if any, between the health judged to be needed and the health care actually provided. According to Sheiham et al. (1982), true treatment need may lie somewhere between the objective (assessed by a dentist) and subjective (assessed by the patient) treatment needs. Spencer (1984) states that “Need does not always lead to use of services and use of services does not always result from need, but the existence of disease and normatively defined need does create a potential for the use of services”. A more modern interpretation of need is: potential to benefit from health care (Carlsson and DeBoever, 1994).
Public Health importance of needs assessment

There are several reasons to conduct a needs assessment:

- To define the problem and to identify its extent and severity
- To obtain a profile of the community to ascertain the causes of the problem (this information helps in developing the appropriate goals and objectives in the problem solution)
- To evaluate the effectiveness of the program (Magi and Allander, 1981).

The definition and concept of need is essential for planning and evaluation of oral health care. Health care needs now extend beyond a narrow clinical interpretation to issues like: the impact of ill health on individuals and on society; the degree of disability and dysfunction that ill health brings; the perceptions and attitudes of patients themselves towards ill health; and the social origin of many common illnesses (Sheiham and Spencer, 1997).

Limitations of oral health needs assessments

Although, clinical criteria based on professional judgement, still largely dominate the assessment of oral health status and the estimation of need, it is increasingly recognized that there are areas where normative need is not sufficient. That does not mean that normative need assessment is not useful. But, it should be recognized that estimates of treatment needs obtained by using the condition-to-need or the direct treatment plan approach do not consider either the outcomes of oral diseases or the consequence of limited resources for health care.

It is also possible that most of these needs would not be perceived by people themselves who, therefore, would not seek the treatments proposed (Sheiham and Spencer, 1997). This observation was confirmed by the gap between the professional and patient’s definitions of need (Reisine and Bailit, 1980). Indeed, objectivity methods often depend upon a consensus obtained from a number of subjective approaches. Even within those agreements, there is intraexaminer and interexaminer variability among different judgement (Sheiham et al., 1982).
Meta-analysis as a research tool

Meta-analysis is a quantitative approach for systematically assessing the results of previous research in order to arrive at conclusions about the body of research. There are four steps in a meta-analysis:

1. studies of a topic are systematically identified
2. eligibility criteria for inclusion and exclusion of the studies are defined
3. data from eligible studies are abstracted or collected from the investigators in study
4. the abstracted data are then analyzed.

The analysis includes formal statistical tests of the heterogeneity of the study results, and, if results are homogeneous, estimation of a summary estimate of the size of the effect of interest. If the studies are not homogeneous, the heterogeneity is explored (Petitti, 2000).

The advantages of meta-analysis are that rather than being based on only a selection of published literature, they contain a comprehensive summary of the evidence, reducing bias and ensuring reliability. Systematic reviews are important because they can help formulate policy and to efficiently use available resources, establish generalisability, increase power and precision and limit bias (Macfarlane et al., 2001).

Meta-analytical methods are already common approaches to the assessment of health technology and related areas, and increasing adaptation of such approaches may be foreseen, in part in response to increasingly wide emphasis on evidence-based approaches to medicine and health care (Sutton, 1998).

The use of meta-analysis of observational epidemiological studies has been increased recently; however, it has also several limitations. One limitation is that publication bias is particularly important in epidemiological research since some analysis may be done in a very explorative way and may be only published selectively. As mainly unexpected significant results may be selected for publication, an overestimation of the risk estimate is likely. An additional problem is that studies may differ considerably in their designs, data collection methods and the definition of the exposure and confounder variables (Blettner et al., 1999).
Temporomandibular disorders: an overview

Brief history of temporomandibular disorders

Pain and dislocation in the jaw region were described and treated in humans as early as 3000 b.c. (McNeill, 1997). In 1934 Costen (an American otolaryngologist) observed that patients with pain in or near the ear, tinnitus, dizziness, a sensation of ear pressure or fullness, and difficulty in swallowing (known as Costen’s Syndrome) seemed to improve by altering the vertical dimension of the occlusion (Costen, 1934).

Early theories of cause and effect espoused by various clinicians and investigators in the 1930's to 1960's focused primarily on the structural and functional relationships between the upper and lower teeth and jaws, or dental occlusion (Costen, 1934; Ramfjord and Ash, 1966). In 1966, Krough-Poulsen made a list to screen the symptoms of craniomandibular disorders (CMD). The list comprised limited mouth opening, deviation of the mandible, pain of the musculature and the TMJ, occlusal disharmony, occlusal wear, local and non-specific changes in the periodontal tissues, and tooth mobility. Because malocclusion was perceived to be the underlying cause, treatment of TMD shifted from medicine to dentistry.

Competing models of causation were proposed in the 1950's, first by Schwarz (1959), who saw stress or anxiety as a major etiological factor, and then by Laskin (1969), who extended Schwarz's psychological model. These theories were based primarily on observations in the clinical setting, and not on epidemiological studies. After 1970, advances in imaging techniques that included tomography, arthrography, computed tomography (CT), and, later, magnetic resonance imaging (MRI) resulted in improved visualization of intracapsular structures (Okeson, 1996). These imaging techniques plus increasing experience in clinical management, provided information for more specific diagnoses.

Since 1990's, TMD are considered not as a single entity but as a group of several diseases of varying aetiology and pathology. However, the controversy about different etiologic theories of TMD still exists because of limited knowledge regarding the aetiology and natural history of the course of TMD (Dworkin and LeResche, 1992; McNeill, 1993a).
Definition and terminology of TMD

The American Academy of Orofacial Pain (AAOP) defined Temporomandibular disorders (TMD) as “a collective term embracing a number of clinical problems that involve the masticatory musculature, the temporomandibular joint (TMJ) and associated structures, or both” (Okeson, 1996). These disorders have been principally characterized by:

1) pain in temporomandibular region or in the muscles of mastication,
2) limitations or deviations in mandibular range of motion,
3) TMJ sounds during jaw function (American Dental Association, 1983).

Okeson (1996) made up three categories of symptoms and signs according to the affected structures: the muscles, TMJ, and the dentition. TMD are considered to be a subclassification of musculoskeletal disorders (Okeson, 1996), and typically run a recurrent or chronic course, with a substantial fluctuation of signs and symptoms over time (Wänman, 1996; Kuttila et al., 1997; Magnusson et al., 2000).

Since the 1930’s, the terminology of signs and symptoms of functional disturbances of masticatory system has varied a great deal:

- Costen’s Syndrome (Costen, 1934)
- Temporomandibular Joint Pain-Dysfunction Syndrome (Schwarz, 1956)
- Myofascial Pain Dysfunction Syndrome (MPDS) (Laskin, 1969)
- Occlusomandibular Disturbances (Gerber, 1971)
- Functional TMJ Disturbances or Disorders (Ramfjord and Ash, 1971)
- Mandibular Dysfunction (MD) (Helkimo, 1974a, 1974c; Solberg et al., 1979; Wänman and Agerberg, 1986a, 1986b)
- Mandibular Stress Syndrome (Ogus and Toller, 1981)
- Craniomandibular Dysfunction (CMD) (Zarb, 1985)
- Temporomandibular Pain-Dysfunction Syndrome was recommended by the International Association for the Study of Pain (Merskey, 1986)
- Oromandibular Dysfunction (OMD) introduced by the International Headache Society (headache Classification Committee of the International Headache Society, 1988)
- Temporomandibular Disorders (TMD) (Bell, 1983; McNeill et al., 1990).
Indices and Classifications of TMD

Helkimo’s indices were the first to be developed mainly for epidemiologic purposes in the diagnosis of TMD (Helkimo, 1974a) and are still frequently used (Carlsson and LeResche, 1995), although criticism also has arisen (Carlsson et al., 1980; Mejersjö and Carlsson, 1983; van der Weele and Dibbets, 1987), and several efforts have been made to improve these indices (Fricton, 1986; van der Weele and Dibbets, 1987). Helkimo’s anamnestic index (Ai) comprises three degrees which are no anamnestic dysfunction (Ai0), mild symptoms (AiI) e.g. joint clicking, and severe symptoms (AiII) of TMD e.g. pain in TMJ and the masticatory muscles, limitation of mandibular movement. The clinical dysfunction index (Di) is based on the evaluation of five clinical signs:

- impaired range of movement,
- impaired function of the TMJ,
- muscle pain,
- TMJ pain,
- pain on movement of the mandible (Helkimo, 1974b).

The Di index comprises four degrees which are no clinical dysfunction (Di0), mild dysfunction (DiI), moderate dysfunction (DiII), and severe dysfunction (DiIII) (Helkimo, 1974b).

In adult population studies, severe symptoms of TMD according to Helkimo’s anamnestic index vary from 5% to 26%, and severe clinical dysfunction of TMD according to Helkimo’s clinical dysfunction index, range from 1% to 22% (Carlsson and LeResche, 1995).

Wänman and Agerberg (1986a) introduced the Accumulated Anamnestic Index (AAi) which consists of seven symptoms and recurrent headache. Wänman (1987) used both Helkimo’s anamnestic index and the Accumulated Anamnestic Index in his two-year follow-up study. In the study population at baseline, Helkimo’s anamnestic index showed no differences in symptoms of TMD between boys and girls, although according to the Accumulated Anamnestic Index, girls reported more often symptoms than did boys. At the two-year follow-up examination a difference between genders in symptoms of TMD was found with both indices. Some other new indices (Levitt, 1990; Pullinger
and Monterio, 1988; Widmer, 1992) have been presented but none of them has become as widely used in population studies as Helkimo’s indices.

The Craniomandibular Index (CMI) was formulated, for epidemiological and clinical research, by Fricton and Schiffman (1986). It consists of two phases which are the Dysfunction Index (DI) reflecting temporomandibular joint tenderness and functional problems, and the Palpation Index (PI) reflecting muscle tenderness problems (Fricton and Schiffman, 1986). Schiffman et al. (1990), in their study used the Craniomandibular Index combined with the Symptom Severity index (SSI), which measures the subjective severity of pain and symptoms. In this study the prevalence of joint disorder was 19%, muscle disorder 23%, and combined muscle and joint disorder 27%. Although Helkimo’s clinical dysfunction index does not separate joint and muscle problems and the Craniomandibular Index does, in this study the correlation between the two indices is high (0.89) (Schiffman et al., 1992).

The TMJ Scale (Levitt, 1990; Levitt, 1991; Levitt et al., 1994) has been developed as a self-report measure for use in the home or office and assesses three domains: physical, psychosocial, and a global, or overall, scale. The physical domain includes assessment of pain, while the psychosocial domain assesses psychological factors and stress. The scale yields information which may be useful to guide clinicians treating TMD, although some questions of its validity as a psychological assessment tool have been noted by Rugh (Rugh et al., 1993) and by Deardorff (1995) as well as by others (Glaros and Glass, 1993). The TMJ Scale has not been the subject of longitudinal studies – that is, cohorts of patients have not been repeatedly assessed with the TMJ Scale over time – but substantial data are available as cross-sectional data collected over a number of years. Reports of scale scores in large samples of patients from multiple dental practices have been published (Levitt and McKinney, 1994). However, the TMJ scale is based solely on self-report, rather than examination findings.

Over the years, many classification schemes for TMD have been offered (Dworkin and LeResche, 1992; Block, 1992; Stegenga et al., 1992a,b; De Leeuw et al., 1994a,b; DeBoever and Carlsson, 1994; Lobbezoo-Scholte et al, 1995a,b; Okeson, 1995; Clark and Takeuchi, 1995).
The research diagnostic criteria for TMD (RDC/TMD), developed by Dworkin and LeResche (1992), is widely used. It is a dual axis system for classifying TMD patients and subjects. It provides specifications for conducting a standardized clinical examination and established a dual diagnosis that recognizes not only the physical conditions (axis I), including muscle disorders, disc displacements and other types of joint conditions that may contribute to the pain disorder, but also the psychosocial issues (axis II) that contribute to the suffering, pain behavior, and disability associated with the patient's pain experience. Three main diagnostic subgroups of TMD can be distinguished: muscle disorders (Group I); disc displacement (Group II); and arthralgia, arthritis, and arthrosis (Group III). Of these 3 groups, the muscle disorders, with or without limited mouth opening, are most prevalent in the community-based samples. Group II and III diagnosis, which do not involve the masticatory muscles, are less common (Lobbezoo et al., 2004). It also includes an assessment of limitation in jaw functional activities. The RDC/TMD has been shown to be reliable for diagnosing TMD in U.S. and Swedish populations (Wahlund et al., 1998). The development of RCD/TMD is a pragmatic attempt to address the classification problem, and a number of studies have shown adequate reliability of the clinical test procedures (John and Zwijnenburg, 2001). However, in the study of Emschoff and Rudisch (2001), the RDC/TMD has been shown to provide insufficient reliability for the determination of arthrogenous TMD.

In 1990, the American Academy of Orofacial Pain (AAOP) established the first well-defined diagnostic classification for TMD, which was revised in 1993 (McNeill, 1993a). Further, the AAOP published an updated diagnostic classification in 1996 (Okeson, 1996). Distinctions have been made between subgroups of TMD patients. The subclassification of TMD consists of two primary diagnostic categories: arthrogenous and myogenous. The myogenous classification is often further subdivided into muscular hyperarousal due to stress and muscular abnormality associated with parafunctional oral habits (e.g., bruxism), and the arthrogenous category is subdivided on the basis of specific structural abnormalities (e.g. internal derangement of the temporomandibular joint or degenerative disease). These classifications are not always clear, and there can be a considerable overlap or progression from one so-called syndrome to another (Kuttila et al., 1998a).
Prevalence of TMD and fluctuation of signs and symptoms

Over the last 50 years, several hundred studies have attempted to determine the prevalence of TMD. The earlier studies reported a high prevalence of both signs and symptoms of TMD, and also a large variance in the prevalence figures (Helkimo, 1979; Carlsson, 1984; Rugh and Solberg, 1985). For example, Helkimo (1974b), studying prevalences in a population of Lapps in the north of Finland, found that 57% of the population suffered from anamnestic symptoms, and 88% were diagnosed as having clinical signs.

In 1990 De Kanter reviewed the published studies of TMD and found a range of 11% to 58% for anamnestic symptoms and 28% to 88% for clinical signs. In his studies of the adult Dutch population, approximately 5% had moderate to severe signs and symptoms depending on age, gender, and status of dentition (de Kanter, 1990).

Longitudinal studies conducted on children and adolescents showed fluctuation tendency of signs and symptoms of TMD (Hirata et al., 1992; Könönen and Nyström, 1993). The same fluctuation tendency was also shown among adults (Österberg et al., 1992; Wänman, 1996).

The variation in the prevalence figures is often due to differences between samples, study designs, definitions, diagnostic criteria, or data presentation (Gross et al., 1988; Von Korff et al., 1988b; De Kanter et al., 1993; Goulet et al., 1995). The methodological factors can probably explain more of the variation in prevalence figures than can any real difference between samples (Carlsson and De Boever, 1994).

In the earlier studies the prevalence of severe dysfunction in the adult population was assumed to vary from 20 to 30% (Helkimo, 1979). However, the studies in the 90’s have reported the prevalence of severe dysfunction, according to Helkimo’s clinical dysfunction index, to be from 1% to 3% (De Kanter, 1990; Salonen et al., 1990).

An epidemiological study of TMD (Dworkin et al., 1990a) compared patients who were both symptomatic and seeking treatment (clinical cases, CLCA) with randomly selected selected persons who were free from TMD pain (community controls, COCO). In this study, the clinic cases had the highest prevalence of reported symptoms. They had more symptoms than signs, while the community controls had a much higher prevalence of clinical signs than symptoms (Dworkin et al., 1990a).
The prevalences of TMD symptoms and signs are apparently high in non-patient populations (Agerberg and Inkapööl, 1990). About 40 to 75% of non-patient adults had at least one sign, while approximately 33% of persons had at least one symptom of TMD (Schiffman and Fricton, 1988; Dworkin et al., 1990a; De Kanter et al., 1993). Recent studies have concluded that the signs and symptoms of TMD are common in non-patient populations (Pow, 2001; Wahlund, 2003; Gesch, 2004).

TMD signs have been estimated to occur approximately twice as commonly as symptoms, the prevalence of symptoms varying from 5% to 33%, and the prevalence of signs from 1% to 75% (Schiffman and Friction, 1988; DeKanter et al., 1993; Carlsson and LeResche, 1995). In population-based studies, the signs of TMD occur more frequently than the symptoms, usually in a ratio of 2:1 (Carlsson, 1984).

The most common symptoms in the general population are jaw tiredness, jaw stiffness, headache, sounds associated with the TMJs and pain in the jaw and face area (Solberg et al., 1979; Nilner, 1992; Okeson, 1996). One of the most common signs found in clinical examination is muscle tenderness (Jensen et al., 1992). The most common clinical sign of TMD is clicking of the TMJ, the prevalence levels varying from 8 to 50% (Wänman and Agerberg, 1990; Duckro et al., 1990; Glass et al., 1993; Goulet et al., 1995; Könönen et al., 1996; Magnusson et al., 2000). In contrast, mouth opening limitations are relatively rare, occurring in 5% or less of the population (Huber and Hall, 1990; DeKanter et al., 1993).

A great fluctuation was seen in studies concerning TMJ clicking (Magnusson et al., 1986; Wänman, 1987; Könönen et al., 1996).

TMD and age

Both signs and symptoms of TMD are uncommon in young children (De Vis et al., 1984; Kirveskary et al., 1986; Nydell et al., 1994). Prevalence of TMD signs and symptoms reported in epidemiologic studies of children are lower than in adults (Carlsson, 1999). In 15- to 18-year-olds, the frequency of signs and symptoms is similar to that found in the 20- to 40-year age group (Nilner, 1981). Older subjects have reported TMD symptoms less frequently than younger ones according to most epidemiologic cross-sectional studies (Carlsson, 1999). A study of a
group of 90-year-old subjects revealed no or only mild TMD signs and symptoms and practically no complaints of masticatory difficulties, in spite of varying dental conditions (Tzakis et al., 1994).

Several studies have reported lower frequencies of symptoms with increasing age (Österberg et al., 1992; De Kanter, 1993; Matsuka et al., 1996) and have shown that the highest prevalence of TMD occurs among adults under 45 years of age, with decreasing levels at an earlier age (Locker and Slade, 1988; Von Korff et al., 1988a; Dworkin, 1990a; Agerberg and Inkapölö, 1990; Duckro et al., 1990; Glass et al., 1993; Lipton et al., 1993; Goulet et al., 1995; LeResche, 1997a). Opposing studies have indicated an increased risk for TMD with advancing age (Tervonen and Knuuttila, 1988; Agerberg and Bergenholtz, 1989; Salonen et al., 1990). Salonen and Hellden (1990) have found that reported symptoms of TMD decrease with age, while clinical signs increase. Other studies provide conflicting results and have shown no relation to age (Harriman et al., 1990; Dworkin et al., 1990a).

The majority of the TMD patients are found to be between 15 and 45 years old (Carlsson, 1999). Therefore, the adult population is of special interest as far as TMD is concerned, and studies regarding the prevalence of TMD and related factors should be directed especially at this stage of age.

TMD and gender

Earlier population studies found the prevalence of symptoms and signs of TMD to be distributed fairly evenly between men and women (Helkimo, 1974a, 1976; Hansson and Nilner, 1975; Swanljung and Rantanen, 1979; Heft 1984). The same tendency has been found in younger populations (Egermark-Eriksson et al., 1981; Nilner and Lassing, 1981; Nilner, 1981). However, later studies have reported a higher prevalence among women (DeKanter, 1990; Salonen et al., 1990; DeKanter et al., 1993; Glass et al., 1993; Lipton et al., 1993; Magnusson et al., 1993; De Leeuw et al., 1994a; Goulet et al., 1995; Magnusson et al., 2000; Johansson et al., 2003). Published data on Brazilian high school and university students showed that women had moderate or severe symptoms of TMD four times as often as men (Conti et al., 1996). Several studies having representative general populations indicate that women experience more TMD-related
pain than men, usually at a ratio of two to one (Dworkin et al., 1990a; Lipton et al., 1993; Goulet et al., 1995; LeResche, 1997; Kamisaka et al., 2000; Riley and Gilbert, 2001).

The most prominent sex differences have been found at the age of 20-40 years (Magnusson et al., 1993; Levitt and McKinney, 1994). According to Goulet et al. (1996), women between 35 and 44 years reported more frequency symptoms associated with TMD and had a two to three times higher prevalence of clinical signs than men.

Many authors have tried to explain why TMD bother women more than men (Sändstrom, 1988; Levitt and McKinney, 1994; LeResche et al., 1994). However, the true reason or set of reasons remains unknown and warrants additional studies.

In conclusion, the prevalence of many symptoms, such as headache, TMJ clicking, TMJ tenderness and muscle tenderness seems to be higher in women than in men (Locker and Slade, 1988; Pullinger et al., 1988; Agerberg and Bergenholz, 1989; Agerberg and Inkapööl, 1990; De Kanter, 1990; Dworkin et al., 1990a; Salonen et al., 1990; Lipton et al., 1993; Magnusson et al., 1993; De Leeuw et al., 1994a; Wänman, 1995a, 1996).

Risk factors for TMD

The literature on the analytic epidemiologic study of risk factors for any type of TMD is still in its infancy, and only few studies about disc displacements (Group II) or about arthralgia, arthritis, and arthrosis (Group III) disorders are available (Lobbezoo et al., 2004). Numerous efforts have been made in order to resolve the etiology of TMD. De Boever (1979) reported five different etiologic theories of TMD:

- mechanical displacement theory
- neuromuscular theory
- psychophysiological theory
- muscular theory
- psychological theory.

Ramfjord and Ash (1971) supported the muscular and neuromuscular theory associating occlusion with dysfunction. Their conclusion was that the adaptive capacity of adult TMJ is limited. In agreement with them was de Bont (1985), who studied the association between the TMJ and the function of the masticatory system.
The multifactorial etiological approach has been widely discussed. De Boever (1979) concluded that aetiology is a combination of dental, psychological, and muscular factors.

Of the few risk factors studies of TMD subgroups, several case-control studies have shown moderate associations between joint laxity and group II disorders (Westling, 1989), and between loss of posterior support and the risk of Group III disorders (Sato et al., 1996). A recent case-control study of TMD subgroups showed that somatization, tooth clenching, third molar removal, and trauma were risk factors for the myalgia-only and myalgia/arthralgia subgroups (Huang et al., 2002).

General factors, such as impaired health, general joint and muscle diseases, psychological and psychosocial factors, and local influences such as occlusal disturbances, parafunctional activities, i.e. bruxism, and traumas, can affect the condition of the stomatognathic system (Okeson, 1996).

Although occlusion continued to be regarded as one of the major influences on TMD, and treatment of the occlusion as the most important strategy in treatment of TMD (De Boever et al., 2000), the significance of the role of occlusion in the aetiology is still unclear, creating a demand for further longitudinal studies. Several reviews and studies have not found any strong support for an occlusal aetiology of TMD, at least not as a unique or dominant factor (Tervonen and Knuuttila, 1988; Egermark-Eriksson et al., 1990; McNeill, 1993a; Pullinger et al., 1993; McNamara et al., 1995; Okeson, 1996; Clark et al., 1997; Kitai et al., 1997; Watanabe et al., 1998; De Boever et al., 2000; Pullinger and Seligman, 2000). Some studies considered occlusion to be a TMD-related or a co-etiologic factor (Könönen et al., 1987; Szentpetery et al., 1987; Pullinger et al., 1988; Kirveskari et al., 1989; Runge et al., 1989).

The association between trauma and TMD has also been shown epidemiologically (Seligman and Pullinger, 1996; Kamisaka et al., 2000). In contrast, a population-based study by Locker and Slade (1988) found no association between trauma and signs or symptoms of TMD. Additionally, a critical review by Ferrari and Leonard (1998) revealed no substantial theory of mechanical TMJ injury to be connected with TMD.

The generally accepted etiologic concept nowadays is the multifactorial and biopsychosocial approach (De Boever and Carlsson, 1994; Okeson, 2003). The role of
different factors in TMD is still unclear. For instance, condylar displacement (Stohler, 1994), internal derangement, and osteoarthrosis (Zarb and Carlsson, 1994) can be considered either the cause or result of TMD (De Boever and Carlsson, 1994). The balance between function and dysfunction is said to be dynamic and periodic (De Boever and Carlsson, 1994). Unexplored risk factors, such as adverse early life events, physical activity, obesity, beliefs and coping strategies, and mild traumatic brain injury, among others, all await further study (Lobbezoo et al., 2004). Additional population-based studies are needed to clarify the heterogenous factors related to TMD.

General health and TMD

A number of signs and symptoms of TMD have been found to correlate with poor general health (Mejersjö and Carlsson, 1983). Multidisciplinary knowledge and improved diagnostic techniques have led to the realization that patients with temporomandibular disorders may suffer from a variety of conditions, including systemic-related problems and articular, neuromuscular, neurologic, neurovascular and behavioural disorders (McNeill, 1993a). Several studies with patient samples have found a significant overlap between TMD and pain conditions in other parts of the body (Allebring and Hagerstam, 1993; Hagberg et al., 1994; Turp et al., 1998). Especially patients with masticatory muscle problems have complaints beyond the masticatory system, mostly in the head, neck and back areas (Hagberg et al., 1994). Furthermore, infectious events were associated with the onset of chronic orofacial muscle pain in 67% of patients (McGregor et al., 1996).

A higher prevalence of TMD symptoms than in the general population has been found in patients with rheumatoid arthritis (Tegelberg, 1987), psoriatic arthritis (Könören, 1987) and ankylosing spondylitis (Wenneberg, 1983). Systemic joint laxity has been suggested to be a significant risk factor of TMD (Blasberg and Chalmers, 1989; Westling, 1992). In addition, high rates of comorbidity between myogenous facial pain and fibromyalgia, a chronic widespread pain of unknown origin, have been noted in several studies (Plesh et al., 1996; Hedenberg-Magnusson et al., 1999). Several studies have shown that approximately 75% of fibromyalgia patients fulfill criteria for TMD, and 12-25% of TMD patients meet diagnostic criteria for fibromyalgia (Plesh et al., 1996;
Cimino et al., 1998). Whether fibromyalgia increases risk for TMD, or TMD increases risk for fibromyalgia or is another manifestation of this syndrome, or whether both conditions are caused by common risk factors is not known (Wolfe, 1995).

Several other disorders appear to occur more often among persons with TMD than among the general population. Both migraine and tension-type headache have been associated with TMD symptoms in cross-sectional and case-control studies (Wänman and Agerberg, 1987). Headache, ear and neck problems have often been related to TMD (Magnusson, 1995; Keersmaekers, 1996).

Aural symptoms like otalgia, tinnitus, impaired hearing, fullness of ears, hyperacusis and vertigo are common in functional disorders of the masticatory system (Cooper and Cooper, 1993; Keersmaekers et al., 1996). In patient studies, otalgia and tinnitus are often correlated with temporomandibular disorders (Feinmesser and Fluman, 1987).

According to Austin (1997), insomnia, defined as the inability to initiate or maintain sleep, may be a perpetuating factor of TMD. In the study by Goulet et al. (1995), 36% of those with jaw pain and restlessness after sleep complained of severe pain, compared with only 15% in the group with jaw pain without sleep problems.

Symptomatic TMD patients reported three or four times more other joint problems than asymptomatic subjects (Morrow et al., 1996). The symptoms of TMD may be reduced by treating the contributing general diseases (Agerberg and Helkimo, 1987).

In addition, the severity of signs and symptoms of TMD has been correlated with the length of sick leave, both in TMD patients and in population samples (Alanen and Kirveskari, 1983). After stomatognathic treatment the amount of prescribed medicine as well as sick leaves decreased (Kirveskari and Alanen, 1984).

Psychological and behavioural factors and TMD

The importance of psychological factors has been emphasized in TMD (Rollman and Gillespie, 2000). They are thought to have a role in the cause or maintenance of TMD (Rugh, 1992), and may predispose the condition to chronicity (Gatchel et al., 1996).

The patients with TMD may often have a combination of psychological and somatic manifestations (Mohl and Ohrbach, 1994). They may also have difficulties in coping with increased life stress and personality characteristics causing problems in difficult life
situations (De Leeuw et al., 1994c). On the other hand, it has been stated that psychological disturbances may be a direct consequence of pain-related life events in TMD patients (Murray et al., 1996). The subjects, who rated themselves as tense, had a risk ratio of temporomandibular disorders from 3.4 to 8.5 times higher than those who did not experience tension (Wänman and Agerberg, 1990). Conflicts at home or at work, financial problems or cultural readjustments may increase stress and thus, increase parafunctional habits, such as bruxism and clenching, which loads the masticatory system more, perhaps too much (Okeson, 1996). Stress may also modify a patient’s ability to tolerate TMD pain (Zarb et al., 1994). On the other hand, chronic pain may cause stress, behavioural and emotional changes (Schwarzman and McLellan, 1987), but these may also be a cause of pain (Rugh and Davis, 1992).

Subcategorization of the patients into diagnostic subgroups of TMD suggests that myogenous patients may have more psychological difficulties than patients with arthrogenous TMD (Levitt and McKinney, 1994; Lobbezoo-Scholte et al., 1995a; Spruijt and Wabeke, 1995). TMD patients have many psychological profiles (Lobezoo-Scholte et al., 1995a) and there seems to be widespread agreement that stress, depression, disability and dysfunctional illness behaviour are aspects of TMD patients’ profiles (Dworkin and LeResche, 1992). TMD patients with muscle pain have also increased scores in somatization (McGregor et al., 1996).

Somatization is defined as a tendency to experience and communicate somatic distress in response to psychosocial stress and to seek medical help for it (Lipowski, 1988). Somatoform disorder is a condition in which the patient reports somatic complaints, yet no physical evidence of organic disease is present (American Psychiatric Association, 1994). About 20% of patients who frequently use health care resources have been classified as chronically somatizing patients (Karlsson et al., 1997).

It has been suggested that especially patients with masticatory muscle pain may be more prone to report symptoms as compared to normal controls (Wilson et al., 1991) and are likely to be more sensitive to painful stimuli (Reid et al., 1994), although this is argued by the data of Carlson et al. (1998).

Depression is a disorder that can be defined as a collection of symptoms such as depressed mood, loss of interest or pleasure, weight loss or weight gain, insomnia or
hypersomnia, feelings of worthlessness, and diminished ability to think or concentrate, etc. (American Psychiatric Association, 1987).
Epidemiological studies have shown that depression is the most common mental disorder in man. Depression affects at least 20 percent of women and 10 percent of men during their lifetimes (Kessler et al., 1994). Numerous studies have also shown a high prevalence of depression in patients with facial pain and TMD (McCreary et al., 1991; Gallagher et al., 1991; Gatchel et al., 1996; Korszun et al., 1996; Carlson et al., 1998; Madland et al., 2000), while the number of population-based studies concerning the connection between depression and TMD (Von Korff et al., 1988a; Dworkin et al., 1990b; Vimpari et al., 1995) is lower than the number of studies with patient samples. In contrast, McGregor (1996) found no differences between depression prevalences in orofacial pain patients and normal controls.

Use of health care services and TMD

Pain is the most frequent reason for seeking medical treatment, irrespective of gender (Nylenna, 1985). Approximately one in three adults will develop TMD pain in his or her lifetime (Dworkin and LeRshe, 1993). Thus, pain from temporomandibular disorders is a common condition. However, only about one fourth of persons with temporomandibular pain sought treatment for their symptoms (von Korff, 1988b; Linet et al., 1989). The severity and persistence of pain, but also its more recent onset influence people’s treatment seeking (Von Korff et al., 1991).

A unique aspect of TMD pain is that patients often comment that they are not sure whom they should consult first for their symptoms a physician, dentist, or other health care provider. Indeed, anywhere from 50% to 75% of patients will visit a dentist, while the reminders seek a physician (Turp et al., 1998). However, Patients visit physicians because of a variety of symptoms for example ear problems, headache or dizziness which may be obscuring the TMD (Cooper and Cooper, 1993). According to Glass and Glaros (1995), about 40% of TMD patients may have been misdiagnosed by physicians. Delays in diagnosis and subsequent appropriate referral (Foreman et al., 1994), or incorrect diagnosis (Foreman et al., 1994; Glaros et al., 1995) were common findings in several studies of both dentists and physicians.
There can be overlapping symptomatology between TMD and other medical disorders. In addition to dental diseases, one has to consider diseases and disorders like neuralgias (trigeminal and post-herpetic neuralgia), vascular diseases (migraine, temporal arteritis), ear infections, diseases of salivary glands and lymphatic tissue, sinusitis and neoplasms (McNeill, 1993b).

An association of TMD with cervical spine disorder (CSD) has been often reported (Clark et al., 1987; Cachiotti et al., 1991; De Laat et al., 1993). Patients with temporomandibular or cervical spine disorders may have the same symptoms and differentiating between them depends on clinical examination. According to De Wijer (1995), patients with CSD reported higher intensity, longer duration and greater impact of neck pain, more often tenderness on palpation in the neck, but less often aural symptoms than the patients with TMD.

One has also to include an infected third molar, apical root infection or an impacted tooth in the differential diagnosis of TMD. As a source of orofacial pain, gingival and oral mucosal diseases, pain disorders of the tongue, burning mouth syndrome or atypical odontalgia may mimic the symptoms of TMD.

Twenty nine percent of temporomandibular pain patients had seen at least three different health care providers and 12% had seen five or more different providers (Von Korff, 1995). Consultation of many providers wastes health care resources and can be harmful for the patient (Von Korff, 1995). Glass and Glaros (1993) hypothesized that TMD patients who see a “TMD specialist” are more satisfied with their care and receive care of higher quality than patients who do not visit a TMD specialist.

Demand and need for TMD treatment

Treatment demand

In the general population, treatment-seeking for TMD is usually smaller than the professionally evaluated treatment need for TMD (Magnusson et al., 1994). Despite the large percentages of the population having signs and symptoms of TMD, between 1 and 12% of samples have reported that they sought treatment because of TMD symptoms (Markowitz and Gerry, 1949; Norheim and Dahl, 1978; Swanljung and Rantanen, 1979;
Solberg et al., 1979; Helöe and Helöe, 1979; Pullinger et al., 1988; Von Korff et al., 1988a; Locker and Slade, 1988; Agerberg and Inkapöööl, 1990; Schiffman et al., 1990; Magnusson et al., 1991; De Kanter et al., 1992; Magnusson et al., 1993; Goulet et al., 1995; Bibb et al., 1995; Wänman and Wigren, 1995b; Kuttila et al., 1998a; Riley et al., 1998; Egermark et al., 2001; Pow et al., 2001; Magnusson et al., 2002; Macfarlane et al., 2002).

Through a longitudinal approach, a recent study on 114 subjects examined at three different occasions over 20 years followed from the age of 15 to 35 years, 18% had demanded and been provided with some kind of treatment related to TMD during the 20-year follow-up period (Magnusson et al., 2002).

Pain in the face and the TMJs is a common symptom of TMD, and supposed to be the most important reason for seeking treatment for TMD (Von Korff et al., 1988a; Dworkin et al., 1990a). Since most people seek medical care because of subjective complaints as pain, restricted mouth opening or loud clicking, the evaluation of subjective symptoms gives a more realistic basis for the estimation of the actual treatment need (Szentpetery et al., 1986b).

The age of the subjects is of special interest, since many investigations have shown that the majority of patients seeking treatment for TMD are between 20 and 50 years old (Carlsson, 1999).

Individuals seeking professional help for TMD seem to be predominantly women between 20 to 40 years old (Helkimo, 1979; Rieder et al., 1983; de Kanter et al., 1993). The predominance of women is even higher in surveys of people seeking treatment for TMD pain (Dworkin et al., 1990a; Goulet et al., 1995), at a ratio of 4:1 or 5:1 (Locker and Slade, 1988; Bush et al., 1993; Dworkin and LeResche, 1993; Levitt and McKinney, 1994; McNeill 1997).

Treatment need

The estimation of treatment need for TMD has been made in several ways. The early epidemiologic studies of TMD estimated that 20% to 25% of the general population had severe signs of dysfunction and were in need of treatment (Helkimo, 1979). In a Hungarian population based study by Szentpetery (1986a), it is postulated that the
prevalence of subjective symptoms (20%) might represent the extent of treatment need of a population. In a cross-sectional study by Tervonen (1988), stomatognathic treatment need in Finnish adults was recorded as the number of subjects with one or more clinical signs of stomatognathic dysfunction, excluding those needing a complete set of full dentures. Altogether 44% of the study population had at least one clinical sign and 27% had moderate or severe signs (Tervonen, 1988). Magnusson et al. (1991) based their estimation for TMD treatment need on the examiner’s clinical experience, taking into account both the clinical signs and the subjective symptoms, and assumed functional TMD treatment need to be between 21% and 27%.

After knowledge of TMD increased, estimations of treatment need have decreased, although opinions vary greatly (Carlsson, 1984; Rugh and Sohlberg, 1985; De Kanter et al., 1990; Magnusson et al., 1991). The levels of the treatment need are suggested to be varying from 5% to 16% (Schiffman et al., 1990; Agerberg and Inkapööl, 1990; Dworkin et al., 1990a; Salonen et al., 1990; Magnusson et al., 1993; Kuttilla et al., 1998a). Schiffman et al. (1990) estimated treatment need for TMD with the Symptom Severity Index to be 6%. In their study, the subjects who had disorders severe enough to be comparable to patients’ disorders were considered to need treatment for TMD. In the study of Agerberg and Inkapööl (1990), the estimation of treatment need was based on the subjects’ estimation and was 12%. According to Bakke and Möller (1992), prevalences of severe craniomandibular disorders accompanied by headache and facial pain urgently in need of treatment are 5-15% in adults.

Little is known about the significance of TMD diagnostic subgroups, i.e., myogenous or arthrogenous symptoms, in the treatment need for TMD. It has been suggested that patients with myogenous TMD have a more acute need for treatment than arthrogenous patients (De Leeuw et al., 1994a; Kuttilla et al., 1998a), as well as a less favourable prognosis (Scholte et al., 1993). In recent studies, the group needing active treatment was about 10% (Kuttilla et al., 1997; Magnusson et al., 2002).

It is obvious that it is impossible to relate prevalence figures directly to treatment need, while aetiology, diagnosis, and definitions have led to variation in estimations (Magnusson et al., 1991; Zarb and Carlsson, 1994). In the older population however, the need for treatment seems to decrease with age (Greene, 1994). Further, it has been
shown that women need treatment for their TMD problems two to three times as often as men (Agerberg and Inkapölö, 1990; Kuttila et al., 1998a). Need is relative to time, place and assessor (Magi and Allander, 1981).

De Kanter et al. (1992) suggested that signs and symptoms should be separated from treatment need for TMD, and the treatment need indices should also include “signs present with no need for treatment” versus “signs present with need for treatment”.

A review identified estimates for TMD treatment need ranging from 1.5% to 30% (Carlsson et al., 1999). This report was based on a narrative review of the literature up to the year 1994.

Aim of the study

Prevalence of TMD and treatment need estimation varies considerably among studies. In addition, prevalence figures cannot be transferred directly into treatment need. As there is a variety of figures for TMD treatment need, a meta-analysis is necessary to answer this important question. In addition, meta-analysis is superior to narrative reviews because of its advantages, as it contains a comprehensive summary of the evidence rather than being based on only a selection of the published literature, and its ability to reduce bias and ensure reliability.

The hypothesis for the present study is that it should be possible to find common methods and criteria in estimating treatment need for TMD among studies, and to derive a generalized treatment need estimate in more practical and reliable way than is possible from present-day review studies.

The aims of the study were to:

I. identify and describe adult population-based and non-patients studies which have a treatment need estimate for temporomandibular disorders,

II. determine the prevalence of treatment need for TMD in adult populations through conducting a meta-analysis and

III. describe factors influencing treatment need for TMD.