

# Prevalence of Temporomandibular Disorders in the Northern Finland Birth Cohort 1966

## Päivi Jussila, DDS

Doctoral Student  
Research Unit of Oral Health Sciences  
Faculty of Medicine, Medical Research  
Center, Oulu University Hospital and  
University of Oulu, Oulu, Finland

## Heikki Kiviahde, DDS

Doctoral Student  
Research Unit of Oral Health Sciences  
Faculty of Medicine, Medical Research  
Center, Oulu University Hospital and  
University of Oulu, Oulu, Finland

## Ritva Näpänkangas, DDS, PhD

Adjunct Professor  
Research Unit of Oral Health Sciences  
Faculty of Medicine, Medical Research  
Center, Oulu University Hospital and  
University of Oulu, Oulu, Finland

## Jari Pääkkilä, MSc

University Teacher  
Department of Mathematical Sciences  
University of Oulu, Oulu, Finland

## Paula Pesonen, MSc

Statistician  
Research Unit of Oral Health Sciences  
Faculty of Medicine, University of Oulu  
Medical Research Center  
Oulu University Hospital and  
University of Oulu, Oulu, Finland

## Kirsi Sipilä, DDS, PhD

Professor and Chairman  
Institute of Dentistry  
University of Eastern Finland  
Oral and Maxillofacial Department  
Kuopio University Hospital, Kuopio, Finland  
and Research Unit of Oral Health Sciences  
Faculty of Medicine, University of Oulu  
Medical Research Center  
Oulu University Hospital and  
University of Oulu, Oulu, Finland

## Pertti Pirttiniemi, DDS, PhD

Professor and Chairman  
Research Unit of Oral Health Sciences  
Faculty of Medicine, University of Oulu  
Medical Research Center  
Oulu University Hospital and  
University of Oulu, Oulu, Finland

## Aune Raustia, DDS, PhD

Professor and Chairman  
Research Unit of Oral Health Sciences  
Faculty of Medicine, University of Oulu  
Medical Research Center  
Oulu University Hospital and  
University of Oulu, Oulu, Finland

## Correspondence to:

Dr Päivi Jussila  
Research Unit of Oral Health Sciences  
Faculty of Medicine, P.O. Box 5281  
FIN-90014 University of Oulu, Finland  
Fax +358-8-5315037  
Email: paivi.jussila@plusterveys.fi

©2017 by Quintessence Publishing Co Inc.

**Aims:** To investigate the prevalence of temporomandibular disorders (TMD) in the 46-year-old cohort subjects from the Northern Finland Birth Cohort 1966 (NFBC 1966). **Methods:** Altogether, 1,962 subjects (1,050 women, 912 men) participated in a clinical medical and dental examination and responded to questionnaires in 2012 to 2013. The stomatognathic examination was performed according to a modified protocol of the Diagnostic Criteria for Temporomandibular Disorders (DC/TMD). Pearson's chi-square test and Fisher's exact test were used to analyze the signs of TMD between genders, and logistic regression models were used to analyze the relationship between self-reported pain associated with TMD and modified DC/TMD protocol ( $P < .05$ ). **Results:** Of the subjects available for analyses, 18.5% responded positively to the self-reported screening question for pain related to TMD. The most common signs of TMD were clicking in the temporomandibular joint (TMJ) (26.2%) and palpation pain in the masticatory muscles (11.2%). Women had signs of TMD more often than men ( $P < .05$ ). The most common diagnosis was disc displacement with reduction (7.0%). Myalgia, arthralgia, disc displacement with reduction, and degenerative joint disease diagnoses were statistically significantly more common in women than in men ( $P < .05$ ). The prevalence of TMD signs among the cohort subjects was 34.2%. **Conclusion:** The most common sign of TMD was clicking in the TMJ and the most common TMD diagnosis was disc displacement with reduction. The prevalence of TMD signs among the examined cohort subjects was 34.2%. TMD was diagnosed in women more often than in men. The results are comparable with other corresponding population-based studies in adults. *J Oral Facial Pain Headache* 2017;31:159–164. doi: 10.11607/ofph.1773

**Keywords:** cohort study, DC/TMD, NFBC 1966, temporomandibular disorders, TMD

Temporomandibular disorders (TMD) are defined as “a collective term embracing a number of clinical problems that involve the masticatory muscles, the temporomandibular joints (TMJs) and associated structures, or both.”<sup>1</sup> Several studies of adult populations have shown that TMD symptoms are manifested in approximately 25% to 50% of subjects, while clinical findings of TMD are even more common, being found in 40% to 90% of subjects depending on the examination methods used as well as the study sample.<sup>2–8</sup>

A prospective cohort sample ( $n = 2,737$ ) was enrolled for the Orofacial Pain: Prospective Evaluation and Risk Assessment (OPPERA) study performed in 2006 to 2008 in the United States.<sup>9</sup> The study showed that first-onset TMD developed in 3.9% of cases per annum in adults, that the prevalence of TMD was much higher in women than in men, and that there was a positive association between aging and TMD, as also noted previously.<sup>3,5</sup> Another investigation, the Study of Health in Pomerania, Germany (SHIP), was a population-based longitudinal study consisting of two cohorts.<sup>10</sup> During this 5-year follow-up study ( $n = 3,006$ ), signs of TMD, especially TMJ pain, developed in 4% ( $n = 122$ ) of the participants.<sup>10</sup> Progiante et al<sup>11</sup> also assessed the prevalence of TMD in an adult Brazilian community population ( $n = 1,643$ ) in 2011 to 2012 using the Research Diagnostic Criteria for TMD (RDC/TMD).<sup>11</sup> They found that the prevalence of both

symptoms and signs of TMD was relatively high, but the proportion of patients in need of treatment was much lower.<sup>11</sup>

In Finland, the prevalence of TMD was studied as part of a Health 2000 survey.<sup>5</sup> A nationally representative sample included 8,028 Finnish adults from the ages of 30 to over 80 years. According to a clinical examination, 38% of the subjects had at least one sign of TMD, and TMD signs were more common in women than in men. The most frequent signs were TMJ clicking (15%) and palpation pain in the masticatory muscles (14%).<sup>5</sup>

General health and well-being have been studied in the Northern Finland Birth Cohort 1966 (NFBC 1966), an unselected, population-based sample of all live births in 1966 (n = 12,058) in the former provinces of Oulu and Lapland in Finland.<sup>12</sup> In the study conducted in 1997, the study questionnaire (n = 5,696) revealed that the most usual TMD symptom in these 31-year-old subjects was TMJ clicking (28% in women, 21% in men). Facial pain was reported by 17.9% of women and by 12.2% of men.<sup>13</sup>

A follow-up study of the NFBC 1966 subjects concerning their general and oral health was done in 2012 to 2013 that included questionnaires and clinical medical and dental examinations. The aim of this study was to investigate the prevalence of TMD in the 46-year-old cohort subjects in the NFBC 1966.

## Materials and Methods

### Subjects

The NFBC 1966 is a longitudinal and epidemiologic research program concerning subjects in an unselected population born in 1966 in Oulu and Lapland, two Northern provinces in Finland (<http://www.oulu.fi/nfbc/>)<sup>12</sup> (Fig 1). The research program is coordinated by the Department of Health Sciences, Faculty of Medicine, University of Oulu.

The follow-up study of the cohort subjects was organized in 2012 to 2013. The target population for the study was 11,366 subjects (Fig 1). The study included questionnaires and clinical examinations, participation in the study was voluntary, and the subjects had the right to refuse to give information concerning themselves. Subjects provided a written consent for the study. The Ethical Committee of Northern Ostrobothnia Hospital District approved the study (74/2011).

The invitation to attend the clinical medical and dental examinations was sent to 3,150 subjects currently living in the Oulu region, and 1,964 subjects (61.7%) attended the examination. Two subjects refused to give their information for the study, and so the total number of subjects for analyses was 1,962.

### Questionnaires

Subjects with a known postal address (n = 10,321) received two questionnaires to be filled out at home (Fig 1). The questionnaires included (1) the subjects' background information, lifestyle, and health; and (2) economy, work, and mental resources. In addition, subjects attending the clinical medical and dental examination (n = 1,964) filled in Questionnaire 3, which included additional questions about dental health. Questions concerning TMD were included in Questionnaires 1 (response rate 66.5%, n = 6,868) and 3 (response rate 97.3%, n = 1,909) (Fig 1). Questionnaire 1 included two questions related to TMD symptoms that have been shown to be valid for screening TMD pain<sup>14</sup>:

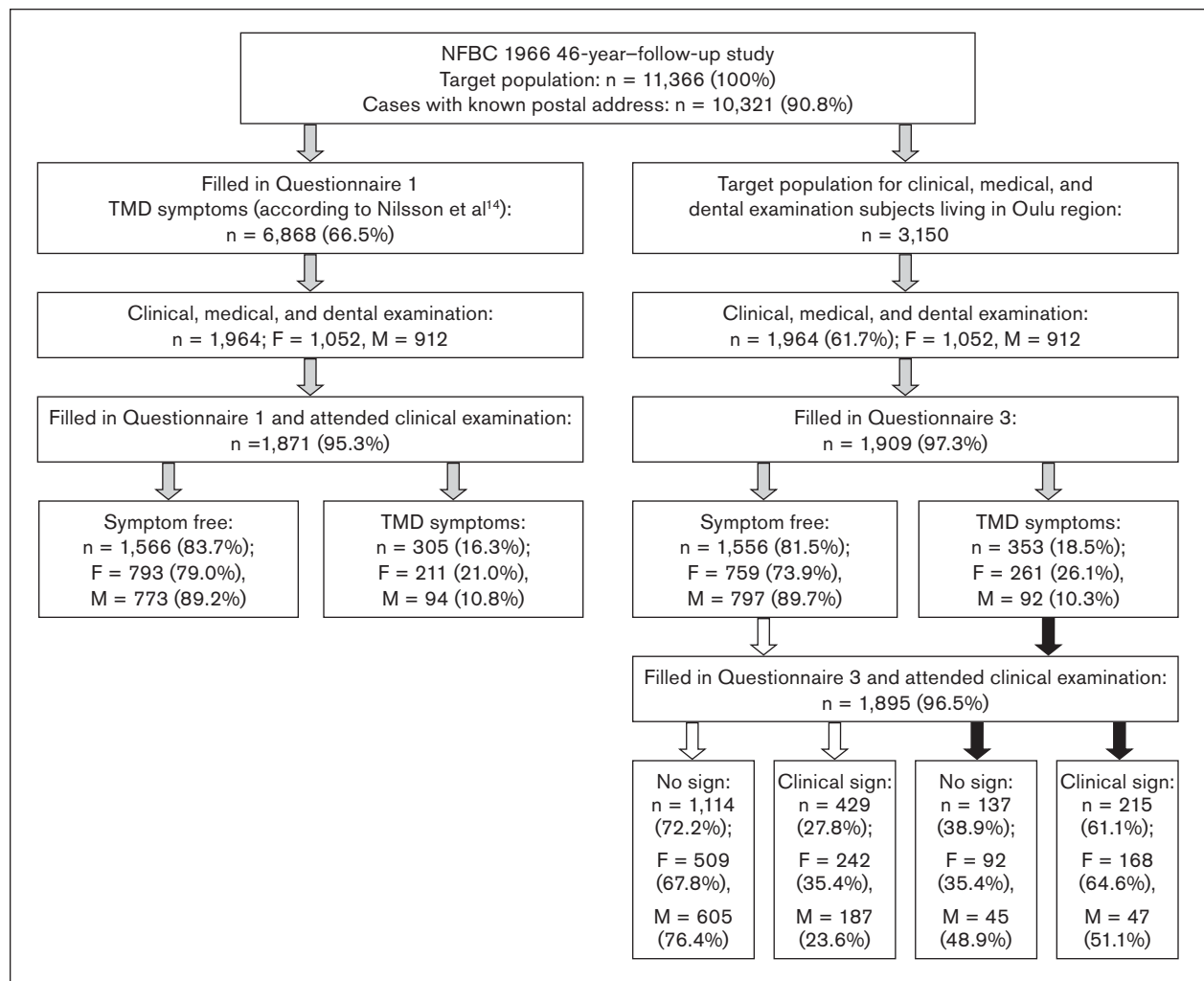
1. Do you have pain in your temples, temporomandibular joints, face, or jaw? (Answer options were: no/once a week/more often; dichotomized as no pain/pain)
2. Do you have pain when you open your mouth wide or chew? (Answer options were: no/once a week/more often; dichotomized as no pain/pain)

In Questionnaire 3, the subjects were asked further questions related to TMD. The questions dichotomously defined the subjects as having TMD symptoms or having no symptoms in the clinical stomatognathic examination (Fig 1). Questions 2 through 6 were used in the modified Diagnostic Criteria for Temporomandibular Disorders (DC/TMD) diagnostics protocol.

1. Have you had pain in areas of your face, jaws, temples, ears, or behind your ears during the prior 30 days? (with options yes/no)
2. During the prior 30 days, have you felt pain that was modified by jaw movement, function, parafunction, or being at rest? (with options yes/no)
3. Have you had jaw locking in the closed position that restricted maximum mouth opening? (with options yes/no)
4. Did this restricted opening cause difficulty in mastication? (with options yes/no)
5. Have you had clicking noises in the TMJ during opening or closing jaw movements or during mastication? (with options yes/no)
6. Have you had crepitation in the TMJ during opening or closing jaw movements or during mastication? (with options yes/no)

### Clinical Stomatognathic Examination

Altogether, 1,964 subjects participated in a standardized clinical dental examination performed by five calibrated dentists (examiners) at the Institute of Dentistry, University of Oulu. The repeatability of



**Fig 1** Flowchart showing frequencies of TMD symptoms reported in the questionnaires and signs found in clinical dental examinations of the 46-year-old subjects in the NFBC 1966.

the examination was ensured by having the investigators train under experienced specialized dentists before the beginning of the study. Inter-examiner agreement was also determined regularly during the study by a senior dentist serving as a gold standard. The stomatognathic examination was performed by the modified protocol of the DC/TMD presented in a symposium at The International Association for Dental Research (IADR) Conference in 2010.<sup>15</sup>

The prevalence of TMD signs was counted on the basis of the subjects having one or more signs of TMD in the clinical examination. Maximum mouth opening without any assistance by the examiner as well as lateral and protrusive movements (< 7 mm restricted) were recorded. In maximum assisted opening (MAO), the jaw was actively pushed on by the examiner. The patients were asked if they felt familiar pain in any movements, which is defined as pain that

is similar to or like the pain he/she has had previously in that same location during the preceding 30 days. Familiar pain in the area of the TMJ and masticatory muscles was registered.

The examiner recorded TMJ noises (clicking, crepitus) during opening and closing movements, as well as during protrusive and lateral excursive movements. The crepitus was registered at a distance of 15 cm.

The temporalis muscles were bilaterally palpated at the anterior, middle, and posterior regions, and the masseter muscles were bilaterally palpated at the origin, deep, and insertion regions. Palpation for familiar pain was done by applying a pressure of 1.0 kg (2–3 lbs). Palpation for familiar pain in the TMJ was done by applying a pressure of 1.0 kg (2–3 lbs) around the TMJ pole, and 0.5 kg (1 lb) for the lateral pole of the TMJ. Palpation force calibration was registered with a digital postage scale.

**Table 1** Frequencies of Signs of TMD in the NFBC 1966 Study Group

Clinical sign	n	%	$\chi^2$ value	<i>P</i> value
<b>Limited mouth opening</b> ( $< 40$ mm) (n = 1,949)				
Women	53	5.1		
Men	19	2.1		
Total	72	3.7	12.138	$< .001$
<b>Clicking in TMJ</b>				
Women	304	29.2		
Men	205	22.7		
Total	509	26.2	10.756	.001
<b>Crepitus in TMJ</b>				
Women	118	11.3		
Men	69	7.6		
Total	187	9.6	7.633	.006
<b>Pain in masticatory muscles</b>				
Women	159	15.3		
Men	59	6.5		
Total	218	11.2	37.410	$< .001$
<b>Pain in TMJ</b>				
Women	144	13.8		
Men	58	6.4		
Total	202	10.4	28.699	$< .001$

**Table 2** TMD Diagnoses in the NFBC 1966 Study Group

Diagnosis	Women		Men		Total		$\chi^2$ value	<i>P</i> value
	n	%	n	%	n	%		
Myalgia	77	7.4	20	2.2	97	5.0	27.640	$< .001$
Arthralgia	85	8.2	18	2.0	103	5.3	36.453	$< .001$
Disc displacement with reduction	88	8.4	49	5.4	137	7.0	6.776	.009
Disc displacement without reduction	3	0.3	1	0.1	4	0.2		.628 <sup>a</sup>
Degenerative joint disease	66	6.3	34	3.7	100	5.1	6.637	.010

<sup>a</sup>Fisher's exact test.

A total of 1,895 subjects (95.5%) filled in Questionnaire 3 and attended the clinical stomatognathic examination, and the subjective TMD symptoms and clinical TMD signs of these subjects were collated (Fig 1).

The TMD diagnoses based on the modified DC/TMD protocol<sup>15</sup> were myalgia, arthralgia, disc displacement with reduction, disc displacement without reduction, and degenerative joint disease. The criteria for the subdiagnoses of TMD were:

- Myalgia: Reported pain in areas of the face, jaws, temples, ears, or behind the ears; pain modified by movement during the prior 30 days; and familiar pain in the masticatory muscles during jaw movements and/or pain on palpation (familiar pain) in any of the muscle sites
- Arthralgia: Reported pain in areas of the face, jaws, temples, ears, or behind the ears; pain modified by movement during the prior 30 days; and familiar pain

in the TMJ during jaw movement and/or pain on palpation in the right or left TMJ (around the lateral pole or laterally)

- Disc displacement with reduction: Reported history of clicking noises in the TMJ and TMJ clicking recorded by the examiner during opening and closing movements, or during opening or closing movements and in either protrusive or right/left lateral movement.
- Disc displacement without reduction: Self-reported jaw locking in closed position and restricted MAO
- Degenerative joint disease: Self-reported history of noises in the TMJ and TMJ crepitus recorded by the examiner

**Statistical Analyses**

Cross tabulation was used to analyze the association between gender and signs of TMD and TMD diagnoses based on a modified DC/TMD protocol.<sup>15</sup> Pearson's chi-square test and Fisher's exact test were used to evaluate differences between genders. *P* values less than .05 were considered to be statistically significant. The binary logistic regression models were used to analyze relationship between self-reported pain associated with TMD and modified DC/TMD diagnostics protocol. The data were analyzed by using the IBM SPSS Statistics version 22.0 and R software (version 3.1.2, R Foundation for Statistical Computing; <http://www.R-project.org/>).

**Results**

According to the self-reported screening question for pain-related TMD, 18.5% (n = 353) of the subjects reported positively, and 61.1% of those subjects (n = 215) had clinical signs of TMD (Fig 1). In the clinical examination, 27.8% (n = 429) of the subjectively symptom-free subjects were recorded as having signs of TMD (women 32.2%, men 23.6%).

The prevalence of TMD signs was 34.2% in this clinically examined study group (n = 1,962; women 40.8%, men 26.7%). The most common clinical signs of TMD were clicking in the TMJ (26.2%) and palpation pain in the masticatory muscles (11.2%) (Table 1). Women had clinical TMD signs statistically significantly (*P*  $< .05$ ) more often than men.

The most common TMD diagnosis was disc displacement with reduction (7.0%) (Table 2). Arthralgia, degenerative joint disease, and

**Table 3 Self-Reported Pain Associated with TMD in Relation to Modified DC/TMD Diagnostics Protocol<sup>15</sup> in the NFBC 1966 Study Group**

Question	Myalgia (%)	Arthralgia (%)	Disc displacement with reduction (%)	Disc displacement without reduction (%)	Degenerative joint disease (%)
Do you have pain in your temples, face, TMJ, or jaws once a week or more?					
Yes (13.5%)	20.9	22.2	14.7	0.4	11.5
No (86.5%)	2.2	2.5	6.1	0.2	4.2
Total (100.0%)	4.7	5.1	7.2	0.2	5.2
OR <sup>a</sup>	11.69	11.05	2.65	2.15	2.97
95% CI	(7.47, 18.30)	(7.17, 17.04)	(1.77, 3.97)	(0.22, 20.74)	(1.88, 4.69)
Do you have pain when you open your mouth wide or chew once a week or more?					
Yes (6.5%)	32.2	30.1	21.5	0.8	15.7
No (93.5%)	2.8	3.4	6.2	0.2	4.4
Total (100.0%)	4.7	5.0	7.2	0.2	5.1
OR <sup>a</sup>	16.65	12.17	4.14	4.85	4.07
95% CI	(10.35, 26.78)	(7.55, 19.61)	(2.57, 6.65)	(0.50, 47.01)	(2.37, 6.98)

<sup>a</sup>Odds ratio (OR) and 95% confidence interval (CI) values were calculated with binary logistic regression.

myalgia were diagnosed nearly as often (5.3%, 5.1%, and 5.0%, respectively). The frequency of these diagnoses was statistically significantly higher in women than in men, except for disc displacement without reduction. In women, the most common diagnoses were disc displacement with reduction (8.4%) and arthralgia (8.2%), and in men the most common diagnoses were disc displacement with reduction (5.4%) and degenerative joint disease (3.7%) (Table 2). Disc displacement without reduction was rare in both genders, being 0.3% in women and 0.1% in men, respectively (Table 2).

The self-reported pain-related symptoms were associated strongly with the DC/TMD diagnoses of myalgia and arthralgia (Table 3).

## Discussion

The prevalence of TMD signs among the 46-year-old NFBC subjects was 34.2%. The TMD symptoms reported by the subjects who were clinically examined were less frequent (18.5%) than the signs recorded in this group (61.1%). On the other hand, 27.8% of the subjectively symptom-free subjects had clinical signs of TMD. The results of this study confirm the association between self-reported pain and TMD, especially for myalgia and arthralgia.<sup>14,15</sup>

The prevalence of facial pain was analyzed in the previous NFBC study in 1997,<sup>13</sup> when the subjects were 31 years old. In the present study, the prevalence of TMD symptoms in areas of the face, jaws, temples, ears, or behind the ears was higher than 15 years before. However, it should be noted that in 1997 only pain in the face during the preceding year

was inquired in the questionnaire, while in the present study the question concerned pain in the face and also other areas (jaws, temples, ears, or behind ears) within the last 30 days.

The prevalence of TMD signs in these subjects seems to be at the same level as found in other recent population studies.<sup>11,16</sup> Women had clinical signs of TMD more often than men, especially pain in the masticatory muscles, and this is also in accordance with earlier studies, emphasizing that signs of TMD are more often related to the female gender<sup>17</sup> regardless of the age of the subject.<sup>3,5,9</sup> Overall, signs of TMD have been shown to be associated with age; the older the subject, the higher the prevalence of TMD signs.<sup>5,9</sup> Earlier studies have shown that patients between 20 and 50 years of age are the majority group seeking treatment for TMD<sup>4</sup>; however, when stratified by gender, the association with age has not been clear.<sup>9</sup>

The most common TMD diagnosis was disc displacement with reduction. In a systematic review by Manfredini et al,<sup>17</sup> it was also found at the general population level that disc displacement with reduction was the most common diagnosis, while in TMD patients myofascial pain with or without limited jaw opening scored the highest. It has been shown that diagnosis based on the DC/TMD has good validity for diagnosing myalgia and arthralgia, but lower validity for diagnosing disc displacements.<sup>16</sup> Definitive diagnosis of intra-articular disorders needs additional diagnostic methods such as magnetic resonance imaging,<sup>2</sup> which were not used here.

The TMD examination was conducted according to a modified DC/TMD protocol presented in a symposium at the IADR Conference in 2010<sup>15</sup> because

the recommended new evidence-based DC/TMD<sup>16</sup> was not yet available in 2012. Based on the clinical examination protocol and additional questionnaires, most of the diagnoses included in the DC/TMD Axis I diagnostic protocol were used, but there are some discrepancies between the methods used in the present study and the DC/TMD protocol. In this study, the locations of headaches, intermittent locking with limited opening, or extension of pain beyond the muscles (referred pain) were not registered. In addition, the Axis II protocol was not used.

The NFBC 1966 is a population-based cohort of subjects that has been screened several times during the subjects' lifetimes. The strengths of this study are the large study population ( $n = 1,962$ ) and the data collected by both questionnaires and clinical, medical, and dental examinations. The number of study subjects was larger than in other population-based and demographically similar studies concerning the prevalence of TMD.<sup>17</sup> The weakness of this study may be its cross-sectional study design, as the symptoms and signs of TMD were analyzed at one time point. No earlier comprehensive NFBC 1966 follow-up data related to TMD were available, but will be possible in follow-up studies.

Prospective cohort studies are needed because of significant financial costs and the need for resources in the health care system.<sup>18</sup> The influence of background factors (ie, general health) and occlusal characteristics on TMD symptoms and signs will be analyzed in subsequent studies.

## Conclusions

The prevalence of TMD signs was 34.2% in the Finnish population based on the NFBC 1966 cohort ( $n = 1,962$ ) in 46-year-old subjects. The most common clinical sign was clicking in the TMJ, and the most common diagnosis was disc displacement with reduction. The results are comparable with other corresponding adult population studies.

## Acknowledgments

The authors thank the late professor Paula Rantakallio (launch of NFBC 1966), the participants in the 46y study, and the NFBC project center. NFBC 1966 received financial support from University of Oulu Grant no. 24000692, Oulu University Hospital Grant no. 24301140, and ERDF European Regional Development Fund Grant no. 539/2010 A31592. The authors report no conflicts of interest.

## References

- Okeson JP (ed). *Orofacial Pain: Guidelines for Assessment, Diagnosis, and Management*. Chicago: Quintessence, 1996.
- Okeson JP. *Management of Temporomandibular Disorders and Occlusion*. St Louis: Elsevier, 2013.
- Kuttila M, Niemi PM, Kuttila S, Alanen P, Le Bell Y. TMD treatment need in relation to age, gender, stress, and diagnostic subgroup. *J Orofac Pain* 1998;12:67–74.
- Carlsson GE. Epidemiology and treatment need for temporomandibular disorders. *J Orofac Pain* 1999;13:232–237.
- Rutkiewicz T, Könönen M, Suominen-Taipale L, Nordblad A, Alanen P. Occurrence of clinical signs of temporomandibular disorders in adult Finns. *J Orofac Pain* 2006;20:208–217.
- Al-Jundi MA, John MT, Setz JM, Szentpétery A, Kuss O. Meta-analysis of treatment need for temporomandibular disorders in adult nonpatients. *J Orofac Pain* 2008;22:97–107.
- Anastassaki Köhler A, Hugoson A, Magnusson T. Prevalence of symptoms indicative of temporomandibular disorders in adults: Cross-sectional epidemiological investigations covering two decades. *Acta Odontol Scand* 2012;70:213–223.
- Yekkalam N, Wänman A. Prevalence of signs and symptoms indicative of temporomandibular disorders and headaches in 35-, 50-, 65- and 75-year-olds living in Västerbotten, Sweden. *Acta Odontol Scand* 2014;72:458–465.
- Slade GD, Bair E, Greenspan JD, et al. Signs and symptoms of first-onset TMD and sociodemographic predictors of its development: The OPPERA prospective cohort study. *J Pain* 2013;14(12, suppl):T20–T32.e1–3.
- Kindler S, Samietz S, Houshmand M, et al. Depressive and anxiety symptoms as risk factors for temporomandibular joint pain: A prospective cohort study in the general population. *J Pain* 2012;13:1188–1197.
- Progiante PS, Pattussi MP, Lawrence HP, Goya S, Grossi PK, Grossi ML. Prevalence of temporomandibular disorders in an adult Brazilian community population using the Research Diagnostic Criteria (Axes I and II) for temporomandibular disorders (the Maringá Study). *Int J Prosthodont* 2015;28:600–609.
- Rantakallio P. The longitudinal study of the northern Finland birth cohort of 1966. *Paediatr Perinat Epidemiol* 1988;2:59–88.
- Rauhala K, Oikarinen KS, Järvelin MR, Raustia AM. Facial pain and temporomandibular disorders: An epidemiological study of the Northern Finland 1966 Birth Cohort. *Cranio* 2000;18:40–46.
- Nilsson IM, List T, Drangsholt M. The reliability and validity of self-reported temporomandibular disorder pain in adolescents. *J Orofac Pain* 2006;20:138–144.
- Schiffman E. Diagnostic algorithms for TMJ disorders. Diagnostic Criteria for TMD (DC/TMD): A New Version of the RDC/TMD. *J Dent Res* 2010;89(Spec Iss B): no. 1954.
- Schiffman E, Ohrbach R, Truelove E, Look J, Anderson G, Goulet J-P et al. Diagnostic Criteria for Temporomandibular Disorders (DC/TMD) for Clinical and Research Applications: Recommendations of the International RDC/TMD Consortium Network and Orofacial Pain Special Interest Group. *J Oral Facial Pain Headache* 2014;28:6–27.
- Manfredini D, Guarda-Nardini L, Winocur E, Piccotti F, Ahlberg J, Lobbezoo F. Research Diagnostic Criteria for Temporomandibular Disorders: A systematic review of Axis I epidemiologic findings. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2011;112:453–462.
- Slade GD, Fillingim RB, Sanders AE, et al. Summary of findings from the OPPERA prospective cohort study of incidence of first-onset temporomandibular disorder: Implications and future directions. *J Pain* 2013;14(suppl):T116–T1124.