

Public health impact of TMD

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R03-DE022595



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Topics for this presentation

1. Descriptive epidemiology of TMD
 - Case-definition
 - Prevalence, incidence and natural history
2. Impact of TMD on quality of life and public health burden
 - Overlap of TMD and other chronic pain conditions
3. Risk factors for TMD
4. Healthcare for TMD
 - Treatments and health care providers
 - Barriers to care
5. Data sources and methodology
 - Classification systems

DC-TMD case-classification*

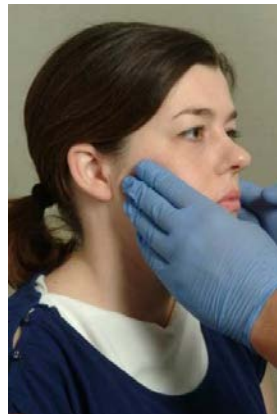
Clinical diagnosis of TMD myalgia or arthralgia requires history of symptoms and examiner-confirmation:

1. Patient's symptom history

- 1a. Pain in the jaw, temple, in the ear or in front of the ear, not including toothache or ear infection; AND
- 1b. The pain is modified with jaw movement, function or parafunction.

2. Examiner-confirmation of pain

- 2a. Confirmation that patient-reported location of symptoms is in temporalis, masseter, or TM joint(s); AND
- 2b. Pain is evoked during examination by patient's maximum jaw opening OR examiner-palpation of muscle(s)/joint(s)



* Schiffman E, et al. J Oral Facial Pain Headache. 2014 Winter;28(1):6-27.

Single item screening question

Clinical diagnosis of TMD myalgia or arthralgia requires history of symptoms and examiner-confirmation:

1. Patient's symptom history

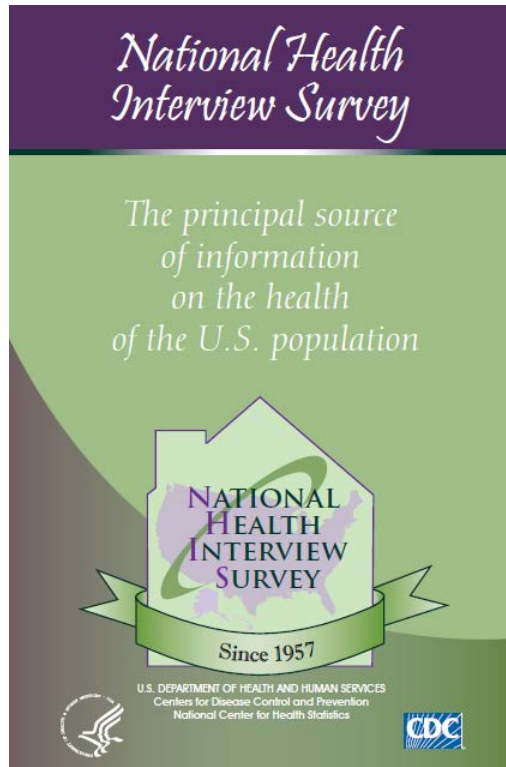
- Pain in the jaw, temple, in the ear or in front of the ear, not including toothache or ear infection. **Sensitivity = 42.7%, Specificity=94.7% compared to examiner-classification.**
- The pain is modified with jaw movement, function or parafunction.

2. Examiner-confirmation of pain

- Confirmation that patient-reported location of symptoms is in temporalis, masseter, or TM joint(s); AND
- Pain is evoked during examination by patient's maximum jaw opening OR examiner-palpation of muscle(s)/joint(s)



National Health Interview Survey



Conducted annually since 1957 by the
National Center for Health Statistics

Nationally-representative sample of
~100,000 people in ~40,000
households per annum

Approximately one hour face-to-face,
computer-assisted interviews by
trained personnel

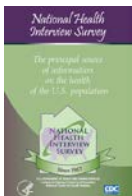
>85% response rate in recent decades



National Health Interview Survey

The following questions are about pain you may have experienced in the PAST THREE MONTHS. Please refer to pain that LASTED A WHOLE DAY OR MORE. Do not report aches and pains that are fleeting or minor.

During the PAST THREE MONTHS, did you have facial ache or pain in the jaw muscles or the joint in front of the ear?



US adults: facial ache or jaw pain

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Year	Prevalence	
	%	95% CL
1989*	6.0	5.7, 6.3
1999	4.3	4.0, 4.5
2009	5.1	4.7, 5.4
2017	4.4	4.0, 4.7

* In 1989, the reference period was SIX MONTHS

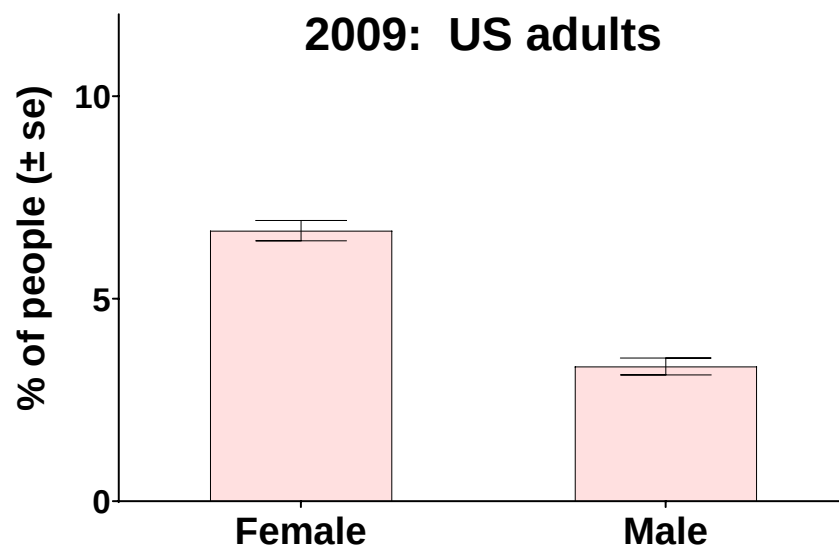
US adults: facial ache or jaw pain

The following questions are about pain you may have experienced in the PAST THREE MONTHS. Please refer to pain that LASTED A WHOLE DAY OR MORE. Do not report aches and pains that are fleeting or minor.

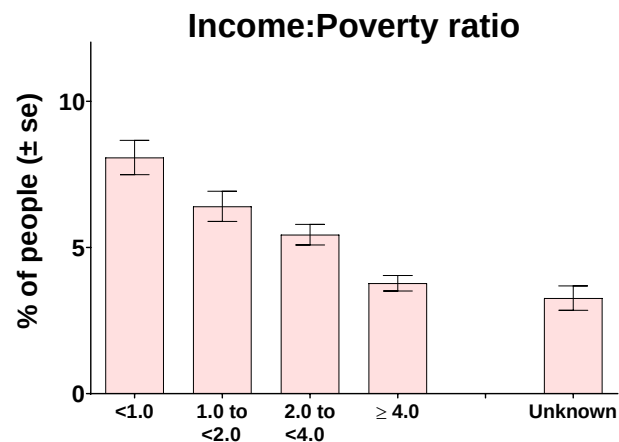
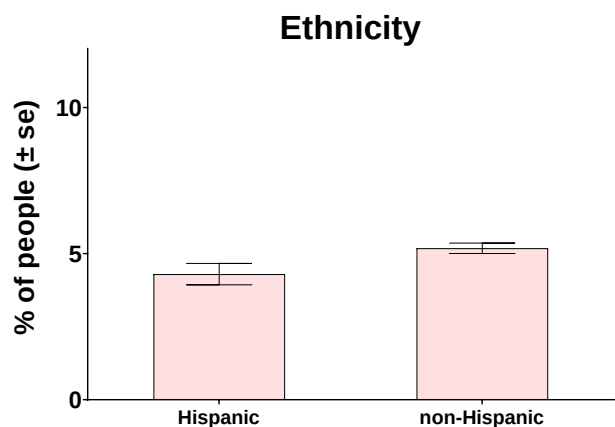
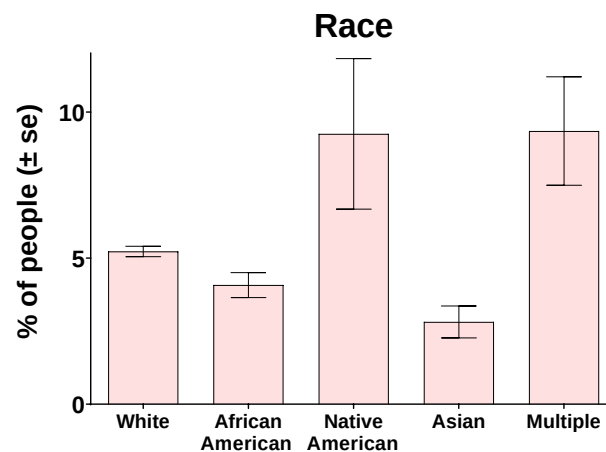
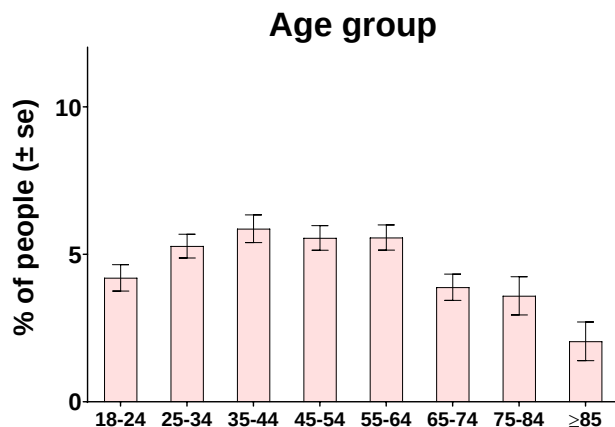
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* In 1989, the reference period was SIX MONTHS



US adults 2009: facial ache or jaw pain



Age x gender: cross-sectional

2009: cross-sectional

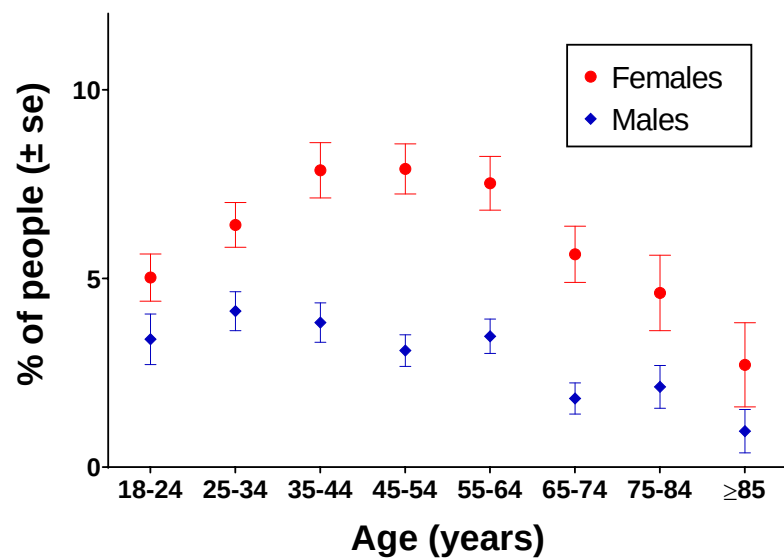


Figure 1 is a scatter plot with error bars showing the percentage of people (± se) versus Age (years) for Females (circles) and Males (diamonds). The y-axis ranges from 0 to 10, and the x-axis shows age groups from 18-24 to ≥85. Females generally have a higher percentage of people than males across most age groups, with both showing a slight decline in the oldest age groups.

Age (years)	Females (%)	Males (%)
18-24	~5.0	~3.5
25-34	~6.5	~4.2
35-44	~8.0	~3.8
45-54	~8.0	~3.2
55-64	~7.5	~3.5
65-74	~5.5	~1.8
75-84	~4.8	~2.2
≥85	~2.8	~1.0

[illegible]



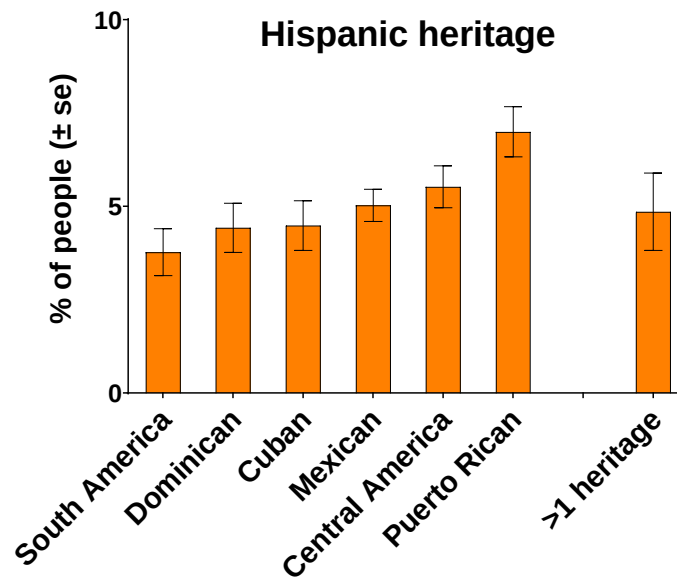
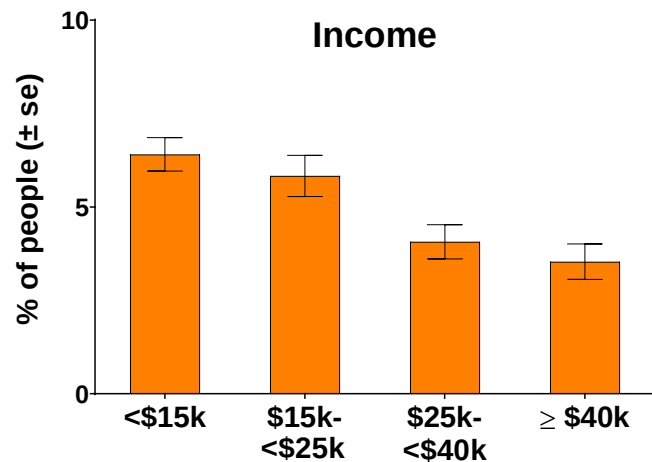
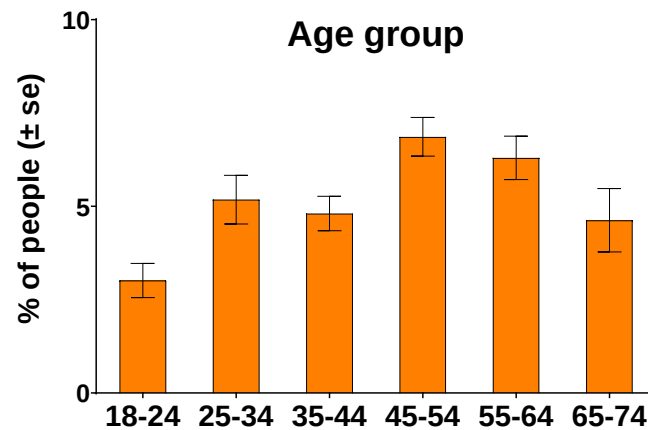
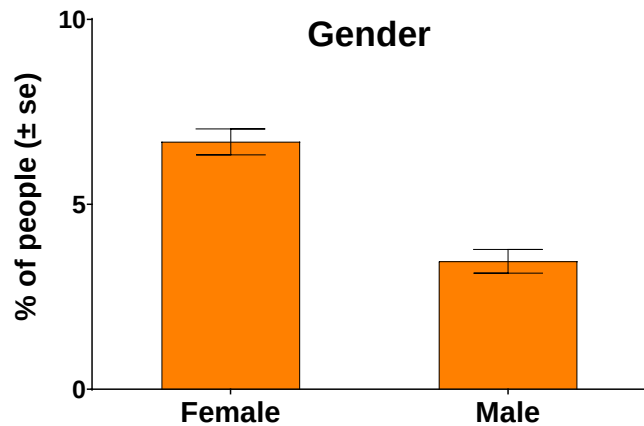
HCHS-Study of Latinos, 2008-2011

n=16,415 Hispanic/Latino participants aged 18–74 yrs at 4 U.S. study sites

In the past 12 months have you had or do you currently have:

- pain in your face?
 - pain in your jaw joint?
- } 5.1% (95%CL = 4.7, 5.5) reported both

HCHS: prevalence of face+jaw joint pain





OPPERA

Orofacial Pain: Prospective Evaluation and Risk Assessment
A Study of Muscle, Joint and Jaw Function

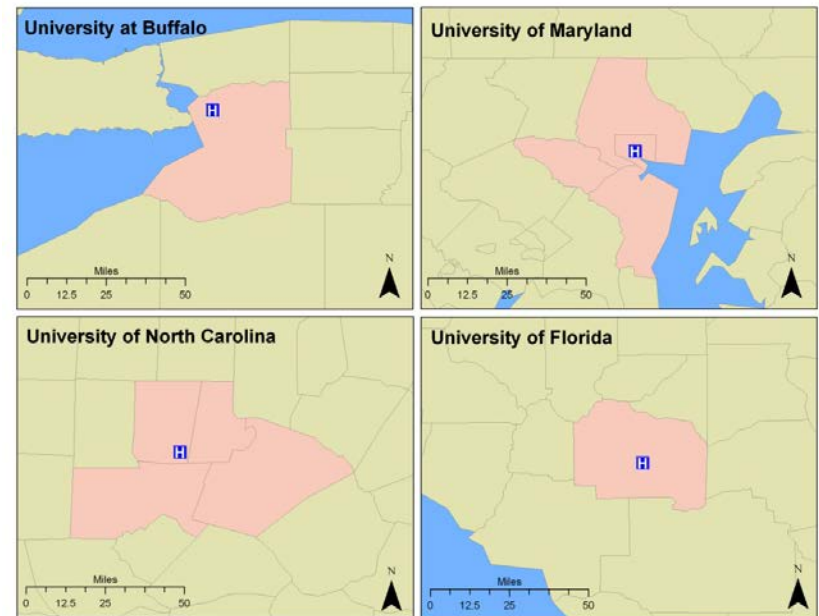
2006-08: community-based recruitment of 3,258 TMD-free volunteers

Enrollment at four U.S. study sites

- Participants aged 18-44 years
- No significant history of facial pain
- Absence of arthralgia/myalgia

n=2,737 followed for median 2.7 yrs

- Quarterly questionnaires; examination of people with TMD symptoms

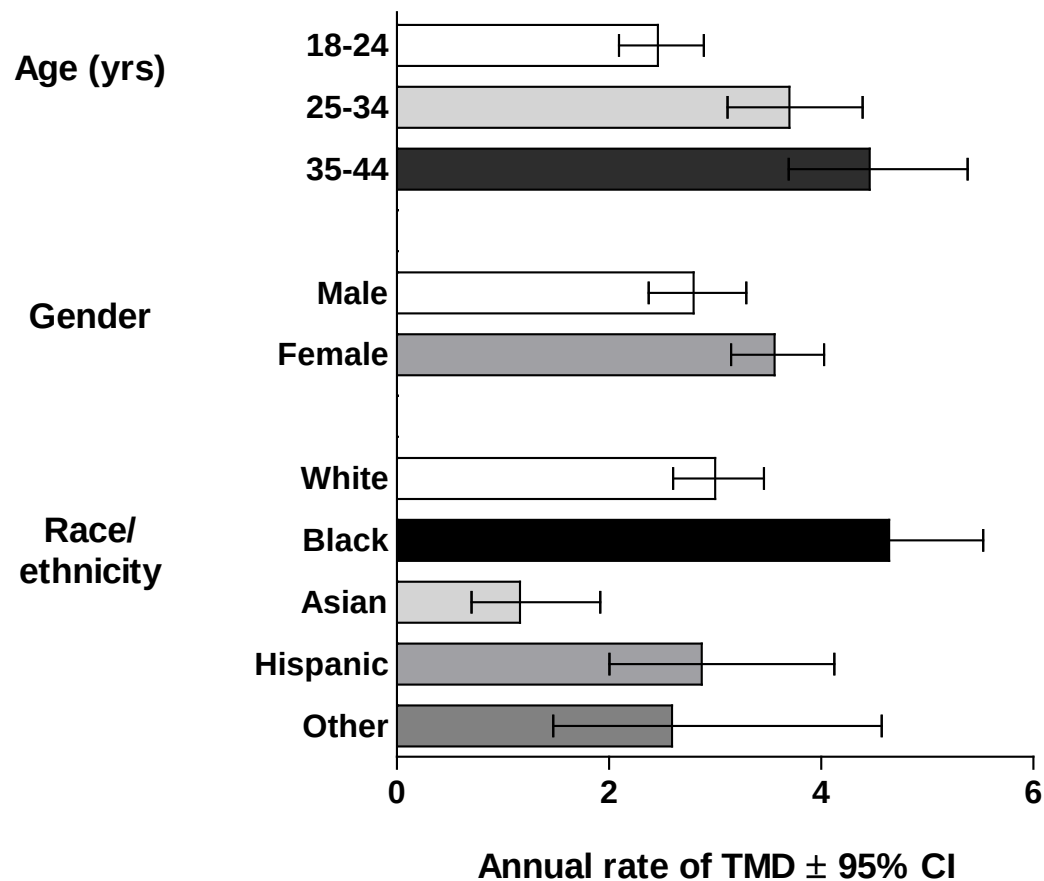


260 people developed clinical TMD

- Incidence rate = 3.5% of people per annum (95% CL = 3.2, 3.9)



Incidence of first-onset TMD





Development of persistent TMD

**N=147 people with first-onset TMD who were
re-examined six months later**

		% developing persistent TMD
All incident TMD cases		49.0%
Age (yrs)	18–24	53.7%
	25–34	55.6%
	35–44	37.5%
Gender	Male	40.7%
	Female	53.8%
Race/ ethnicity	White	61.4%
	Black/ African American	35.5%
	Other	46.7%



Factors predictive of persistent TMD

- ✓ Examination-evoked pain in masticatory muscles
- ✓ Examination-evoked pain in temporomandibular joint(s)
- ✓ Facial pain intensity
- ✓ Range of pain-free jaw opening
- ✓ General health conditions/symptoms

- ✗ Examination-assessed joint sounds
- ✗ Jaw functional limitation and jaw parafunction
- ✗ Depression, anxiety

Impact of TMD on quality of life and public health burden



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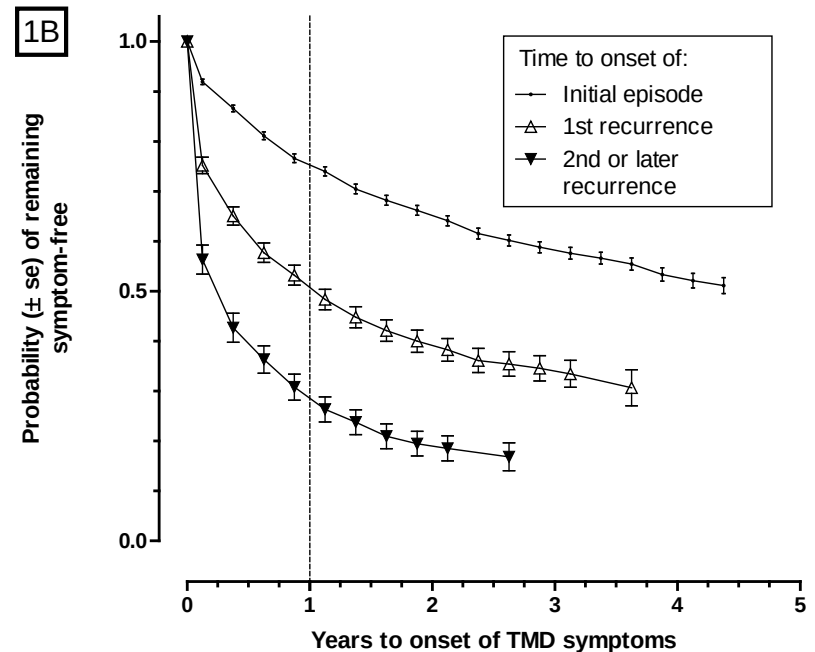


TMD “symptom iceberg”

During follow-up of initially symptom-free OPPERA subjects, one third reported one or more episodes of TMD symptoms, defined as ≥ 5 days of jaw/face pain per month.

Symptom rate = 19% of people per annum

- After each episode, recurrent symptoms developed at more than double that rate
- Pain intensity was severe for one quarter of symptom episodes
- 6% of participants developed three or more episodes of TMD symptoms





OPPERA

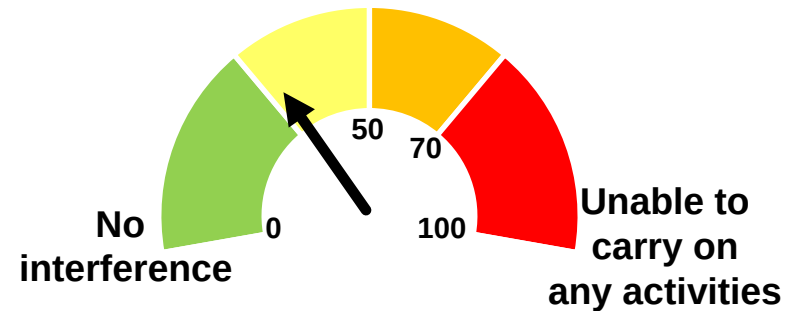
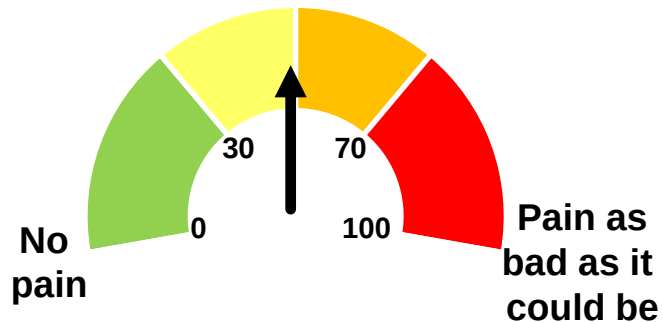
High impact TMD pain*

Graded Chronic Pain Scale[†] applied to TMD[‡]

**Pain intensity
≥ 50**

AND

**Pain-interference
≥ 30**



* Dahlhamer J, et al. *MMWR Morb Mortal Wkly Rep*. 2018 Sep 14;67(36):1001-1006.

† Von Korff M, et al. *Pain* 1992 Aug;50(2):133-49.

‡ Dworkin SF, et al. *J Orofac Pain* 2002 Winter;16(1):48-63.



High impact pain in chronic TMD

N=846 OPPERA-1 subjects with chronic TMD (≥6 months)

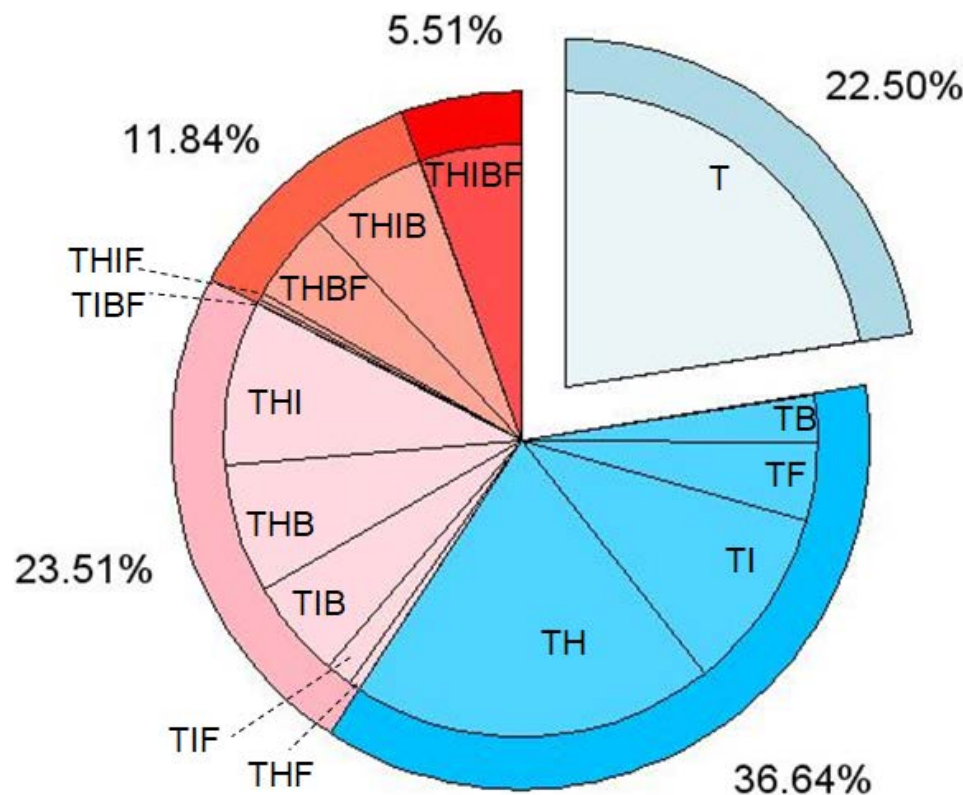
All chronic TMD cases		% with high impact pain
		33.5%
Age (yrs)	18–24	27.1%
	25–34	32.8%
	35–44	43.2%
Gender	Male	35.1%
	Female	33.0%
Race/ ethnicity	White	29.0%
	Black/ African American	59.2%
	Asian	23.7%
	Hispanic	32.1%
	Other	35.7%



OPPERA

Overlapping pains in chronic TMD

n=182 OPFERA-2 subjects with TMD



Pain condition

T TMD

H Headache

I Irritable Bowel Syndrome

B Low back pain

F Fibromyalgia

Number of overlapping conditions*



1



2



3



4



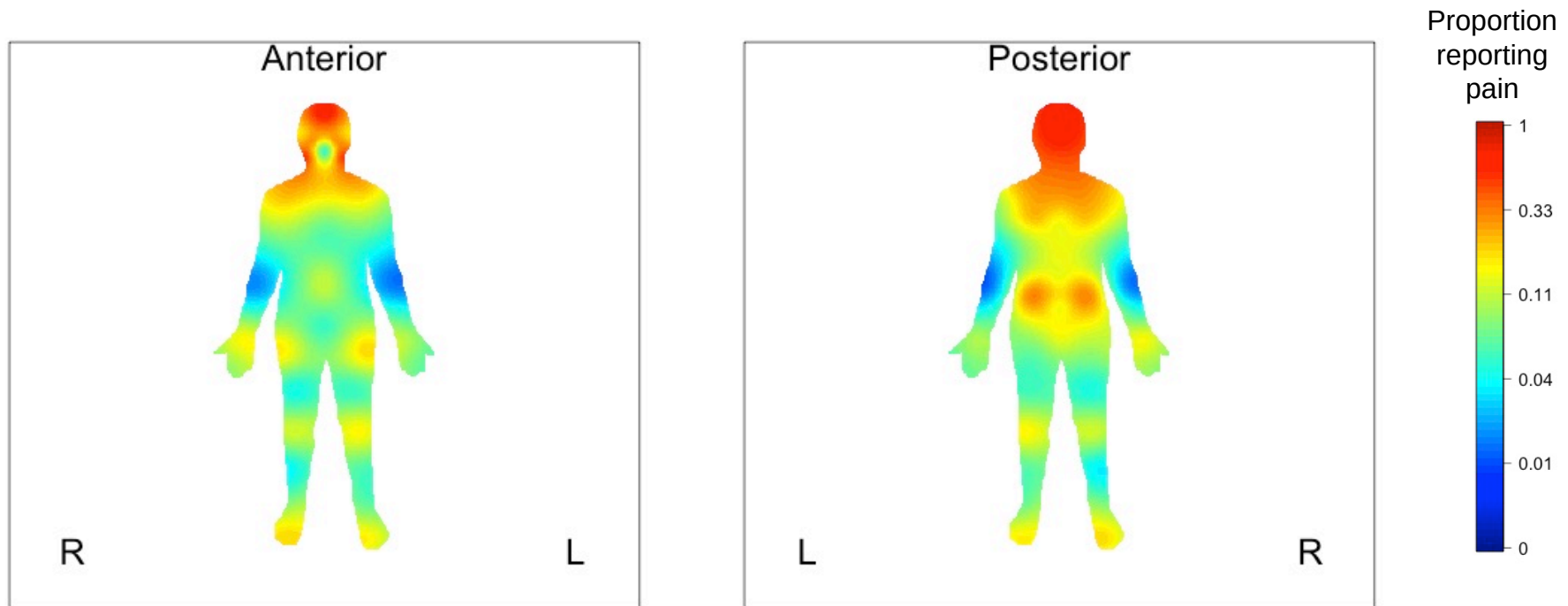
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OPPERA

Body pain in chronic TMD

n=182 OPPERA-2 subjects with TMD:
Pain lasting ≥ 1 day within last 3 months



Risk factors for TMD



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Clinical Review

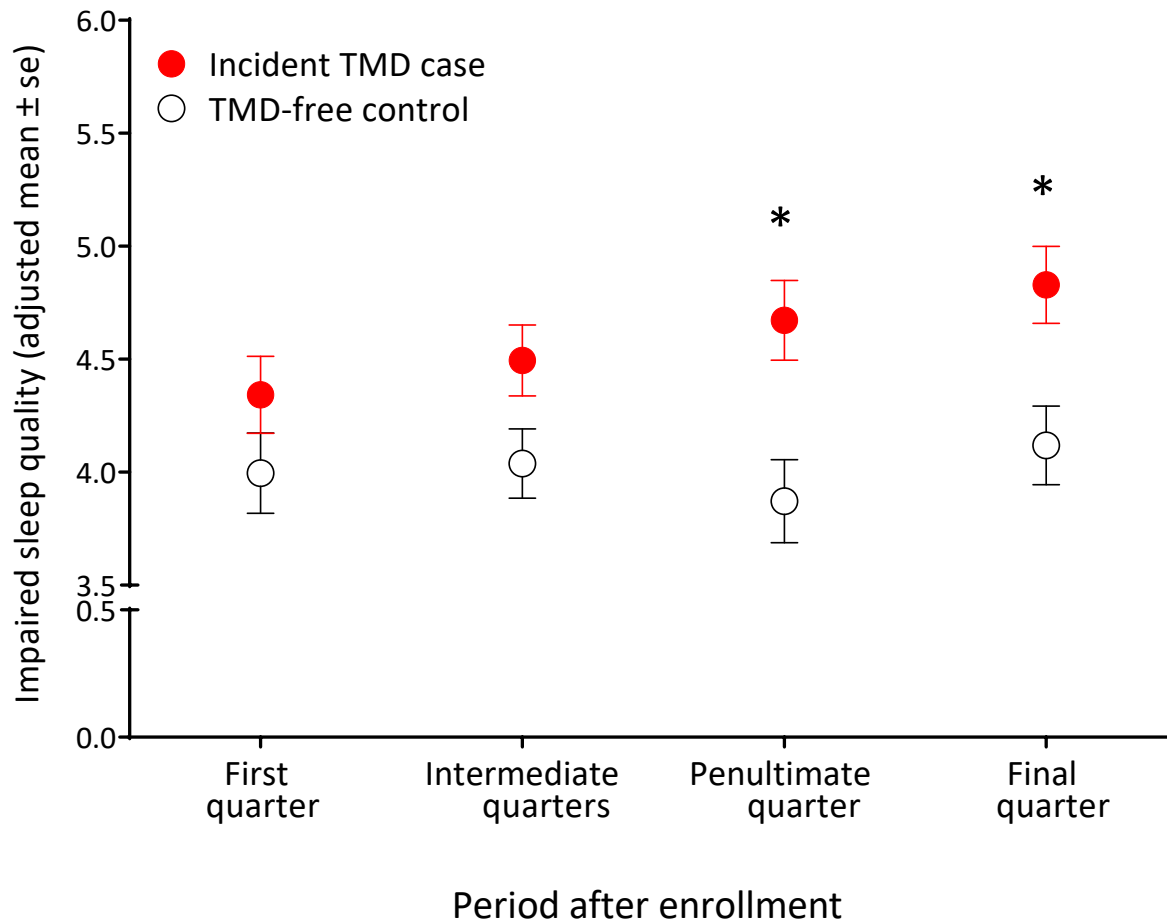
Painful Temporomandibular Disorder: Decade of Discovery from OPPERA Studies

Journal of Dental Research
2016, Vol. 95(10) 1084–1092
© International & American Associations
for Dental Research 2016
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sagepub.com/journalsPermissions.nav
DOI: 10.1177/0022034516653743
jdr.sagepub.com

- Somatic symptoms: *the strongest predictor of TMD incidence*
- Oral parafunction and TMJ derangements: *patients know best*
- Sleep and sleep breathing: *distinguishing chicken and egg*
- Pain thresholds: *a consequence of TMD, not a predictor of it*
- Psychological stress: *COMT genotype modifies effects of stress on TMD*
- Genetic associations: *SNPs and pathways of their combined effects*
- Comorbid conditions: *non-painful ones also matter*
- Putting it all together: *finding the forest...and clusters...among the trees*



Temporal sequence: sleep quality deteriorates prior to onset of TMD





COMT genotype x Stress interaction

Effect of psychological stress on TMD incidence



	Hazard ratio (95% CL)
All subjects	1.84 (1.42, 2.37)
Catechol- <i>O</i> -methyltransferase genotype	
Low-activity COMT	2.34 (1.65, 3.31)
High-activity COMT	1.41 (0.96, 2.07)



Heat pain sensitivity x Injury interaction

Effect of jaw/face injury on TMD incidence



All subjects

**Incidence odds
ratio (95% CL)**

4.2 (2.4, 7.4)

Heat pain sensitivity
at enrollment

Low

2.9 (1.2, 7.0)

Medium

4.6 (1.8, 11.8)

High

6.9 (2.1, 22.2)

Health care for TMD



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Treatments for first-onset TMD

Treatments for TMD from health care providers or other qualified professionals: 6-month follow-up of N=147 people with first-onset TMD

		% reporting treatment(s)			% reporting treatment(s)
All incident TMD cases		56.6%	Race/ ethnicity	White	59.1%
Age (yrs)	18–24	58.0%		Black/ African American	49.1%
	25–34	57.1%		Other	76.9%
	35–44	54.6%			
Gender	Male	41.7%	Clinical status at follow-up	Persistent TMD	72.7%
	Female	64.8%		Transient TMD	41.4%



Treatments for first-onset TMD

Treatments for TMD during 6-month follow-up reported by
≥10% of people with first-onset TMD

25%	Anti-inflammatory medication (e.g., aspirin)
19%	Counseling/advice
19%	Massage
19%	Evaluation
18%	Antibiotics
16%	Anti-depressant medication (e.g., amitriptyline)
15%	Mouth appliance
13%	Muscle relaxant medication (e.g., Robaxin)
12%	Analgesic medication (e.g., codeine)
11%	Yoga
11%	Physical therapy

MEPS Medical Expenditure Panel Survey

The screenshot shows the MEPS website homepage. At the top left is the MEPS logo. To its right is the title 'Medical Expenditure Panel Survey' in a blue serif font. Below the title are links for 'Contact MEPS', 'MEPS FAQ', and 'MEPS Site Map'. A search bar with the text 'Search MEPS' and a 'Go' button is also present. To the right of the search bar are font size options: 'S', 'M', 'L', and 'XL'. The main content area is divided into several sections. On the left is a vertical navigation menu with links like 'MEPS Home', 'About MEPS', 'Survey Background', 'Workshops & Events', 'Data Release Schedule', 'Survey Components', 'Household', 'Insurance/Employer', 'Medical Provider', 'Survey Questionnaires', 'Data and Statistics', 'Data Overview', 'MEPS Topics', 'Publications Search', 'Summary Data Tables', 'MEPSnet Query Tools', and 'Data Files'. The central part of the page contains a paragraph describing the survey: 'The Medical Expenditure Panel Survey (MEPS) is a set of large-scale surveys of families and individuals, their medical providers, and employers across the United States. MEPS is the most complete source of data on the cost and use of health care and health insurance coverage. [Learn more about MEPS.](#)'. Below this paragraph is a section titled 'MEPS Topics' with a grid of links including 'Access to Health Care', 'Children's Health', 'Children's Insurance Coverage', 'Elderly Health Care', 'Health Insurance', 'Medical Conditions', 'Medicare/Medicaid/SCHIP', 'Men's Health', 'Mental Health', 'Obesity', 'Prescription Drugs', 'Projected Data/Expenditures', 'Quality of Health Care', 'State and Metro Area Estimates', 'The Uninsured', and 'Women's Health'. On the right side of the main content area is a box titled 'Contact MEPS' with a sub-section 'New to MEPS?' and a list of links: 'Select a profile:', 'General user', 'Researcher', 'Policymaker', 'Media', and 'Survey participant'.

Conducted annually since 1996 by the Agency for Healthcare Research and Quality

Approximately 1:4 subsample of households that participated in the prior year's National Health Interview Survey

Household component collects information from household members and healthcare providers about use of health services, their cost, and source of payment

Insurance Component is a separate survey of employers concerning employer-based health insurance

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RESEARCH
EDUCATION
TREATMENT
ADVOCACY



The Journal of Pain, Vol 00, No 00 (), 2019: pp 1–14
Available online at www.jpain.org and www.sciencedirect.com

Original Reports

Eighteen-Year Trends in the Prevalence of, and Health Care Use for, Noncancer Pain in the United States: Data from the Medical Expenditure Panel Survey

Richard L. Nahin,* Bryan Sayer,[†] Barbara J. Stussman,* and Termeh M. Feinberg^{‡,§,¶}

Figure 1. Age-adjusted, 18-year trends in prevalence of painful health condition(s) in U.S. adults

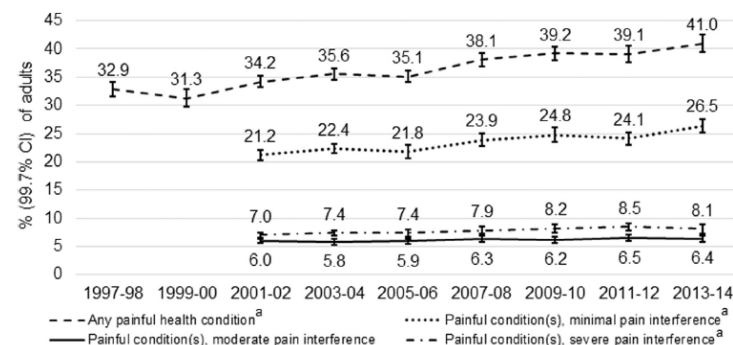
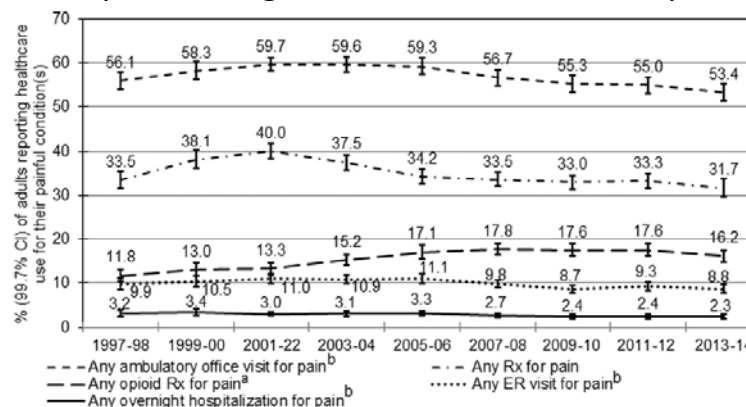


Figure 2. Age-adjusted 18-year adult trends in health care for pain management in U.S. adults with pain



Data sources and methodology



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MEPS Medical Expenditure Panel Survey

ICD-9 codes used by Nahin et al

CCC Code*	CONDITION
61	Sickle cell anemia
84	Headache, including migraine
102	Nonspecific chest pain
202	Rheumatoid arthritis and related disease
203	Osteoarthritis
204	Other nontraumatic joint disorders
205	Spondylosis, intervertebral disc disorders, other back problems


Medical Expenditure Panel Survey

[Contact MEPS](#)
[MEPS FAQ](#)
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[MEPS Home](#)

About MEPS

- Survey Background
- Workshops & Events
- Data Release Schedule

Survey Components

- Household

MEPS NHIS Link: 1996 - 2016 MEPS Link Files to NHIS

Release date: November 2018
 [printer-friendly](#)

All of the 1996-latest data year completed MEPS/NHIS link files are available through the data center. Each MEPS/NHIS link file contains a crosswalk that allows data users to merge MEPS Full-Year public use files (PUFs) to NHIS person-level public use data files that contain data collected for MEPS respondents in the year prior to

- [Notes on viewing and downloading files](#)
- [Printing tips](#)

For reasons of confidentiality, the MEPS/NHIS link files are available only through the [AHRQ Data Center](#). Additionally, qualified researchers can also access the MEPS/NHIS link files through the National Center for Health Statistics (NCHS) Data Center (RDC) network (<https://www.cdc.gov/nchs/nhis/nhismep.htm>), and the U.S. Census Research Data Center (RDC) network (<https://www.census.gov/ces/dataproducts/index.html>). Documentation for the latest data year MEPS/NHIS link file, however, is available in the online data files.

350.1	Chronic paronychia
350.1x	Trigeminal neuralgia
353.6x	Phantom limb pain
354.0x	Carpal tunnel syndrome
354.4x	Causalgia of the upper limb
355.7x	Other mononeuritis of the lower limb
356.xx	Hereditary and idiopathic peripheral neuropathy
357.xx	Inflammatory and toxic neuropathy

524.6 Temporomandibular joint disorder

564.1	Irritable bowel disorder
595.1	Chronic interstitial cystitis
601.1	Chronic prostatitis
625.7	Vulvodynia
625.9	Chronic pelvic pain
729.1	Fibromyalgia
729.2x	Neuralgia, neuritis, radiculitis
780.96	Generalized pain

Conclusions and future directions

TMD prevalence of 5% in U.S. adults has not changed in 30 yrs

- Marked inequalities according to age, gender, race/ethnicity and income
- Knowledge gaps: reasons for disparities by age, race, ethnicity and income
- Incidence of 3% per annum is the tip of a TMD “symptom iceberg” in the community
- 50% of people with first-onset TMD develop persistent symptoms

One third of people with chronic TMD have high-impact pain

- Chronic TMD is rarely an isolated pain condition

There are multiple risk factors for TMD that cluster and often interact

- Somatic symptoms, psychological distress, poor sleep, injury, pain sensitivity, genetics
- Knowledge gap: interactions of environmental and behavioral risk factors

During six months, 70% of people with persistent TMD sought professional care for it

- Diverse treatments, dominated by medication, advice, massage, oral appliances
- Knowledge gap: healthcare for TMD in the U.S. population

DC/TMD provides a rigorous, evidence-based framework for case-definition

- MEPS is a potentially rich source of information about TMD healthcare

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Supplementary slides



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N=846 OPPERA-1 subjects with chronic TMD (≥ 6 months)

- ✓ Pressure pain threshold at facial and non-facial sites
- ✓ Finger pinprick pain
- ✓ Jaw functional limitation and jaw parafunction
- ✓ Other (non-TMD) pain conditions
- ✓ Somatic symptoms
- ✓ Negative mood and catastrophizing

- ✗ Duration of TMD symptoms

International Classification of Diseases: ICD-9-CM

Diseases Of Oral Cavity, Salivary Glands, And Jaws 520-529 >

- 520 Disorders of tooth development and eruption
- 521 Diseases of hard tissues of teeth
- 522 Diseases of pulp and periapical tissues
- 523 Gingival and periodontal diseases
- 524 Dentofacial anomalies, including malocclusion
 - 525 Other diseases and conditions of the teeth and..... ▶ 524.6 Temporomandibular joint disorders
 - 526 Diseases of the jaws
 - ▶ 524.60 Temporomandibular joint disorders, unspecified
 - ▶ 524.61 Temporomandibular joint disorders, adhesions ar
 - ▶ 524.62 Temporomandibular joint disorders, arthralgia of
 - ▶ 524.63 Temporomandibular joint disorders, articular disc
 - ▶ 524.64 Temporomandibular joint sounds on opening and
 - ▶ 524.69 Other specified temporomandibular joint disorder

International Classification of Diseases: ICD-10-CM

2019 ICD-10-CM Codes

- **A00-B99** Certain infectious and parasitic diseases
- **C00-D49** Neoplasms
- **D50-D89** Diseases of the blood and blood-forming organs and certain disorders
- **E00-E89** Endocrine, nutritional and metabolic diseases
- **F01-F99** Mental, Behavioral and Neurodevelopmental disorders
- **G00-G99** Diseases of the nervous system
- **H00-H59** Diseases of the eye and adnexa
- **H60-H95** Diseases of the ear and mastoid process
- **I00-I99** Diseases of the circulatory system
- **J00-J99** Diseases of the respiratory system
- **K00-K95** Diseases of the digestive system
- **L00-L99** Diseases of the skin and subcutaneous tissue

• **M00-M99** Diseases of the musculoskeletal system and connective tissue

- **N00-N99** Diseases of the genitourinary system
- **O00-O9A** Pregnancy, childbirth and the puerperium
- **P00-P96** Certain conditions originating in the perinatal period
- **Q00-Q99** Congenital malformations, deformations and chromosomal abnormalities
- **R00-R99** Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified
- **S00-T88** Injury, poisoning and certain other consequences of external causes
- **V00-Y99** External causes of morbidity
- **Z00-Z99** Factors influencing health status and contact with health services

► **M26** Dentofacial anomalies [including malocclusion]

- **M26.6** Temporomandibular joint disorders
 - **M26.60** Temporomandibular joint disorder, unspecified
 - **M26.601** Right temporomandibular joint disorder, unspecified
 - **M26.602** Left temporomandibular joint disorder, unspecified
 - **M26.603** Bilateral temporomandibular joint disorder, unspecified
 - **M26.609** Unspecified temporomandibular joint disorder, unspecified side
 - **M26.61** Adhesions and ankylosis of temporomandibular joint
 - **M26.611** Adhesions and ankylosis of right temporomandibular joint
 - **M26.612** Adhesions and ankylosis of left temporomandibular joint
 - **M26.613** Adhesions and ankylosis of bilateral temporomandibular joint
 - **M26.619** unspecified side
 - **M26.62** Arthralgia of temporomandibular joint
 - **M26.621** Arthralgia of right temporomandibular joint
 - **M26.622** Arthralgia of left temporomandibular joint
 - **M26.623** Arthralgia of bilateral temporomandibular joint
 - **M26.629** unspecified side
 - **M26.63** Articular disc disorder of temporomandibular joint
 - **M26.631** Articular disc disorder of right temporomandibular joint
 - **M26.632** Articular disc disorder of left temporomandibular joint
 - **M26.633** Articular disc disorder of bilateral temporomandibular joint
 - **M26.639** unspecified side
 - **M26.69** Other specified disorders of temporomandibular joint
- **M79** Other and unspecified soft tissue disorders, not elsewhere classified
 - **M79.0** Rheumatism, unspecified
 - **M79.1** Myalgia

From: <https://www.icd10data.com/ICD10CM/Codes>, cited March 13, 2019

The IASP classification of chronic pain for *ICD-11*: chronic secondary headache or orofacial pain

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Table 1

List of primary and secondary headache and orofacial pain disorders with their *ICD-10* code if applicable.

Chronic primary headache or orofacial pain

Chronic migraine without or with aura (G43.3)

Chronic tension-type headache (G44.22)

Chronic trigeminal autonomic cephalalgias (TACs):

Chronic cluster headache (G44.02)

Chronic paroxysmal hemicranias (G44.04)

Short-lasting unilateral neuralgiform headache with conjunctival injection and tearing (SUNCT) (G44.05)

Hemicrania continua (G44.51)

Chronic primary temporomandibular disorder pains

Myalgia (M79.1)

Myofascial pain with referral

Arthralgia (M26.62)

Chronic burning mouth

Glossodynia (K14.6)

Chronic primary orofacial pain

Orofacial pain as a presentation of primary headaches

Persistent idiopathic dentoalveolar pain

Atypical facial pain (persistent idiopathic facial pain) (G50.1)