Public health impact of TMD

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UNC Adams School of Dentistry, Chapel Hill, NC.

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Washington DC, March 28, 2019
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R03-DE022595
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
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)

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
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

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?

<table>
<thead>
<tr>
<th>Year</th>
<th>%</th>
<th>95% CL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1989*</td>
<td>6.0</td>
<td>5.7, 6.3</td>
</tr>
<tr>
<td>1999</td>
<td>4.3</td>
<td>4.0, 4.5</td>
</tr>
<tr>
<td>2009</td>
<td>5.1</td>
<td>4.7, 5.4</td>
</tr>
<tr>
<td>2017</td>
<td>4.4</td>
<td>4.0, 4.7</td>
</tr>
</tbody>
</table>

* In 1989, the reference period was SIX MONTHS
US adults: facial ache or jaw pain

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<tr>
<td>2017</td>
<td>4.4</td>
<td>4.0, 4.7</td>
</tr>
</tbody>
</table>

* In 1989, the reference period was SIX MONTHS
US adults 2009: facial ache or jaw pain

2009: cross-sectional

% of people (± se)

Age (years)

Females

Males
Birth cohort analysis of aging effects

2009: cross-sectional

% of people (± se)

Age (years)

Females
Males

Females: 8 generations in 4 surveys

Decade of birth
- 1980s
- 1970s
- 1960s
- 1950s
- 1940s
- 1930s
- 1920s
- 1910s

% of people

Age (years) at time of NHIS interview
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

Gender

Age group

Income

Hispanic heritage

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

- Age (yrs):
  - 18-24
  - 25-34
  - 35-44

- Gender:
  - Male
  - Female

- Race/ethnicity:
  - White
  - Black
  - Asian
  - Hispanic
  - Other

Annual rate of TMD ± 95% CI
**Development of persistent TMD**

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

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

Meloto CB, et al. (submitted for publication)
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

Meloto CB, et al. (submitted for publication)
Impact of TMD on quality of life and public health burden
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
High impact TMD pain*

Graded Chronic Pain Scale† applied to TMD‡

Pain intensity
≥ 50

AND

No pain
0
30
70
100
Pain as bad as it could be

Pain-interference
≥ 30

No interference
0
50
70
100
Unable to carry on any activities

## High impact pain in chronic TMD

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

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

Overlapping pains in chronic TMD

n=182 OPPERA-2 subjects with TMD

Pain condition
T  TMD
H  Headache
I  Irritable Bowel Syndrome
B  Low back pain
F  Fibromyalgia
Body pain in chronic TMD

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

- 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

Effect of psychological stress on TMD incidence

Hazard ratio
(95% CL)

All subjects 1.84 (1.42, 2.37)

Catechol-O-methyltransferase genotype
Low-activity COMT 2.34 (1.65, 3.31)
High-activity COMT 1.41 (0.96, 2.07)

* Slade et al, J Dent Res. 2015 Sep;94(9):1187-95.
Heat pain sensitivity x Injury interaction

Effect of jaw/face injury on TMD incidence

<table>
<thead>
<tr>
<th>Heat pain sensitivity at enrollment</th>
<th>Incidence odds ratio (95% CL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>All subjects</td>
<td>4.2 (2.4, 7.4)</td>
</tr>
<tr>
<td>Low</td>
<td>2.9 (1.2, 7.0)</td>
</tr>
<tr>
<td>Medium</td>
<td>4.6 (1.8, 11.8)</td>
</tr>
<tr>
<td>High</td>
<td>6.9 (2.1, 22.2)</td>
</tr>
</tbody>
</table>

* Sharma S. PhD dissertation, 2018, University at Buffalo.
Health care for TMD
## 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

<table>
<thead>
<tr>
<th></th>
<th>% reporting treatment(s)</th>
<th>Race/ethnicity</th>
<th>% reporting treatment(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>All incident TMD cases</strong></td>
<td>56.6%</td>
<td>White</td>
<td>59.1%</td>
</tr>
<tr>
<td>Age (yrs)</td>
<td></td>
<td>Black/African American</td>
<td></td>
</tr>
<tr>
<td>18–24</td>
<td>58.0%</td>
<td>Other</td>
<td>76.9%</td>
</tr>
<tr>
<td>25–34</td>
<td>57.1%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>35–44</td>
<td>54.6%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>41.7%</td>
<td>Persistent TMD</td>
<td>72.7%</td>
</tr>
<tr>
<td>Female</td>
<td>64.8%</td>
<td>Transient TMD</td>
<td>41.4%</td>
</tr>
</tbody>
</table>

Clinical status at follow-up

- Persistent TMD
- Transient TMD
<table>
<thead>
<tr>
<th>Percentage</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>25%</td>
<td>Anti-inflammatory medication (e.g., aspirin)</td>
</tr>
<tr>
<td>19%</td>
<td>Counseling/advice</td>
</tr>
<tr>
<td>19%</td>
<td>Massage</td>
</tr>
<tr>
<td>19%</td>
<td>Evaluation</td>
</tr>
<tr>
<td>18%</td>
<td>Antibiotics</td>
</tr>
<tr>
<td>16%</td>
<td>Anti-depressant medication (e.g., amitriptyline)</td>
</tr>
<tr>
<td>15%</td>
<td>Mouth appliance</td>
</tr>
<tr>
<td>13%</td>
<td>Muscle relaxant medication (e.g., Robaxin)</td>
</tr>
<tr>
<td>12%</td>
<td>Analgesic medication (e.g., codeine)</td>
</tr>
<tr>
<td>11%</td>
<td>Yoga</td>
</tr>
<tr>
<td>11%</td>
<td>Physical therapy</td>
</tr>
</tbody>
</table>
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

From https://meps.ahrq.gov/mepsweb/ cited March 13, 2019
MEPS: trends in non-cancer pain

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
ICD-9 codes used by Nahin et al

<table>
<thead>
<tr>
<th>CCC Code</th>
<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>61</td>
<td>Sickle cell anemia</td>
</tr>
<tr>
<td>84</td>
<td>Headache, including migraine</td>
</tr>
<tr>
<td>102</td>
<td>Nonspecific chest pain</td>
</tr>
<tr>
<td>202</td>
<td>Rheumatoid arthritis and related disease</td>
</tr>
<tr>
<td>203</td>
<td>Osteoarthritis</td>
</tr>
<tr>
<td>204</td>
<td>Other nontraumatic joint disorders</td>
</tr>
<tr>
<td>205</td>
<td>Spondylosis, intervertebral disc disorders, other back problems</td>
</tr>
</tbody>
</table>

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.
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
References

Supplementary slides
Factors associated with high-impact TMD pain

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......
  - 526 Diseases of the jaws
  - 527 Diseases of the salivary glands
  - 528 Diseases of the oral soft tissues excluding lesion
  - 529 Diseases and other conditions of the tongue

- 524.6 Temporomandibular joint disorders
  - 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 disorders

International Classification of Diseases: ICD-10-CM

2019 ICD-10-CM Codes

- **M00-M99** Diseases of the musculoskeletal system and connective tissue
  - **M00-M99** Diseases of the genitourinary system
  - **C00-C99** 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-Z99** 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](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

Rafael Benoliel\(^a\), Peter Svensson\(^b\), Stefan Evers\(^c\), Shuu-Jiun Wang\(^d,\(^e\), Antonio Barke\(^f\), Beatrice Korwisi\(^f\), Winfried Rief\(^f\), Rolf-Detlef Treede\(^d,\(^e\), The IASP Taskforce for the Classification of Chronic Pain


| Table 1 |
| List of primary and secondary headache and orofacial pain disorders with their *ICD-10* code if applicable. |

<table>
<thead>
<tr>
<th>Chronic primary headache or orofacial pain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chronic migraine without or with aura (G43.3)</td>
</tr>
<tr>
<td>Chronic tension-type headache (G44.22)</td>
</tr>
<tr>
<td>Chronic trigeminal autonomic cephalalgias (TACs):</td>
</tr>
<tr>
<td>Chronic cluster headache (G44.02)</td>
</tr>
<tr>
<td>Chronic paroxysmal hemicranias (G44.04)</td>
</tr>
<tr>
<td>Short-lasting unilateral neuralgiform headache with conjunctival injection and tearing (SUNCT) (G44.05)</td>
</tr>
<tr>
<td>Hemicrania continua (G44.51)</td>
</tr>
</tbody>
</table>

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<thead>
<tr>
<th>Chronic primary temporomandibular disorder pains</th>
</tr>
</thead>
<tbody>
<tr>
<td>Myalgia (M79.1)</td>
</tr>
<tr>
<td>Myofascial pain with referral</td>
</tr>
<tr>
<td>Arthralgia (M26.62)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Chronic burning mouth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glossodynia (K14.6)</td>
</tr>
</tbody>
</table>

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<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Orofacial pain as a presentation of primary headaches</td>
</tr>
<tr>
<td>Persistent idiopathic dentoalveolar pain</td>
</tr>
<tr>
<td>Atypical facial pain (persistent idiopathic facial pain) (G50.1)</td>
</tr>
</tbody>
</table>