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COMMENTARY INTERPROFESSIONAL EDUCATION

Temporomandibular Disorders at a Crossroads: Meeting Summary

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ABSTRACT

Temporomandibular disorders (TMDs) present a complex challenge, impacting millions worldwide with limited progress in effective treatments and comprehensive care strategies. The 2023 “TMD at a Crossroads” meeting brought together experts to evaluate current efforts and propose actionable solutions aligned with the National Academies of Sciences, Engineering, and Medicine recommendations. Despite strides in research, education, and patient engagement, barriers persist, including insufficient funding, inadequate interprofessional collaboration, and limited access to specialized care. This commentary highlights key areas for advancement, including reframing TMD as a musculoskeletal condition to support translational research, expanding biologic therapeutics, and integrating TMD education into medical and dental curricula. Translational science is key in bridging the gap between foundational research and clinical practice, ensuring that scientific discoveries directly inform the development of effective treatments and care strategies. Patient engagement remains central, emphasizing the importance of incorporating diverse experiences into research and care to enhance outcomes. Proposed solutions include establishing Centers of Excellence, fostering interprofessional care, and leveraging funding opportunities to bridge critical gaps in TMD research and treatment. Our recommendations aim to build a robust framework that addresses TMD complexities, fosters collaboration across disciplines, and translates research findings into holistic, evidence-based care. With coordinated efforts, these initiatives can transform the landscape of TMD research and care, ultimately improving patient quality of life and advancing the field.

Keywords: Biologic Therapeutics, Interprofessional Education, Musculoskeletal Conditions, Patient Engagement, Temporomandibular Disorders, Translational Research

INTRODUCTION

On September 12, 2023, the Temporomandibular joint (TMJ) Association (TMJA), in collaboration with Medical Device Epidemiology Network (MDEpiNet), hosted a roundtable meeting to discuss the current status of temporomandibular disorder (TMD) initiatives. Grounded in the TMD Priorities for Research and Care set forth by the National Academies of Science, Engineering, and Medicine (NASEM),^[1] the primary goal was to provide an overview of existing TMD efforts, identify opportunities, and address barriers in TMD research, education, and care. This commentary outlines the following opportunities and proposed TMJ Patient-Led Roundtable considerations arising from meeting discussions, emphasizing their alignment with

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NASEM TMJ recommendations and the role of translational science in transforming these efforts into meaningful progress.

TMJ ORTHOPEDIC RESEARCH

The advancement of temporomandibular joint (TMJ) orthopedic research benefits from a pragmatic approach that involves framing TMJ disorders as musculoskeletal, orthopedic conditions. This strategy supports translational research and comprehensive education for all stakeholders, including patients, medical, dental, physical therapy students, the public, investigators, and third-party payers. Collaborative initiatives, exemplified by joint meetings like those with the Orthopedic Research Society, enhance scientific interactions.

Identified critical research opportunities spanned periprosthetic joint infection biofilm immunosuppression, periarticular heterotopic bone prevention, acoustic emission feedback for hardware, and multifunctional smart implants. Participants emphasized that progress may depend on surgeon proficiency, and noted that manufacturer-led credential reviews and cadaver-based training courses could help ensure proficiency by facilitating the use of these devices before providing access to their products, especially with joint replacement prostheses. These efforts collectively advance TMJ-related orthopedic research and care, address the complexities of this musculoskeletal unit and NASEM Recommendations 2, 3, and 4. The discussed potential solutions and their alignment with NASEM recommendations are summarized in Table 1.

BIOLOGICS - BEYOND MEDICAL DEVICES

The area of biologic therapeutics for TMD-related symptoms and comorbidities is emerging, as evidenced by the inclusion of Non-addictive Analgesic Therapeutics Development (Small Molecules and Biologics) in the Helping to End Addiction Long-term (HEAL) grant.^[2] Propelling biological advancements in this domain can benefit from dedicated research and collaborative efforts spanning several key areas. These areas include antibody research that explores proteins, amino acids, post-translational inflammation, and modifications, including isoforms and proteoforms, along with antibiotics targeting these newly formed proteins. Participants highlighted avenues such as tissue engineering and development of cell-based and Regenerative Medicine products as promising for transformative outcomes. These strategic opportunities align with NAM Recommendation 2.

The meeting participants discussed opportunities to broaden engagement across the Food and Drug Administration (FDA) Centers (i.e., Biologics and Devices) and collaboratively leverage National Institutes of Health (NIH) resources. In

addition, a comprehensive review of existing literature on patient management and potential TMD comorbidities is another important step in steering the trajectory of biologics research toward optimal outcomes.

INTERPROFESSIONAL EDUCATION (IPE) AND TRAINING

Discussions at the meeting on integrating TMJ and TMD education into medical and dental curricula emphasized the pressing need to include this type of comprehensive content that not only reviews existing knowledge but also provides insights into the challenges and opportunities in addressing this complex condition. The proposed curriculum should encompass essential elements such as the anatomy and physiology of TMJ, general awareness of TMD, and specific self-management skills beneficial for TMD patients. However, the legacy efforts to implement similar educational initiatives has encountered obstacles, primarily attributed to the discrepancy in the amount of time that has been allocated to the topic, versus the amount of time that may be necessary for such a complex condition.

The discussions highlighted the value of incorporating TMJ-related topics into both the didactic and practical training of medical and dental students. This exposure would include clinical correlations in basic science courses, case studies, interactions with standardized patients focusing on history and physical examinations, and increased exposure to differential diagnoses involving TMD. Recognizing the potential connections between TMD and other medical conditions is essential to enabling medical students to make informed referrals to specialists for comprehensive evaluations and practicing patient-centered care, potentially leading to proper treatments and, subsequently, enhanced management of jaw symptoms. Furthermore, given that TMD negatively affects quality of life, regardless of the specialty of the treating clinician, the need for empathy for the impact that pain and oral disability have on the patient is crucial.

It was noted that surgical experience lags in the training received by oral and maxillofacial (OMF) residents compared to orthopedic residents. Addressing this gap in training can include offering enhanced or additional training opportunities for OMF residents. For instance, OMF residents might benefit from attending and observing orthopedic joint surgeries, exposing them to relevant surgical approaches and enhancing their overall surgical proficiency.

The enhancement of interprofessional education (IPE) and training on TMJ and TMD presents a multifaceted challenge and opportunity. Key strategies may include a continuous and comprehensive review of learning objectives and desired outcomes to ensure long-term relevance to patient

Table 1: Identified opportunities and alignment with NAM recommendations.

	National Academies Recommendation Number										
	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11
TMJ orthopedic research											
Develop translational research and education material about TMJ framed as musculoskeletal orthopedic disorder		X	X	X							
Enhance scientific interactions between orthopedic and TMJ scientists		X	X	X							
Future research opportunities at the intersection of TMJ and orthopedics		X	X	X							
Engage the manufacturers of TMJ devices to review the surgical credentials of new customer surgeons		X	X	X							
Biologics											
Expand opportunities across FDA and NIH to build on biologics beyond traditional device therapeutics		X									
Review literature on patient management and/or other TMD comorbidities		X									
IPE and training											
Review learning objectives and outcomes desired and ensure that they include relevance to patient care long term								X	X		
Develop a comprehensive IPE and expand IPE to other disciplines								X	X		
Review assessment tools and improve yearly								X	X		
Promote and encourage faculty engagement in IPE from didactic to the clinic								X	X		
Expand this IPE topic to include pain management								X	X		
Engage the international community								X	X		
Best role for patients											
Analyze the impact of patients' negative encounters with dentists and other healthcare providers	X	X	X	X	X	X	X	X	X	X	X
Draft a list of therapeutic outcomes and their consequences for patients based on existing communications	X	X	X	X	X	X	X	X	X	X	X
Based on the developed list, identify gaps in knowledge transfer between science/research and daily practice	X	X	X	X	X	X	X	X	X	X	X
Raise awareness of the need for translational efforts	X	X	X	X	X	X	X	X	X	X	X
Engage patients who have undergone successful conservative and/or surgical management of their TMJ disorder	X	X	X	X	X	X	X	X	X	X	X
Opportunities for funding											
Launch of the TMD IMPACT Collaborative		X	X	X							
Leverage Blueprint and HEAL to build the pipeline of TMD investigators		X	X	X							
Focus Blueprint and HEAL investment in technology and device development as much as possible		X	X	X							
Increase NIDCR and appropriate sister NIH agencies awareness of and funding for TMJ-related projects		X	X	X							
Centers of excellence/specialized centers											
Continuously and comprehensively review the performance of the surgeons					X			X		X	
Support the development of an independent TMJ replacement registry					X			X		X	
Interprofessional care											
Encourage diversity of care providers in a multi-disciplinary approach to diagnosis and care								X	X	X	
Expand IPE to other disciplines								X	X	X	
Work with schools/organizations to develop a comprehensive IPE curriculum that extends to CE								X	X	X	
Establish implementation strategies								X	X	X	
Advance partnerships with key stakeholders								X	X	X	
NAM: National Academies of Science, Engineering, and Medicine, TMD: Temporomandibular disorders, CE: Continuing education, IPE: Interprofessional education TMJ: Temporomandibular joint, FDA: Food and drug administration, NIH: National institutes of health, HEAL: Helping to end addiction long term, NIDCR: National institute of dental and craniofacial research.											

care. Expanding IPE to other disciplines, such as pharmacy, physical therapy, nursing, and interprofessional practice, can lead to a more holistic understanding of TMJ and TMD. Advancing IPE involves periodic reviews of assessment tools, ensuring continuous improvements aligned with evolving educational needs. Advocacy for the inclusion of pain management in the IPE curriculum, now mandated for accreditation in dental schools^[3] and potentially others, can foster greater acceptance and interest in TMJ and TMD education. Additional steps discussed at the meeting were highlighting the need to continuously improve and enhance IPE education and training opportunities include sharing IPE curricula across educational institutions and continuing education (CE) courses, collaborating with other schools and organizations to develop a comprehensive IPE curriculum, and promoting faculty engagement in IPE from didactic to clinical levels. Ensuring the highest quality in educational materials, lectures, and hands-on experiences is paramount to the success of IPE initiatives.

The participants also discussed how incorporating patient-centered care models into medical and dental education early on enhances the ability of trainees and eventual healthcare providers to recognize and respond to the psychosocial dimensions of TMD. Given that many patients experience chronic pain and frustration due to the complexity of the condition, training healthcare providers to integrate empathy, active listening, and reassurance into their practice can significantly improve patient experiences. Customized care plans, interdisciplinary collaboration, and the promotion of emotional support beyond clinical treatment are essential components of patient-centered approaches. By ensuring that future healthcare professionals are equipped with these skills, IPE and CE initiatives can foster a generation of providers who prioritize patient trust, holistic care, and interprofessional teamwork in the management of TMD.

Finally, the participants highlighted that engaging the international community would add a global perspective, facilitating the exchange of best practices and diverse insights in TMJ and TMD education and treatment. Appropriate collaborative efforts on an international scale can contribute to the standardization of educational approaches, benefiting students, healthcare professionals, and, most importantly, patients globally. The improvement and expansion of IPE initiatives align with all NASEM recommendations.

OPTIMIZING THE ROLE FOR PATIENTS

A patient's perspective is not only invaluable but also integral to comprehending the nuances of TMJ experiences across the disease spectrum^[4] and addresses all NAM recommendations. Meeting discussion highlighted the value of a platform that captures the patient's voice and maximizes benefits for individuals and the broader TMD population.

To achieve this, a diverse range of patient experiences, from initial diagnosis to advanced cases, can be engaged to ensure a comprehensive understanding across the full spectrum of disease progression.

Engaging patients throughout the research process, from conceptualization to interpretation of findings, is foundational for meaningful, relevant, and robust research.^[5,6] Several proposed research ideas underscore the critical role of patient engagement, including conducting a patient outcomes study to scrutinize the impact of patients' negative encounters with dentists and other healthcare providers. In addition, drafting a list of therapeutic outcomes and consequences based on existing communications, comparing it with current knowledge, and identifying gaps in knowledge transfer between research and daily practice are essential steps. Furthermore, raising awareness of the need for translational efforts enhances the representation of patient experiences. Several proposed research ideas where patient engagement is critical and essential include a patient outcomes study that analyzes the impact of patients' negative encounters with dentists and other healthcare providers. Additional research ideas include drafting a list of therapeutic outcomes and consequences based on existing communications, comparing it with current knowledge, and identifying gaps in knowledge transfer between research and daily practice. Furthermore, raising awareness of the need for translational efforts enhances the representation of patient experiences.

Finally, it is imperative and highly beneficial to include patients who have successfully undergone conservative or surgical management of TMJ disorders in future roundtable sessions. The involvement of successful patients offers hope to prospective patients and showcases the ongoing commitment to education and research, ensuring continued success in managing TMJ conditions. These strategic involvements of patients contribute to a more comprehensive and impactful understanding of TMJ experiences, ultimately guiding improvements in research, education, and treatment.

OPPORTUNITIES FOR FUNDING

The current landscape of TMD Research and Registry development faces limitations in funding due to competition with research on general pain management interventions and larger joint systems. The National Academies emphasize the necessity for increased funding for TMDs from various NIH institutes and biomedical organizations to address existing research gaps and develop safe, effective treatments.^[7] This is further emphasized through the NASEM Recommendations 2, 3, and 4. Proposed strategies discussed at the meeting to bolster TMD research funding include launching the TMD IMPACT Collaborative,^[8] leveraging Blueprint and HEAL initiatives to cultivate a robust pipeline of TMD

investigators, and directing Blueprint and HEAL investment toward technology and device development. Raising awareness among federal agencies for projects investigating the impact of TMJ implantable device material wear on tissue biology is important for enhancing materials, design, and manufacturing. Federal agencies should also consider funding translational work at universities, focusing on biologics and cell therapies specific to the TMJ. Additionally there's a need for increased research funding to compare findings between the TMJ and other joints, such as the knee, covering tissue pathophysiology, pain, tissue degeneration, and healing.

CENTERS OF EXCELLENCE/SPECIALIZED CENTERS

Patients experiencing TMJ-related issues often struggle to identify specialists with expertise in both TMJ and TMD progression. This results in patients seeking advice from multiple providers from various disciplines. In the absence of a single-payer healthcare system in the US, the suggestions discussed at the meeting included to develop strategic approaches to cultivating specialized expertise by: strengthening advanced training opportunities; establishing interdisciplinary "Centers of Excellence" for TMJ; or increasing the support of the development of an independent TMD/TMJ patient registry are strategic approaches to cultivating specialized expertise and addressing NASEM recommendations 5, 8, and 10. Furthermore, promoting data sharing across professional specialties could enhance communication and therapeutic options compared to traditional disparate care systems. Establishing these centers of excellence and interoperable data systems requires continuous and comprehensive reviews of surgeons' performance using a quality assurance approach, including established consultant surgeon monitors.

INTERPROFESSIONAL CARE AND THE ROLE OF PROVIDER EMPATHY IN TMD MANAGEMENT

In the absence of specialized centers, discussions noted that the coordination of medical and dental care for patients is often left to individual providers. Given the multifactorial nature of TMD, with its psychological and emotional components, the conversations emphasized the role that interprofessional care can play in supporting comprehensive management. In line with the National Academy of Medicine (NASEM) recommendations 8, 9, and 10, participants highlighted that collaboration among healthcare professionals, including dentists, physicians, physical therapists, and mental health specialists, has the potential to improve diagnostic accuracy and treatment outcomes. Documenting the challenges and barriers to interdisciplinary

coordination was described as a valuable way to refine communication strategies and strengthen patient care.

The discussions also underscored that patient-provider communication, empathy, and psychosocial support are central aspects of managing TMD. Many patients face chronic pain and frustration due to the complexity of the condition, which can be difficult to diagnose or treat. Establishing strong therapeutic relationships, providing emotional support, and demonstrating empathy were described as strategies that may improve patient satisfaction and outcomes. Suggestions included active listening, addressing patient concerns about pain, and offering reassurance, alongside care plans tailored to individual needs. Such approaches, paired with consistent and compassionate communication, were viewed as ways to build trust and support long-term adherence to treatment.

Enhancing interprofessional care was also linked to the promotion of Interprofessional Education (IPE), Continuing Education (CE), and the development of implementation strategies that encourage collaboration across specialties. Building partnerships with key stakeholders, such as Educational and Professional Associations, was seen as important in facilitating clinical practice and preparing providers and trainees to integrate patient-centered models of care. Recognizing the value of interprofessional collaboration was described as a step toward better pain management, improved treatment outcomes, and stronger support for the psychosocial well-being of TMD patients.

CONCLUSION AND IMPLICATIONS FOR TRANSLATION

This roundtable meeting marks a significant step toward enhancing TMD research, education, and care. The outlined opportunities and their alignment with the NASEM recommendations provide a set of patient-led considerations for strengthening TMD relief initiatives. Collectively, these seven opportunities for advancement of TMJ and TMD priorities outline a novel, multidimensional approach. The meeting discussions suggest that adherence to NASEM recommendations and leveraging the identified opportunities could help stakeholders mobilize resources effectively and foster collaborative efforts that promise to transform TMD research, education, and care. Central to this effort is the role of translational science, which bridges the gap between foundational research and clinical application. By translating research findings into actionable treatments, innovative educational programs, and patient-centered care models, this approach ensures that scientific advancements lead directly to measurable improvements in patient outcomes. This collaborative and translational approach holds the potential to significantly improve the quality of life for individuals affected by TMJ disorders, marking a crucial milestone in the ongoing pursuit of enhanced TMD relief initiatives.

Key Messages

1) Interdisciplinary collaboration and increased funding are critical to advancing TMD research and improving patient care. 2) It is important for patient engagement to remain central to research and care strategies, ensuring various perspectives and experiences guide health outcomes. 3) Potentially establishing centers of excellence and integrating TMD education into medical and dental curricula are essential steps to address gaps in knowledge and treatment.

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COMPLIANCE WITH ETHICAL STANDARDS

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