



**3RD ANNUAL
POSTER
SYMPOSIUM
2024**

June 22 & 23



Table of Contents

Basic Research	5
Activity of prefrontal cortex serotonin 2A receptor expressing neurons is necessary for the head-twitch response of mice to psychedelic drug DOI in a sex-dependent manner.....	6
Direct Comparison of Orthopaedic and Neurosurgical Residency Applicants’ Research Productivity During Medical School	7
Identification of Stratifin as a Potential Biomarker for Oral Cancer Progression	9
Treatment Utilization for Substance Use Disorders Among LGBTQ+ Youth: A Scoping Review.....	10
Behavioral induction of ALDH1A2 and EGR1 expression in the zebra finch vocal circuit	12
Examining the Relationship Between Gaseous Microemboli and Platelet Activation While on In Vitro Cardiopulmonary Bypass.....	13
On the Evolution of the Paranasal Sinuses: A Darwinian Approach to Explaining Purpose.....	15
Clinical Research.....	17
A Retrospective Comparison of Radiological Imaging of Disseminated Coccidioidomycosis in Multiple High-Risk Groups.....	18
Case Study of Catamenial Pneumothorax with Surgical and Medical Treatment.....	20
Comparing Patient Communication Event Demand for External Ring Fixators to Other Common Foot and Ankle Orthopedic Procedures	21
Correlation of Shoe Wear Patterns and Weight Bearing Radiographs	22
Dacryocystorhinostomy Outcomes for Congenital Nasolacrimal Duct Obstruction Associated with Craniofacial Abnormalities	24
Differences in Publications Authored by Successful Neurosurgical Residency Applicants Across Medical Degree and Medical Schools’ NIH Funding	25
Social Needs of Children with Medical Complexity and Inpatient Care Utilization	27
The Quality of Chatbot Responses Related to Peyronie’s Disease.....	29
Availability of Ulipristal Acetate as Emergency Contraception in Rural vs Urban Pharmacies in Arizona.....	31
Missed Connections: Unraveling the Overlooked Diagnosis of Antiphospholipid Syndrome in Lupus Patients - A Critical Case Study.....	32
Rural Health Realities: Observing Disparities in Rectal Cancer Care within Rural Health Settings	33
Clinical Vignette.....	35
A Case on The Role of Socioeconomic Variables in Multifaceted Illness: Strongyloidiasis, Mastocytosis, and Acute Kidney Injury	36
A Rare Case of Necrotizing Myopathy with Immune Checkpoint Inhibitor Therapy	38
An Atypical Presentation of Viral Myocarditis Masquerading as NSTEMI	39
An Uncommon Convergence: Ankylosing Spondylitis Co-Occurring with Henoch-Schönlein Purpura in an Adult Male	41

An Unexpected Discovery: A Suspicious Duodenal Mass Revealed as Burkitt Lymphoma.....	42
Challenges of Imiquimod in Lentigo Maligna: A Case Report	44
Diagnosis of MGUS Alongside Monoclonal Antibody Administration.....	46
Dual chamber pacemaker implantation for complete heart block in a patient with calcinosis cutis in the setting of limited cutaneous scleroderma.....	48
Mycobacterium Tuberculosis Implicated in Formation of a Rectal Abscess: A Case Study	49
Post-transplant lymphoproliferative disorder presenting a patient five years status post renal transplant, A case report.....	50
Presentation of Paraneoplastic Cerebellar Degeneration in a Patient with Anti-YO Antibodies.....	51
Resolution of Central Sleep Apnea Following Upper Airway Surgery	53
Sebaceous Carcinoma In A Patient With The I1307k Variant Of Attenuated Familial Adenomatous Polyposis	54
SOS1-Related Noonan Syndrome and Sudden Cardiac Arrest in the Absence of Cardiomyopathy – An Arrhythmia Phenotype?	55
Successful Treatment of Refractory Cholinergic Urticaria with Scheduled Sublingual Cannabinoid Therapy:57	
A Congenital Problem Detected in Adulthood: A Case of a Morgagni Hernia	59
Severe Acute Inflammatory State of Pancreatitis: Contributory and Causation for Pulmonary Embolism....	61
A Clinical Vignette: Overcoming Diagnostic Challenges in Autoimmune Encephalitis	63
Evaluating The Potential Use of Wearable Fitness Devices as a Measure of Outcomes in Orthopaedics.....	65
Addressing dysphagia in Hepatocellular Carcinoma Metastasis: A Radiation Oncology Perspective	66
Health Policy/Medical Education	67
A Bibliometric Analysis of Female Authorship in the Top 100 Most Influential Orthopedic Publications.....	68
A lack of difference between female and osteopathic physicians on the editorial boards of primary care, surgical subspecialty, and medical subspecialty journals.	70
Analysis of Common Patient-Directed Web Queries and Online Website Quality for Hip Fractures.....	72
Analysis of Racial, Ethnic, and Gender Trends in Foot and Ankle Fellowships from 2007 to 2022	74
Assessing Online Patient Information for Mohs Surgery: A Comparative Study of Classification Models	76
Disparities in Industry Payments to Pediatric Orthopedic Surgeons: A 2022 Medicare Database Study.....	78
Distribution of Osteopathic Residents in Orthopedic Surgery by Region and Program Setting	79
Examining Health Equity in Online Patient Resources for Pediatric Skull Fractures: An Analysis of Readability and Quality	81
First Year Medical Students' Views on Orthopedic Surgery as a Specialty Across Gender	83
Geographical Variation in Utilization, Surgeon Reimbursement, and Patient Characteristics for Common Hand Surgeries from 2013 to 2021: A Temporal Analysis.....	84

Impact of an Orthopaedic Surgeon Instructor During a Cadaveric Anatomy Course on First-year Medical Student Interest in Surgery	85
Efficacy and Medical Student Perception of the Learning Environment with Peer versus Physician Led Ultrasound Instruction	86
Genesis of Desire for Medicine Amongst Pre-Collegiate Students	87
Representation of Females and Osteopathic Physicians as Editors on Editorial Boards from the Seven Core Osteopathic Rotations	89
Regional Differences in Women Representation in Orthopedic Surgery	90

BASIC RESEARCH

Implies the use of scientific method to derive original data in the laboratory.

Activity of prefrontal cortex serotonin 2A receptor expressing neurons is necessary for the head-twitch response of mice to psychedelic drug DOI in a sex-dependent manner

Authors: Ozols A.B., Wei J., Campbell J.M., Hu C.2, Qiu S., Gallitano A.L.

Affiliations: Department of Basic Medical Sciences, University of Arizona College of Medicine – Phoenix, 425 N. 5th St., Phoenix, AZ, 85004

Introduction: Serotonin 2A receptors (5-HT_{2A}R) mediate the effects of psychedelic drugs. 5-HT_{2A}R agonists, such as (-)-2,5-dimethoxy-4-iodoamphetamine hydrochloride (DOI), that produce a psychedelic experience in humans induce a head-twitch response (HTR) behavior in rodents. However, it is unknown whether the activity of 5-HT_{2A}R expressing neurons is sufficient to produce the HTR in the absence of an agonist, or in which brain region 5-HT_{2A}R control the HTR. Here, we use an optogenetic approach to examine whether activation of 5-HT_{2A}R expressing neurons in the mouse prefrontal cortex (PFC) is sufficient to induce HTRs alone, or may augment the HTR produced by DOI, and if inhibition of these neurons prevents DOI-induced HTRs in mice.

Methods: We crossed Htr2a-Cre mice to Cre-dependent optogenetic lines Ai32 (channelrhodopsin) and Ai39 (halorhodopsin) to selectively activate and inhibit (respectively) 5-HT_{2A}R-expressing neurons in the PFC of adult mice. Function was validated by whole cell patch clamp recordings performed on cortical slices from Ai32^{+/-};Htr2a-Cre^{+/-} and Ai39^{+/-};Htr2a-Cre^{+/-} mice, confirming that blue (470nm) and yellow (590nm) light activated and inhibited 5-HT_{2A}R⁺ cells, respectively. Next, fiber optic cannulae were implanted bilaterally into the PFC of male and female Ai32^{+/-};Htr2a-Cre^{+/-} vs. Ai32^{+/-};Htr2a-Cre^{-/-} and Ai39^{+/-};Htr2a-Cre^{+/-} vs. Ai39^{+/-};Htr2a-Cre^{-/-} mice. Immediately after administration of either DOI (0.1, 0.3, 1mg/kg, i.p.) or vehicle, mice were placed into an automated HTR apparatus and monitored for 30 minutes. For optogenetic stimulation, Ai32⁺ mice received 5 ms pulses of blue light delivered at 10 Hz, 5sec on/5sec off and Ai39⁺ mice received continuous yellow light, for the full recording session. Automated HTRs from the latter 15 minute period were analyzed.

Results: We found that optogenetic stimulation of PFC 5-HT_{2A}R expressing neurons in the absence of an agonist does not increase HTRs in mice. In both male and female Ai32 mice that received vehicle, there was no difference in HTRs in mice that expressed Htr2a-Cre compared with control mice, indicating that optogenetic activation of 5-HT_{2A}R⁺ cells in the PFC was not sufficient to produce HTRs in the absence of an agonist. In female mice, activation of PFC 5-HT_{2A}R expressing neurons augmented the HTR produced by DOI. However, this result was not seen in male mice. In contrast, inhibition of 5-HT_{2A}R expressing neurons in the PFC prevented the increase in HTR produced by DOI in male, but not in female, mice.

Discussion: Together, these findings suggest that activation of 5-HT_{2A}R in the PFC is not sufficient to induce HTRs in the absence of a 5-HT_{2A}R agonist but is necessary for induction of HTRs by a 5-HT_{2A}R agonist in a sex-dependent manner.

Direct Comparison of Orthopaedic and Neurosurgical Residency Applicants' Research Productivity During Medical School

Authors: Mason Kyle, Elliot Jensen, Alexandria McGuire, Matthew Dufault, Timothy Glass, John Ashurst

Affiliation(s): Midwestern University, Arizona College of Osteopathic Medicine

Introduction: Aspiring applicants for orthopaedic surgery and neurosurgery residency programs are increasingly encouraged to engage in research within their desired specialty to gain a competitive edge in the residency match. The 2022 neurosurgery match demonstrated an average of 25.5 research items for successful allopathic applicants and 32.6 research items for successful osteopathic applicants. In contrast, successful orthopaedic applicants demonstrated 16.5 and 7 research items for successful allopathic and osteopathic applicants, respectively.^{1,2} With the inclusion of abstracts and presentations in the metrics for tallying research items, it is a common strategy for applicants to produce multiple research items from one project. This study aims to determine only the number of peer-reviewed publications authored by applicants to generate a more accurate representation of the research involvement required to match into these two specialties.

Methods: A retrospective analysis of US osteopathic and allopathic neurosurgery and orthopaedic residents who matriculated into residency during 2017 (neurosurgery only), 2019, 2021, and 2023 was conducted. Residency programs were identified using the AAMC ERAS directory tool and residents were then identified from each program's website. Data collected included resident's specialty, medical degree, sex, and total publications authored before January 1st of the year they matriculated into residency. Total publications by matched applicants were then compared across specialties and subsequently stratified by medical degree, sex, and match year using Mann-Whitney U test. Statistical significance was defined as $P \leq 0.05$.

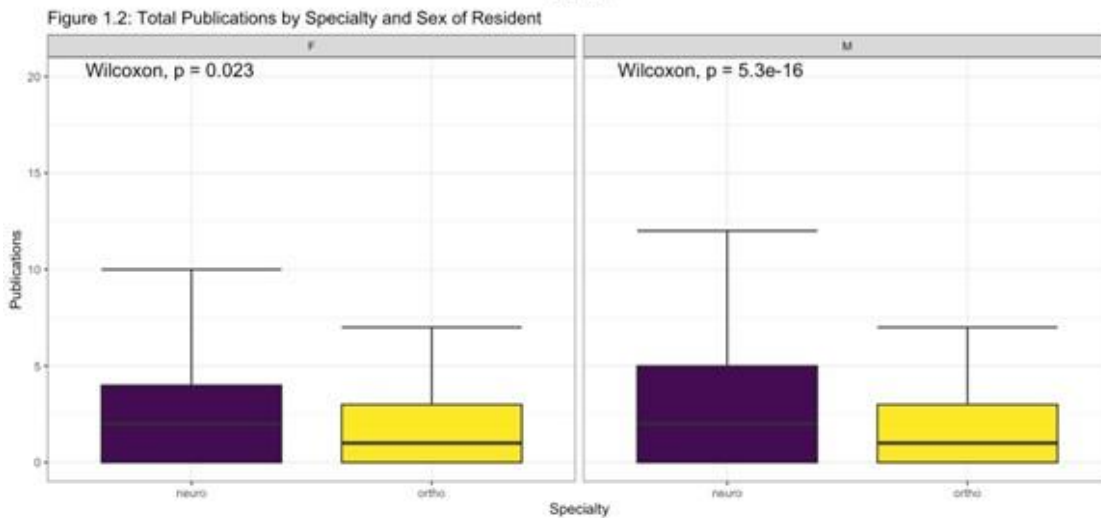
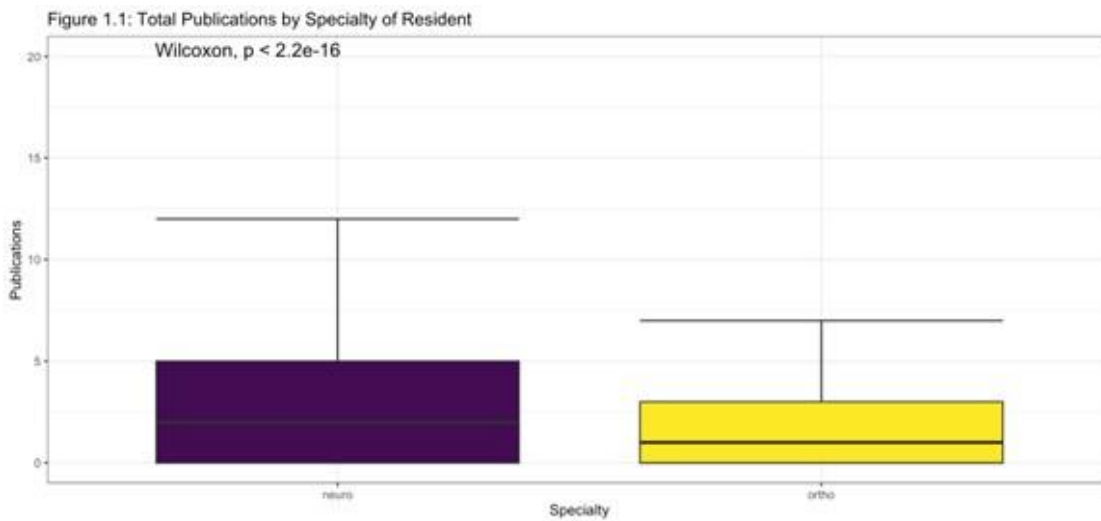
Results: In total, 783 neurosurgical residents with 2611 publications were reviewed and 2491 orthopaedic residents with 8070 publications were reviewed. Wilcoxon Rank-Sum test demonstrated a significant difference in total publications between neurosurgical and orthopaedic applicants (2[6] vs 1[3]; $p < 0.0001$). Both female (2[5] vs 1[3]; $p < 0.005$) and male neurosurgical applicants produced more publications than female and male orthopaedic applicants. Allopathic neurosurgery applicants produced significantly more publications than allopathic orthopaedic applicants (2[5.25] vs 1[3]; $p < 0.0001$). Neurosurgery applicants produced significantly more publications than orthopaedic applicants in 2019 (2[5] vs 1[2]; $p < 0.0001$), 2021 (3[6] vs 1[3]; $p < 0.0001$), and 2023 (4[6.75] vs 2[4]; $p < 0.0001$).

Discussion: Significant involvement in research during medical school is vital to securing residency positions at neurosurgical and orthopaedic training programs. The quantity of peer-reviewed publications prior to the match process directly corresponds to an applicant's dedication to research involvement during their undergraduate medical education. Notably, successful neurosurgery applicants exhibit a significantly higher rate of peer-reviewed research publications across all stratified categories compared to orthopaedic applicants. This highlights that neurosurgical residency programs place a greater emphasis on peer-reviewed research in their selection criteria for aspiring neurosurgeons. These findings indicate the strategic importance of dedicating time and resources to research endeavors for future applicants targeting residency positions in these specialties. Moreover, these results underscore peer-reviewed research publications as a key factor in determining a candidate's competitiveness during the residency match.

References:

1. National Resident Matching Program, Charting Outcomes in the Match: Senior Students of U.S. DO Medical Schools, 2022. National Resident Matching Program, Washington, DC: 2022.
2. National Resident Matching Program, Charting Outcomes in the Match: Senior Students of U.S. MD Medical Schools, 2022. National Resident Matching Program, Washington, DC: 2022.

Figures:



Identification of Stratifin as a Potential Biomarker for Oral Cancer Progression

Authors: Shuaa Rizvi, Hilal Arnouk M.D. Ph.D.

Affiliations: Arizona College of Osteopathic Medicine, Department of Pathology Midwestern University-IL

Introduction: Oral squamous cell carcinoma (OSCC) is a major type of head and neck cancer. Stratifin is a squamous epithelium keratinocyte protein that functions as a tumor suppressor. Previously, it has been shown that the expression of Stratifin is downregulated in several cancerous tissues. The objective of this research is to investigate Stratifin expression at the cellular level in four cell lines that reflect the successive steps of OSCC progression. Thus, assessing the significance of using Stratifin as a diagnostic and prognostic indicator for the disease.

Methods: This study evaluated the differential expression of Stratifin across four cell lines representing successive progression steps of OSCC. Western blotting was performed to quantify the expression of Stratifin in primary gingival keratinocytes, dysplastic oral keratinocytes (DOK), squamous cell carcinoma 25 (SCC25) cells, and Detroit 562 cells that represent normal oral keratinocytes, oral premalignant lesions, locally invasive OSCC cells, and metastatic OSCC cells, respectively. Additionally, Proteomics studies are underway to identify a panel of proteins, including Stratifin, that can serve as novel biomarkers for oral cancer progression.

Results: Stratifin expression was found to be downregulated alongside the progression steps from normal oral keratinocytes to premalignant, and from premalignant to metastatic oral cancer cells. Quantitative analysis revealed that Stratifin was downregulated significantly in the metastatic cells compared to both normal and dysplastic cells ($p < 0.05$). There was also a significant downregulation in the expression of Stratifin in the dysplastic cells compared to the normal ($p < 0.05$).

Conclusion: This study demonstrated that the expression of Stratifin was downregulated as oral cancer progressed in a stepwise manner. Specifically, Stratifin expression decreased as oral keratinocytes progressed from normal to premalignant to locally invasive to metastatic phenotypes. Therefore, Stratifin can potentially serve as a diagnostic and prognostic biomarker for patients suffering from oral cancer.

Treatment Utilization for Substance Use Disorders Among LGBTQ+ Youth: A Scoping Review

Authors: Adam Thompson, MS; Laura Kollar, PhD MPH; Andrew Terranella, MD MPH

Affiliations: University of Arizona College of Medicine Tucson; Centers for Disease Control & Prevention

Background: Lesbian, gay and bisexual youth are more likely to misuse prescription medication and more likely to use illicit drugs than their heterosexual counterparts. Transgender youth are twice as likely as their cisgender peers to use cocaine or amphetamines and nearly three times as likely to misuse inhalants. Intersectionality is also an important consideration. Native/Indigenous and multiracial LGBTQ+ youth have greater odds of reporting prescription drug misuse compared to white LGBTQ+ youth. Given the higher burden and stigmatization that LGBTQ+ youth disproportionately face, information on how they access treatment for substance use disorders is vital. The objectives of this scoping review are to 1) review the body of existing literature describing treatment utilization for substance use disorders among LGBTQ+ youth and 2) identify knowledge gaps to inform future research for this population.

Methods: A scoping review of the available literature was conducted to identify all studies related to substance use treatment among LGBTQ+ youth. Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines on scoping reviews were followed. We searched six electronic databases and relevant studies released between January 2018 and December 2023. We included English-language studies of LGBTQ+ youth between the ages of 10 and 21 involving treatment addressing use of opioids, stimulants, cannabis, and/or illegal drugs (including in combination with other substance use). We excluded all studies mentioning alcohol or tobacco use only, those with populations older than 21, those in a language other than English, those with a focus on substance use alone (without mention of treatment), systematic reviews, meta-analyses, and single case reports.

Results: A total of 490 non-duplicate studies were identified and screened. After applying exclusion criteria, 0 studies met this review's criteria for inclusion.

Conclusion: Our review of nearly 500 published studies found none examining treatment of substance use disorders for LGBTQ+ youth. Existing studies describe a higher prevalence of substance use among LGBTQ+ youth relative to their peers; however, no studies address how treatment is accessed or provided nor describe systems in place to mitigate disparities. Although several studies have analyzed substance use treatment for LGBTQ+ adults and could inform LGBTQ+ youth treatment, there is a great need for the collection and analysis of data that include LGBTQ+ youth explicitly. Qualitative studies as well as quality improvement work assessing best practices for identifying LGBTQ+ youth at risk for substance use disorders or overdose, facilitating access and linkage to care, and delivering evidence-based care could inform clinical and health systems approaches and harm reduction services to ensure this vulnerable population's engagement and retention with treatment for substance use disorders.

Figure 1. Flow diagram of search criteria used in the scoping review of literature on substance use disorder treatment among LGBTQ+ youth, 2018-2023

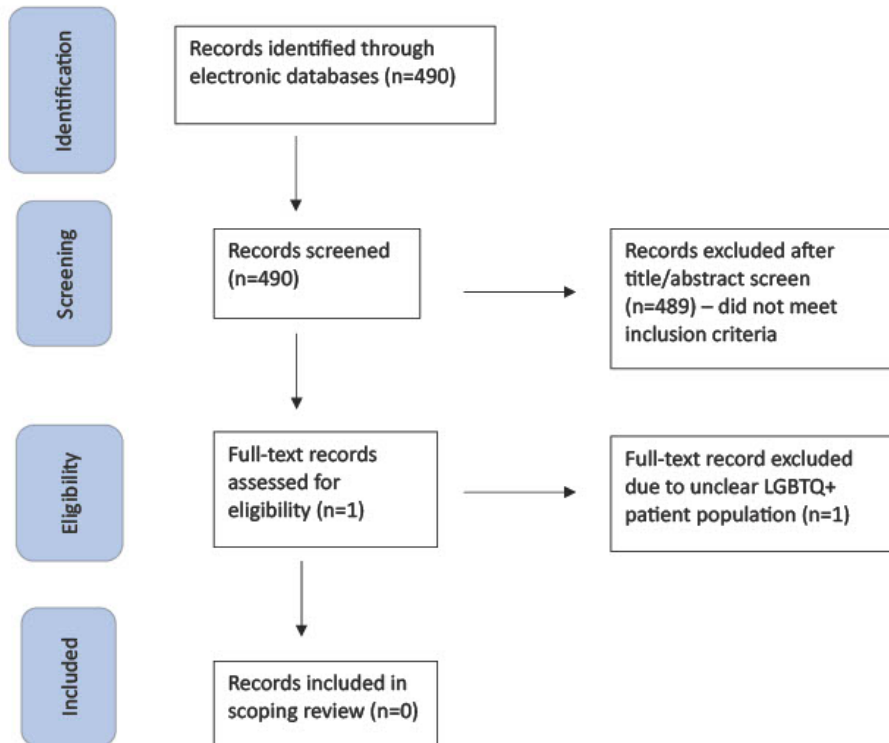


Table 1. Parameters used to perform a scoping review of literature on substance use disorder treatment among LGBTQ+ youth, 2018-2023

Electronic databases	Medline (OVID), Embase (OVID), Psycinfo (OVID), CINAHL (Ebsco), Scopus, ProQuest Central (includes Sociological Abstracts and ERIC)
Search criteria	<ol style="list-style-type: none"> exp "Sexual and Gender Minorities"/ OR (trans* OR gender minorit* OR sexual minorit* OR gender fluid OR non-binary OR nonbinary OR gay OR LGBT* OR homosexual* OR bisexual* OR pansexual* OR Lesbian* OR gay OR queer OR intersex OR two-spirit*).ti,ab,kf. Adolescent/ OR (youth* OR young OR teen* OR adolescen* OR preteen* OR tween*).ti,ab,kf. exp substance-related disorders/ OR (Substance use* OR substance misuse* OR substance abuse* OR opioid use* OR opioid misuse* OR opioid abuse* OR drug use* OR drug misuse* OR drug abuse* OR drug addiction* OR substance addiction* OR drug dependenc* OR substance dependenc* OR substance-related disorder*).ti,ab,kf. Drug therapy/ OR Opiate Substitution Treatment/ OR (psychotherapeutic* OR maintenance treatment* OR medication assisted treatment* OR replacement therap* OR substitution treatment* OR substitution therap* OR Medication* for Opioid Use* Disorder OR Medication* for Addiction Treatment OR MOUD OR MAT OR agonist therap*).ti,ab,kf. 1 AND 2 AND 3 AND 4 Limit 6 to yr= "2018-current"
Inclusion criteria	LGBTQ+ youth age 10-21; substance use treatment for opioids, stimulants, cannabis, and/or illegal drugs (including in combination with other substance use); studies in English; studies published between 2018-2023; May include: Treatment protocol, Case series (multiple case reports)
Exclusion criteria	Alcohol or tobacco use ONLY (including alcohol and tobacco ONLY); 21 or older ONLY; studies in a language other than English; focus on substance use alone (without mention of treatment); systematic reviews, meta-analyses, single case reports

Authors: Sariah Watchalotone, Minh-Quan Tran, Christopher R. Olson

Affiliations: Midwestern University, College of Osteopathic Medicine – Arizona, Midwestern University, Department of Graduate Studies, Department of Physiology – Arizona

Introduction: Retinoic acid (vitamin A) signaling in the adult brain is well-established, yet its regulation is not understood. The conversion of retinol to retinoic acid is achieved by tissue-active enzymes, including ALDH1A2, a marker of vocal nuclei HVC and LMAN in the avian vocal forebrain circuit. The immediate early gene EGR1, a broad-acting transcription factor, is behaviorally induced by singing towards potential mates (female-directed song) and when alone (undirected song), relative to non-singing silent controls. We tested the hypothesis that vocal behavior and social context will upregulate vitamin A signaling via increased ALDH1A2 expression, akin to song-induced EGR1.

Methods: Male zebra finches (300-400 days old; N=18) were behaviorally conditioned to produce (a) female-directed song, (b) undirected song, or (c) were non-singing controls (n=6/trmt). Birds were sacrificed at 2 hrs after peak song and brains were blocked for cryosectioning and in situ hybridization of HVC and LMAN. Slides were labeled for ALDH1A2 and EGR1 expression, and brain sections were photographed, and analyzed for cell density and per cell expression indices within vocal nuclei. Relationships of vocal behavior and immediate early genes to vitamin A signaling were tested with Generalized Linear Models.

Results: EGR1 expression and cell density in HVC and LMAN was positively related to singing, and expression was highest with female-directed song, intermediate with undirected song, and reduced in the control, relative to surrounding tissue. In contrast, ALDH1A2 expression in HVC was increased in female-directed song compared to silent controls, whereas the undirected song was similar to the silent control. A non-significant pattern of low ALDH1A2 expression in LMAN was found in the undirected song group, while the female-directed song and silent control groups had similar expression. A strong positive relationship between ALDH1A2 and EGR1 cell density exists in HVC and is particularly pronounced with female-directed song.

Discussion: Our findings support the novel hypothesis that behavior induces and reinforces brain retinoic acid signaling. These data reveal an important distinction in vocal circuit activation related to vitamin A signaling in that it depends on (1) the overall amount of song produced, and (2) the social context in which song is produced. Undirected singing is characterized by the activation of a cortical-striatal circuit (HVC-X) for the learning and maintenance of song, while performance of female-directed song relies on a direct circuit (HVC-RA) while suppressing the cortical-striatal loops. Our discovery that female-directed song increased ALDH1A2 parallels prior studies that implicate HVC in context-dependent song production. Singing in a given social context changes retinoic acid signaling, potentially altering the expression of hundreds of genes that are under its transcriptional control. Alternatively, undirected song resulted in decreased expression in LMAN but not HVC, and mirrors previous studies which show undirected song to suppress FOXP2 expression in songbird area X. In humans, FOXP2 is a language-associated pathway rich in RAR β receptors, and proposed to require retinoic acid signaling. These findings reinforce the role of micronutrients in mechanisms of brain function and point to how vitamin A nutrition may be relevant to communication and mating success.

Examining the Relationship Between Gaseous Microemboli and Platelet Activation While on In Vitro Cardiopulmonary Bypass

Authors: Mitchell Rentschler, B.A.; Zeyu Song, B.S.; Breanne Collison B.S.; Hunter Delmoe B.S.; Marisa Sugden B.S.; Charlotte Bolch, Ph.D.; Weidang Li, Ph.D.; Mitra Esfandiarei, Ph.D.; Nathaniel Darban, Ph.D.; Thomas Rath CCP

Affiliations: Midwestern University - Arizona College of Osteopathic Medicine, Midwestern University - College of Health Sciences, Midwestern University, Midwestern University - College of Graduate Stud, Midwestern University - College of Health Science

Introduction: Cardiopulmonary bypass (CPB) is critical to provide a bloodless motionless field for the surgeon to operate. However, many complications can arise from CPB caused by platelet activation and ischemia by gaseous microemboli (GME) (1-3). Another complication of GME is that suction return to the cardiomy reservoir introduces GME that acts as a foreign surface leading to platelet activation before the GME is removed by the oxygenator (4, 5). Techniques that reduce GME are important to prevent ischemic complications as well as potential GME-induced platelet activation. The purpose of this study was to determine if introduction of GME lead to increased amount of platelet activation by measuring the biomarker platelet factor 4 (PF4).

Methods: The laboratory CPB protocol was established (Figure 1). The circuit was primed with crystalloid consisting of Xcoating™ Surface and used heparinized bovine blood while maintaining hematocrit of 23%-28%. A BCC300 GAMPT mbH was placed between the reservoir and centrifugal pump to measure GME. Bovine blood was circulated continuously with 6 blood samples collected at 5, 45, 90, 95, 120, and 135 minutes. At 90 minutes, 50 RPM (200mL/min) of room air was suctioned into the cardiomy reservoir. The plasma from the blood samples were centrifuged, extracted, and frozen at -80°C. An ELISA for the biomarker PF4 was used to quantify platelet activation. An ANOVA and a two-sample t-test were used to analyze PF4 concentration at each timepoint and PF4 concentrations at 0 RPM and 50 RPM of air introduction, respectively.

Results: PF4 concentrations increased throughout the trial from the baseline at 5 minutes to 135 minutes. Higher PF4 concentrations were measured from 90 minutes to 135 minutes during air introduction compared to PF4 concentration from 5 minutes to 90 minutes (Figure 2).

Discussion: The increase in platelet activation between 5 and 90 minutes could be due to blood interaction with the circuit. After air was introduced, the circulating GME interacted with platelets leading to platelet activation. Due to the possibility of GME interacting with platelets leading to their activation and ischemic consequences of GME, measures should be taken to reduce GME during CPB to lower the risk of complications.

References

1. Bartoszko J, Karkouti K. Managing the coagulopathy associated with cardiopulmonary bypass. *J Thromb Haemost.* 2021;19(3):617-32. Epub 20201217. doi: 10.1111/jth.15195. PubMed PMID: 33251719.
2. Judge C, Mello S, Bradley D, Harbison J. A Systematic Review of the Causes and Management of Ischaemic Stroke Caused by Nontissue Emboli. *Stroke Res Treat.* 2017;2017:7565702. Epub 20171016. doi: 10.1155/2017/7565702. PubMed PMID: 29123937; PubMed Central PMCID: PMC5662829.

3. Massoth C, Zarbock A, Meersch M. Acute Kidney Injury in Cardiac Surgery. *Crit Care Clin.* 2021;37(2):267-78.
4. Willcox TW, Mitchell SJ, Gorman DF. Venous air in the bypass circuit: a source of arterial line emboli exacerbated by vacuum-assisted drainage. *Ann Thorac Surg.* 1999;68(4):1285-9. doi: 10.1016/s0003-4975(99)00721-3. PubMed PMID: 10543494.
5. Barak M, Katz Y. Microbubbles. *Chest.* 2005;128(4):2918-32. doi: 10.1378/chest.128.4.2918.

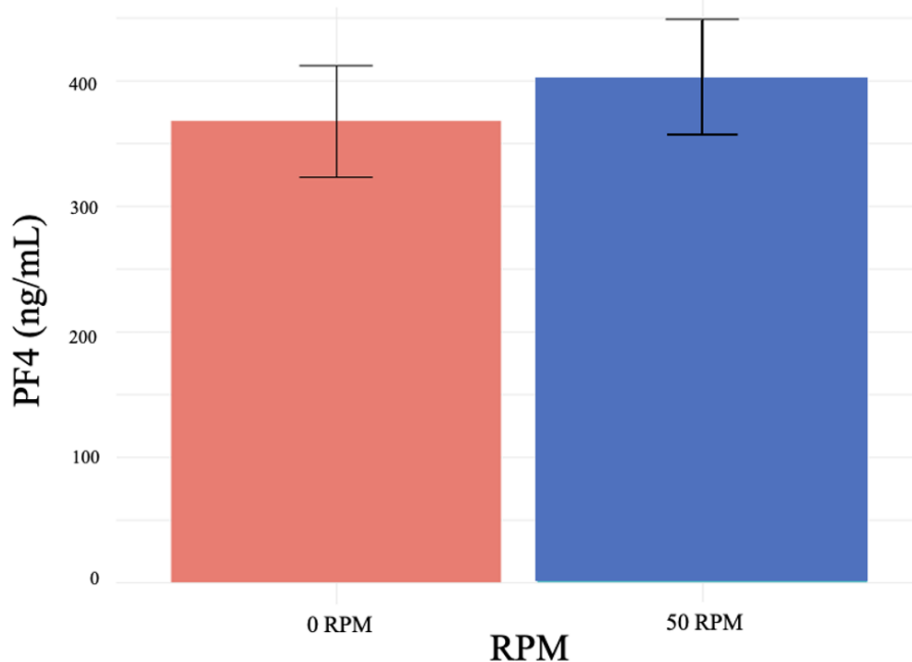
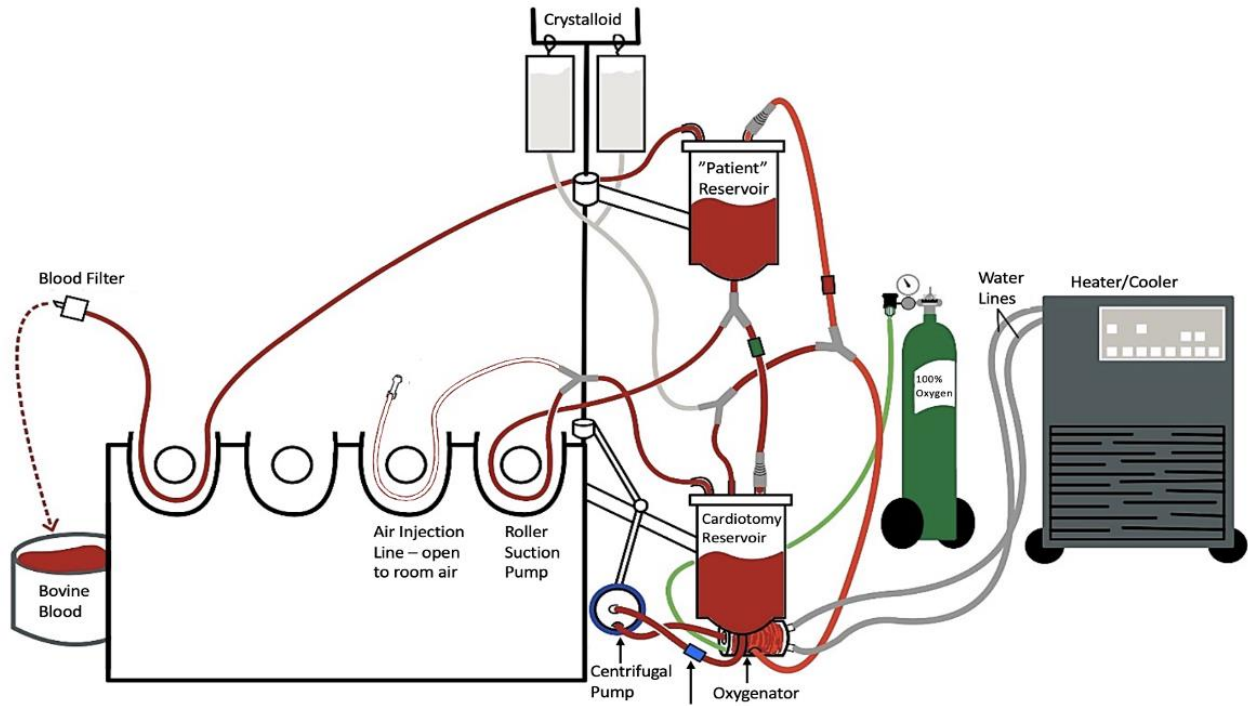


Figure 2: PF4 concentration before and after air introduction.

On the Evolution of the Paranasal Sinuses: A Darwinian Approach to Explaining Purpose

Authors: Pedro L. Gomes, Mary K. Ebbert, Devyani Lal

Affiliations: Mayo Clinic Alix School of Medicine, Department of Otolaryngology, Head and Neck Surgery, Mayo Clinic, Phoenix, AZ, Independent Scholar

Introduction: For years, experts have debated the purpose and evolutionary origins of mammalian paranasal sinuses (1-2). To that end, a scoping review was conducted to explore the presence and drainage pathways of paranasal sinuses across mammalian orders and to gain insights into the evolutionary progression in mammals to better understand paranasal sinus purpose in humans.

Methods: A scoping review was conducted to identify publications on mammalian paranasal sinus anatomy. Data on gross and radiological images was compiled in up to 3 species each from 31 mammalian orders. Images were independently evaluated by 3 reviewers to assess presence of sinuses and its drainage (gravitational/anti-gravitational). Affinity propagation clustering (`sklearn.cluster.AffinityPropagation`, `scikit-learn`, v1.4.1) and hierarchical clustering (`scipy.cluster.hierarchy.linkage`, `SciPy`, v1.12.0) analyses were used to categorize species based on presence of maxillary, frontal, ethmoid, sphenopalatine, lacrimal, and sphenoid sinuses (3-6).

Results: The prevalence of paranasal sinuses in mammalian orders is the following: maxillary 56%, frontal 44%, sphenoid 33% and ethmoid 20%. Frontal sinuses are more common in higher mammals than lower (71% vs. 22%). Mammals without a frontal sinus are unlikely to have ethmoid or sphenoid sinuses. Mammals that significant amount of time in water lack sinuses. All maxillary sinuses, except those in rodents, have antigravitational drainage. When present, lower mammal sphenoid sinuses drain gravitationally, and higher sphenoid sinuses have mixed patterns. Cluster analysis yielded five groups with high preservation of sinuses within orders (exceptions: Chiroptera, Marsupialia).

Discussion: Paranasal sinuses developed in mammals after the common ancestor moved from aquatic homes to land. The first sinuses to develop were likely maxillary and frontal. Sinuses may be air reservoirs and lighten the skull. Frontal sinuses, more common in higher mammals, may protect the bulkier brain and support bipedal posture.

References: 1) Cappello ZJ, Minutello K, Dublin AB. Anatomy, head and neck, nose paranasal sinuses.

2) Haight JS, Djupesland PG, Qjan W, Chatkin JM, Furlott H, Irish J, Witterick I, McClean P, Fenton RS, Hoffstein V, Zamel N. Does nasal nitric oxide come from the sinuses?. *Journal of otolaryngology*. 1999 Aug 1;28(4):197-204.

3) Mullner D. Modern hierarchical, agglomerative clustering algorithms. *arXiv:1109.2378v1*.

4) Bar-Joseph Z, Gifford DK, Jaakkola TS. Fast optimal leaf ordering for hierarchical clustering. *Bioinformatics*. 2001;17(Suppl 1):S22. DOI:10.1093/bioinformatics/17.suppl_1.S22.

5) Frey BJ, Dueck D. Clustering by Passing Messages Between Data Points. *Science*. 2007 Feb.

6) Pedregosa F, Varoquaux G, Gramfort A, et al. *Scikit-learn: Machine Learning in Python*. *JMLR*. 2011;12:2825-2830.

Cluster	Order	Species	Lower / Higher Mammal	Quadruped / Biped
1	Chiroptera	Artibeus jamaicensis (Bat)	L	B
	Didelphimorphia	Monodelphis domestica (Opossum)	L	Q
	Eulipotyphla	Insectivora	L	Q
	Lagomorpha	Rabbit	L	Q
2	Cetacea	*	H	Q
	Chiroptera	Myotis lucifugus (Bat)	L	B
	Dasyuromorphia	*	L	Q
	Marsupiala	Macropodid (kangaroo)	L	Q
	Monotremata	Tachyglossa	L	Q
	Sirenia	Manatees/Dugongs	H	Q
	Monotremata	Platypoda	L	Q
3	Carnivora	Felines	H	Q
	Carnivora	Canines	H	Q
	Pilosa	Giant Anteater	H	Q
4	Marsupiala	Phascolarctos cinereus (Koala)	L	Q
	Primate	Platyrrhini	H	B
	Primate	Anthropoid Apes	H	B
	Primate	Humans	H	B
	Rodentia	Mice	L	Q
	Artiodactyla	Camelus bactrianus	H	Q
	Artiodactyla	Bubalus bubalis	H	Q
5	Perissodactyla	Equus asinus	H	Q
	Perissodactyla	Equus ferus caballus	H	Q

Table 1: Groups determined by the affinity propagation clustering analysis

Order	Species	Maxillary Sinus	Frontal Sinus	Ethmoidal Sinus	Sphenoidal Sinus	Sphenopalatine Sinus	Lacrimal Sinus
Chiroptera	Artibeus jamaicensis (Bat)	Yes	No	No	No	No	No
Didelphimorphia	Monodelphis domestica (Opossum)	Yes	No	No	No	No	No
Eulipotyphla	Insectivora	Yes	No	No	No	No	No
Lagomorpha	Rabbit	Yes	No	No	No	No	No
Cetacea	*	No	No	No	No	No	No
Chiroptera	Myotis lucifugus (Bat)	No	No	No	No	No	No
Dasyuromorphia	*	No	No	No	No	No	No
Marsupiala	Macropodid (kangaroo)	No	No	No	No	No	No
Monotremata	Tachyglossa	No	No	No	No	No	No
Sirenia	Manatees/Dugongs	No	No	No	No	No	No
Monotremata	Platypoda	No	No	No	No	No	No
Carnivora	Felines	No	Yes	No	Yes	No	No
Carnivora	Canines	No	Yes	No	No	No	No
Pilosa	Giant Anteater	No	Yes	No	No	No	No
Marsupiala	Phascolarctos cinereus (Koala)	Yes	Yes	No	Yes	No	No
Primate	Platyrrhini	Yes	Yes	Yes	Yes	No	No
Primate	Anthropoid Apes	Yes	Yes	Yes	Yes	No	No
Primate	Humans	Yes	Yes	Yes	Yes	No	No
Rodentia	Mice	Yes	No	Yes	Yes	No	No
Artiodactyla	Camelus bactrianus	Yes	Yes	Yes	Yes	No	Yes
Artiodactyla	Bubalus bubalis	Yes	Yes	Yes	Yes	No	Yes
Perissodactyla	Equus asinus	Yes	Yes	No	No	Yes	No
Perissodactyla	Equus ferus caballus	Yes	Yes	No	No	Yes	No

Table 2: The presence/absence of primary sinuses in the mammalian species selected; *denotes all species within order



CLINICAL RESEARCH

Implies the use of scientific method to derive original data in the patient care setting.

A Retrospective Comparison of Radiological Imaging of Disseminated Coccidioidomycosis in Multiple High-Risk Groups

Authors: S Potlapalli, P Kang, D Gridley, and A Roh

Affiliations: School of Medicine, Creighton University, Phoenix, Arizona, Department of Radiology, Valleywise Health Medical Center, Phoenix, Arizona

Background: Coccidioidomycosis is a systemic fungal infection, caused by *Coccidioides immitis* and *C. posadasii* that is termed the “Great Mimicker” due to its ability to disseminate and create lesions in any part of the body, like miliary tuberculosis or other systemic fungi^{1,2}. Coccidioidomycosis begins in the lungs, but can then disseminate into the bones, visceral organs, serosa, meninges, and skin. Though most infections are mild without lasting sequelae, these understudied disseminated forms pose a diagnostic challenge in radiology.

Multiple high-risk groups for disseminated coccidioidomycosis (DC) have been identified by previous literature, such as African American race, male gender, HIV status, and older age above 50 years^{3,4,5,6}. However, there is little research discerning whether specific presentations of DC trend higher within these populations at risk, which is what this investigation aims to do.

Methods: Data was collected from 128 patient charts originating from 2013-2023 from the Valleywise Health system in Phoenix, Arizona. Imaging manifestations of coccidioidomycosis were categorized into four systems: Musculoskeletal (MSK), Body, Neurological, and Pulmonary. Different demographic covariates were compared amongst these categories to determine whether a certain population trended more heavily with an increasing number of categories. Those who presented with only the pulmonary category were defined as radiologically non-disseminated and make up the patient population demonstrating only one imaging group. Wilcoxon Rank Sum and Kruskal-Wallis test was used to compare continuous and ordinal variables. Chi-squared and Fisher’s Exact Test was used to compare categorical variables. Logistic regression with a binary outcome (disseminated and non-disseminated) was employed to associate covariates with the odds of dissemination.

Results: Patients with non-pulmonary manifestations (n=29) demonstrated disseminated coccidioidomycosis and were compared to patients with only pulmonary (non-disseminated) imaging (n=99). Multivariable logistic regression under AIC determines that decreasing age, male gender, African American race, and HIV status have the strongest association with disseminated findings (ROC area under the curve = 0.79) (Table 1). Table 2 demonstrates that African American patients, male patients, younger patients, and patients with a normal BMI (18.5-24.9 kg/m²) were increasingly represented in patient populations that had radiologically disseminated infections in multiple body systems.

Discussion: Concurring with previous studies^{3,4}, African American and male patients had increased demographic representation in patients with DC. However, our study indicates that mean age decreases and normal weight BMI increases in representation in patient populations with increasing disseminated imaging category presentations, disagreeing with the notion that larger body mass and older age predispose to a stunted immune system that allows for easier dissemination of coccidioidomycosis. Interestingly, while patients with HIV were 3 times as likely to have disseminated radiography than non-disseminated, HIV status does not show any significant trend with increasing number of imaging groups (Table 2). Hence, HIV status cannot be fully explained as the confounding variable that suggests that normal weight and decreased age may increase risk for DC. Our

unexpected novel findings may be due to small sample size, thus require additional investigation to determine if they have utility as clinical prognostic factors for dissemination of coccidioidomycosis in diagnostic radiology.

References:

- [1] Ocampo-Garza, J., Castrejon-Perez, A.D., Gonzalez-Saldivar G., Ocampo-Candiani J. Cutaneous coccidiomycosis: a great mimicker. *BMJ Case Rep.* 2015. Accessed Feb 12, 2023. doi: 10.1136/bcr-2015-211680
- [2] Johnson R.H., Sharma R., Kuran R., Fong I., Heidari A. Coccidiomycosis: a review. *J Investig Med.* 2021; 69(2):316-323. Accessed Feb 12, 2023. doi: 10.1136/jim-2020-001655
- [3] McCotter O.Z., Benedict K, Engelthaler D.M., Komatsu K, Lucas K.D., Mohle-Boetani J.C., Oltean H., Vugia D., Chiller T.M., Sondermeyer Cooksey G.L., Nguyen A., Roe C.C., Wheeler C., Sunenshine R. Update on the Epidemiology of coccidioidomycosis in the United States. *Medical Mycology* 2019; 57 (S1): S30-S40. Accessed February 12, 2023. doi: 10.1093/mmy/myy095
- [4] Gupta N.A., Iv M., Pandit R.P., Patel M.R. Imaging manifestations of primary and disseminated coccidioidomycosis. *Applied Radiology* 2015. Accessed February 12, 2023.
- [5] Crum N.F., Lederman E.R., Stafford C.M., Parrish J.S., Wallace M.R. A Descriptive Survey of a Reemerging Disease. Clinical Characteristics and Current Controversies. *Medicine* 2004; 83(3): 149-175. Accessed February 12, 2023. doi: 10.1097/01.md.0000126762.91040.fd
- [6] Blair J.E., Coakley B., Santelli A.C., Hentz J.G., Wengenack N.L. Serological testing for symptomatic coccidioidomycosis in immunocompetent and immunosuppressed hosts. *Mycopathologia* 2006; 162(5): 317-324. Accessed February 12, 2023. doi: 10.1007/s11046-006- 0062-5.

Case Study of Catamenial Pneumothorax with Surgical and Medical Treatment

Authors: Talal Alomar, S. Alomar, Dr. Deepti Boddupalli

Affiliations: Creighton University, UCLA

Catamenial pneumothorax (CP) is a rare and spontaneous accumulation of air or fluid in the pleural cavity occurring 72 hours before or after the onset of menstruation. Recurrent attacks are common per menstrual cycle with symptoms ranging from chest pain, abdominal pain, dyspnea, discomfort, and fatigue. This condition is thought to occur following ectopic migration of endometrial tissue from the uterus and implantation in the thorax. During menstruation, this endometrial tissue proliferates and irritates the lung parenchyma, contributing to a pneumothorax. The diagnosis is made with a thorough history combined with radiographic imaging of these recurrent pneumothoraces. The condition can be treated with oral contraceptives which decrease endometrial proliferation and thoracoscopic pleurodesis to eliminate the pleural space and prevent further recurrence. Here, we report a case of CP successfully treated with hormonal contraceptives and pleurodesis.

A 30-year-old female with no significant past medical history presented to an outside hospital for shortness of breath. A day prior, she sat up from bed, coughed, and subsequently experienced severe right chest and mid back pain. On admission, the patient's vitals were all within normal range and the patient had 97% oxygen saturation on room air. A chest X-ray showed a right-sided pneumothorax and a chest tube was placed. The patient started her menstrual period around the time she developed this chest pain. She reports that she had similar, more mild chest pain on the right side a few months prior; however, she does not recall if that episode was perimenstrual.

She was transferred to our institution for further care and thoracic surgery evaluation. Chest X-ray and CT scans demonstrated a right apical pneumothorax with small blebs. Due to the patient's age, menstrual timeline, history of recurrent pneumothoraces, radiographic findings of bulla in the lungs, and the fact the lesions were right-sided, a diagnosis of catamenial pneumothorax was made. The patient underwent thoracoscopic mechanical and doxycycline pleurodesis. Additionally, the patient was started on oral contraceptives. Post-procedure, the patient denied any shortness of breath, chest pain, or palpitations. The patient was discharged in good health.

Catamenial pneumothorax is a rare condition, only occurring in 1-5% of menstruating women. However, it should be suspected in any young woman with a pneumothorax during menses. Swift intervention is key to preventing tension pneumothorax, a deadly condition. Additionally, oral contraceptives and surgical intervention with pleurodesis or removal of the thoracic endometrial tissue should be done to prevent further complications during the subsequent menstrual cycles.

Comparing Patient Communication Event Demand for External Ring Fixators to Other Common Foot and Ankle Orthopedic Procedures

Authors: Santiago Logan-Baca B.S., Sara Kisiel B.S., Trevin Reyes B.S., Jordan Henderson B.S., David Jaffe M.D.

Affiliations: The University of Arizona College of Medicine - Phoenix, OrthoArizona

Introduction: There may be hesitancy for surgeons to apply an external ring fixator (ERF) due to the potential perceived clinical burden. This study aims to compare the number of points of contact (POC) between patients and their clinical treatment teams following the application of an ERF vs. the POC in other common orthopaedic foot and ankle procedures. The study aims to quantify the post-operative demand of ERFs on the clinic and patient. Understanding the differences in the POC between these procedures can provide valuable insights into the postoperative experience of the patients with ERFs and their physicians, potentially decreasing the intimidation of their use or fear of increased clinical burden.

Methods: Patients who underwent the application of an ERF, hallux valgus osteotomy (HVO), or lateral ligamentous reconstruction (LLR) were identified utilizing a CPT code search in a single surgeon database. Data was collected through a retrospective medical record review at a single institution of patients who underwent one of the three surgeries between 2017 and 2023. A POC was defined as a communication event between the patient and the treatment team, which included phone calls, portal messages/documentated emails, in-person visits, and operations. As part of the treatment team's routine care plan, an outgoing call was provided to check on all surgical patients, therefore, this single POC was excluded from the analysis. The data was further categorized by visit type, including expected visits (routine follow-ups), unexpected visits (falls and infections), and unexpected operations (revision surgeries and irrigation and debridement). Analyses were performed using unpaired t-tests, comparing ERF data to HVO and LLR.

Results/Expected Results: 194 patients were included in the study (81 LLR, 64 HVO, 49 ERF), and all data was collected within a 6-month period after initial surgery. ERF patients on average had 2.27 more total clinic visits than HVO patients (6.91 vs. 4.64 respectively; $p < 0.0001$) and 2.8 more total clinic visits than LLR patients (6.91 vs. 4.11 respectively; $p < 0.0001$). There were on average 0.42 more unexpected clinic visits for ERF than HVO patients (0.94 vs. 0.52; $p = 0.06$) and 0.84 more unexpected clinic visits than LLR patients (0.94 vs. 0.1; $p < 0.0001$). There was an average of 0.96 unexpected operations for ERF, compared to 0.09 for HVO ($p < 0.0001$) and 0 for LLR ($p < 0.0001$).

Conclusion: Unexpected visits were not statistically significant when comparing ERF to HVO procedures. Expected visits were statistically significant when comparing both ERF to HVO and LLR, (1.99 and 1.73 more visits on average respectively), as well as unexpected operations (0.87 and 0.96 more operations respectively), however when analyzing the mean differences, the clinical impact on the treatment team does not seem substantially increased for patients with an ERF. There may be limitations due to a potential lack of documentation. This data can encourage ERF use when clinically indicated without fear of extensive staff burden. Further research could investigate additional factors influencing physician hesitations or deterrents in utilizing ERFs.

Correlation of Shoe Wear Patterns and Weight Bearing Radiographs

Authors: Trevin Reyes, BS; Sara Kisiel, BS; Jordan Henderson BS; David Jaffe, MD

Affiliations: University of Arizona College of Medicine - Phoenix, OrthoArizona

Introduction: The pattern of wear on a patient's shoe may provide valuable data about a patient's foot and ankle alignment and clinical presentation. Whether this finding correlates with routine radiographic analysis or is a dynamic behavioral pattern is unclear. This interesting physical examination tool could play a role in diagnosis and treatment algorithms. We aim to analyze the location and extent of shoe tread wear and examine its correlation with radiographs and clinical presentation.

Methods: Patients presenting to an orthopaedic foot and ankle clinic with routine standing radiographs were asked to participate in shoe measurement and a clinical survey. Survey questions included age of footwear, patient-perceived ankle stability (PPAA), number of previous ankle sprains, and personal interpretation of their walking pattern (lateral or medial aspect). Exclusion criteria included patients with new shoes (< 3 months), orthotics, and no discernible shoe tread wear (i.e. rarely wore the shoes). The tread was visually categorized (lateral, centrolateral, medial, central medial, or uniform) and the tread depth was quantified by digital tire tread gauge measurement. Shoe wear pattern was determined by subtracting lateral from medial depth (absolute wear). The absolute wear was correlated to lateral talo-first metatarsal angle (LTFMA) and calcaneal pitch (CP), which were measured on weight-bearing lateral radiographs. Analyses were performed using Spearman's correlation coefficient with Fisher's z transformation and Mann-Whitney U tests.

Results: 44 patients were included in the study. The distribution of qualitative wear was: 25 lateral, 10 centrolateral, 3 medial, and 6 uniform. Analyses of CP vs absolute wear and LTFMA vs absolute wear both showed some evidence for a weak positive correlation ($p=0.20$, $p=0.15$ respectively). Patient interpretation of walking pattern vs absolute wear correlation was significant ($p=0.01$), but interpretation of walking pattern correlation vs CP was not ($p=0.52$). Number of ankle sprains vs absolute wear was not significant ($p=0.34$). PPAA vs absolute wear was not significant ($p=0.68$). PPAA vs CP was not significant ($p=0.31$) nor was PPAA vs LTFMA ($p=0.30$).

Discussion: There was a predilection for lateral shoe wear, regardless of radiographic findings. 79.5% had either lateral or centrolateral wear, and only 3 had medial wear. Statistical correlations may not have reached significance, but a slight trend towards lateral wear and higher CP and LTFMA. Loss of longitudinal arch on radiographs did not necessarily correlate to medial shoe wear. These interesting findings imply that shoe tread is not exclusively driven by hindfoot alignment and there could be behavioral influence, i.e. pain avoidance or other extrinsic gait determinants. This study implies that shoe inspection be included in interpretation of patients' presenting symptomatology.

Table 1:

	Spearman's Correlation Coefficient	(95% CI)	P-VALUE
CALCANEAL PITCH VS ABSOLUTE WEAR	0.20	(-0.11 – 0.47)	0.20
LTFMA VS ABSOLUTE WEAR	0.23	(-0.09 – 0.50)	0.15
NUMBER OF ANKLE SPRAINS VS ABSOLUTE WEAR	0.22	(-0.08 – 0.49)	0.14
NUMBER OF ANKLE SPRAINS VS CALCANEAL PITCH	-0.02	(-0.32 – 0.28)	0.89
NUMBER OF ANKLE SPRAINS VS LTFMA	0.15	(-0.16 – 0.43)	0.34

*Indicates statistically significant result for alpha level = 0.05

Analysis via Spearman's correlation coefficient with Fisher's z transformation

Table 2:

TRUST ANKLE	No (n = 10)	YES (N = 32)	P-VALUE
LATERAL WEAR	0.57 (0.31 – 1.40)	0.60 (0.08 – 0.88)	0.68
CALCANEAL PITCH	19.75 (16.30 – 20.10)	21.55 (17.80 – 26.30)	0.31
LTFMA ANGLE	-7.90 (-10.00 – 0.10)	-5.90 (-10.90 – [-0.70])	0.30

*Indicates statistically significant result for alpha level = 0.05

Analysis via Mann-Whitney U test

Dacryocystorhinostomy Outcomes for Congenital Nasolacrimal Duct Obstruction Associated with Craniofacial Abnormalities

Authors: Krishna Sinha, BS1, Grayson Ashby, MD2, Scott Odorico, MD3, Lilly Wagner, MD2

Affiliations: Mayo Clinic Alix School of Medicine, Scottsdale, AZ, Department of Ophthalmology, Mayo Clinic, Rochester, MN, Division of Plastic Surgery, Mayo Clinic, Rochester, MN

Introduction: The success rate of lacrimal probing for congenital nasolacrimal duct obstruction (CNLDO) has been found to be lower in children with concurrent craniofacial abnormalities. Persistent symptoms are addressed with dacryocystorhinostomy (DCR). There is little data on the effectiveness of DCR for patients in this group. This retrospective observational study compared the clinical characteristics and outcomes of DCR for CNLDO in children with and without concurrent craniofacial abnormalities.

Methods: Chart review was completed of a single institution cohort including all patients <16 years of age who underwent DCR for CNLDO over a 20-year period. Patients with acquired NLDO and those who did not attend at least one postoperative visit were excluded. Patients with isolated or syndromic craniofacial abnormalities were included in the craniofacial cohort.

Results: DCR for treatment of CNLDO was required for 37 eyes among 29 patients. Craniofacial abnormalities were present in 18 of the 37 eyes. Mean age at the time of surgery was 5.8 years and 52.5% were female. There was no significant difference in age at time of surgery or patient sex between the craniofacial and simple CNLDO groups. Craniofacial patients were significantly more likely to have concurrent canalicular pathology ($p=0.01$) and require intraoperative multidisciplinary collaboration with otorhinolaryngology and ophthalmology ($p=0.0006$). There was no significant difference in use of intraoperative navigation, surgical approach (endoscopic versus external), or additional procedures conducted under anesthesia. Four of 21 DCRs in the craniofacial group were revisions compared to one revision in the simple CNLDO group. Three of 19 DCRs in the simple CNLDO group had remaining symptoms after surgery compared to seven of 21 DCRs in the craniofacial cohort ($p=0.28$).

Discussion: CNLDO in patients with associated craniofacial abnormalities is more likely to present with coexisting canalicular pathology and require multidisciplinary care compared to patients with simple CNLDO. Failure rate may be higher with craniofacial abnormalities, but larger case numbers are needed to confirm this trend. Further studies could examine whether specific DCR approaches (endoscopic versus external) produce better functional and anatomical outcomes in CNLDO associated with craniofacial abnormalities.

Differences in Publications Authored by Successful Neurosurgical Residency Applicants Across Medical Degree and Medical Schools' NIH Funding

Authors: Matthew Dufault, Elliot Jensen, Alexandria McGuire, Timothy Glass, Mason Kyle, John Ashurst

Affiliations: Midwestern University, Arizona College of Osteopathic Medicine

Intro: Successfully matched neurosurgery applicants demonstrate strong research productivity, and higher productivity in comparison to their unmatched counterparts.^{1,2} Over the past several years, applicants have demonstrated heightened competition driving significant increases in total research products.³ The 2022 neurosurgery match saw the highest research productivity recorded with allopathic matches (n=174) averaging 25.5 abstracts, presentations, and publications, and osteopathic matches (n=9) averaging 32.6 abstracts, presentations, and publications.^{1,2} This has been primarily attributed to research products that are not formally peer-reviewed such as abstracts and presentations.³ Therefore, the aim of this study was to extrapolate peer-reviewed publication data relating to individual applicants and compare across medical degree of applicant and related factors.

Methods: A retrospective cohort of all neurosurgery residents with graduation dates of 2024, 2026, 2028, and 2030 who authored publications before January 1st of their matriculation year were included in final analysis. Data abstracted included resident degree, medical school, NIH funding of medical school, total number of publications, author position, relatedness to orthopaedics, and type of article. Only US DO, MD, and MD PhD graduates were included in the final analysis. The Kruskal-Wallis test was used to compare groups and a Bonferroni corrected Mann-Whitney was used for post-hoc multiple comparisons. Statistical significance was defined as $P \leq 0.05$.

Results: A total of 783 neurosurgical residents with 2611 publications were reviewed. Medical degree held by residents is as follows: 32 (4.1%) DO, 669 (85.4%) MD, and 82 (10.5%) MD PhD. Kruskal-Wallis demonstrated a significant difference between medical degrees in the number of total publications ($p < 0.0001$), neurological topic ($p < 0.0001$), non-neurological topic ($p < 0.0001$), 1st author ($p < 0.0001$), 2nd author ($p = 0.001$), other author position ($p < 0.0001$), article ($p < 0.0001$) and review ($p < 0.005$) publications (Table 1). Multiple comparisons with a Bonferroni correction elucidated differences for every pairwise degree comparison ($p < 0.0001$) (Figure 1.1). When categorized by amount of NIH funds received by the applicant's medical school, there were 169 (21.6%) applicants from a "Top-20" school, 582 (74.3%) applicants from a "Not Top-20" school, and 32 (4.1%) applicants from an osteopathic school. Kruskal-Wallis demonstrated a significant difference between NIH funding categorization in the number of total publications ($p < 0.0001$) as well as a difference in each sub-categorization of publications with a significance of at least $p < 0.0005$ for each category. Multiple comparisons with Bonferroni correction were significant for every pairwise comparison ($p < 0.0001$) (Figure 1.2).

Discussion: It is crucial for neurosurgical residency applicants to perform research early and often during their medical school tenure. Differences in publications across applicant degree is readily apparent and suggests type of medical degree plays a significant role in research productivity. This same analysis applies to the amount of NIH funding of the applicant's medical school. Top 20 NIH funded medical schools produce applicants with significantly more research than all other MD or DO programs, whereas DO institutions produce applicants with significantly less publications than any MD institution, regardless of funding. It is critical for both future neurosurgery applicants and program directors to understand these research differences to appropriately evaluate student research involvement on an individual basis.

References:

1. National Resident Matching Program, Charting Outcomes in the Match: Senior Students of U.S. DO Medical Schools, 2022. National Resident Matching Program, Washington, DC: 2022.
2. National Resident Matching Program, Charting Outcomes in the Match: Senior Students of U.S. MD Medical Schools, 2022. National Resident Matching Program, Washington, DC: 2022.
3. Wadhwa H, Shah SS, Shan J, Cheng J, Beniwal AS, Chen JS, Gill SA, Mummaneni N, McDermott MW, Berger MS, Aghi MK. The neurosurgery applicant's "arms race": analysis of medical student publication in the Neurosurgery Residency Match. J Neurosurg. 2019;133(6):1913-21. Epub 20191101. doi: 10.3171/2019.8.JNS191256. PubMed PMID: 31675693.

Figure 1.1: Multiple Comparisons of Total Publications Across Medical Degrees

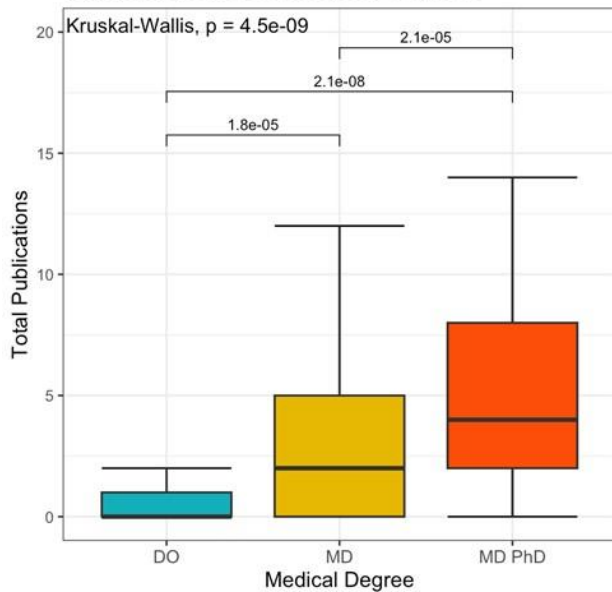


Figure 1.2: Multiple Comparisons of Total Publications by Medical Schools' NIH Funding

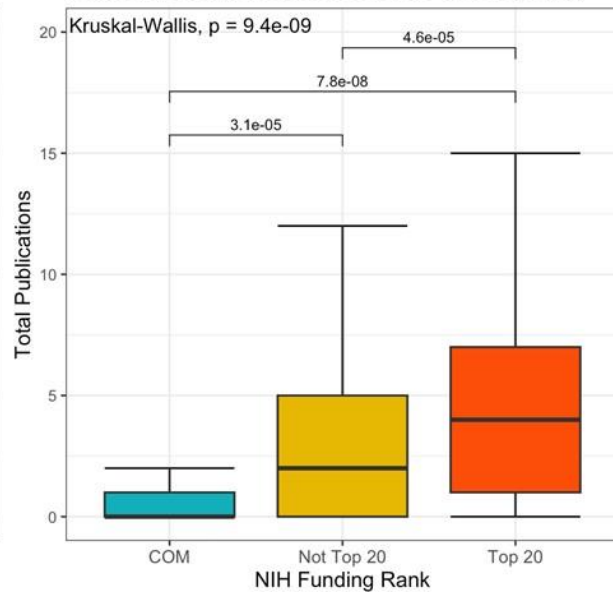


Table 1: Publication Statistics by Medical Degree & NIH Funds

Publication Category	By Medical Degree				By NIH Funding Rank			
	DO ¹	MD ¹	MD PhD ¹	Kruskal-Wallis ^a	COM ^{1*}	Not Top 20 ¹	Top 20 ¹	Kruskal-Wallis ^a
Total Publications	0 (1)	2 (5.25)	5 (6)	p < 0.0001	0 (1)	2 (5)	4 (6)	p < 0.0001
By Topic								
Neurological Topic	0 (1)	1 (4)	3 (6)	p < 0.0001	0 (1)	1 (4)	3 (6)	p < 0.0001
Non-Neurological Topic	0 (0)	0 (1)	1 (2)	p < 0.0001	0 (0)	0 (1)	0 (2)	p < 0.0005
By Journal								
Neurological Journal	0 (0)	1 (3)	2 (4)	p < 0.0001	0 (0)	1 (3)	2 (5)	p < 0.0001
Non-Neurological Journal	0 (1)	1 (2)	3 (4)	p < 0.0001	0 (1)	1 (2)	2 (3)	p < 0.0001
By Author Position								
1st Author	0 (0)	0 (2)	2 (2)	p < 0.0001	0 (0)	0 (1)	1 (3)	p < 0.0001
2nd Author	0 (0)	0 (1)	1 (1)	p = 0.001	0 (0)	0 (1)	1 (2)	p < 0.0001
Other Author Position	0 (1)	1 (3)	2 (4)	p < 0.0001	0 (1)	1 (2)	2 (4)	p < 0.0001
By Publication Type								
Article	0 (1)	2 (5)	4 (6)	p < 0.0001	0 (1)	2 (4)	4 (6)	p < 0.0001
Review	0 (0)	0 (1)	0 (1)	p < 0.005	0 (0)	0 (1)	0 (1)	p < 0.0001

¹ Median (IQR);

^a Statistical significance defined as p < 0.05;

* COM = College of Osteopathic Medicine

Social Needs of Children with Medical Complexity and Inpatient Care Utilization

Authors: Lauren Ondrejka, Edith Allen, MD, Sandra Gage, MD, Wendy Arafiles, MD, Mehrtash Hashemzadeh, MS

Affiliations: University of Arizona College of Medicine – Phoenix, Phoenix Children's Hospital

Introduction: The literature shows children with medical complexity (CMC) have a significant burden of social risk factors and high levels of interaction with inpatient care systems. Studies have suggested a potential relationship between social needs and hospital utilization for CMC, but results are inconsistent. We hypothesized CMC with positive social needs screenings would have more readmissions and longer average length of stay (LOS).

Methods: This retrospective cohort study was conducted at a tertiary care children's hospital on CMC patients ages 0-21 admitted between 10/1/22 and 9/30/23. CMC were defined as patients requiring management by 3 or more subspecialists and medical technology dependence (Figure). Caregivers received a text link to the survey upon admission if not completed in the past 6 months. The survey consisted of 6 questions regarding access to various social needs including food, housing, transportation, childcare, employment, healthcare, utilities, medications, phone, clothing, and interest in mental health counseling. Screenings were deemed "positive" if at least one need was reported. The Man-Whitney Test was used to compare continuous variables. The Chi-squared/Fisher's Exact Test was used to compare categorical variables. All p-values are 2-sided and $p < 0.05$ is considered statistically significant.

Results: 583 charts of CMC were reviewed. 94 patients were excluded, mainly due to lack of completed screening (N=89). 489 patients were included: 131 with a positive screening and 358 with a negative screening. There were no significant differences in demographic features between groups except for race/ethnicity ($p=0.01$). Patients with a positive screening had significantly more readmissions ($p=0.04$) and longer LOS ($p=0.03$) compared to patients with a negative screening (Table).

Discussion: Our study shows that CMC who reported one or more social needs had significantly more readmissions and longer LOS than CMC who did not report social needs. Hospital admission presents a unique and valuable opportunity to identify families' social needs and connect them to community-based resources. However, regular assessment of social needs in the pediatric inpatient setting remains uncommon. These findings highlight the impact of social needs and can inform future interventions to support patients and reduce care utilization.

Care Utilization and Demographics

	Negative Social Needs Screening	Positive Social Needs Screening	p-value
Total Readmissions*	0 (0-2)	1 (0-2)	0.04
LOS*	7 (3-18)	11 (3-41)	0.03
Age*	6 (2-12)	5 (1-11)	0.17
Sex Assigned at Birth			0.71
Male	198 (55.3%)	70 (53.4%)	
Female	160 (44.7%)	61 (46.6%)	
Race/Ethnicity			0.01
White/Caucasian	167 (46.6%)	38 (29.0%)	
Hispanic/Latinx	119 (33.2%)	58 (44.3%)	
Black/African-American	28 (7.8%)	17 (13.0%)	
Native American	29 (8.1%)	13 (9.9%)	
Asian	10 (2.8%)	5 (3.8%)	
Hawaiian/Pacific Islander	5 (1.4%)	0 (0.0%)	
Payer			0.28
Medicare/Medicaid	249 (69.6%)	99 (75.6%)	
Commercial	104 (29.1%)	29 (22.1%)	
Other	4 (1.1%)	3 (2.3%)	
Self-pay	1 (0.3%)	0 (0.0%)	
Primary Chronic Condition			0.56
Neurological	140 (39.1%)	52 (39.7%)	
Respiratory	48 (13.4%)	17 (13.0%)	
Neurogenetic	40 (11.2%)	12 (9.2%)	
Gastrointestinal	33 (9.2%)	11 (8.4%)	
Cardiovascular	35 (9.8%)	8 (6.1%)	
Musculoskeletal	24 (6.7%)	8 (6.1%)	
Heme/Immuno	13 (3.6%)	4 (3.1%)	
Urologic	7 (2.0%)	4 (3.1%)	
Connective Tissue	4 (1.1%)	4 (3.1%)	
Oncologic	5 (1.4%)	3 (2.3%)	
Endocrine	5 (1.4%)	3 (2.3%)	
Metabolic	2 (0.6%)	4 (3.1%)	
Psychiatric	2 (0.6%)	1 (0.8%)	

Table: Care Utilization and Demographics. *Results presented as median (IQR); LOS = Length of stay

Figure: Children with Medical Complexity (CMC) Classification

- Active medical co-management by three or more subspecialists
- AND**
- Use of high-risk medical technology:
 - Home ventilator
 - In-dwelling central venous catheter
 - Ventriculoperitoneal shunt
 - Diaphragmatic pacer
- EXCLUDING**
- Patients with Bone Marrow Transplant, Oncology, Cardiac Transplant, or Hemodialysis identified as primary

Examples of specific patient populations:

- Tracheostomy with home ventilator
- Complex congenital heart disease
- Spina bifida with ventriculoperitoneal shunt
- Short-gut syndrome with central line and total parenteral nutrition
- Cerebral palsy with Gross Motor Function Classification System (GMFCS) level IV or V

The Quality of Chatbot Responses Related to Peyronie's Disease

Authors: JennaKay Colquitt , Sarah Y Wu, Christopher J Warren, MD, Victoria S Edmonds, MD, Nicolette G Payne, MD, Nahid Punjani, MD MPH

Affiliations: Mayo Clinic Arizona, Department of Urology, Mayo Clinic Alix School of Medicine

Introductions and objectives: Large language model (LLM) Chatbots, a form of artificial intelligence (AI) that rely on user prompts to mimic conversation have been shown to excel at many tasks in the medical field. Our aim was to assess the information generated from 4 LLMs with searches related to Peyronie's disease (PD), to improve responses, and to assess responses to artificial patient messages (Fig 1,2).

Methods: The National Institute of Health's (NIH) frequently asked questions related to PD were entered into 4 LLMs unprompted and prompted (Fig 1,2). The responses were evaluated for overall quality using the DISCERN questionnaire (Fig 1). Accuracy and completeness of LLM responses to 11 pre-surgical patient messages were evaluated with previously accepted Likert scales (Fig 2). Descriptive statistics and analysis were performed.

Results: Without prompting, the quality of information was moderate across all LLMs but improved to high quality with prompting (Table 1). LLMs were accurate and complete with an average score of 5.8 out of 6.0 (SD 0.5) and 3.0 out of 3.0 (SD 0.2) respectively. The average Flesch-Kincaid reading level was grade 11.7 (SD 2.1). Chatbots were unable to communicate at a grade 8 reading level when prompted. In contrast, the reading level of the NIH website was significantly lower (9.8, SD 2.1, $P < .05$) than the prompted LLM responses.

Discussion: LLMs may become a valuable tool for patient education for PD but they currently rely on clinical context and appropriate prompting by humans to be useful. Unfortunately, their prerequisite reading level remains higher than that of the average patient. Given their increasing uptake, patients and physicians should be educated on how to interact with these LLMs to elicit the most appropriate responses. In the future, LLMs may reduce burnout by helping physicians respond to patient messages.

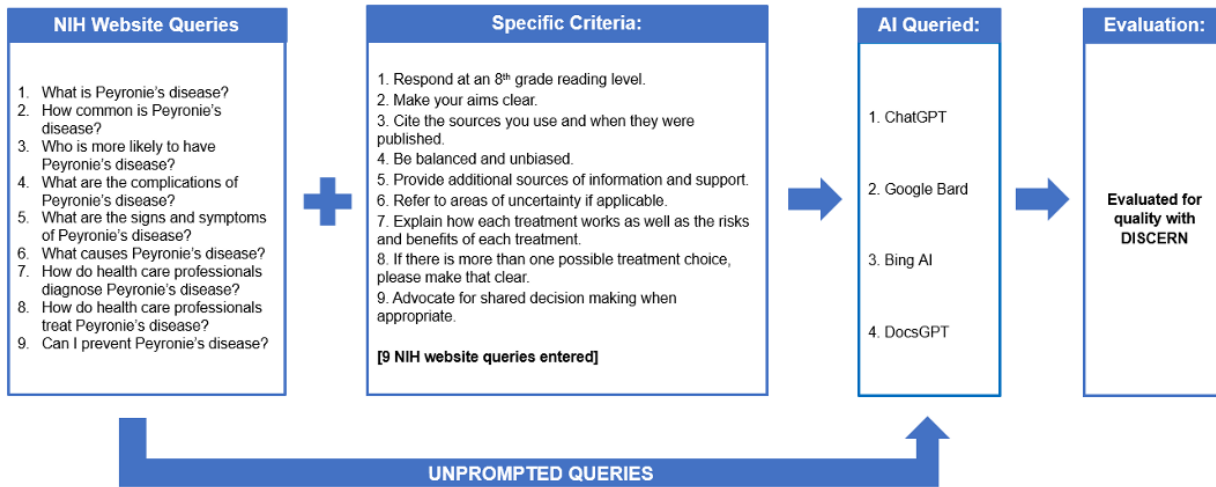


Figure 1: Methodology for assessing the quality of information generated from prompted and unprompted queries related to Peyronie’s disease. AI= Artificial Intelligence, NIH= National institute of Health

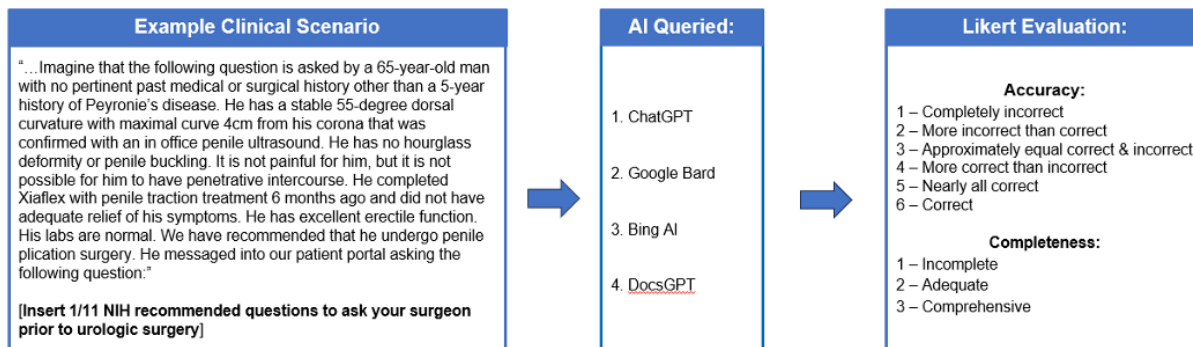


Figure 2: Methodology for evaluating Chatbot responses to 11 questions recommended to ask your surgeon before undergoing urologic surgery preceded by an abridged clinical scenario. AI= Artificial Intelligence, NIH= National institute of Health

Availability of Ulipristal Acetate as Emergency Contraception in Rural vs Urban Pharmacies in Arizona

Authors: Ava Smesik BS, Sofia Infante MD, Whitley Figg BS, Maya Block BS, Meghana Tripuraneni BS, Blake Feldmar BS, Linda Chambliss MD

Background: Ulipristal acetate (UA) is the only FDA-approved prescription oral emergency contraceptive, offering efficacy up to five days after unprotected intercourse. In regions with limited family planning services like rural areas, UA emerges as a crucial recourse for emergency contraception. This cross-sectional study investigated accessibility and pharmacist knowledge of UA throughout Arizona.

Methods: Utilizing Arizona State Board of Pharmacy's database, pharmacies were categorized as rural or urban based on USDA codes. Telephone-based secret shoppers contacted a randomized sample of 98 urban and 98 rural pharmacies and followed a predefined script to determine the pharmacists' knowledge of UA.

Results: UA was available in 74.5% (n=73) of urban and 78.6% (n=77) of rural pharmacies (p=0.5). Only 10.2% (n=20) had same day availability (11.2% urban, 9.2% rural, p=0.64), while 71.9% (n=141) had availability within 5 days (70.4% urban, 73.5% rural, p=0.63). 67.2% of pharmacists were able to correctly answer questions regarding the effectiveness window for UA (71.1% urban, 63.4% rural, p=0.27). Significantly fewer rural pharmacists (36.0%, n=32) correctly explained differences between UA and over-the-counter alternatives compared to urban pharmacists (51.6%, n=46) (p=0.03).

Conclusion: Although access to UA appears equitable across rural and urban pharmacies in Arizona, the study highlights critical gaps in pharmacist knowledge in rural settings. Additionally, few pharmacies had same-day availability, reflecting potential access issues given the narrow time window for effectiveness as well as time required to obtain a prescription.

Missed Connections: Unraveling the Overlooked Diagnosis of Antiphospholipid Syndrome in Lupus Patients - A Critical Case Study

Authors: Robert Easter, Talal Alomar, Neil Dudeja, S. Alomar, Dr. Deepti Boddupalli

Affiliations: Creighton University , UCLA

Systemic Lupus Erythematosus (SLE) is an autoimmune condition associated with antiphospholipid syndrome (APS) in 30-50% of patients. APS is a hypercoagulable state associated with frequent thrombotic events, adverse outcomes during pregnancy, and livedo reticularis skin findings. The identification of APS is crucial as the patient should be placed on warfarin anticoagulation instead of direct oral anticoagulants (DOACs) for proper thrombosis prevention. APS can be easily missed if the thrombotic events are attributed to SLE alone. We present the rare case of a young man with a lupus flare who was found to have APS.

A 25-year-old male patient with recently diagnosed rheumatoid arthritis, lupus, and pulmonary embolism, presented to the ER with diffuse chest pain and pressure worse with inspiration and coughing. He was recently hospitalized at an outside hospital (OSH) 1 month prior for chest pain and was found to have bilateral pulmonary embolisms (PEs). He was discharged on methotrexate, hydroxychloroquine, and Eliquis. The patient returned to the OSH a few days later with continued chest pain and was found to have recurrent PEs. This indicated a failure of Eliquis anticoagulation, so the patient was switched to Lovenox. His chest pain had resolved at that time, but had now returned.

At our institution, the patient met sepsis criteria with a maximum temperature of 39.5C, tachycardic to 126, tachypneic with respirations up to 52. He had an oxygen saturation of 98% on 2 liters of nasal cannula. CT angiography of the chest showed no pulmonary emboli, and small, bilateral pleural effusion. He was started on azithromycin and unasyn as it was not clear if his symptoms were due to a lupus flare or infection from his compromised immune state. Antibiotics were discontinued after an infectious workup of blood cultures, urinalysis, sputum culture was negative. Echocardiography was done due to pleuritic chest pain and showed moderate pericardial effusion, likely secondary to lupus pericarditis.

The patient was treated with steroids and colchicine for his serositis and lupus flare, with significant improvement of his dyspnea the next day. Due to the clinical history of recurrent PEs and a history of SLE, anticardiolipin, beta-2 microglobulin and lupus anticoagulant were sent for testing. These levels were all positive, indicating a diagnosis of APS. The patient was discharged on Lovenox bridging to warfarin until reaching therapeutic INR of 2.0-3.0.

APS concurrent with lupus is a very rare diagnosis in a young man, which was missed in this case. It is imperative to make this diagnosis so patients can be put on appropriate anticoagulation of warfarin. Considering the deadly consequences of PEs and strokes in these patients, it is crucial to consider APS in lupus patients to prevent a missed diagnosis such as this one in the future.

Authors: Goodman, Lily C., Bifulco, Alessandro V., Zaki, Abbas, Ligorio, Matteo

Affiliations: Creighton University School of Medicine, Phoenix, AZ, Department of Surgery, University of Texas Southwestern, Dallas, TX

Introduction

Rectal cancer is one of the leading causes of cancer-related deaths, highlighting the need for equitable access to timely screening and treatment. We sought to investigate potential disparities in time-to-treatment and survival rates between urban and rural-residing patients.

Methods

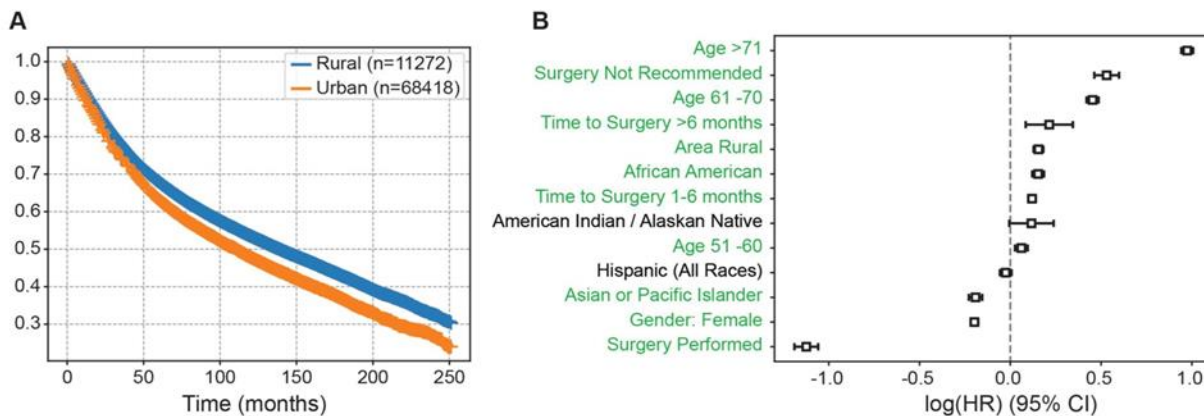
Patients diagnosed with rectal adenocarcinomas over 18 years old (population range 30-79 years old) were selected from the “Surveillance, Epidemiology, and End Results (SEER)” database and categorized by urban or rural. Included variables are sex, race, age at diagnosis, time to treatment, surgery resection, and survival. Kaplan-Meier (KM) and log-rank tests, as well as the Cox regression model, were used to assess differences in survival rates between urban and rural-residing groups in univariate and multivariate fashion, respectively.

Results

This study included 79,690 patients. 11272 (14 %) are from rural areas, and 68418 (86%) are from urban areas. The rural residence is associated with a higher risk of mortality (139 vs. 111 months, $p < 0.005$, Figure 1A) compared to the urban residence. It remains significant in our COX regression model (HR: 1.17, 95% CI: 1.14–1.20; $p < 0.005$, Figure 1B) alongside all the other variables described above (Methods section). Interestingly, the American Indian/Alaskan Native population and the Hispanic populations were not significant in both univariate and multivariate analyses.

Conclusions

Our analyses indicate that rural-residing patients have a lower median overall survival compared to urban-residing patients. Based on our preliminary data, future studies should focus on assessing the specific cancer-related deaths in rural vs. urban populations across the country for patients with rectal carcinoma.





CLINICAL VIGNETTE

Involves the presentation of one or more patient encounters that illuminate unique observation of a known disease, or that describe a novel disease process.

A Case on The Role of Socioeconomic Variables in Multifaceted Illness: Strongyloidiasis, Mastocytosis, and Acute Kidney Injury

Authors: Yezan Hassan, Saif Alshaka, Ahmed Dudic, Eliace Noory, Moustafa Hazin, DO

Affiliations: Creighton University, St. Vincent de Paul, Creighton University

Introduction: In Arizona, small businesses are not mandated to provide health insurance to their workers.¹ Small businesses are defined as “which is not dominant in its field and which employs fewer than one hundred full-time employees or which had gross annual receipts of less than four million dollars in its last fiscal year”.²

AHCCCS, Arizona’s State Medicaid program, provides coverage for most lower socioeconomic groups. However, once an individual makes over 133% of the Federal Poverty Level (~\$15,060), they no longer qualify and must pay out of pocket for insurance if they are otherwise uninsured.³

Saint Vincent de Paul (SVdP) is a clinic that offers free, temporary healthcare to uninsured individuals.⁴ This includes undocumented immigrants, unhoused individuals, and people working without employee-sponsored health insurance.

Case Presentation: The patient is a 60-year-old male. He is married, worked as a landscaper, and speaks non-native English. The patient did not have insurance through his employer nor qualified for AHCCCS. The patient’s wife was also employed but does not receive health insurance through her employer.

The patient was in good health until December 2020 when he was hospitalized for 16 days for COVID, bacterial pneumonia, and acute kidney injury secondary to stone obstruction.

After treatment and discharge, the patient was readmitted to the hospital in March for 31 days due to an intraparenchymal and intraventricular hemorrhage. During this stay, the patient had a ureteral stent placed. The stroke resulted in significant right-sided hemiparesis, communication difficulties, and deteriorated vision.

Between July and September 2022, the patient was admitted 5 times for complications relating to his stent. Throughout this time, the patient had increased stone burden and an atrophic kidney. We ultimately referred the patient to undergo a nephrectomy. Throughout his medical course, the patient lost his home due to rent hikes and his wife lost her job. This forced them to apply for temporary housing through their church.

In March 2023, our team did a comprehensive workup of the patient which revealed elevated tryptase levels in the absence of allergic symptoms. Diagnostic algorithm was followed and revealed a strongyloidiasis infection, suspected to have arisen when working as a landscaper. Furthermore, the patient was found to have systemic mastocytosis, which was verified by a bone marrow biopsy.

Discussion: This patient represents an example of an otherwise healthy man whose socioeconomic circumstances can be cited as an appreciable contributor to his outcomes. The patient fell through the cracks of the current health insurance system because neither his nor his wife’s employer offered health insurance and he made too much to qualify for AHCCCS.

Throughout his hospital course, the patient and his wife became unemployed and unable to work. The loss of income and increased cost of living forced them to find temporary housing, which compromised the spaces where the patient recovered from his illnesses.

The patient's health outcomes were detrimental to his quality of life. Between the hospitalizations, stroke sequelae, kidney dysfunction, and infection, the patient will continue to experience further deterioration of his health.

Supporting Labs:

Date	PROTEIN/CREAT RATIO
06/2021	2998
09/2021	4184
10/2021	3903
11/2021	4032
12/2021	3698
12/2021	3488
01/2022	4515
01/2022	NP *
03/2022	4330
01/2023	4904

Date	ALKALINE PHOSPHATASE
04/2021	121 IU/L
10/2021	67 IU/L
11/2021	133 IU/L
12/2021	128 IU/L
09/2022	139 IU/L
10/2022	140 IU/L
01/2023	124 IU/L
03/2023	152 IU/L

Date	EOS (ABSOLUTE)
04/2021	1.2 x10E3/uL
06/2021	1.6 x10E3/uL
09/2021	1.4 x10E3/uL
12/2021	1.4 x10E3/uL
01/2022	1.4 x10E3/uL
03/2022	1.3 x10E3/uL
10/2022	2.8 x10E3/uL
01/2023	1.3 x10E3/uL
03/2023	1.8 x10E3/uL

Date	STRONGYLOIDES IGG ANTIBODY
03/2023	Positive

Date	TRYPTASE
03/2023	19.2

A Rare Case of Necrotizing Myopathy with Immune Checkpoint Inhibitor Therapy

Authors: Zeinab Alnahas, Ahmed Abdelaziz, Sujata Sarkar

Affiliations: TMC Health Medical Education Program (THMEP), Arizona Oncology, Tucson Medical Center

Introduction: Immune checkpoint inhibitors are novel cancer immunotherapies that can induce anti-tumor immune responses by targeting immune inhibitory receptors such as programmed cell death 1 (PD-1) and cytotoxic T lymphocyte antigen 4 (CTLA-4) and, more recently, T cell immunoglobulin and ITIM domain (TIGIT).

Case Presentation -- History: A 69-year-old woman with a one-year history of stage IVb, RET fusion-positive non-small cell lung adenocarcinoma with an isolated hepatic metastasis. Initially, she was treated with RET kinase inhibitor (selpercatinib) for 8 months with suboptimal response and disease progression to pleural and bone metastases. Then, she started an experimental novel immune checkpoint inhibitor (combination of anti-TIGIT antibody and sasanlimab (anti-PD-1)) infusion therapy every 3- 4 weeks. After receiving the fourth cycle, the patient experienced a progressive painful muscle weakness that started in her neck and upper shoulders, followed by lower extremities. She had difficulties holding up her head and rising from a chair. It was associated with double vision, atypical retrosternal chest pain, and shortness of breath with exertion. She denied ptosis, difficulty swallowing, rash, joint pain, or fever. The physical exam noted proximal symmetrical muscle weakness affecting the shoulder and hip girdle (grade 4) but no muscle tenderness or gait abnormalities. The cranial nerve examination was unremarkable.

Hospital Course: Her laboratory workup showed elevated serum creatine kinase of 3473 IU/L, Troponin T of 2.66 ng/mL, ALT of 231 IU/L, AST of 159 IU/L, LDH of 828 IU/L, and Aldolase of 38 IU/L. Other laboratory findings were within normal limits, including serum electrolytes, creatinine, ESR, and CRP. The evaluation included ruling out acute coronary syndrome with normal EKG, unremarkable echocardiography, and CT coronary angiography with a coronary artery calcification score of 0.

Except for a positive ANA of 1:320 (cut of 1:80), her autoimmune panel was negative, including Anti- Jo 1, anti-HMG CoA-reductase, anti-acetylcholine receptor antibodies, and myositis panel antibodies. MRI of the lower extremities showed intramuscular edema and enhancement within the large muscle groups of both thighs, suggestive of a multifocal myopathy. Muscle biopsy from the left quadriceps revealed features of immune-mediated necrotizing myopathy with patchy mononuclear inflammatory cell infiltrates, acute and chronic degenerative atrophy, and no rimmed vacuoles.

Immunotherapy was discontinued, and the patient was started on prednisone 60 mg orally daily with slow improvement in serum creatine kinase level.

Clinical Impacts/Relevance: To the best of our knowledge, this is the first case report showing an association between the use of dual checkpoint inhibitors (a combination of anti-TIGIT antibody and sasanlimab) for the treatment of advanced non-small cell lung cancer and the development of inflammatory myopathy.

Discussion: Inflammatory myopathy is an immune-mediated muscle injury that can be associated with the use of certain medications, including immune checkpoint inhibitors, especially with anti-PD-1 and anti-CTLA-4 therapy. Although Immune checkpoint inhibitors have shown revolutionary results in treating advanced malignancy and improving clinical outcomes, they can unleash immune-related adverse effects in all organ systems, including the neuromuscular system causing myopathy.

An Atypical Presentation of Viral Myocarditis Masquerading as NSTEMI

Authors: Katerina Liong, Talal Alomar, Anupama Somaratna, Merica Vorachitti, Deepti Boddupalli

Affiliations: Creighton University School of Medicine.

Introduction: Myalgias can often have a broad differential, and may include weakness, swelling, pain, and tenderness. Because of muscles' relative resistance to infection, infectious myositis is relatively uncommon. Furthermore, the most common cause of viral myositis is influenza [1]. This is a rare case of Coxsackie B myositis associated with myocarditis and polyarthralgia.

Case presentation: A 47-year-old male patient with a history of hypertension and obesity presented to the Emergency Department (ED) for a 3-day history of worsening back pain radiating to his chest, migratory arthralgia, exertional dyspnea, bilateral shoulder pain with arm weakness.

On arrival the patient was tachycardic with a low-grade fever of 37.8°C. Electrocardiogram (EKG) showed sinus tachycardia. Troponin I was elevated at 128 ng/L, and increased to 209 ng/L 3 hours later. Labs were notable for elevated white blood cell count of 14,300/uL, creatinine kinase (CK) of 558 Units/L, and C-reactive protein of 232.1 mg/L. A negative CT Angiogram (CTA) ruled out aortic dissection and pulmonary embolism (PE). CT C-spine and MRI were also ordered in light of the upper extremity weakness with no significant findings. Echocardiogram showed an ejection fraction of 60-65% with no abnormalities.

Given the symptomatic findings as well as uptrending troponin without EKG changes, there was high concern for Non ST-elevation Myocardial Infarction (NSTEMI). The patient was treated with aspirin and IV heparin. Troponin I downtrended 6 hours later to 148 ng/L, and heparin was stopped. Cardiology indicated that the minimal troponin elevation was likely not a primary ischemic event.

However, on further questioning the patient endorsed a sore throat and chills and revealed that his wife was sick a few weeks prior. Because of this, an infectious etiology was suspected, and blood cultures and respiratory viral panels were obtained. Extensive workup for possible autoimmune causes for his myositis was ordered. While these were pending, ampicillin/sulbactam and vancomycin were started.

Viral panel revealed Coxsackie B virus infection and was negative for autoimmune etiologies. Antibiotics were discontinued. The patient improved with 2 days of supportive treatment and was discharged in stable condition.

Clinical Impacts/Relevance: Coxsackie B virus is often associated with myocarditis but is a very rare cause of additional migratory polyarthralgia and myositis; therefore, it's important to have on the differential when these symptoms present together.

Discussion: Generally, Coxsackie B is most associated with fever, pharyngitis, and gastrointestinal symptoms; carditis has only been reported as an association in 2% of cases [2][3]. Although arthralgias are a known symptom of viral illness, only one prior case report showed polyarthralgia due to Coxsackie B virus [4][5].

Our case demonstrates that in a patient experiencing myalgias alongside cardiomyopathy and polyarthrititis, it is important to keep Coxsackie B in the differential alongside myocardial infarction (MI). In fact, one paper found a possible association of coxsackie B patients with acute (MI), [6] suggesting the virus' link with MI may extend further, and in fact cause structural changes that cause a predisposition to MI.

References:

- [1] Crum-Cianflone NF. Bacterial, fungal, parasitic, and viral myositis. *Clin Microbiol Rev.* 2008 Jul;21(3):473-94. doi: 10.1128/CMR.00001-08. PMID: 18625683; PMCID: PMC2493084.
- [2] Moore M, Kaplan MH, McPhee J, Bregman DJ, Klein SW. Epidemiologic, clinical, and laboratory features of Coxsackie B1-B5 infections in the United States, 1970-79. *Public Health Rep.* 1984 Sep-Oct;99(5):515-22. PMID: 6091168; PMCID: PMC1424625.
- [3] Ager EA, Felsenstein WC, Alexander ER, Wymer ME, Sabotta E, Ashby V. An Epidemic of Illness Due to Coxsackie Virus Group B, Type 2. *JAMA.* 1964;187(4):251-256. doi:10.1001/jama.1964.03060170005001
- [4] Gómez Rodríguez N, Ibáñez Ruán J, González Rodríguez M. Miositis y poliartritis asociada a infección por virus Coxsackie B [Coxsackie virus infection associated with myositis and polyarthritis]. *An Med Interna.* 2008 Feb;25(2):90-2. Spanish. doi: 10.4321/s0212-71992008000200009. PMID: 18432367.
- [5] Holland R, Barnsley L, Barnsley L. Viral arthritis. *Australian Family Physician.* 2013 Nov;42(11).
- [6] Andréoletti L, Ventéo L, Douche-Aourik F, et al. Active Coxsackieviral B infection is associated with disruption of dystrophin in endomyocardial tissue of patients who died suddenly of acute myocardial infarction. *J Am Coll Cardiol.* 2007 Dec 4;50(23):2207-14. doi: 10.1016/j.jacc.2007.07.080. Epub 2007 Nov 19. PMID: 18061067.

An Uncommon Convergence: Ankylosing Spondylitis Co-Occurring with Henoch-Schönlein Purpura in an Adult Male

Authors: Talal Alomar, Zayn Lateef, Eliace Noory, Ragul Yuvaraj, Anthony Yeung

Affiliations: Creighton School of Medicine, Arizona State University

Introduction: Ankylosing spondylitis is a seronegative spondyloarthropathy that most commonly affects men in their 20-40s. In this case, it is presented along with Henoch-Schönlein purpura (HSP), also known as IgA vasculitis. HSP is a vasculitis that is distinguished by IgA deposits in small vessels in a variety of different organ systems. It primarily impacts the small vessels of the skin, gastrointestinal tract, kidneys, and joints. HSP is primarily seen in children “approximately 90% of cases occur in children between 2 and 10 years of age, with a peak incidence at 4 to 7 years”¹. Additionally, the two conditions presented in unison have only been reported in a few case reports². Here we present a case of an adult male with ankylosing spondylitis in combination with HSP.

Case description: A 50-year-old male with past medical history of coronary artery disease, ankylosing spondylitis noncompliant with medications, and a history of meth use presented for evaluation of a rash that began approximately 10 days ago. He states that it began on his bilateral legs and has moved upwards toward his torso and arms. Physical exam showed a blistering, purple maculopapular rash more pronounced on the lower extremities. There was no mucosal involvement, systemic symptoms, or new medication exposure. The patient left against medical advice, and was prescribed keflex and bactrim for possible bacterial infection.

One week later, he returned for continued symptoms. The rash had more extensive spread to the trunk and with pustules and crusted lesions. CBC and CMP were within normal limits, ESR was slightly elevated at 23 mm/hr (0-20mm/hr). A full infectious panel for HIV, syphilis, hepatitis, Strep A, COVID, influenza, HSV, and VZV was negative. Wound and blood cultures were negative. Double-stranded DNA antibody testing for lupus was negative. Skin punch biopsy was performed. Results from the punch biopsy demonstrated findings consistent with Henoch-Schönlein Purpura (IgA vasculitis). Patient was given prednisone 60 mg during his hospital stay, and remarkable improvement was seen in his rash 5 days later. He was discharged with a 7 day course of doxycycline and prednisone 20mg taper. He will follow up with rheumatology for continued treatment.

Relevance: HSP is an extremely rare diagnosis in adults and can lead to kidney failure, seizures, hemorrhage, and other deadly complications if untreated. Although it can mimic cellulitis and infection, distinguishing between the two is extremely important as treatment differs drastically.

Conclusion: As seen in the progression of the patient’s symptoms, treating HSP patients with antibiotics is not effective and can even be harmful. Instead, proper treatment is with immunosuppressive steroids. Prompt treatment is imperative to prevent deadly sequelae of the condition. It should be noted that recovery from HSP is a long and painful process.

Citations:

1. John KJ, Sadiq M, Thomas M, Turaka VP. Henoch-Schonlein purpura associated with HLA-B27 positive axial spondyloarthritis in a young man. *BMJ Case Rep.* 2019 May 24;12(5):e228881. doi: 10.1136/bcr-2018-228881. PMID: 31129640; PMCID: PMC6536201.
2. Leung AKC, Barankin B, Leong KF. Henoch-Schönlein Purpura in Children: An Updated Review. *Curr Pediatr Rev.* 2020;16(4):265-276. doi: 10.2174/1573396316666200508104708. PMID: 32384035.

An Unexpected Discovery: A Suspicious Duodenal Mass Revealed as Burkitt Lymphoma

Authors: Aaron Sidhu, MD, PGY-2, Harneet Grewal, MD, PGY-1, Heather Murray, DO, PGY-1, Khushbir Bath, MD

Affiliations: Abrazo Health Internal Medicine Residency Program

Introduction: Burkitt Lymphoma (BL) is a rare and aggressive B-cell non-Hodgkin lymphoma that is classified into three separate categories - endemic, sporadic and immunodeficiency-related subtypes. Each of these subtypes have distinct pathological and clinical features, however all are characterized by rapidly progressive tumors with high rates of extranodal involvement [1]. Most can be cured with intensive combination chemotherapy regimens, but optimal therapies have not been defined. These curative therapies are more challenging in older populations - especially those with CNS involvement or relapsed disease - due to the high treatment-related toxicity in these age groups [2]. This review highlights clinical features, diagnostic work-up and emerging treatment options for adult patients with BL.

Case Presentation: Patient is a 40-year-old male with a past medical history of GERD, diabetes mellitus, hypertension, and hyperlipidemia. Patient presented with intermittent melena, worsening epigastric pain, and coffee ground emesis. He was trialed on sucralfate, famotidine and omeprazole without relief. Labs were significant for leukocytosis and thrombocytosis. Patient underwent CT abdomen and pelvis with contrast that revealed an irregular mass-like wall thickening of the gastric antrum and proximal duodenum with adjacent inflammatory change measuring 5.9 x 6.8 x 6.7 cm. Patient underwent EGD which showed erosive esophagitis and an obstructive mass involving the duodenal bulb and the second portion of the duodenum. CA19-9 and CEA returned negative, LDH was elevated at 632. Biopsy of the mass revealed Burkitt Lymphoma which expressed cMYC, CD10, CD20, Ki-67, MUM1, and Pax5. Hematology/oncology followed the patient outpatient, CT chest for initial staging showed no evidence of pulmonary or mediastinal mass or metastases. He was subsequently discharged and referred for stem cell transplantation, of which the patient is currently undergoing and tolerating well.

Clinical Impacts/Relevance: While BL is very treatable in young adults and children, the high treatment-related toxicity reduces the use of traditional approaches in older adults [1]. There are intermediate-intensity regimens that have been explored with high cure rates and low toxicity in all age groups. Autologous stem cell transplantation (ASCT) has been seen to be beneficial in high-risk and advanced BL [3]. Additionally, the MYC-oncogene has maintained a critical role in the diagnosis of BL. Recent biological advances have identified several additional mutations that interact with the MYC in the growth and development of lymphoma, leading the way for exploration of additional drug regimens for BL.

Discussion: Burkitt Lymphoma is a highly treatable disease with great chemotherapeutic response; however, there is currently no defined standard of care. The additional considerations of those who are older, with cardiac disease, and/or with CNS involvement necessitate alternative treatment options to fit the needs of each of these patient populations. Dose adjustments have been made for a more tolerable combination given the treatment-related toxicity; however, in those patients with baseline CNS disease, the lack of high-dose therapy contributes to poorer outcomes [1]. ASCT has been proven to be beneficial in chemosensitive patients with disease relapse [3]. There is a need to explore therapeutic options for those patients with primary refractory or relapsed disease. Studies using chimeric antigen receptor T-cells, bispecific antibodies, and other novel approaches are ongoing [2].

References:

[1] Dunleavy, Kieron. "Approach to the diagnosis and treatment of adult Burkitt's lymphoma." *Journal of Oncology Practice*, vol. 14, no. 11, Nov. 2018, pp. 665–671, <https://doi.org/10.1200/jop.18.00148>.

[2] Crombie, Jennifer, and Ann LaCasce. "The Treatment of Burkitt Lymphoma in Adults." *American Society of Hematology, American Society of Hematology*, 11 Feb. 2021, ashpublications.org/blood/article/137/6/743/474125/The-treatment-of-Burkitt-lymphoma-in-adults.

[3] Maramattom LV;Hari PN;Burns LJ;Carreras J;Arcese W;Cairo MS;Costa LJ;Fenske TS;Lill M;Freytes CO;Gale RP;Gross TG;Hale GA;Hamadani M;Holmberg LA;Hsu JW;Inwards DJ;Lazarus HM;Marks DI;Maloney DG;Maziarz RT;Montoto S;Rizzieri DA;Wirk B;Gajewski JL; "Autologous and Allogeneic Transplantation for Burkitt Lymphoma Outcomes and Changes in Utilization: A Report from the Center for International Blood and Marrow Transplant Research." *Biology of Blood and Marrow Transplantation : Journal of the American Society for Blood and Marrow Transplantation*, U.S. National Library of Medicine, pubmed.ncbi.nlm.nih.gov/23200705/.

Challenges of Imiquimod in Lentigo Maligna: A Case Report

Authors: Sabine Obagi, BA; Zaidal Obagi, MD; Jeff Krase, MD, PharmD

Affiliations: University of Arizona, Division of Dermatology/Banner

Introduction: Lentigo maligna (LM) presents a diagnostic challenge due to its subtle clinical features and potential for misinterpretation. Imiquimod, though commonly used off-label, remains controversial in its efficacy for LM [1]. We present a case highlighting the complexities of diagnosing LM and the limitations of imiquimod therapy.

Case Presentation: A 61-year-old woman with a history of non-melanoma skin cancer presented with a suspicious pigmented lesion on her left zygoma. Despite prior imiquimod use, the lesion showed no improvement. Dermoscopic examination revealed features atypical of benign lentigo, prompting a biopsy. Histopathological analysis confirmed lentigo maligna with adnexal extension, contradicting the expected regression with imiquimod treatment [2].

Clinical Impacts/Relevance: This case challenges the reliance on imiquimod as a diagnostic tool for LM. Imiquimod's variable efficacy underscores the necessity of histopathological confirmation in suspicious lesions. Our patient's experience highlights the importance of early biopsy in suspected LM cases to avoid delays in diagnosis and appropriate management.

Discussion: Imiquimod's mechanism of action in LM involves immune modulation and direct cytotoxic effects on atypical melanocytes [3]. Despite its potential, response rates vary, with some cases showing resistance or recurrence post-treatment [2]. Factors influencing imiquimod response include inflammatory reactions and genetic polymorphisms.

Histopathological evaluation remains paramount for LM diagnosis, especially considering the potential for imiquimod-induced histological changes, leading to misinterpretation [4]. Somani et al. reported on three patients with atypical nevi previously treated with imiquimod, where the lesions were initially misread as more severely atypical post-excision. A reanalysis revealed features of a halo or regressing nevi, underscoring the confounding pathological results that can occur with imiquimod use [4].

While imiquimod holds promise as a non-invasive treatment option, its efficacy in LM management remains debated. Studies report long-term clearance rates ranging from 50% to 88%, with recurrence rates averaging 24.5% [1, 2]. Notably, patients exhibiting an inflammatory response to imiquimod tend to benefit more from treatment [3].

Conclusion: This case underscores the necessity of histopathological confirmation in suspected LM cases, despite prior imiquimod use. Imiquimod's limited efficacy emphasizes the importance of early biopsy for accurate diagnosis and timely management.

References:

1. Seyed Jafari SM, et al. Long-Term Follow-Up of Lentigo Maligna Patients Treated with Imiquimod 5% Cream. *Cancers (Basel)*. 2023;15(5):1546. doi:10.3390/cancers1505154
2. Read T, et al. A systematic review of non-surgical treatments for lentigo maligna. *J Eur Acad Dermatol Venereol*. 2016;30:748–753. doi: 10.1111/jdv.13252

3. Naylor MF, et al. Treatment of lentigo maligna with topical imiquimod. *Br J Dermatol.* 2003;149:66–70. doi: 10.1046/j.0366-077X.2003.05637.x
4. Somani N, et al. Treatment of Atypical Nevi With Imiquimod 5% Cream. *Arch Dermatol.* 2007;143(3):379–385. doi:10.1001/archderm.143.3.379

Diagnosis of MGUS Alongside Monoclonal Antibody Administration

Authors: Harshita Talkad, Joshua Tobin, MD

Affiliations: University of Arizona College of Medicine – Phoenix, Banner University Medical Center Phoenix

Introduction: Monoclonal gammopathy of undetermined significance (MGUS) is a plasma cell dyscrasia in which a monoclonal expansion of plasma cells produces increased copies of a single immunoglobulin or its components. Patients who receive therapeutic monoclonal antibodies have been misdiagnosed with plasma cell dyscrasias due to a false positive serum protein electrophoresis. While few such cases are currently reported, the increased use of therapeutic monoclonal antibodies (MABs) necessitates a protocol for assessing whether an immunoglobulin laboratory abnormality is an artifact of a therapeutic monoclonal antibody, or a true plasma cell dyscrasia.

Case Presentation: A 67-year-old female’s migraines were well-controlled with eptinezumab, a kappa light chain type MAB approved for migraine prevention, at a dose of 300 mg IV q 3 months. She was subsequently diagnosed with MGUS, but her use of eptinezumab led to concern that her MGUS was an artifact of the MAB rather than true MGUS. Because of how effective it was, she did not want to stop the eptinezumab to see if doing so would result in resolution of her laboratory abnormalities. Instead, pre- and post-eptinezumab infusion results permitted confirmation of MGUS (Table 1) rather than her having to stop it. Furthermore, her laboratory abnormalities related to increased lambda light chain, whereas eptinezumab contains a kappa light chain.

Table 1. Patient’s Pre- and Post-Infusion Immunofixation Electrophoresis Results

Pre-Infusion Date Collected	Pre-Infusion Free Kappa/Lambda Ratio (nl: 0.26-1.65)	Pre-Infusion Free Kappa Light Chain (nl: 3.30-19.40 mg/L)	Pre-Infusion Free Lambda Light Chain (nl: 5.71-26.30 mg/L)	Post-Infusion Date Collected	Post-Infusion Free Kappa/Lambda Ratio (nl: 0.26-1.65)	Post-Infusion Free Kappa Light Chain (nl: 3.30-19.40 mg/L)	Post-Infusion Free Lambda Light Chain (nl: 5.71-26.30 mg/L)
2/28/23	0.12	16.14	132.28	3/1/23	0.10	14.60	146.85
6/1/23	0.12	15.47	125.88	6/2/23	0.11	15.85	140.41
8/31/23	0.13	15.13	113.55	9/1/23	0.12	13.12	111.75

Clinical Impacts/Relevance: This patient’s case is an important step toward the goal of developing a protocol to diagnose MGUS in patients receiving a therapeutic MAB. Had it been known that eptinezumab contained kappa type light chains that would be reflected in her free kappa/lambda ratio, the patient would have had a definitive MGUS diagnosis earlier in her clinical course.

Discussion: Assessing whether an abnormal immunoglobulin test result is an artifact of a therapeutic MAB or indicative of a plasma cell dyscrasia is crucial. In this case, MGUS was confirmed in a patient receiving a MAB without resorting to cessation of the MAB.

¹ Atkin, C., Richter, A., & Sapey, E. (2018). What is the significance of monoclonal gammopathy of undetermined significance?. *Clinical medicine (London, England)*, 18(5), 391–396. <https://doi.org/10.7861/clinmedicine.18-5-391>

¹ Gonsalves, W. I., & Rajkumar, S. V. (2022). Monoclonal Gammopathy of Undetermined Significance. *Annals of internal medicine*, 175(12), ITC177–ITC192. <https://doi.org/10.7326/AITC202212200>

¹ Chuang, F. L., & Alcantar, J. (2021). False-positive Serum Protein Electrophoresis due to Natalizumab Therapy. *Proceedings of UCLA Health*, 25. <https://proceedings.med.ucla.edu/wp-content/uploads/2021/04/Chuang-A210308FC-BLM-formatted.pdf>

¹ Felicia Tang, Ehsan Malek, Susan Math, Christine L Schmotzer, Rose C Beck, Interference of Therapeutic Monoclonal Antibodies With Routine Serum Protein Electrophoresis and Immunofixation in Patients With Myeloma: Frequency and Duration of Detection of Daratumumab and Elotuzumab, *American Journal of Clinical Pathology*, Volume 150, Issue 2, August 2018, Pages 121–129, <https://doi.org/10.1093/ajcp/aqy037>

¹ Wheeler RD, Costa MV, Crichlow A, et al. Case report: Interference from isatuximab on serum protein electrophoresis prevented demonstration of complete remission in a myeloma patient. *Annals of clinical biochemistry*. 2022;59(2):144-148. doi:10.1177/00045632211062080

Dual chamber pacemaker implantation for complete heart block in a patient with calcinosis cutis in the setting of limited cutaneous scleroderma

Authors: Connor Mayes, Dan Sorajja, MD

Affiliations: Mayo Clinic Alix School of Medicine, Department of Cardiovascular Medicine, Mayo Clinic, Phoenix, AZ

Introduction: Calcinosis cutis is a condition marked by the formation of insoluble deposits of calcium salts in the skin and subcutaneous tissues. Multiple subtypes of calcinosis cutis exist, but the most common is dystrophic calcinosis cutis in which local tissue damage leads to formation of calcium deposits. This subtype frequently presents secondary to underlying medical conditions, most commonly autoimmune connective tissue disorders such as scleroderma, /systemic sclerosis, or dermatomyositis. Rarely, calcium deposits in patients with calcinosis cutis can impact the performance of other medical procedures. Here we report the implantation of a dual chamber pacemaker for complete heart block in a patient with calcinosis cutis requiring modification of the normal implantation approach.

Case Presentation: A 68 year. old. Woman female patient, with a history of dermatomyositis and limited cutaneous scleroderma with extensive, generalized calcinosis cutis, as well as progressive aortic valve calcification and first-degree AV block, presented for symptoms including of significant fatigue and periodic chest discomfort. She was evaluated via echocardiogram and ECG and was found to have significant calcific aortic stenosis and newly developed complete heart block. The decision was made to admit the patient for further management of her symptoms. She was evaluated by the cardiology service in the hospital, and placement of a dual-chamber permanent pacemaker was recommended.

The procedure was performed the day after admission and proceeded normally apart from the location of pacemaker implantation. While the pacemaker leads were secured in the deltopectoral groove as usual, due to a large calcium deposit obstructing the normal placement of the pacemaker in the left infraclavicular area, a separate pocket was made for the pacemaker inferior to the a large calcium deposit obstructing the normal placement location in the inferolateral region of the left pectoral muscle in the left infraclavicular area. The leads were then tunneled from the area of the deltopectoral groove to join the pacemaker and both pockets were closed. Following pacemaker placement, further evaluation of the patient's cardiovascular concerns the aortic stenosis and symptoms were was conducted.

Clinical Impacts/Relevance: The presentation of calcinosis cutis as an impediment to pacemaker placement posed a clinical challenge which required a creative approach to completing the procedure. This case illustrates provides a useful example for other clinicians who may face similar challenges in patients with anatomic barriers to device implantation.

DISCUSSION: This case represents a unique instance of a modified approach to permanent dual-chamber pacemaker placement requiring a modified approach necessitated by extensive cutaneous calcium deposits in the setting of dermatomyositis and limited cutaneous scleroderma. When performing procedures in patients with similar anatomical barriers, a similar presentation, physicians should familiar themselves with consider alternative techniques to address and overcome these creative solutions to barriers imposed by the patient's unique patient situations medical and anatomical features.

Mycobacterium Tuberculosis Implicated in Formation of a Rectal Abscess: A Case Study

Authors: Nadia Khan, Caroline Casper, Ana Moran, Erin Honsa, Ahmad Aldeiri

Affiliations: Creighton University School of Medicine-Phoenix Regional Campus, Arizona Pulmonology Specialists

Abstract: There have been few cases of anorectal disease associated with Mycobacterium tuberculosis reported in the literature. We present a case of a 28-year-old male who presented with a left perirectal abscess and right ischioanal abscess with no significant past medical history. Incision and drainage and exam under anesthesia was completed. Cultures of the perirectal abscess were sent and tested positive for M. tuberculosis and Escherichia Coli. He was placed on rifampin, isoniazid, pyrazinamide, and ethambutol therapy. After the procedure, he developed encephalopathy, fever, tachypnea and CT chest revealed left lower lobe consolidation. Shortly after, he entered acute hypoxic respiratory failure and sepsis and was transferred to the ICU, where he was intubated and unfortunately developed acute respiratory distress syndrome. He was placed on extracorporeal membrane oxygenation, but unfortunately passed away. This case of mortality in a young healthy patient emphasizes the need for further literature and protocols for anorectal presentation of tuberculosis.

Introduction- Case Presentation: The patient is a 28-year-old male with no significant past medical history who presented due to rectal pain and peri-rectal purulent drainage. The patient met the criteria for sepsis at the time. CT in the emergency department showed a perirectal abscess and left lower lobe consolidation in the lung. The patient was taken to the operating room by general surgery where multiple abscesses, including a left perirectal abscess and right ischial-anal abscess, and fistula tracts were noted on exam under anesthesia. Both abscesses were debrided and cultures were taken. He was placed on ceftriaxone, metronidazole, and fluconazole. Culture of the left perirectal abscess was positive for Escherichia Coli and acid fast bacilli stain was positive for Mycobacterium tuberculosis complex. After this, the patient was placed on rifampin, isoniazid, pyrazinamide, and ethambutol (RIPE therapy).

After the procedure, the patient became encephalopathic and remained febrile and tachypneic. Chest imaging showed a persistent pneumonia. Subsequently, a lumbar puncture was completed. Shortly after, the patient was transferred to the intensive care unit (ICU) for acute hypoxic respiratory failure. Though he became stable after one day in the ICU and was transferred back to the floor, that patient decompensated immediately after with oxygen saturation in the 80s on high flow nasal cannula. He was transferred back to the ICU where he continued to decompensate despite diuresis and vasopressors. The patient developed acute respiratory distress syndrome and, after continuing to decompensate, was placed on ECMO. Respiratory culture was positive for Enterobacter cloacae complex. The patient continued to decompensate with worsening chest x-rays and ECMO requirements so tracheostomy was completed. The patient had prolonged bleeding from the tracheostomy site and continued to be hypoxic. The family was consulted, flew to Phoenix, and the patient was transitioned to comfort care. Unfortunately, he passed away shortly after this.

Post-transplant lymphoproliferative disorder presenting a patient five years status post renal transplant,
A case report

Authors: Othniel Balizou MD, Alexandra Roach MD, Sunil Tulpule MD

Affiliations: Banner University Medical Center Phoenix - - Phoenix, AZ

Introduction: Non-Hodgkin's lymphoma (NHL) constitutes a significant portion of lymphomas, encompassing a spectrum of aggressiveness. Immunocompromised individuals, particularly transplant recipients, face an elevated risk of developing lymphomas, predominantly B-cell lymphomas. Post-transplant lymphoproliferative disorders (PTLDs) represent a distinct subset of lymphomas, displaying variable onset times and clinical presentations

Case Presentation: A case study is presented of a 39-year-old male with a history of renal transplant due to Goodpasture's syndrome, presenting with symptoms suggestive of lymphoproliferative disorder. Laboratory findings revealed marked leukocytosis with white blood cell count of 128,000 (as compared to 8,000 recorded on laboratory testing from two weeks prior to ED presentation) a potassium of 8.3, phosphorus of 8.3, calcium of 8.7, lactate dehydrogenase greater than 2,000, worsening renal function, and severe metabolic acidosis concerning for a tumor lysis syndrome. Imaging of the patient chest demonstrated bilateral interstitial opacity. Emergent interventions including dialysis and leukapheresis were initiated to manage metabolic disturbances and leukostasis. Further investigation confirmed splenic B-cell lymphoma/leukemia, with concurrent aspergillosis contributing to the clinical presentation. Treatment involved reduction of immunosuppressive medications, rituximab therapy, and antifungal agents. Resolution of symptoms occurred post-treatment, with the patient discharged and advised outpatient oncology follow-up. Discussion highlights the heterogeneity of PTLDs, occurring in up to 20% of solid organ transplant recipients and 4% of hematopoietic stem cell transplant recipients. Onset varies, with a bimodal distribution and potential association with Epstein-Barr virus (EBV) infection. EBV-negative PTLDs pose diagnostic challenges, potentially involving other viral infections or genetic mutations.

Conclusion: Conclusion underscores the need for risk stratification tools, such as pre-transplant EBV serology testing, and expanded viral screening for EBV-negative cases. Further research is warranted to elucidate the pathogenesis of EBV-negative PTLDs and optimize management strategies. In summary, this case study sheds light on the complexities of PTLDs in transplant recipients, emphasizing the importance of vigilance in diagnosis, individualized treatment, and ongoing research efforts to improve patient outcomes.

Presentation of Paraneoplastic Cerebellar Degeneration in a Patient with Anti-YO Antibodies

Authors: William Graham, Noory, Eliace, Alomar, Talal, Noory, Mukhtar, Hatamy, Mena

Affiliations: Creighton School of Medicine

Introduction: Paraneoplastic cerebellar degeneration (PCD) is a rare autoimmune neurological disorder in which antibodies responding to a malignant tumor destroy Purkinje cells in the cerebellum. The neurologic symptoms typically present before the cancer is diagnosed and are thought to be related to production of anti-YO antibodies. PCD is treated by addressing the malignancy causing the autoimmune response and early diagnosis is critical. Unfortunately, PCD often carries a poor prognosis even if it is diagnosed early. Here we present a case of PCD that initially presented with ataxia and other cerebellar symptoms.

Case Presentation: A 59-year-old female presented with ataxia and other cerebellar symptoms. MRI and PET of the brain confirmed cerebellar damage. Lab examination then confirmed presence of anti YO antibodies. Anti YO antibodies are typically associated with breast cancer or gynecological cancers and may present before cancer can be seen on imaging.

Follow up PET scan found one reactive lymph node in the armpit that was confirmed to be breast cancer. Intraoperative ultrasound then removed the malignant lymph node and additionally removed a benign breast mass. Patient was started on immunomodulatory medication for the cancer. Medications included intravenous immunoglobulin (Ivlg), steroids and plasmapheresis.

5 days after starting chemotherapy, the patient developed symptoms of double vision, dizziness, nausea, and vomiting. Further treatment will not include plasmapheresis to keep the chemotherapy drugs in her system. In order to address the cerebellar dysfunction, the underlying malignancy must be treated. It should be noted that the IvIG was not effective in lowering the anti-YO antibody because anti-YO is an intracellular antibody that is unaffected by the extracellular effects of IvIG.

Discussion: Paraneoplastic cerebellar degeneration is a complication of cancer in which antibodies attack Purkinje cells in the cerebellum. This condition is most commonly detected and associated with breast and gynecological malignancies and can eventually lead to degeneration of the entire cerebellum.

Anti-YO antibody is frequently associated with PCD. This antibody is produced early during malignancy and often will begin to attack and kill cerebellar Purkinje cells before the tumor appears on imaging. Further study is needed to understand the exact mechanism, but it is believed that anti-YO antibodies first attack midline structures and lead to degradation of the pyramidal tract and brainstem.

Clinical Impacts: Treatment for PCD is highly dependent on early identification and treatment of the causative malignancy. While early treatment is associated with more favorable outcomes, PCD typically carries a poor prognosis. Symptoms typically progress for weeks to months and then stabilize after 6 months. At this time many patients are significantly physically disabled and may be required to use a wheelchair or to stay immobilized in bed.

It is essential to diagnose PCD as early as possible and to differentiate the disease from other common cerebellar disorders such as demyelinating disorders, autoimmune diseases, or central nervous systems infections.

References

Aly R, Emmady PD. Paraneoplastic Cerebellar Degeneration. 2023 Jul 4. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 Jan-. PMID: 32809473.

Afzal S, Recio M, Shamim S. Paraneoplastic cerebellar ataxia and the paraneoplastic syndromes. *Proc (Bayl Univ Med Cent)*. 2015 Apr;28(2):217-20. doi: 10.1080/08998280.2015.11929234. PMID: 25829659; PMCID: PMC4365125.

Le May M, Dent S. Anti-Yo antibody-mediated paraneoplastic cerebellar degeneration associated with cognitive affective syndrome in a patient with breast cancer: a case report and literature review. *Curr Oncol*. 2018 Dec;25(6):e585-e591. doi: 10.3747/co.25.4106. Epub 2018 Dec 1. PMID: 30607127; PMCID: PMC6291278.

Resolution of Central Sleep Apnea Following Upper Airway Surgery

Authors: Nathan G Rasmussen, BS; Kari A Martin, MD; Christopher Lamas, RPSGT; Ashley L Garrett, MD; Stephen F Bansberg, MD; Chad M Ruoff, MD;

Affiliations: ¹Creighton University School of Medicine, Phoenix, Arizona, ²Midwestern University College of Osteopathic Medicine, Glendale, Arizona, ³St. Vincent de Paul Medical Clinic, Phoenix, Arizona

Introduction: Coccidioidomycosis (Valley Fever) is a fungal infection caused by the dimorphic fungus, *Coccidioides*. Endemic to the Southwestern United States⁴, the infection may present with cough, fever, shortness of breath, muscle aches, and in rare instances, lower extremity erythematous rashes³. In this presentation, we report a resident of Arizona with multiple risk factors for coccidioidomycosis presenting to the hospital with multiple erythematous rashes on her lower extremities.

Case Presentation: Patient is a 32-year-old female, with a past medical history of ADHD, and a history of fevers, chills, mild cough and worsening bilateral lower extremities rash. Patient expresses progressively increasing pain with rash, described as pins and needles sensation that becomes worse with standing. She sought treatment for the rash at an urgent care and was prescribed Keflex and Benadryl, which did not alleviate symptoms. Patient states rash began to spread further with the presence of a subjective fever. Social history included employment at Shamrock Farms, local residence in Phoenix. On a physical exam, patient was noted to have scattered raised popular erythematous exanthem on bilateral lower extremities, along with confluent erythematous patch on right anterior foot. Two additional lesions on both posterior triceps appeared red and raised.

Upon consult, CBC, CMP were ordered along with workup with coccidioidomycosis serology, Strep ASO, Mycoplasma, TB QuantiFERON assay, Hep B, RF, ANA, Liver enzyme, and ESR tests. Leukocyte count was noted to be elevated at 24.6. An ultrasound venous duplex scan of the lower extremities showed normal compressibility and no signs of DVT.

Clinical Impacts/Relevance: *Coccidioides* fungus is endemic to the Western Hemisphere, with Arizona, and notably Maricopa County representing one of the highest average incidences of reported Valley Fever per 100,000 people during 2011–2017⁴. *Coccidioides* lives in the soil where it may become airborne if the soil is disrupted². The spherules may be inhaled into the lungs, causing Valley Fever. Risk factors include Environmental Exposure, Age and a Weakened Immune System. Symptoms include but are not limited to cough, fever, chills, shortness of breath, headache and erythematous rashes on the lower extremities.¹

Discussion: We report a resident of Arizona with risk factors for coccidioidomycosis such as occupation and place of residence. Notable in the patient, she presented as an Arizona local with several common symptoms of Valley Fever including a cough, fever, chills, and tender erythematous nodules bilaterally on the anterior shins. Upon blood work, the patient presented with a positive *Coccidioides* IgM and IgG, elevated inflammatory marker CRP and being an Arizona local, lead to the conclusion of an infectious prodrome from cocci infection, leading to the immunological response. Treatment is generally supportive if not severe. For the patient discussed, she presented with Erythema Nodosum secondary to a cocci infection; treatment includes steroids and NSAIDs. In conclusion, *Coccidioides* is a dimorphic fungus that causes Valley Fever, endemic to the Southwestern United States, particularly Maricopa County and should be suspected and diagnosed in the presence of any alarm findings in the history or physical exam.

Sebaceous Carcinoma In A Patient With The I1307k Variant Of Attenuated Familial Adenomatous Polyposis

Authors: Mahnoor Mukarram MS, Aditi Chandra DO, Justin C. Moser MD, Florencia Anatelli MD, Joseph Giancola MD, Adam Lubner MD

Affiliations: Midwestern University

Introduction: Sebaceous carcinoma (SC) is an exceedingly rare and aggressive adnexal cancer, often masquerading as a benign neoplasm on clinical examination, but demonstrating high recurrence and metastasis rates. While the association between SC and Muir-Torre syndrome (MTS) is well documented, no reports have associated SC to Familial Adenomatous Polyposis (FAP), a similar cancer predisposition syndrome. Classic FAP stems from complete deletion of the Adenomatous polyposis coli (APC) gene, whereas attenuated FAP arises from various APC gene mutations. One specific APC gene mutation known as the I1307K does not cause classical FAP but does double the risk of colorectal carcinoma in the Ashkenazi Jewish population.

Case report: We report a case of a 79-year-old male of Ashkenazi Jewish heritage who presented with an 8mm pink atrophic plaque with minimal scale on the posterior neck. Shave biopsies exhibited a nodular dermal tumor connected to the epidermis composed of atypical basaloid and vacuolated cells compatible with sebaceous differentiation. Immunohistochemical stains were positive for cytokeratin (CK), androgen receptor (AR), epithelial membrane antigen (EMA), and cytokeratin 7 (CK7). These findings were consistent with a moderately to poorly differentiated sebaceous carcinoma. Germline testing was obtained to rule out Muir-Torre syndrome (MTS), which revealed a I1307K mutation in the APC gene, consistent with attenuated Familial Adenomatous Polyposis (FAP) instead. The patient was treated with wide local excision and a subsequent PET scan was negative for metastasis.

Discussion: We present the first reported case of a sebaceous carcinoma in a patient with a known heterozygous I1307K APC mutation, highlighting a potential association between sebaceous carcinomas and this genetic anomaly.

The authors state that there are no financial relationships or funding support for this research

SOS1-Related Noonan Syndrome and Sudden Cardiac Arrest in the Absence of Cardiomyopathy – An Arrhythmia Phenotype?

Authors: Michael A. Cirelli, Jr. B.A.; Philip Wackel M.D.; Rabia Javed M.B.B.S.; Ralitzia Gavrilova, M.D.; M. Yasir Qureshi M.B.B.S.; Joseph A. Dearani M.D.; Talha Niaz M.B.B.S.

Affiliations: Mayo Clinic Alix School of Medicine, Mayo Clinic, Scottsdale, AZ, Division of Pediatric Cardiology, Department of Pediatric and Adolescent Medicine, Mayo Clinic, Rochester, MN, Division of Pediatric Hospital Medicine, Department of Pediatric and Adolescent Medicine, Rochester, MN, Department of Clinical Genomics, Mayo Clinic, Rochester, MN, Department of Cardiovascular Surgery, Mayo Clinic, Rochester, MN, Department of Neurology, Mayo Clinic, Rochester, MN

Introduction: Noonan syndrome (NS) is a predominantly autosomal dominant condition with a prevalence of 1/1000 – 1/2,500. Cardiac abnormalities such as pulmonary valve stenosis and hypertrophic cardiomyopathy are highly prevalent and reported in as much as 80% of individuals with NS. NS, similar to other conditions affecting the RAS-MAPK intracellular signaling pathway, has been linked with atrial and ventricular arrhythmias. Atrial arrhythmias are more commonly reported, while ventricular arrhythmias in NS are extremely rare in the absence of underlying structural cardiac abnormalities. NS has been associated with multiple genes, with SOS1 representing the second most commonly reported gene in NS (10-13%). Congenital heart defects are relatively common and cardiomyopathy has been reported in less than 10% of SOS1 cases.

Case Presentation: We present a unique case of a 7-year-old male with aborted sudden cardiac arrest from torsades de pointe in settings of Noonan syndrome related to familial pathogenic SOS1 variant [c.806T>C (p. Met269Thr)], but in the absence of any structural cardiovascular abnormalities or cardiomyopathy. There were no recorded instances of significant arrhythmias, sudden cardiac events or deaths in his family history.

He was in his usual state of health and had been “running around at home” before parents found him unconscious. Following cardiopulmonary resuscitation, an automated external defibrillator identified torsades de pointe (Figure 1A). Conversion to sinus rhythm and return of spontaneous circulation were achieved after two shocks. Following the event, routine workup ruled out traumatic, hematologic, metabolic, and infectious etiologies.

His initial ECG (Figure 1B) showed sinus rhythm with left axis deviation, right ventricular hypertrophy, and borderline QTc interval prolongation in settings of a recent cardiac arrest. His ECG and QTc normalized towards dismissal (Figure 1C). Imaging including echocardiogram, cardiac CT, cardiac MRI (Figure 2), and electroencephalogram demonstrated no abnormalities.

An epicardial implantable cardioverter-defibrillator was placed for secondary prevention. Trimonthly follow-up has revealed no evidence of arrhythmia through his most recent 1-year visit.

Clinical Impacts/Relevance: This is the second reported case of sudden cardiac arrest in a child with Noonan syndrome related to SOS1 in the absence of any additional cardiac defects and provokes the idea of an arrhythmia phenotype in this pathogenic variant of NS. Patients with SOS1-related NS may require periodic cardiac assessment and monitoring in the absence of any underlying structural cardiac abnormalities.

Discussion: We report an instance of aborted sudden cardiac arrest in a 7-year-old male with a confirmed SOS1 variant and a lack of evidence to support a structural cardiac, metabolic, or infectious etiology. At the time of event, his only manifestation of NS was diagnosed autism.

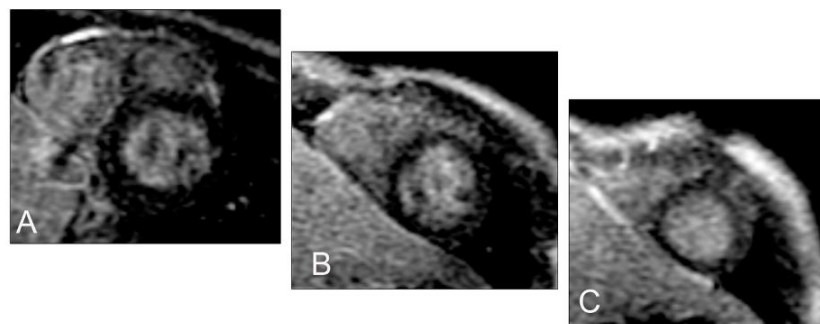
Though no definitive correlation can be ascertained from a limited existing body of knowledge surrounding SOS1 in this setting of ventricular fibrillation unrelated to structural cardiac abnormalities, future research into the correlation between specific RASopathy-associated variants and lethal arrhythmias is warranted to guide proper clinical treatment, monitoring, and management of such individuals. Furthermore, though our patient does not currently express any of the typical cardiac defects associated with NS, such clinical manifestations may become more apparent over time.

Address correspondence to: Michael Cirelli. Mayo Clinic Alix School of Medicine, 13400 E Shea Blvd, Scottsdale, AZ 85259. Email: Cirelli.Michael@mayo.edu, Phone: (203) 767-1338

Figure 1: **A:** The initial rhythm recorded on external defibrillator demonstrating Torsades de Pointe. **B:** Initial 12-lead electrocardiogram (ECG) on arrival demonstrating normal sinus rhythm with left axis deviation, right ventricular hypertrophy, and borderline QTc interval prolongation (469 msec). **C:** Follow-up 12-lead electrocardiogram demonstrating normalization of QTc (441 msec).



Figure 2 A, B, C: Representative short axis late gadolinium enhancement cardiac magnetic resonance imaging (CMRI) demonstrating no evidence of delayed myocardial enhancement.



Successful Treatment of Refractory Cholinergic Urticaria with Scheduled Sublingual Cannabinoid Therapy:

Authors: Elliot Jensen, John Ashurst DO

Affiliations: Midwestern University, Arizona College of Osteopathic Medicine

Introduction: Cholinergic Urticaria (CholU) is a subtype of chronic inducible urticaria that presents as extremely pruritic pinpoint wheals with surrounding erythema.¹ Disease onset is commonly in the 3rd decade of life, affecting males and females equally. CholU is typically induced by a rise in body temperature due to either external (heat, spicy/hot food) or internal (emotional stress) factors.² Mainstay of treatment is H1 antihistamines (H1RA), with omalizumab therapy reserved for non-responders to high doses of H1RA's.³ Recently dupilumab has been shown to be effective in patients unresponsive to standard treatment.⁴ Other medications including scopolamine butylbromide, and a combination of propranolol, montelukast & antihistamines (among others) have been used with varying levels of efficacy. Here we present a novel case of refractory CholU successfully treated with cannabinoids.

Case Presentation: 27-year-old male presents to clinical as transfer of care for primary management of CholU refractory to treatment with antihistamines, glucocorticoids, and omalizumab. The patient has no history of allergic diseases at any point in their life. Disease onset was January 2022 with nicotine as an inciting factor. Pruritis and pinpoint wheals with surrounding erythema that quickly develop into raised and palpable pinpoint papules that are diffusely present over the face, head, neck, arms and torso. Symptoms last 2-3 minutes on average but can persist up to 10 minutes or longer. Main exacerbating factors are heat, exercise, and emotional stress. Cold showers and air conditioning provide relatively immediate relief of symptoms. Patient previously failed H1 antihistamine and omalizumab therapy. During initial visit the patient was given a dupilumab loading dose and questionnaire on quality of life of patients with cholinergic urticaria (CholU-QoL) to help monitor symptoms.⁵ After 6 months of minimal improvement the patient began self-administering 200mg sublingual cannabinoid drops every 2 hours with near-complete resolution of symptoms. CholU-QoL questionnaire results after 1 month of cannabinoid use showed marked improvement in all 5 domains and total aggregate score after 7 months of minimal improvements. (Figure 1)

Clinical Impacts/Relevance: The successful utilization of cannabinoids for treatment of CholU offers new possible avenues of research to help elucidate the underlying cause of this disease. CBD's use in autoimmune diseases lends significance to the theory that CholU is an autoimmune mediated process. While CBD and other cannabinoids are known to be anti-inflammatory, especially in the skin. CBD and CBG are also both known to act upon TRP channels, which notably play a role in thermal nociception in the skin.^{6,7}

Discussion: Here we described the case of a 27-year-old male patient suffering from a 2-year history of CholU unresponsive to treatment. This case provides an alternative therapy option as well as a stepping-stone of information to help elucidate the mechanism of action upon which CholU affects the integumentary system. Given TRP channels' role in thermal nociception, the documented interaction of cannabinoids with these channels, and heat as the largest trigger to CholU symptoms, the investigation of TRP channels and their role in CholU seems a logical next step in research for this disease.

1. Fukunaga A, Oda Y, Imamura S, Mizuno M, Fukumoto T, Washio K. Cholinergic Urticaria: Subtype Classification and Clinical Approach. *Am J Clin Dermatol*. Jan 2023;24(1):41-54. doi:10.1007/s40257-022-00728-6
2. Abajian M, Schoepke N, Altrichter S, Zuberbier T, Maurer M. Physical urticarias and cholinergic urticaria. *Immunol Allergy Clin North Am*. Feb 2014;34(1):73-88. doi:10.1016/j.iac.2013.09.010
3. Maurer M, Fluhr JW, Khan DA. How to Approach Chronic Inducible Urticaria. *J Allergy Clin Immunol Pract*. Jul-Aug 2018;6(4):1119-1130. doi:10.1016/j.jaip.2018.03.007
4. Sirufo MM, Catalogna A, Raggiunti M, De Pietro F, Ginaldi L, De Martinis M. Cholinergic Urticaria, an Effective and Safe "Off Label" Use of Dupilumab: A Case Report with Literature Review. *Clin Cosmet Investig Dermatol*. © 2022 Sirufo et al.; 2022:253-260.
5. Ruft J, Asady A, Staubach P, et al. Development and validation of the Cholinergic Urticaria Quality-of-Life Questionnaire (CholU-QoL). *Clin Exp Allergy*. Apr 2018;48(4):433-444. doi:10.1111/cea.13102
6. Julius D. TRP channels and pain. *Annu Rev Cell Dev Biol*. 2013;29:355-84. doi:10.1146/annurev-cellbio-101011-155833
7. De Petrocellis L, Ligresti A, Moriello AS, et al. Effects of cannabinoids and cannabinoid-enriched Cannabis extracts on TRP channels and endocannabinoid metabolic enzymes. *Br J Pharmacol*. Aug 2011;163(7):1479-94. doi:10.1111/j.1476-5381.2010.01166.x

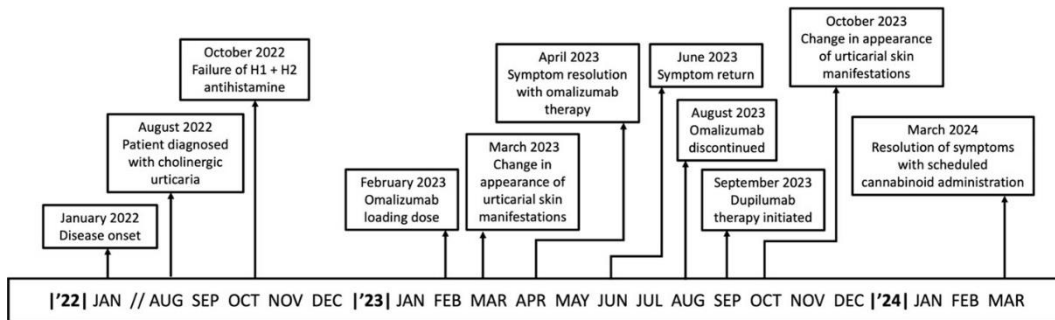


Figure 1: Timeline of cholinergic urticaria disease course, therapies, and symptom progression in an Arizona resident - January 2022 – March 2024



Figure 2.1-2.2: Pinpoint wheals with surrounding erythema diffusely present over the torso, neck, and arms. Figure 2.3: Raised and palpable pinpoint papules on the right forearm. Figure 2.4: Change in cutaneous manifestation to confluent erythematous macules after initiation of dupilumab therapy.

A Congenital Problem Detected in Adulthood: A Case of a Morgagni Hernia

Authors: Whitley Figge, MS, OMS IV, Dr. Devin Gray, MD FACS

Affiliations: A.T. Still University, Surgical Professionals, Inc.

Introduction: The diaphragm is an important respiration muscle and serves as a partition between the thoracic and abdominal cavities³. In the event of developmental defects, these functions of the diaphragm can be compromised. Often congenital diaphragmatic hernias are detected in the prenatal period but under rarer circumstances can be detected in adults either incidentally or secondary to symptom assessment^{1,4,5}. We present a case of an adult female with a hernia in her right hemidiaphragm, also known as a Morgagni hernia.

Case Presentation: The patient is a 61-year-old female with history of migraines and hypothyroid who presented to the clinic with a soft, reducible 10x10cm ventral mass that developed over the last 4-5 months. Her surgical history was also significant for a total abdominal hysterectomy and an ostomy and reversal secondary to a perforated colon. She endorsed a pulling sensation in her abdomen and nausea. She also had a chronic wound at the distal portion of her previous incision, likely a suture granuloma. Due to her abdominal surgical history, a CT scan was obtained for surgical planning of the ventral hernia repair. In addition to the ventral hernia and postoperative changes, this revealed a large Morgagni hernia in the anteromedial right hemidiaphragm with omental fat and part of the right colon herniating into the right hemithorax. Due to the herniation of abdominal contents and the risk for incarceration, surgical intervention was pursued. This patient's procedure was done in open fashion due to the size of the ventral hernia. The Morgagni hernia was visualized in the anteromedial right hemidiaphragm and looked as though the diaphragm had been pulled away from the sternal and costal margins. This defect was addressed with a primary repair while the ventral hernia was repaired with mesh.

Clinical Impact/Relevance: As mentioned above, diaphragmatic hernias are typically diagnosed in the prenatal or neonate period but they should be recognized as a pathology that can present in adults as well⁴. When the diaphragm is compromised a patient may have altered respiratory function or a compromised barrier to the abdominal cavity, thus it is important to surgically correct it to prevent future complications.

Discussion: Morgagni hernias comprise less than 5% of congenital diaphragmatic hernias (the other primary types being Bochdalek and hiatal) and are often asymptomatic due to their location⁵. When symptoms do arise they are often nondescript respiratory and upper gastrointestinal discomfort which carry a multitude of differential diagnoses^{1,5}. This patient serves as an example of someone who lacked specific diaphragm-related symptoms but had a Morgagni hernia requiring surgical repair due to the presence of colonic content in her hemithorax. It is important to note that since Morgagni hernias are quite rare, there is no clear consensus on the preferred method of surgical repair^{1,2}. This patient's defect was easily approximated without significant tension so mesh was not used. It was discussed that should mesh need to be used, biologic would likely be the better choice given the dynamics of the diaphragm, but this is not explicitly supported in the literature^{1,2}.

References

1. Contreras, N, Varghese TK, Miltzman, B. Management of Congenital Hernias in Adults: Foramen of Morgagni Hernia. *Thorac Surg Clin*. 2024. doi: 10.1016/j.thorsurg.2024.01.004
2. Kesieme EB, Kesieme CN. Congenital diaphragmatic hernia: review of current concept in surgical management. *ISRN Surg*. 2011;2011:974041. doi:10.5402/2011/974041

3. Pickering M, Jones JF. The diaphragm: two physiological muscles in one. *J Anat.* 2002;201(4):305-312. doi:10.1046/j.1469-7580.2002.00095.x
4. Rajkumar K, Kulkarni S, Talishinskiy T. Morgagni hernia: an uncommon pathology in adults. *J Surg Case Rep.* 2022;2022(12):rjac597. Published 2022 Dec 30. doi:10.1093/jscr/rjac597
5. Svetanoff, WJ, Rentea RM. Morgagni Hernia. StatPearls. Treasure Island (FL): StatPearls Publishing; 2024 Jan. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK557501>

Authors: Anupama Somaratna, MS, Katerina Liong, BS, Deepti Boddupalli, MD

Affiliations: Creighton University School of Medicine – Phoenix

Introduction: Acute pancreatitis (AP) is an acute inflammatory process of the pancreas causing local tissue injury triggering a systemic inflammatory response and result in vascular complications such as pulmonary embolisms (PE). Early recognition can prevent a major cause of morbidity and mortality.

Case Presentation: The patient is a 27-year-old man with BMI 29 who presented to ED with two-day history of abdominal pain, nausea, and vomiting. He was admitted to ICU for diabetic ketoacidosis (DKA) in the setting of undiagnosed diabetes mellitus (DM). He was downgraded to floor on Day 5 with abdominal drain in the right-lower-quadrant secondary to imaging-confirmed acute interstitial pancreatitis with negative cultures on the drain output. US ordered for fluid collection due to persistent drain output and GI was consulted for outpatient drain follow-up as patient was very keen on discharge. At this time, patient was clinically stable, ambulating on hallways without chest pain or tachycardia, and tolerating diet without evidence of diarrhea or abdominal pain.

On Day 16, patient had an acute decompensation requiring high flow nasal canula FiO₂ 95% and 50L and eventually maximum ventilator settings for acute hypoxic respiratory failure. Bedside CXR showed pleural effusion and increased perihilar congestion. MRI Abdomen demonstrated AP with increased loculation of complex peripancreatic fluid collections suspicious for acute necrotic (or infected) collections. Antibiotics were changed for sepsis differential, cultures drawn, and transferred to ICU. CT Angiography demonstrated bilateral PEs, including right main pulmonary artery saddle embolus. He underwent emergent IR-guided thrombectomy and heparin therapy with immediate resolution of symptoms. Upon further questioning, no family history of blood clots, recent travels, trauma, negative Factor V Leiden Mutation on thrombophilia screening. Patient was on age and weight appropriate chemical uninterrupted anticoagulation appropriately since admission.

Clinical Impact/ Relevance: Extreme acute inflammatory state in AP can lead to PE despite being on age and height appropriate prophylactic anticoagulation. To our knowledge, this is the first description of PE in the setting of AP and DKA.

Discussion: While the exact pathogenesis of AP complicated by PE is unclear, the underlying mechanism is thought to involve the release of pancreatic juices containing proteolytic enzymes into the bloodstream from a cyst connected to the pancreatic duct and direct vasculitis [1]. This triggers the formation of a thrombus secondary to vasculitis, releasing procoagulant substances and activation of platelets, inducing a hypercoagulable state. It is thought that hypercoagulability in AP is due to hepatic dysfunction, hypertrypsinemia (resulting in raised fibrinogen and factor VIII concentrations), and cachexia [2].

DM is a hypercoagulable state and DKA can further affect factors known to affect thrombotic activity and generate hemostatic abnormalities [3]. Studies have implied that the prothrombotic state in DKA is due to the modification of coagulation dynamics with paradoxical platelet behavior, endothelium activation, diminution of anticoagulation system, and global activation of fibrinolytic system [4].

The hypercoagulable state of DM and the extreme inflammatory state of AP can have a combined effect of a highly prothrombotic state that can result in vascular complications such as PEs.

References:

- [1] Fu XL, Liu FK, Li MD, Wu CX. Acute pancreatitis with pulmonary embolism: A case report. *World J Clin Cases*. 2021 Feb 6;9(4):904-911. doi: 10.12998/wjcc.v9.i4.904. PMID: 33585638; PMCID: PMC7852627.
- [2] Skaff Y, Jarrah M, Filippaios A, Sharkawi MA, Mehawej J. Emphysematous pancreatitis with pulmonary embolism: A case report. *Respir Med Case Rep*. 2023 Jan 16;42:101813. doi: 10.1016/j.rmcr.2023.101813. PMID: 36691653; PMCID: PMC9860406.
- [3] Carl GF, Hoffman WH, Passmore GG, Truemper EJ, Lightsey AL, Cornwell PE, Jonah MH. Diabetic ketoacidosis promotes a prothrombotic state. *Endocr Res*. 2003 Feb;29(1):73-82. doi: 10.1081/erc-120018678. PMID: 12665320.
- [4] Langevin C, Lamarche C, Bell RZ, Vallée M. Presumed paradoxical embolus in a patient with diabetic ketoacidosis. *Int J Gen Med*. 2015 Sep 18;8:297-301. doi: 10.2147/IJGM.S87521. PMID: 26445558; PMCID: PMC4590547.

A Clinical Vignette: Overcoming Diagnostic Challenges in Autoimmune Encephalitis

Authors: Taylor Patten, Samantha Blanchard, Mahnoor Mukarram, MS, Sadiya Fatima, MD, Juan Vargas, MD

Affiliations: Midwestern University Arizona College of Osteopathic Medicine, Verde Valley Medical Center

Autoimmune encephalitis is an immune-mediated inflammation of the brain with a heterogeneous clinical presentation that can lead to a perplexing diagnostic dilemma for physicians. Other potential diagnoses must be ruled out before immunotherapy can be administered.

A 73-year-old male with a history of uncontrolled type 2 diabetes mellitus, CKD stage IIIB, hypertension, and hypothyroidism presented to the ED with two days of memory loss, generalized weakness, and tremulousness. On physical exam, he was unable to stand or ambulate. Of note, the patient had a shuffling gait, intention tremor, and cogwheel rigidity, that were new in onset. Imaging in the ED was unremarkable, including a CT of the head. The patient was admitted for metabolic encephalopathy of unclear etiology. While Parkinson's disease was initially suspected, it was ruled out due to the acute onset of symptoms. Throughout his hospital stay, the patient's mentation declined and his symptoms worsened. MRI was unremarkable. EEG demonstrated background slowing consistent with encephalopathy. An underlying neurodegenerative disease such as Lewy body dementia with decompensation was suggested as the patient's condition continued to deteriorate. A lumbar puncture was then obtained which ruled out an infectious etiology. CSF contained 15 WBC/89% lymphocytes. At this time, autoimmune encephalitis was the sole working diagnosis. On hospital day 5, 1 gram of IV methylprednisolone was started daily. After 3 days of this treatment, the patient was markedly improved. He was ambulatory and his mental status had returned to baseline. The Solu-Medrol dosage was reduced to 250 mg twice daily while awaiting the autoimmune encephalitis panel. The patient was discharged on prednisone 80 mg with a long taper. Following discharge, the patient's CSF was determined to be negative for autoantibodies against the tested antigens.

This case demonstrates the challenges involved in accurately diagnosing autoimmune encephalitis. Given the rarity of this disease, it is often overlooked by clinicians in their initial differentials, potentially resulting in inaccurate or missed diagnoses.

One of the diagnostic hurdles lies in the multitude of potential causes of encephalitis. This may lead physicians to initially consider infectious etiologies, especially considering the overlap in symptomatology. Recently however, there has been a surge in cases arising from non-infectious origins, predominantly autoimmune. These cases have been found to be potentially linked to autoantibodies targeting synaptic proteins and neurons. The diagnostic approach for autoimmune encephalitis is limited as laboratory testing is only capable of detecting certain antigens. Recent advances in the diagnostic criteria of autoimmune encephalitis have been made and include the following: 1) new-onset short-term memory loss, altered mentation, or psychiatric illness within the past three months; 2) MRI with evidence of encephalitis, WBC count greater than 5, new-onset seizures, or focal neurological signs; 3) exclusion of all other differentials. Due to the patient's significant clinical improvement with a taper of methylprednisolone therapy along with the exclusion of infectious etiologies, Parkinson's disease, and Lewy body dementia, autoimmune encephalitis became the leading presumptive diagnosis. Although he was found to have antibody-negative disease, our patient ultimately met the criteria for autoimmune encephalitis.

References

Dalmau J, Graus F. Diagnostic criteria for autoimmune encephalitis: utility and pitfalls for antibody-negative disease. *Lancet Neurol*. 2023 Jun;22(6):529-540. doi: 10.1016/S1474-4422(23)00083-2. PMID: 37210100.

Graus F, Titulaer MJ, Balu R, Benseler S, et al. A clinical approach to diagnosis of autoimmune encephalitis. *Lancet Neurol*. 2016 Apr;15(4):391-404. doi: 10.1016/S1474-4422(15)00401-9. Epub 2016 Feb 20. PMID: 26906964; PMCID: PMC5066574.

Nissen MS, Ryding M, Meyer M, Blaabjerg M. Autoimmune Encephalitis: Current Knowledge on Subtypes, Disease Mechanisms and Treatment. *CNS Neurol Disord Drug Targets*. 2020;19(8):584-598. doi: 10.2174/1871527319666200708133103. PMID: 32640967.

Evaluating The Potential Use of Wearable Fitness Devices as a Measure of Outcomes in Orthopaedics

Authors: Jordan Henderson, BS, Santiago Logan-Baca, BS, Sara Kisiel, BS, Fadi Muhaidat, PhD, David Jaffe, MD

Affiliations: The University of Arizona College of Medicine – Phoenix, California State University, San Bernardino, Universal Research Solutions LLC, OrthoArizona

Introduction: Orthopaedic surgeons routinely utilize Patient Reported Outcome Measures (PROMs) to evaluate surgical and nonsurgical treatment outcomes. PROMs can be cumbersome to both patients and surgeons with issues of noncompliance. With the rise of wearable fitness devices and smartphone applications, alternative methods are being explored for a more efficient and objective measurement of outcomes. There is a lack of studies directly comparing PROMs with patient wearable outcome (PWO) methods. This study aims to compare PWOs to PROMs and determine the feasibility of using PWOs as an outcome measurement tool in orthopaedics. The findings of this study could have implications for surgeons to integrate phone application-based technology into orthopaedic care in conjunction with PROMs and the potential to be used independently of PROMs to measure outcomes.

Methods: This study is a non-randomized prospective cohort study with a known foot and ankle orthopaedic condition presenting to an orthopaedic clinic. Subjects with any foot and ankle condition over the age of 16 were asked to participate. Standard PROM surveys were administered at enrollment and then at 1 month, 2 month, and 3 month time periods. Surveys utilized were the Foot and Ankle Ability Measure Computerized Adaptive Testing (FAAM CAT), PROMIS physical function, mobility and pain interference scores, and Visual Analog Scale (VAS). A mobile phone application was then installed in subjects' smartphones that utilized past and future health data including step counts and distance traveled. Statistical analysis was performed to correlate PWO's with PROMs.

Results: Our study analyzed 19 participants aged 17 to 77, who complied with the treatment protocol. There were strong positive correlations in step counts across consecutive months, notably from 1-month to 2-month ($r = 0.913$, 95% CI: 0.783 to 0.966) and 1-month to 3-month ($r = 0.852$, 95% CI: 0.648 to 0.942), indicating consistent physical activity. However, the relationship between activity levels (measured by step counts) and pain perception (Pain-VAS scores) proved complex, with variable moderate correlations (3-month Pain-VAS Score vs 3-month Steps, $r = 0.416$, 95% CI: -0.245 to 0.813) suggesting that higher activity might be associated with greater pain at different time points.

Discussion: This study highlights the potential value of integrating objective physical activity data from wearable devices with PROMs for a more holistic assessment. The variable moderate correlations discovered underscores the challenge of correlating pain directly with physical activity. Despite objective measurements of activity consistency, patient-reported scores on factors like daily living and sport were nuanced, underscoring the complex interplay between physical functioning and subjective experience of pain. A balanced approach considering both objective and subjective data is needed to enhance treatment strategies and improve patient outcomes.

Keywords: PROMs, orthopaedics, smartphone

Addressing dysphagia in Hepatocellular Carcinoma Metastasis: A Radiation Oncology Perspective

Authors: Jad Alsheikh, Eliace Noory

Affiliations: Creighton University School of Medicine, Phoenix, AZ

Introduction: Targeted radiation is a cancer therapy that uses high-energy rays to potentially reduce tumor size. By precisely targeting the tumor, damage to surrounding healthy tissues can be minimized. In this poster, we focus on a case of a 77-year-old male with hepatocellular carcinoma (HCC) with pulmonary metastases presenting with dysphagia due to a retropharyngeal necrotic mass. Our aim is to highlight the therapy's effectiveness in treating tumor-induced obstructions, especially when surgery is not an option.

Case Presentation: Pt was a 77-year-old male, previously diagnosed with hepatocellular carcinoma (HCC) and pulmonary metastases, who presented with dysphagia following the initiation of chemotherapy in September. A CT scan conducted at an outside hospital revealed a retropharyngeal necrotic mass measuring 6x5 cm, raising concerns of malignancy. Initial treatment included medications for potential thrush and mucositis, alongside a consultation with thoracic surgery, which deemed surgical removal unsuitable. Subsequently, the patient was transferred to St. Joseph's for assessment by radiation oncology on 11/1. Both GI and radiation oncology consultations were arranged. The cause of dysphagia was identified as mucositis by the GI team. A plan for CT simulation was made by the radiation oncology team on 11/1. Nutrition management initiated a liquid-only diet under supervision, with a plan to advance to minced foods as tolerated. The patient reported mild dysphagia, which alleviated somewhat. Nutrition plans to advance the diet to minced foods, with the dietitian discussing the goal of achieving 75% of meal intake to prevent excessive weight loss. Radiation oncology planned for a treatment regimen of 20 Gy over 5 fractions. The patient is expected to remain hospitalized until the completion of treatment and will subsequently be discharged to a skilled nursing facility.

Clinical Relevance: Radiation oncology can be consulted for primary treatment, an adjuvant to surgery, or in combination with chemotherapy to enhance treatment efficacy. The development of targeted therapy, such as stereotactic body radiation therapy, has improved the precision and outcomes of this form of treatment. Determining the type and fractionation of radiation is based on a balance between effective tumor control and decreasing side effects.

Discussion: In the presented case, the patient's advanced HCC with pulmonary metastases led to significant complications, including dysphagia from a retropharyngeal mass measuring 6.0 x 5.1 cm. Due to the patient's condition and the tumor's location, surgical intervention was ruled out as a treatment option. Therefore, targeted radiation therapy was chosen as the most viable strategy to address the mass causing the obstruction and to relieve the symptoms of dysphagia.

The decision to use targeted radiation therapy indicates its role in situations where conventional treatments may not be suitable. By focusing the radiation onto the mass itself, we can potentially achieve symptom relief and control its size. This is especially important in complex cases such as this due to the involvement of critical anatomical structures. The patient's improvement in swallowing and the ability to progress to a minced food diet demonstrates how it can offer hope and improve quality of life to patients with advanced cancer.

HEALTH POLICY/ MEDICAL EDUCATION

Refers broadly to any original, systematic, scientific analysis of, or model for, health care education or health care policy.

A Bibliometric Analysis of Female Authorship in the Top 100 Most Influential Orthopedic Publications

Authors: Camryn Payne, BA; Sayi Boddu, BA; Paul Van Schuyver, MD; Joshua S. Bingham, MD

Affiliations: Mayo Clinic Alix School of Medicine, Scottsdale, AZ, Department of Orthopaedic Surgery, Mayo Clinic, Phoenix, AZ

Introduction: Orthopedic surgery is currently the medical specialty with the least gender diversity (1). Female authorship in major orthopedic surgery publications continue to lag behind what would be predicted (2). Our study examines the involvement of women in the top 100 most-cited orthopedic articles published between 2010-2024. We aimed to compare the proportion of female authorship in the top 100 studies to the national proportion of female orthopedic surgeons and evaluate the H-indices of female and male authors.

Methods: Data were obtained from the Clarivate Analytics Web of Knowledge database. The literature search was performed to capture all iterations of "General Orthopedics". The search was conducted with a date range of 2010-2024, and was restricted to publications written in English, originating in the United States, and in the Research Area of "Orthopedics". Articles must present clinical information regarding orthopedics. The top 100 articles were further reviewed and those whose author's first names were not provided were excluded. The gender of all authors was determined based on the author's first name by two independent reviewers through consensus. The Scopus Author Database was utilized to determine the H index for all first and senior authors. Descriptive analysis was used to compare the H-indices of the unique male and female authors.

Results: 90 general orthopedics articles met the criteria. These articles were authored by a total of 542 authors, of which 14.2% were female. Of the 90 papers that met criteria, 11 (12.2%) had female first authors. There were 362 names listed as middle authors, of which 55 (15.2%) were female. 90 papers listed senior authors, of which 11 (12.2%) were female [Figure 1]. There were 9 unique female senior authors. Both male first and senior authors had higher median H-indices than female first and senior authors [Table 1].

Discussion: Our study found that 14.2% of contributing authors in the top 100 most-cited articles were female and the national proportion of females in orthopedics is 5.9%. (1). This discrepancy could indicate that research teams are more productive and create higher quality projects when the research team includes women, as this leads to increased diversity of thought. It could also reflect the fact that female orthopedic surgeons tend to practice in academia more than in private practice (3). The slightly higher percentage of female middle authors (15.2%) compared to first or senior female authors (12.2%) indicates that women in orthopedics may be less likely to be in leadership positions in academia and may therefore have less senior authorship compared to their other roles in research (4). Male first and senior authors were also found to have higher H-indices. While representation is growing in orthopedic surgery, more women are at junior stages of training and professorship (5). This may limit opportunities, connections, and collaborations, ultimately leading to a lower H-index. Considering the underrepresentation of women in orthopedic surgery, it is impressive that they have increased representation in the top 100 studies. Further equity in training, mentorship, and opportunities is necessary to bridge the gap.

Figures:

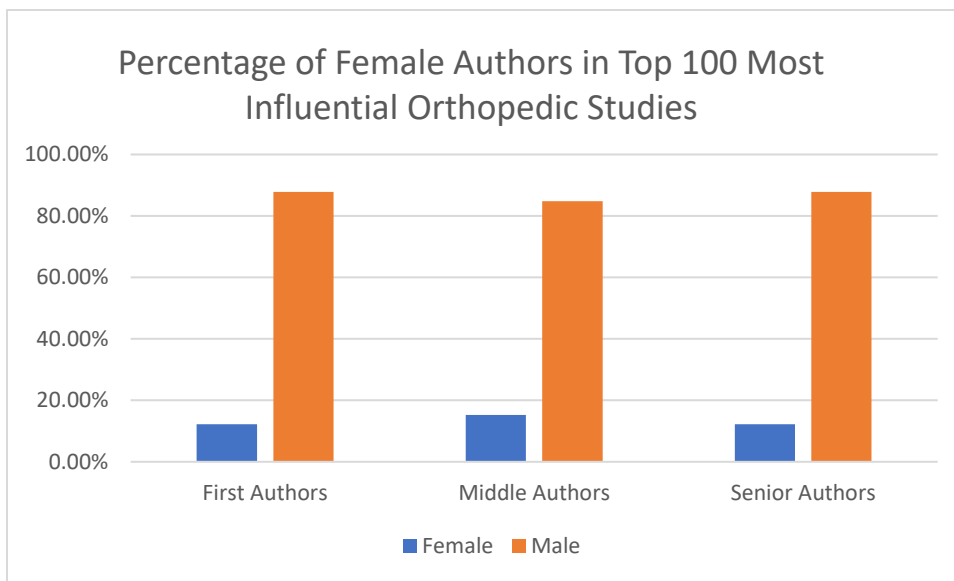


Figure 1. Percentage of Female Authors in Top 100 Most Influential Orthopedic Studies

	N	Mean	Median	IQR	Min	Max
Male First Authors	61	38.4	35	41.5	1	113
Female First Authors	11	24.7	15.5	49.3	1	59
Male Senior Authors	59	55.0	56	38	4	116
Female Senior Authors	9	39.8	33	48	2	85

Table 1. Comparison of H-indices between unique male and female first and senior authors in top 100 most influential orthopedic publications. [2]

References

1. AAMC [Internet]. [cited 2024 Apr 17]. What's your specialty? New data show the choices of America's doctors by gender, race, and age. Available from: <https://www.aamc.org/news/what-s-your-specialty-new-data-show-choices-america-s-doctors-gender-race-and-age>
2. Okewunmi J, Kiani SN, Poeran J, Galatz LM. Female Authorship in the US Orthopaedics Literature: A Bibliometric Analysis of Trends. *J Am Acad Orthop Surg*. 2023 Jun 15;31(12):627–33.
3. Rohde RS, Wolf JM, Adams JE. Where Are the Women in Orthopaedic Surgery? *Clin Orthop*. 2016 Sep;474(9):1950–6.
4. Orthopedic Sub-Specialties Vary in Representation of Female Fellowship Program Directors | Published in *Journal of Orthopaedic Experience & Innovation* [Internet]. [cited 2024 Apr 18]. Available from: <https://journaloei.scholasticahq.com/article/75452-orthopedic-sub-specialties-vary-in-representation-of-female-fellowship-program-directors>
5. Van Heest AE, Agel J, Samora JB. A 15-Year Report on the Uneven Distribution of Women in Orthopaedic Surgery Residency Training Programs in the United States. *JBJS Open Access*. 2021 May 28;6(2):e20.00157.

A lack of difference between female and osteopathic physicians on the editorial boards of primary care, surgical subspecialty, and medical subspecialty journals.

Authors: Angelique Shumway OMSII, Alexander Candel OMS II, Mason Kyle OMS II, Oren Saghian OMSII, Manjinder Gill OMSII, Tara Mohanroy OMS II, Jen Riedel OMSII, Samantha Gluzinski OMSII, Scott Farr OMSII, Dhairya Shah OMSII, Kevin Vander Werff OMSII, Christopher Sleiman OMSII, Muhammad Kashif OMSII, Brian Mayer OMSII, and John Ashurst DO, DEd, MS for the MWU MIRAGE Research Lab

Affiliations: Arizona College of Osteopathic Medicine, Department of Assessment

Background: The Association of American Medical College's annual Physician Specialty Data Report (2022) revealed females represent 47.3% of practicing physicians and osteopathic physicians make up 16.9% of total practitioners. However, several studies, such as the ones evaluated by Spector and Overhouser (2019), showed that there is still a significant gender disparity in hospital staff, journal editorial boards, faculty appointments, and compensation. Despite a 2023 study by Miyawaki et al. (2023) demonstrating comparable patient outcomes between those treated by Allopathic and Osteopathic physicians in the hospital setting, osteopathic physicians face misrepresentation in public eye to the extent that the American Medical Association and American Osteopathic Association released a joint statement in 2020 to stand against such misrepresentation. This research aims to address the lack of representation of females and osteopathic physicians among core, surgical, and medical specialties.

Objective: To determine if there is a difference in the number of female and osteopathic physicians who serve on primary care, surgical, and medical subspecialty editorial boards.

Methods: The editorial boards from the top five journals, based on impact factor and published in the English language, from the traditional primary care, surgical, and medical subspecialties were reviewed. Editorial board members were further categorized based upon their respective titles into the following groups: Editor in chief, Associate/Assistant/Deputy Editor in Chief, Executive/Senior/Section Editors, Assistant/Associate Editors, and Other Editors. Each editor's gender and medical degree were assigned using text, images, or pronouns available on research databases or hospital-affiliated websites. Persons on an editorial board without a medical degree were removed from analysis. An analysis of variance followed by a Turkey test was used to determine if the editorial boards in each subspecialty studied had a difference in the number of female and osteopathic physicians.

Results: A total of 4,877 editors were reviewed with 766 being female and 32 being an osteopathic physician. There was no difference in the number of females who served as an editor ($p=0.82$), editor in chief ($p=0.95$), Associate/assistant/Deputy Editor in Chief ($p=0.49$), Executive/Senior/Section Editors ($p=0.43$), Assistant/Associate Editors ($p=0.85$), or Other Editors ($p=0.29$) between the medical specialties studied. There was also no difference in the number of osteopathic physicians who served as an editor ($p=0.69$), Executive/Senior/Section Editors ($p=0.25$), Assistant/Associate Editors ($p=0.91$), or Other Editors ($p=0.69$) between the medical specialties studied. A statistically significant difference in the number of osteopathic physicians who served as an Associate/assistant/Deputy Editor in Chief was noted between the specialties ($p=0.03$) in aggregate but not between the individual specialties when examined.

Conclusion: Despite the number of females and osteopathic physicians in primary care, there is no difference in the number who serve as editors between journals in primary care, surgical subspecialties, and medical subspecialties.

References:

1. 2022 Physician Specialty Data Report Executive Summary | AAMC. (n.d.). AAMC.
<https://www.aamc.org/data-reports/data/2022-physician-specialty-data-report-executive-summary>
2. American Medical Association. (2020, November 4). AOA and AMA stand against misrepresentation of osteopathic physicians. <https://www.ama-assn.org/press-center/press-releases/aoa-and-ama-stand-against-misrepresentation-osteopathic-physicians>
3. Spector ND, Overholser B. Examining Gender Disparity in Medicine and Setting a Course Forward. *JAMA Netw Open*. 2019;2(6):e196484. doi:10.1001/jamanetworkopen.2019.6484
4. Miyawaki, A., Jena, A. B., Gross, N., & Tsugawa, Y. (2023). Comparison of hospital outcomes for patients treated by allopathic versus osteopathic hospitalists. *Annals of Internal Medicine*, 176(6), 798–806. <https://doi.org/10.7326/m22-3723>
5. Physician Statistics based on Allopathic (M.D.) and Osteopathic (D.O.) Education. *Delaware J Public Health*. 2022 Dec 31;8(5):173. doi: 10.32481/djph.2022.12.041. PMID: 36751593; PMCID: PMC9894055.

Analysis of Common Patient-Directed Web Queries and Online Website Quality for Hip Fractures

Authors: Alejandro M. Holle, BS; Camryn S. Payne, BA; Annika N. Hiredesai, BA; David G. Deckey, MD, Jens T. Verhey, MD, Joshua S. Bingham, MD

Affiliations: Mayo Clinic Alix School of Medicine, Scottsdale, AZ, Department of Orthopaedic Surgery, Mayo Clinic, Phoenix, AZ

Introduction: Femoral neck and intertrochanteric hip fractures are among the most common injuries affecting the elderly. However, publicly available internet content pertaining to hip fractures remains largely unstudied. This study aimed to identify common patient queries and systematically assess the quality of online sources.

Methods: Terms relating to hip fractures and their treatment were entered into the Google search engine. Using the “People Also Ask” function, one hundred frequently asked questions and associated websites were extracted. Each question was categorized according to Rothwell’s classification. Websites were categorized by source and their quality was assessed using the Journal of the American Medical Association (JAMA) benchmark criteria. Pearson’s chi-squared and Student’s t-tests were utilized, where indicated, for analysis.

Results: A total of 600 questions were generated on initial query. After removing duplicates, 310 unique questions and 259 associated websites were extracted and stratified by Rothwell category and JAMA benchmark criteria, respectively. The top three most searched subcategories were post-injury experience or pain (15.2%), activities or restrictions (13.5%), and risks or complications (13.5%), while the least searched subcategory was cost (0.3%). Academic (22.4%), medical practice (20.5%), and social media (20.5%) were the most common website types. Single surgeon personal (3.1%) was the least searched website type. The average JAMA score for all searched websites was 2.5 ± 1.2 . Journals and academic websites had the highest average JAMA scores, 3.9 ± 0.2 and 3.2 ± 1.2 , respectively. Medical practice and social media sites together accounted for 41% of websites searched but had significantly lower JAMA scores relative to academic websites ($p < 0.001$).

Conclusion: Most online queries related to post-injury experience or pain, activities or restrictions, and risks or complications. Over 20% of displayed content was from a social media source. The average website JAMA score was low, indicating that many of the most frequently used sources are of questionable quality. This information may help address patient concerns by guiding patient-physician interactions. Additionally, opportunity exists to improve the quality of online information regarding hip fractures and their treatment.

Table 1. Most Frequently Asked Questions Online

Top 10 Most Asked Questions Before Removing Duplicates	Appearances (%)
Why is mortality so high after hip fracture?	16 (2.7)
What is the quality of life after a hip fracture?	11 (1.8)
What is the survival rate after hip fracture surgery?	11 (1.8)
Can you walk around with a broken hip and not know it?	10 (1.7)
Is sitting bad for a hip fracture?	10 (1.7)
How serious is a broken hip in elderly?	9 (1.5)
What not to do after hip fracture?	9 (1.5)
How long does it take a 70-year-old to recover from hip fracture surgery?	9 (1.5)
Does a broken hip ever fully heal?	9 (1.5)
Is a hip fracture more serious than a hip replacement?	9 (1.5)

Analysis of Racial, Ethnic, and Gender Trends in Foot and Ankle Fellowships from 2007 to 2022

Authors: Annika N. Hiredesai, BA; Alejandro M. Holle, BS; Eugenia Lin, MD, M. Lane Moore, MBA, BS; Karan A. Patel, MD

Affiliations: Mayo Clinic Alix School of Medicine, Scottsdale, AZ, Department of Orthopedic Surgery, Mayo Clinic, Phoenix, AZ

Introduction: Racial and gender disparities in the field of orthopedic surgery are well-documented in the literature. A diverse population of physicians and surgeons is imperative to foster progress in of our field and improve the quality of the care provided to patients. To further address disparities within the field of orthopedic surgery, further analysis of demographic composition at various career timepoints is warranted. The purpose of this study was to describe the historical demographic composition of fellows, including race, ethnicity, and gender, within the subspecialty of orthopedic foot and ankle from 2007 to 2022.

Methods: Gender, race, and ethnicity data were collected from the Accredited Council for Graduate Medical Education (ACGME) annual data resource books for all years available. Published data points included the total number of fellows, race and ethnicity (White, Asian, Hispanic, Latino or of Spanish origin, Black or African American, American Indian or Alaskan Native, Native Hawaiian or Pacific Islander, Multiple Race/Ethnicity, Other, and Unknown), and gender (male, female, and not reported). Percentage equivalents for racial and ethnic groups from 2011 to 2022 and gender groups from 2007 to 2022 were calculated. Trends in representation were analyzed by calculating Sen's slope — the median of slopes calculated between all possible pairs of time points — to reduce sensitivity to outliers.

Results: During the 12-year period, White, Asian, Hispanic, and Black fellows represented on average 80.7%, 14.7%, 1.9%, and 2.3%, respectively. Fellows that identified as Hispanic and Black were underrepresented throughout the study period, with several years of no representation. Male trainees made up the majority of foot and ankle trainees throughout the 15-year period, averaging 79.5%. There were no female foot and ankle fellows from 2007 to 2008. We found no significant trends ($p > 0.05$) in representation for any racial, ethnic, or gender group across the study period.

Discussion: Our analysis shows a persistent underrepresentation of racial and ethnic minorities and women among foot and ankle trainees. Racial and ethnic minority representation was below that of other orthopedic subspecialties. Female representation, while among the highest among orthopedic fellowships, falls short of parity and is in line with the current female orthopedic surgery resident representation. Targeted efforts are required to improve representation among foot and ankle orthopedic surgeons moving forward. Strategies should consist of early mentorship and exposure, continued career promotion, and, ultimately, retention within the field of orthopedic surgery.

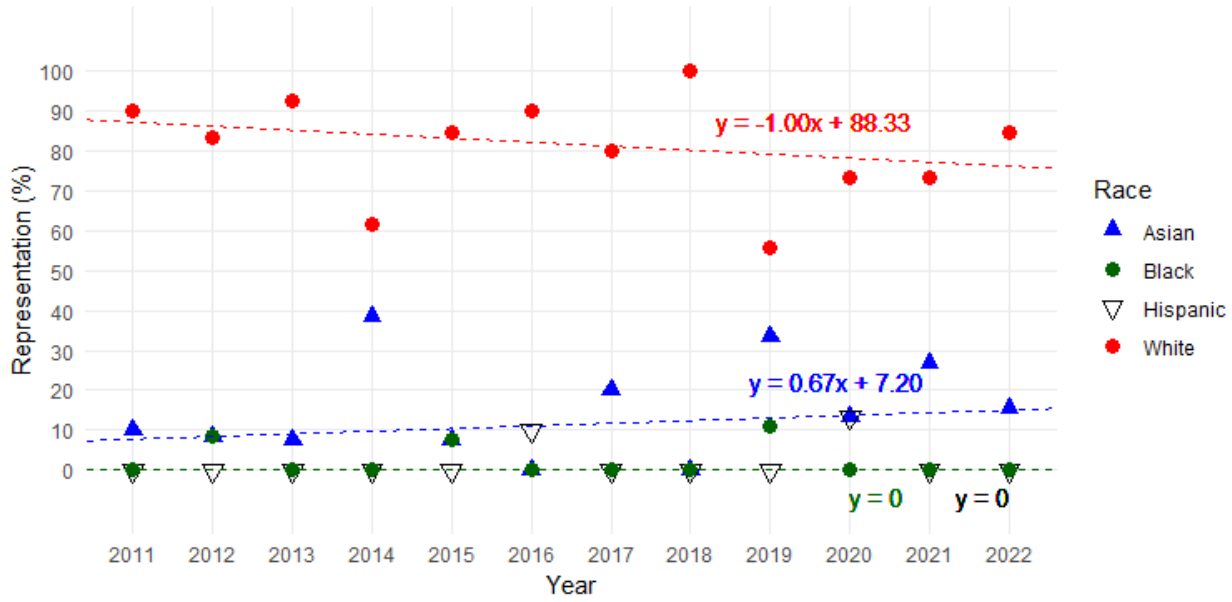


Figure 1. Race/ethnic representation (%) by year in foot and ankle US fellowships.

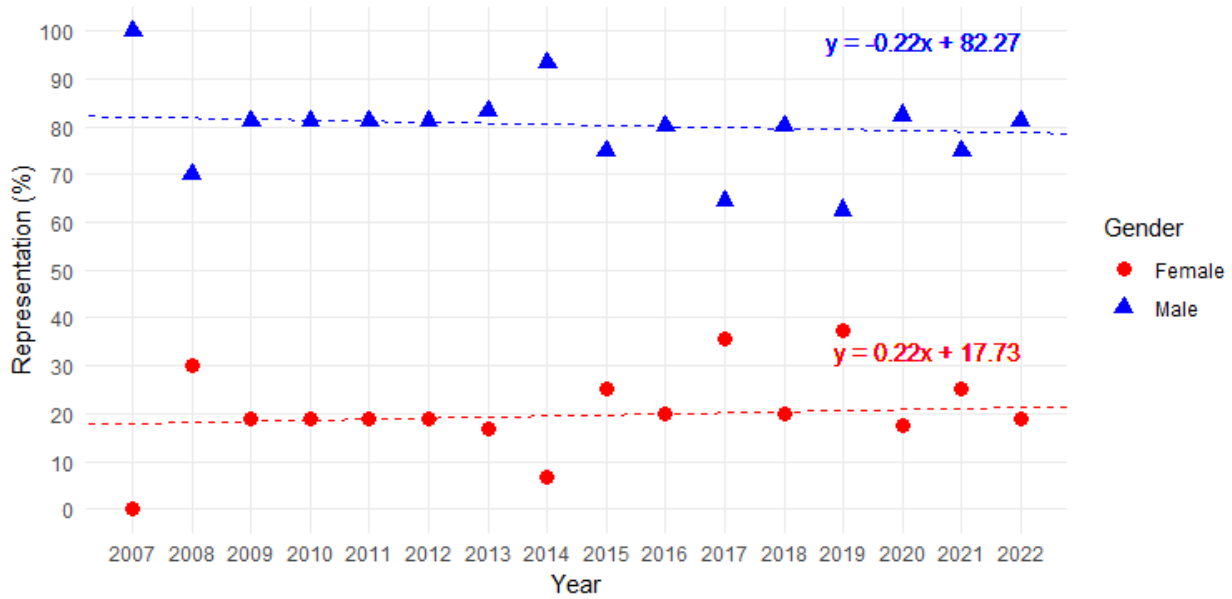


Figure 2. Gender representation (%) by year in foot and ankle US fellowships.

Authors: Justin Knapp, Landon Ebbert, Alejandro Holle, Joshua Ebbert, Maggie Donovan, Lisa Grunebaum

Affiliations: Mayo Clinic Alix School of Medicine, Brigham Young University, Department of Otolaryngology, Head and Neck Surgery, Mayo Clinic, Phoenix, AZ

Introduction: Mohs micrographic surgery (MMS), one of the most commonly performed dermatological procedures, is regularly searched by patients via the internet. While efforts to apply internet search analytics are promising in deriving clinically relevant insights, they are hindered by the resources required for manual extraction and processing. A limiting step is often the classification of relevant questions posed by users prior to statistical analysis. Different classification systems were investigated as potential methods to broaden the scope and augment the statistical power of future analyses.

Methods: A Search Engine Optimization (SEO) minion extracted Google Trends “People Also Ask” questions pertaining to MMS. Questions were grouped by three human reviewers into twelve categories, such as “technical details” and “indications,” adapted from Rothwell’s classification system (1). Four algorithms for question classification were used as a comparison to human reviewers: K-nearest neighbor (KNN) cluster models, decision tree models, logistic regression models, and large language models (LLM). Two methods were proposed for extraction of feature vectors. A CountVectorizer was used to extract word pairs (derived from the overall sample space) that were present in individual questions. A pre-trained embedding model from TensorFlow Hub was used to encode the questions in a semantically significant numerical space (2). Resulting pairs of embeddings and category labels underwent an 80/20 train/test split in preparation for model fitting (3). The first three models were trained to >99% accuracy and then evaluated on the test set for both feature extraction methods. LLM classification was done via zero-shot, one-shot, and many-shot learning approaches, including randomly- and researcher-selected question label pairs (4).

Results: The embeddings generated by the pre-trained TensorFlow model on 510 SEO-extracted questions produced 73%, 79%, and 81% validation accuracies with the fitted Decision Tree model, Logistic Regression model, and KNN cluster algorithm respectively. Use of word-pair feature vectors produced lower accuracies of 75%, 72%, 73%, respectively. Zero-shot learning exhibited 46% agreement between human reviewers and GPT-4. One-shot learning with researcher-selected question label pairs resulted in 61% agreement. When GPT-4 was primed with a random selection of one-third of the questions and their corresponding question categories as determined by the human reviewers, agreement accuracy increased to 88%.

Discussion: This study establishes the potential of computational classification methods to augment the power of classification studies. The lower mean validation accuracies associated with word-pair feature extraction suggest that the semantic meaning is captured less effectively than by a TensorFlow embedding model. The variation in LLM accuracy shows the advantage of priming large language models in attaining more accurate sample classification. The marked improvement with many-shot learning may be ascribed to the context granted to the question labels. Decision Tree, Logistic Regression, and KNN models undergo no pre-training and therefore carry no inherent biases into the classification process. As the scope of analysis expands, greater consistency and generalizability of results can be guaranteed. Traditionally, this comes at the expense of greater time, resources, and risking data collection fatigue; however, we propose the further exploration of LLM classification systems, specifically with a many-shot learning approach.

References:

- 1) Rothwell JD. In Mixed Company: Communication in Small Groups. Wadsworth Cengage Learning; 2013.
- 2) TensorFlow Developers. (2024). TensorFlow (v2.15.1). Zenodo.
- 3) Pedregosa et al. Scikit-learn: Machine learning in Python. JMLR. 2011; 12:2825-2830.
- 4) OpenAI. ChatGPT Web Browser. OpenAI; 2024. Available from: <https://openai.com/chatgpt>

Disparities in Industry Payments to Pediatric Orthopedic Surgeons: A 2022 Medicare Database Study

Authors: Asahi Murata, MPH, Jack Haglin, MD, Bridget Ralston-Ripple, MD, Jessica Burns, MD

Affiliations: University of Arizona College of Medicine - Phoenix, Mayo Clinic Department of Orthopedics, Phoenix Children's Hospital Department of Orthopedics

Introduction: The Sunshine Act requires medical industries to publicly report payments made to physicians. This is relevant to orthopedic surgery with the specialty having the highest percentage of physicians receiving payments and highest payments overall across medicine. The purpose of this study was to evaluate potential disparities within pediatric orthopedic surgeons.

Methods: Data for pediatric orthopedic surgeons was extracted from the 2022 Open Payments Data website. Surgeon demographics analyzed included gender, rural vs urban locality, and years in practice. Physician gender and years in practice were determined through an internet search. Fellowship or residency graduation year was used to calculate the years of practice. Rural practice was determined via Rural-Urban Commuting Area codes. Exclusion criteria were resident physicians, those of other specialties, and those with no available graduation year.

Results: 431 surgeons were included (109 female, 25.3%). In the top 5% of earners, females made up only 18.2% (4 of 22) with no difference in proportion ($p = 0.6151$). Females received less than males in the overall cohort (Mean \pm SD \$2,456 \pm 6,579 vs. \$5,883 \pm 25,341, $p=0.002$) and in the bottom 95% (\$1,354 \pm 2852 vs. \$1,967 \pm 3557, $p=0.003$). Within the top 5%, females received less than males, which did not meet statistical significance (\$31,380 vs. \$72,017, $p=0.34$). Rural surgeons were underrepresented ($n=6$, 1.4%) and received less than urban surgeons (\$279 vs. \$5,083). The top 5% had significantly more years of experience (21.3 \pm 10.5 vs 12.5 \pm 10.3 years; $p < 0.001$). Years into practice was associated with an average of \$370 more per year of experience ($p < 0.001$).

Conclusion: Female pediatric orthopedic surgeons and those at earlier stages in their career received significantly fewer payments from industries. Similarly, rural surgeons received less than those practicing in urban settings demonstrating an evident disparity in industry payments. Our findings prompt further investigation to examine what factors impact differential industry payments within orthopedic surgery and to determine how to best mitigate these disparities.

Distribution of Osteopathic Residents in Orthopedic Surgery by Region and Program Setting

Authors: Austin Cronen, BS, MS1, Alexxa Wirth, MD

Affiliations: University of Arizona College of Medicine - Phoenix

Introduction: In 2020, the American Osteopathic Association and the Accrediting Council for Graduate Medical Education created a unified residency match process for both allopathic (MD) and osteopathic (DO) students. While MD and DO residents score similarly on the Orthopedic Surgery In Training Exam (OITE), DO applicants still face additional hardships when applying. In the 2022 Program Director Survey published by the NRMP, 61% of orthopedic surgery program directors stated that they never or seldom rank a DO graduate. This is reflected in a decreased match rate, even in the setting of osteopathic recognized residencies. In 2024, there were 256 DO seniors applying to orthopedic surgery residencies with a 45.7% match rate. This is much lower than the MD senior match rate of 72.0%. Identifying orthopedic residency program features that are more amenable to DO applicants can help these applicants identify programs where they are more likely to match. This study aims to identify regional and program setting differences in the percentage of osteopathic physicians in orthopedic surgery residency programs.

Methods: Orthopedic surgery residency programs were identified in the Electronic Residency Application Service (ERAS) 2024 participating programs list, and osteopathic recognized programs were excluded. Data were aggregated from each program published website regarding the percentage of osteopathic doctors and program type (academic, community, hybrid). One way ANOVA with subsequent analysis with Tukey HSD test were used to analyze the percentage of DO residents compared to ERAS defined region and program type. Linear regression was used to assess for correlation between total number of residents and proportion of DO residents.

Results: Of the 201 registered orthopedic surgery residency programs, 174 met criteria for analysis. Mean number of DO residents per region ranged from 27.55 ± 42.00 in East North Central to 0.98 ± 1.98 in New England, with an overall 12.04%. One way ANOVA did not identify any significant differences in the average percentage of DO residents per ERAS defined region ($p=0.12$, $F=1.62$). Academic settings had significantly less DO residents compared with both community programs ($p<.001$) and hybrid programs ($p<.001$). No significant difference exists between community and hybrid programs ($p=0.068$). Linear regression analysis shows a statistically significant negative correlation ($p<.001$) between number of total residents and the percentage of DO residents ($R=-0.350$).

Discussion: It has been reported in previous literature that DO applicants consistently have lower orthopedic surgery match rates than MD applicants. Prior hypotheses have focused on hospital affiliations and access to away rotations. This study found that there are significantly less DO residents in academic programs as compared with community programs and hybrid programs. Additionally, we found that smaller program size correlated with a higher percentage of DO residents. There were no differences observed in the distribution of current DO residents across nine distinct ERAS regions. Future studies should further investigate trends in osteopathic distribution since the merger and identify other potential barriers that osteopathic students might face.

References:

1. Aiyer A, Sankar V, Summers S, et al. Unifying the Orthopaedic Surgery Residency Application Process Under a Single Accreditation System: A Primer. *J Am Acad Orthop Surg.* 2020;28(7):263-267. doi:10.5435/JAAOS-D-19-00755
2. Gomez C, Ranson R, Gianakos A, Miskimin C, Mulcahey MK. Allopathic and Osteopathic Residents Perform Similarly on the Orthopedic In-Training Examination (OITE). *J Surg Educ.* 2023;80(5):714-719. doi:10.1016/j.jsurg.2023.02.006
3. National Resident Matching Program, Data Release and Research Committee: Results of the 2022 NRMPP Program Director Survey. National Resident Matching Program, Washington, DC. 2022.
4. Dhillon J, Kraeutler MJ, LaPorte DM, Eberson CP, Mulcahey MK. A Comparison of Match Rates to Orthopaedic Surgery Residency Programs Between First-Time Versus Repeat Applicants: An Analysis of the National Resident Matching Program Data from 2018 to 2022. *JB JS Open Access.* 2023;8(3):e23.00045. Published 2023 Jul 28. doi:10.2106/JBJS.OA.23.00045
5. White PB, Giordano JR, Chen M, et al. Residency Match Rates in Orthopaedic Surgery Based on Sex, Under-Represented in Medicine Status, and Degree Type. *JB JS Open Access.* 2023;8(1):e22.00143. Published 2023 Mar 22. doi:10.2106/JBJS.OA.22.00143
6. McDonald M, Khan S, Cabatu C, Scott F. Osteopathic Orthopaedic Residency Selection Criteria: Program Directors' Survey and Analysis. *Spartan Med Res J.* 2020;4(2):11598. Published 2020 Jan 30.
7. White PB, Henry JP, Partan MJ, et al. Differences in Fourth-Year Orthopaedic Away Rotation Opportunities and Fees Among Osteopathic and Allopathic Medical Students 1 Year After the Implementation of the Single Accreditation System. *JB JS Open Access.* 2022;7(3):e22.00057. Published 2022 Sep 1. doi:10.2106/JBJS.OA.22.00057

Examining Health Equity in Online Patient Resources for Pediatric Skull Fractures: An Analysis of Readability and Quality

Authors: Landon E. Ebbert, Tyson Pace, Cody L. Messick, Timothy J. O'Daniel, Jeffrey C. Mecham, David J. Crockett

Affiliations: Mayo Clinic Alix School of Medicine, Department of Otolaryngology, Head and Neck Surgery, Mayo Clinic, Phoenix, AZ, Division of Otolaryngology, Phoenix Children's Hospital, Phoenix, Arizona, USA

Introduction: Head injuries are common in the pediatric population, with varying degrees of severity. Skull fractures can occur after head trauma and young children are at higher risk than adults (1). Patients and families use the internet as a source for medical information, and online information is of variable quality and literary complexity. Individuals of disadvantaged socioeconomic status (SES) are likely to have a lower educational level and would therefore be less likely to understand more difficult literature. This study evaluates the quality and readability of online patient materials relevant to pediatric skull fractures and explores the associated health equity implications.

Methods: Queries for "child head fracture," "child cranial fracture," "child skull fracture," "pediatric cranial fracture," "pediatric head fracture," and "pediatric skull fracture" were compiled using Google, Bing, and Yahoo. Twenty sites were recorded for each search term on each search engine. Duplicates sites were removed and the remaining sites meeting inclusion criteria were included for analysis. Sites were categorized based on authorship as commercial, academic institution, or medical practice. Flesch Reading Ease Score (FRES) and Flesch-Kincaid Grade Level (FKGL) were used to evaluate readability. Quality was assessed using the QUEST and DISCERN tools. ANOVA testing was used to compare the readability and quality scores between authorship classifications. Linear regression was performed for QUEST vs DISCERN scores and for FRES vs FKGL.

Results: Twenty-four unique sites were analyzed. Authorship was commercial (33%), academic institution (42%), and medical practice (25%). Mean FRES and FKGL scores were 65.1 (± 9.9) and 7.9 (± 1.8), which both approximately correspond to an eighth-grade reading level. Mean DISCERN and QUEST scores were 48.8 (± 8.7) and 15.0 (± 6.3). No significant difference was identified between authorship classification for FRES, FKGL, DISCERN, or QUEST scores ($***p < .01$). No significant correlation was noted between QUEST and DISCERN scores ($R^2 = 0.26$) and a strong inverse correlation was noted between FRES and FKGL scores ($R^2 = 0.05$).

Discussion: The readability scores indicated that the online material available for pediatric skull fractures is above the NIH's recommendation of a 6th grade reading level (2). Quality scores using both QUEST and DISCERN criteria were fair. The websites analyzed frequently lost quality points for poor attribution of scientific sources and unclear explanations of treatment options, alternatives, and consequences. DISCERN and QUEST tools appear to measure website quality differently. In analyzed sites, readability and quality were not significantly associated. The high readability scores of these sites are problematic and may disproportionately result in poor health literacy among individuals of lower SES populations. Care should be taken to enhance the quality further and to lower the readability levels of patient materials so greater health equity may be achieved.

References:

- 1) McGrath A, Taylor RS. Pediatric Skull Fractures. [Updated 2023 Jan 23]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 Jan-. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK482218/>
- 2) NIH Office of Communications and Public Liaison. NIH Clear & Simple: what Is Clear & Simple?. 2016 Jul 29. Accessed: 2024 Apr 16.
- 3) Boyer C, Selby M, Scherrer JR, Appel RD. The health on the net code of conduct for medical and health websites. *Computers in biology and medicine*. 1998 Sep 1;28(5):603-10.
- 4) Ozduran E, Büyükçoban S. Evaluating the readability, quality and reliability of online patient education materials on post-covid pain. *PeerJ*. 2022 Jul 20;10:e13686.
- 5) Moorthi C, Saravanakumar RT, Kumar CS, Manavalan R, Kathiresan K. Systematic assessment of the quality of patient information leaflets supplied by the pharmaceutical manufacturers. *Pharmacie Globale*. 2012 Feb 1;3(2):1..

First Year Medical Students' Views on Orthopedic Surgery as a Specialty Across Gender

Authors: Sara Kisiel, Divya Jeyasingh, Halszka Glowacka, PhD

Affiliations: University of Arizona College of Medicine- Phoenix

Background/purpose: Orthopedic surgery has been historically male-dominated. Although recent strides have been made to increase female representation, recruitment of female medical students may be difficult due to the lack of female role models and the perceived stigma against women in orthopedic surgery due to this historical male domination. This study analyzes first-year medical students' opinions of orthopedic surgery as a specialty before and following prolonged exposure to orthopedic surgeons in an academic setting.

Methods: The study was conducted during a cadaveric clinical anatomy course's musculoskeletal (MSK) portion. The MSK portion of the course involves volunteer orthopedic surgeons circulating in the lab, sharing relevant clinical applications, and answering student questions. The orthopedic surgeons who came into the lab were predominantly male. Students were anonymously surveyed before the start and after the completion of the MSK portion of the course. Associations within the pre-survey or post-survey were evaluated using the Mann-Whitney U test, and associations comparing the pre-survey to the post-survey were evaluated using the Wilcoxon signed-rank test. An α value of 0.05 was used. Analyses were performed using IBM SPSS Statistics 29.

Results: Forty-nine students responded to both the pre-and post-surveys. In the pre-survey, females had a lower mean response agreeing with the statement, "Gender diversity and inclusion are welcomed in orthopedic surgery culture" than males ($p = 0.006$). Females also had a lower mean response agreeing to the statement, "Racial/ethnic diversity and inclusion are welcomed in orthopedic surgery culture." ($p = 0.024$). In the post-survey, females still had a lower mean agreement with both statements ($p=0.023$ and $p=0.019$, respectively). In the post-survey, students reported the number of times they interacted with a circulating orthopedic surgeon, which was significantly lower for females than males ($p=0.35$). There was a significant increase in interest in orthopedic surgery after the dissection of MSK anatomy in males ($p=0.022$). However, this did not impact whether or not they wanted to pursue orthopedic surgery as a specialty ($p=1.000$).

Conclusions: Even after prolonged exposure to orthopedic surgeons in an academic setting, female medical students continued to believe that orthopedic surgery culture is not gender or racially-inclusive ($p=0.023$, $p=0.019$ respectively). Additionally, throughout the course, female students reported significantly fewer interactions with orthopedic surgeons ($p=0.035$), despite there being no significant difference in interest in orthopedic surgery between genders ($p=0.167$). It is unclear, however, whether these interactions were driven by the students or the surgeons. More female orthopedic surgeon representation in the lab may have yielded different results. These data portray a significant stigma associated with orthopedic surgery, which may deter female medical students from pursuing orthopedic surgery as a specialty. We plan to conduct a repeat survey analysis of incoming first-year medical students, this time encouraging more female orthopedic surgeons to attend.

Geographical Variation in Utilization, Surgeon Reimbursement, and Patient Characteristics for Common Hand Surgeries from 2013 to 2021: A Temporal Analysis

Authors: Nathan C. Beckett, BS, Alejandro M. Holle, BS, Vikram S. Gill, BS, Eugenia Lin, MD

Affiliations: Mayo Clinic Alix School of Medicine, Scottsdale, AZ, Department of Orthopedic Surgery, Mayo Clinic, Phoenix, AZ

Introduction: In the past several years, attention has been drawn to the decrease in inflation-adjusted Medicare reimbursement for various surgical procedures despite an ever-increasing Medicare population (1-6). However, few studies have evaluated trends in utilization, reimbursement, and practice profiles of hands surgeons, with none examining them on a regional level, to our knowledge. The primary purpose of this study was to examine these metrics for five common outpatient hand surgeries from 2013 to 2021 within the Medicare population on a national and regional level.

Methods: The “Medicare Physician and Other Practitioners – By Provider and Service” public database was queried for data from 2013-2021 for trigger finger release, basal joint arthroplasty, flexor synovectomy, Dupuytren’s contracture release, and excision of a tendon sheath lesion. Procedure volume, average inflation-adjusted reimbursement, billed services, and patient demographics were extracted from each year. Data was also stratified regionally according to US Census classifications. Welch’s t-test and Kruskal-Wallis tests were used to analyze regional differences.

Results: From 2013 to 2021, utilization for common hand surgeries increased by 61.3% nationally and over 55% across all individual regions in the Medicare population (see Figure 1). Regionally, the West is utilizing the most procedures per 10,000 beneficiaries. There was a decline in the average inflation-adjusted reimbursement for all five examined procedures within this study from 2013 to 2021 (see Figure 2). The decline most significantly affected the Midwest, which had the largest decrease seen in three of the five surgeries. Over time, hand surgeons are performing more billable services per beneficiary (+2.5%, $p < 0.001$), but fewer unique services within their practices (-11.8%, $p < 0.001$). The proportion of hand surgery patients who were dual enrolled in Medicare and Medicaid decreased significantly in the same period (-35.4%, $p < 0.001$).

Discussion: This study shows a marked increase in the number of common hand surgeries being utilized among the Medicare population. This is consistent with prior literature that has found increased utilization of common hand surgeries in previous years (7-10). This study found that the West is performing the most procedures per 10,000 beneficiaries and is reimbursed most for three of the five surgeries examined. At the same time, average nationwide inflation-adjusted reimbursement has decreased for all examined procedures within this study, decreasing most in the Midwest. A decline in Medicare reimbursements for hand surgeries has been reported in previous years (2, 11) although no data has heretofore been published on regional differences to our knowledge. Surgeons are performing more services per beneficiary but fewer unique services, suggesting increased surgeon sub-specialization. The patient populations were less often dual Medicare-Medicaid enrollees across all regions despite an increase of total Medicaid enrollment (12), which may suggest a surgeon preference for non-Medicaid-insured patients. This study indicates a need to monitor national and regional Medicare hand surgery reimbursement rates alongside inflation to ensure the economic stability of hand surgery practices and encourage equitable access to hand surgery for Medicare patients. We also recommend close monitoring of Medicaid patients in hand surgery practice to prevent inequity in access to hand surgery.

Impact of an Orthopaedic Surgeon Instructor During a Cadaveric Anatomy Course on First-year Medical Student Interest in Surgery

Authors: Divya Jeyasingh, MS; Sara Kisiel, BS; Halszka Glowacka, PhD

Affiliations: University of Arizona College of Medicine Phoenix

Introduction: A cadaveric dissection-based clinical anatomy course is a significant experience for first-year medical students in shaping their interest in surgery. This study aims to determine the effect of an orthopaedic surgeon instructor on preferred learning methods for studying anatomy and interest in orthopaedic surgery.

Methods: First-year medical students were surveyed after completing the musculoskeletal (MSK) portion of a cadaveric clinical anatomy course. Some students were assigned to groups with an orthopaedic surgeon as their dissection table instructor for the MSK portion.

Results: 64 students responded to the post-survey, of which 16 (25%) had an orthopaedic surgeon as a table instructor. The surgeon-instructed students reported a significantly higher mean agreement with the statements: "I learn anatomy best through surgical applications" ($p=0.014$), "I am considering a surgical specialty" ($p=0.009$), "Dissection of the spine, upper, and lower extremities has increased my interest in orthopedic surgery" ($p=0.007$), and "I am considering orthopedic surgery as a specialty" ($p<0.001$) when compared with students who did not have an orthopaedic surgeon as a table instructor.

Conclusion: Clinical anatomy is an influential experience for students and could be an area of focus for medical educators to engage an interest in surgery. This study focused on the influence of orthopedic surgeon instructors in anatomy, yet there may be comparable outcomes with exposure to other surgical disciplines. Early exposure to surgical mentors and discussion of clinical relevance could encourage students to pursue surgery as a specialty.

Efficacy and Medical Student Perception of the Learning Environment with Peer versus Physician Led Ultrasound Instruction

Authors: Rowan Lovich, Augustus Malan, Randy Richardson

Affiliations: Creighton University SOM

Background and Purpose: With correct use ultrasound (US) is a rapid and low-cost diagnostic tool, leading many medical schools to incorporate it into their preclinical curriculum. The most cited barriers to implementation of US curriculum found in a 2016 national survey of medical schools included funding and lack of time.¹ Peer-led instruction may be an option to increase accessibility of US instruction while addressing the financial barrier. Therefore, this study's purpose was to investigate trained peer versus physician led instruction of head and neck US. Outcomes of interest included instructor effectiveness and participant perception of the learning environment.

Methods: First and second year medical students were randomly assigned to the peer (n=10) or physician led (n=12) group. Participants completed a post-workshop survey with five multiple choice questions reflecting instructor effectiveness by assessing US knowledge, and five statements evaluating the learning environment using a five-point Likert scale. An unpaired t-test was used to analyze instructor effectiveness questions, and a top two box analysis was performed on the participant perception results.

Results: The multiple choice questions had no significant difference in percent correct between the peer (mean 0.80 ± 0.16) and physician-led groups (mean 0.92 ± 0.10); alpha level of 0.05 and p-value = 0.054. The top two score average of the Likert scale responses was higher in the peer-led group (1.0 ± 0) than physician-led (0.92 ± 0.04) indicating a more favorable, though not significant, response towards the learning environment; z-score= 0.93, p=0.35, significance p <0.05.

Conclusions: Both groups performed well on the questions assessing instructor effectiveness indicating that peer-led US teaching is a viable method. The slightly more positive response toward the peer-led learning environment suggests a benefit of peer-led teaching in medical education. Student led workshops within medical school curriculum could be a viable option to address the financial barrier and the time constraints of physician instructors.

References:

So S, Patel RM, Orebaugh SL. Ultrasound imaging in medical student education: Impact on learning anatomy and physical diagnosis. *Anat Sci Educ.* 2017;10(2):176-189. doi:10.1002/ase.1630

Authors: Sara Kisiel, Hanna Kim, Nicole Falls, Aiai Price-Smith, Jordan Coulston, Jeff Wellard

Affiliations: Creighton University SOM

Background/Objectives: Physician shortage and consequently, diminished healthcare access across rural areas of the United States have become increasingly evident in recent years. In an effort to reverse the trend of physicians preferentially choosing to practice in larger, more affluent areas¹, medical schools have created outreach programs specifically targeting students from low-income rural towns in hopes they return to their hometown to practice medicine². However, there is little information on the motivations of precollegiate students to pursue a career in medicine. If these outreach programs were privy to what initiated the students’ interest in the medical field, there could be a more targeted approach to lean into what excites them about the career path, as well as explain what a career in healthcare really means. The primary objectives of this study were to determine what factors are important to precollegiate students pursuing a career in medicine.

Hypothesis: There is a significant difference in the motivations to pursue medicine for precollegiate students based on parental income variability (low income (LI) vs high income (HI)) and having physician family member(s) (physician family member ((PFM) vs no physician family member (NPFM)).

Methods: The University of Arizona College of Medicine - Phoenix created educational programs to introduce high school students in Arizona to careers in healthcare (high school students from low income families were preferentially given spots to attend these educational events). Students who attended these sessions were surveyed, asking about factors contributing to their interest in medicine, specialty interest, and their demographics. Wilcoxon Rank Sum test was performed to assess the difference in responses from the different populations.

Results: 216 students who attended at least 1 of 3 University of Arizona institutional healthcare outreach programs participated in the survey. Factors that may affect the students’ interest in the medical field were not significantly different between the LI population (n=20) vs the HI population (n=196). However, the PFM group (n=41) showed a significant difference in the student’s interest in pursuing a medical career based on their perceived future impact on their local community (p=0.02).

Table 2. Comparisons by Students with Family as Physicians (n = 216)

	No Family as Physicians (n = 41)	Family as Physicians (n = 175)	Unadjusted p-value ^a	Adjusted ^b p-value
Survey Question, Median (IQR)				
Q8	5.0 (5.0 – 5.0)	5.0 (4.0 – 5.0)	0.1168	0.27
Q10	5.0 (3.0 – 5.0)	5.0 (4.0 – 5.0)	0.9784	0.98
Q12	4.0 (3.0 – 5.0)	4.0 (3.0 – 5.0)	0.9590	0.98
Q5	4.0 (4.0 – 5.0)	5.0 (4.0 – 5.0)	0.0590	0.17
Q6	5.0 (4.0 – 5.0)	5.0 (4.0 – 5.0)	0.1815	0.28
Q15	4.0 (3.0 – 5.0)	5.0 (4.0 – 5.0)	0.0072*	0.05*
Q16	4.0 (3.0 – 4.0)	4.0 (4.0 – 5.0)	0.0602	0.17
Q17	4.0 (3.0 – 5.0)	4.0 (3.0 – 5.0)	0.1632	0.28
Q18	4.0 (3.0 – 4.0)	4.0 (3.0 – 5.0)	0.3464	0.48
Q19	2.0 (1.0 – 3.0)	2.5 (1.0 – 4.0)	0.1481	0.28
Q21	1.0 (1.0 – 1.0)	3.0 (1.0 – 4.0)	<0.001*	0.01*
Q23	2.0 (1.0 – 4.0)	4.0 (2.0 – 4.0)	0.0228*	0.11
Q24	3.0 (1.0 – 4.0)	3.0 (1.0 – 4.0)	0.7640	0.89
Q25	4.0 (1.0 – 4.0)	4.0 (2.0 – 5.0)	0.6364	0.81

*Indicates statistically significant result for alpha = 0.05

^aWilcoxon Rank Sum test; ^bBenjamini & Hochberg adjustment for multiple comparisons

Conclusion: There was no significant difference found between LI and HI groups, likely due to low power. This may change as more survey responses are gathered from low income students. The difference in the motivation to become a physician between PFM and NPFM groups could be due to the PFM group witnessing their family members' impact on their community. The NPFM group may not have had the exposure to the healthcare field to have seen the impact physicians can make in their community. Continued investigation into motivations of precollegiate students to pursue a career in medicine should continue; these studies can help outreach programs to create activities and events that will allow for a better understanding of and interest in a career in healthcare, in order to recruit more physicians to practice in rural areas. This study will recruit more high school students to increase power.

1. Arredondo K, Touchett HN, Khan S, Vincenti M, Watts BV. Current Programs and Incentives to Overcome Rural Physician Shortages in the United States: A Narrative Review. *J Gen Intern Med.* 2023 Jul;38(Suppl 3):916-922. doi: 10.1007/s11606-023-08122-6. Epub 2023 Jun 20. PMID: 37340266; PMCID: PMC10356718.
2. Granruth CB, Esantsi ME, Sommi CP, Stamm MA, Mulcahey MK. Mentoring on Orthopedic Surgery Clinical Rotations: A Survey of Mentor Effectiveness on Student Mentees Compared to an Unmentored Control Group. *J Surg Educ.* 2023 May;80(5):697-705. doi: 10.1016/j.jsurg.2023.02.007. Epub 2023 Mar 6. PMID: 36890044.

Representation of Females and Osteopathic Physicians as Editors on Editorial Boards from the Seven Core Osteopathic Rotations

Authors: Christina Mortensen OMSII, Elias Sherzad OMSII, Mohammad Rifai OMSII, Dakota Marshall OMSII, Jacob Ryu OMSII, Mitchell Rentschler OMSII, Lucas Gerbasi OMSII, Manjinder Gill OMSII, Angelique Shumway OMSII, Jen Riedel OMSII, Tara Mohanroy OMSII, Dhairya Shah OMSII, Muhammad Kashif OMSII, and John Ashurst for the MWU MIRAGE Research Lab

Affiliations: Department of Assessment, Arizona College of Osteopathic Medicine, Glendale, Arizona

Background: Diversity among gender and degrees in the medical field is important to allow for different perspectives, research, healthcare, and issues to be addressed. Data has shown an evident disparity between genders and degree types in medicine that requires closer examination to determine the impact that this could have on medical publishing. In a limited previous study, females and osteopathic physicians were less likely to hold a high-ranking position on an editorial board for a medical journal. Research has also shown that both females and osteopathic physicians are less likely to serve as first or senior author on high impact published manuscripts and receive less grant funding from the National Institute of Health.

Objective: To determine the current representation of females and osteopathic physicians on editorial boards from journals that comprise the seven core osteopathic rotations.

Methods: The editorial boards of a cohort of the top five journals from the seven-core osteopathic clinical rotations (Family Medicine, Internal Medicine, Pediatrics, Psychiatry, Obstetrics and Gynecology, General Surgery and Emergency Medicine) published in the English language based upon the Scimago Journal and Country Rank and impact factor were reviewed. Editorial board members were categorized based upon their title and divided into the following groups: Editor in Chief, Associate/assistant/Deputy Editor in Chief, Executive/Senior/Section Editors, and Other Editors. Gender was assigned using images or pronouns on research databases or hospital-affiliated websites. Medical degree was assigned in a similar manner to gender and all of those without a medical degree were removed from analysis. The total number of female and osteopathic physicians was determined based upon the 2021 AAMC Physician Specialty Data Report. A binomial proportion test was used to compare the distribution of women and osteopathic physicians serving on editorial boards and the number of women (42.36%) and osteopathic physicians (9.06%) in current practice amongst the specialties reviewed.

Results: A total of 1282 editors were reviewed with being female 29.41% ($p < 0.0001$) and 1.25% ($p < 0.0001$) being an osteopathic physician. Females consisted of 16.67% all editors in chief ($p = 0.002$), 35.48% of all Associate/Assistant/Deputy editors in chief ($p = 0.21$), 26.87% of all executive/section/senior editors ($p = 0.013$), 38.27% of all associate/assistant editors ($p = 0.30$), and 27.92% of all editors categorized as other ($p < 0.0001$). Osteopathic physicians consisted of 0% of all editors in chief ($p = 0.07$), 0% of all Associate/Assistant/Deputy editors in chief ($p = 0.0003$), 4.48% of all executive/section/senior editors ($p = 0.28$), 0.62% of all associate/assistant editors ($p < 0.0001$), and 1.19% of all editors categorized as other ($p < 0.0001$).

Conclusion: Females and osteopathic physicians are under-represented on the editorial boards of the top journals from the traditional seven osteopathic clinical rotations. Future efforts should focus on where this disparity begins for females and osteopathic physicians, considering if it stems from UME/GME programs, resources available, or other factors outside of the medical program and individual.

Authors: Katja Klosterman BS, MSI, Alexxa Wirth, MD

Affiliations: University of Arizona College of Medicine Phoenix

Introduction: Despite the growing representation of women in historically male dominated specialties, only 5.3% of orthopedic surgeons identified as women in 2018. Furthermore, while the proportion of women students matriculating into allopathic medical schools has superseded that of men in recent years according to AAMC, women made up only 12.1% of orthopedic surgery sports medicine residents and fellows. One study using data from 2013-2014 demonstrated that there were geographic disparities amongst women orthopedic surgeon residents, noting that programs in the South are less likely to train women and minorities compared with training programs in the West and Northeast regions. There is a need for an updated assessment of the regional differences in women representation in orthopedic surgery training programs. Gathering insight into these differences may provide important information for women entering orthopedic surgery, especially in the selection of regional preferences in the ERAS application service.

Methods: Data regarding the percentage of female residents at individual residency programs during the 2023-2024 application cycle was collected from the Orthopedic Residency Information Network tool published by the American Orthopedic Association. This data were grouped by region, defined by the ERAS regions, and analyzed using a One Way ANOVA with subsequent analysis with Tukey HSD test .

Results: Overall, there was a mean number of 21.1% of female orthopedic surgery residents, from programs that self-reported this metric (n=165). There were significantly more female residents ($p=0.01887$) in Pacific region programs (26.4 CI:13.56) versus East South Central programs (12.5 CI:15.04) . There were no other regions with significant differences in female representation.

Discussion: Our study demonstrated that there remains a persistent regional difference in the representation of women in orthopedic surgery residency programs. We discovered that there are significantly more women residents in Pacific region programs compared to East South Central programs. Of note, the average percentage of females in our study is higher than previous recorded numbers of 12.1%. This may be due to the self-reporting nature of the data, where programs with more female representation may be more likely to report these statistics. Factors for impacting this difference could stem from a variety of causes: applicant choice, living factors, program variables, location desirability, amongst many others. Further study will be done to explore the factors creating this regional difference.

References

1. Female Representation in Orthopaedic Surgery and Primary Care Sports Medicine Subspecialties: Where We Were, Where We Are, and Where We Are Going. *J Wom Sports Med.* 2022;2(3):127-135. doi:10.53646/jwsm.v2i2.30
2. Rajani R, Haghshenas V, Abalihi N, Tavakoli EM, Zelle BA. Geographic Differences in Sex and Racial Distributions Among Orthopaedic Surgery Residencies: Programs in the South Less Likely to Train Women and Minorities. *J Am Acad Orthop Surg Glob Res Rev.* 2019;3(2):e004. Published 2019 Feb 13. doi:10.5435/JAAOSGlobal-D-19-00004