

**Pacific Northwest University of Health Sciences**

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Research  
Symposium**

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# Abstracts

# Empirical Research



## Estrogen Regulation of CUZD1 Gene Expression in Human Breast Cancer Cells

Authors: Liezel Lenhart, OMS4; Jon Eilers, MSC; Janelle Mapes, PhD

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### **Introduction:**

As the second most common cancer in women globally, breast cancer is a formidable disease. Estrogen-receptor (ER) positive breast cancers account for over 70% of diagnosed breast cancers. Overexpression of ER promotes cancer development through increased cell survival, angiogenesis, and cell cycle alteration. Estrogen (E2) binds to ER, which translocates to the nucleus and binds to estrogen response elements to induce gene expression. CUZD1 has been identified as an estrogen-regulated gene in rodents that participates in mammary gland development and tumorigenesis. This research investigates E2 regulation of CUZD1 gene expression in the human breast cancer cell line, MCF7.

### **Methods:**

MCF7 cells were maintained in 10% FBS with antibiotics. Disulfide benzamide (DIBA) is an ER inhibitor that prevents ER binding to DNA regulatory elements. Cells were treated with E2 alone and E2 plus DIBA to inhibit ER binding and gene regulation. Quantitative real-time PCR (qPCR) analysis was performed using gene-specific primers to assess CUZD1 gene expression. The Encyclopedia of DNA Elements (ENCODE) was used to identify regions annotated as putative ER promoters, enhancers, and full binding sites upstream of CUZD1. Chromatin immunoprecipitation (ChIP) was performed to isolate protein-DNA complexes in E2 and DIBA-treated MCF7 cells. qPCR was used to look for enrichment in specific DNA sequences identified in ENCODE.

### **Results:**

E2-treated MCF7 cells revealed an increase in CUZD1 expression, which was decreased in DIBA-treated MCF7 cells. ChIP analysis demonstrated ER occupancy on specific DNA sequences identified upstream of CUZD1. Collectively, these data indicate that E2 regulates CUZD1 expression through ER binding to DNA sequences upstream of CUZD1 in MCF7 cells.

### **Discussion:**

As the burden of ER positive breast cancer continues to increase, it is critical to identify and characterize estrogen-regulated genes and their role in breast cancer pathogenesis. The binding of E2-ER complex to specific DNA sequences increased CUZD1 gene expression and decreased with DIBA disruption. This study indicates CUZD1 expression is regulated by estrogen through ER in human breast cancer cells. Understanding the role CUZD1 plays in tumorigenesis creates the opportunity for potential treatment targets and eventual clinical applications.



## Foundational Metrics of the Greater Omentum: A Cadaveric Study

Authors: Liezel Lenhart, OMS4; Ronald Walser, DPT

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### Introduction:

From neoangiogenesis to tissue regeneration to flap-based breast reconstruction, the greater omentum has been used in a variety of unlikely, but innovative ways. This apron-shaped peritoneal tissue, spanning over the abdominal viscera, exhibits variation in its size and shape. Despite its clinical importance, the anatomy of the greater omentum has not been systematically characterized. This research aims to collect and analyze biometrics of the greater omentum using cadavers.

### Methods:

Greater omenta metrics were collected from 27 embalmed cadavers from a medical school gross anatomy course. The cadaver ages ranged from 59 to 99 years old, with 11 females and 16 males. The omenta were dissected, photographed, weighed for mass, and measured for volume and depth. ImageJ was used to calculate length, width, and surface area. Statistical analysis using R compared anatomical parameters with age and sex using a student's t-test.

### Results:

Mean mass was  $81.1 \pm 10.1$  g, ranging between 24.7 to 651.9 g. Mean volume was  $222.1 \pm 159.0$  ml, ranging between 40.0 to 700.0 ml. Mean surface area was  $440.8 \pm 152.5$  cm<sup>2</sup>, ranging between 188.5 to 725.8 cm<sup>2</sup>. Mean length was  $17.8 \pm 4.7$  cm, ranging between 7.8 to 29.4 cm. Mean width was  $39.3 \pm 7.8$  cm, ranging between 19.7 to 51.7 cm. Mass, volume, surface area, and average depth demonstrated statistically significant differences between sexes ( $P < 0.05$ ). Length and width between sexes demonstrated nonsignificant differences. Mass and volume correlated linearly, and density was consistent at approximately 0.9 g/ml regardless of sex. Omental morphology varied on a spectrum between standard apron-shaped and triangular-shaped.

### Discussion:

The anatomy of the greater omentum has been a focus for several researchers, including Liebermann-Meffert and Das. Since their research in the 1980s, a systematic survey of greater omenta biometrics has not been done. Biometric averages from this study were comparatively lower than previous studies, which may be attributed to the fixation process, elderly cadavers, unknown abdominal medical or surgical history, small sample size, and sample population differences. Biometrics provide foundational knowledge that will promote future studies of the greater omentum in medical and surgical applications.



## How well is PNWU recruiting COM students from rural and disadvantaged groups?

Authors: Caitlynn Smith-McGregor, OMS1; Malcolm Cutchin, PhD

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### **Introduction:**

Pacific Northwest University's College of Osteopathic Medicine (PNWU-COM) employs a "recruit, educate, and return" model. Do PNWU's applicant and matriculant backgrounds suggest that the model is working with regard to recruitment? We examined if the applicant and matriculant profiles at PNWU differed in terms of geographic origins and indicators of disadvantage from those at all other US COMs.

### **Methods:**

We collected applicant and matriculant data from the American Association of Colleges of Osteopathic Medicine for PNWU and all other COMs combined. For the three year period 2019-2021, we examined whether the distribution of applicants and matriculants differed across six categories of the type of geographic area raised (more urban to more rural) and ten Health Resources and Services Administration (HRSA) indicators of disadvantage/underserved. We performed chi-square tests to analyze differences between the two groups across the 16 categories.

### **Results:**

Applicants (n=71653) and matriculants (n=24542) were analyzed. PNWU applicants were less rural than all other COMs, but their proportions were higher ( $p < .001$ ) for HRSA indicators of: family lives in a Health Professional Shortage Area (HPSA) or Medically Underserved Area (MUA); family receives public assistance; and graduated from a high school with low graduation rates. In terms of rural origins, PNWU matriculants were more similar to all other COM matriculants, but PNWU matriculant proportions were higher ( $p < .001$ ) across five HRSA indicators of disadvantage: graduated from a high school with many eligible for reduced price lunches; family lives in HPSA or MUA; family receives public assistance; 50% or less from high school go to college; and graduated from a high school with many eligible for reduced price lunches.

### **Discussion:**

The aggregated student applicant and matriculant profiles of PNWU-COM differ from all other COMs, but less than we anticipated in terms of rurality. Although PNWU cannot easily control applicants based on geographic origins or disadvantage, it appears to use the admissions process to shape matriculants in crucial ways that align with its rural and underserved mission. The study's limitations include our inability to control geographic and demographic differences in applicant catchment areas, as well as the typical applicant's multiple applications ( $M = 9$ ).





## Preliminary Analysis of Health-Related Quality of Life among American Asian Indians in the National Health Interview Survey

Authors: Amanpreet Kaur, OMS2, Shreya Kumar, OMS2, Priyanka Taneja, OMS2, Steven Day, PhD, Kathaleen Briggs Early, PhD

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### **Background:**

Health-related quality of life (HRQOL), a psychosocial construct, is defined as a person's physical and mental health, and is linked to health outcomes. There is a dearth of literature evaluating HRQOL of American Asian Indians (AAI) despite this being a growing ethnic group with higher rates of chronic health conditions, like diabetes. Therefore, the purpose of this study was to evaluate HRQOL across age and sex categories in a nationally representative sample.

### **Methods:**

We examined HRQOL as measured via the Health and Activity Limitation Index (HALex; scores can range from 0-1, with 1 being the highest score) from the National Health Interview Survey (NHIS) using data collected from 2003 to 2018. NHIS collects information on health status, health care access, and behaviors as a cross-sectional, stratified, and weighted household interview survey. We examined adults over age 18 and considered the weighted and stratified nature of the data to compare HRQOL among AAI to non-Hispanic Whites.

### **Results:**

This study represents 245 million adults, among whom 2.67 million were AAI. Across all ages below 85 years, AAI had a mean age-and-sex-adjusted HALex score similar to but lower than that of whites with a mean of [95% CIs] 0.857 (0.855, 0.859) and 0.837 (0.836, 0.837), respectively. However, among adults aged 85+, a significant disparity develops, as HALex scores for AAI dropped to 0.392 (0.272, 0.511), with Whites at 0.630 (0.623, 0.638). In the 65-85-year age group, women had lower HALex scores (mean 0.731 (0.681, 0.782) than males 0.822 (0.784, 0.860).

### **Conclusions:**

Lower HALex scores among AAI at ages 85+ could be attributed to increased likelihood of multiple comorbidities, limited access to resources, inadequate healthcare education, immigration status, and communication barriers. AAI women having lower average HALex scores than males in ages 65-85 years could be due a variety of factors like childbearing and gender roles. Lack of HRQOL data among AAI shows that ethnic subgroups should be studied to promote health equity in research. Sex and age differences observed herein warrant further evaluation to clearly determine causes and mitigating factors.



## Gene Expression Signatures in Breast Cancer among patients treated with the Aromatase Inhibitor Letrozole

Authors: Amanda Skogsberg, OMSII; Steven Day, PhD; and Janelle Mapes, PhD

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### Introduction:

Breast cancer is the second leading cause of death in women worldwide, with estrogen receptor positive (ER+) breast cancer accounting for 80% of breast cancers and a 40% prevalence of resistance to therapy. The aim of this study was to examine genes in signaling pathways related to CUZD1, an estrogen-regulated gene. We examined ER+ breast cancer samples, comparing expression in responders and non-responders before and after treatment with letrozole, an aromatase inhibitor.

### Methods:

We analyzed a gene expression dataset obtained from the NIH repository. In the original study, ER+ tumor samples (n=58) were collected 10-14 days before letrozole treatment and 10-14 days after 3 months of treatment. Of the 58 tumors sampled, 37 responded to treatment as evidenced by a reduction in tumor size of at least 50%, while 15 did not respond; 6 tumors were excluded. In our analysis, pre-treatment vs post-treatment of responders and pre-treatment vs post-treatment of non-responders were evaluated by a paired t-test. Responders vs non-responders for pre-treatment and responders vs non-responders for post-treatment underwent an unpaired t-test. Mean and 95% confidence intervals for individual gene expression and gene signatures associated with CUZD1 were plotted.

### Results:

The result closest to significance was Gene Signature 3 ( $p=0.0419$ ); however due to multiple comparisons, the p-value of significance was adjusted to ( $p<0.001$ ) with Bonferroni correction. Mean expression of the individual CUZD1-related genes or gene signatures showed no statistically significant difference in association with response versus non-response or pre- versus post-treatment.

### Discussion:

Although current literature suggests a strong link between CUZD1 signaling and breast cancer, we found no significant correlations with this signaling pathway and responsiveness to letrozole. Results are potentially not statistically significant due to small sample size. Evaluating more patient samples could increase statistical power. Continued analysis of gene expression in individuals treated with letrozole using the gene signatures developed in this study may shed light on the role of CUZD1 in breast cancer. Finding a significant connection between responsiveness to therapy and gene expression can give us more targeted treatment approaches, leading to better outcomes.



## Great Saphenous Vein Valve Mapping for The Purpose of Coronary Artery Bypass Grafting

Authors: Schafer Paladichuk, OMS 2; David Dommermuth, OMS2; Andy Shang, OMS2; Alex Downs, OMS2

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### **Introduction:**

The great saphenous vein (GSV) is a commonly used conduit for coronary artery bypass grafting (CABG) surgery. The presence of valves in the GSV can affect the patency and longevity of the graft. This study aims to investigate which portions of the GSV typically have fewer valves.

### **Methods:**

GSV's were accessed through dissection from the inferior base of the medial malleolus to the saphenofemoral junction. Measurements were recorded in centimeters (cm) and valve measurements started from the inferior base of the medial malleolus. Forceps were used to glide along the vein, marking and measuring each valve. Leg valve locations were standardized to each leg as a percentile location. A histogram was created to show the distribution of valves per five-percentile section. The distance between each valveless segment was calculated and the longest and second longest segment along each GSV was found. A T-test was done to compare these segments between the left and right leg. Further analysis was conducted to find the distribution of the segments along the leg, grouping them as "Calf", "Knee", and "Thigh" segments.

### **Results:**

Measurements from 39 legs across 29 donated bodies were analyzed. Results showed a median of 7 valves per leg, with a range of 2-13 valves. The intervals between valves had a median distance of 8.1 cm and a range of 0.1 to 36.9 cm. The longest intervals had a median length of 21.3 cm and were found in the calf 61.5% of the time, and in the thigh 10.2% of the time. The second longest intervals had a median distance of 15.8 cm and were found in the calf 46.2% of the time and in the thigh 30.1% of the time. The longest intervals were significantly longer than the second longest with a  $p < 0.001$ . The longest and second longest intervals between left and right legs had a p-value of 0.3266 and 0.8464, respectively.

### **Discussion:**

This study suggests that harvesting the GSV in the calf region may result in longer valveless portions of the GSV regardless of leg, potentially improving patency of the graft.



## Interprofessional Learning and training outside the classroom: Pharmacy preceptors' knowledge, perception, and experiences

Authors: Pascual Garcia-Garcia, PY2; Angela Stewart, PharmD; Damianne Brand-Eubanks, PharmD

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### **Introduction:**

Over 1/3 of the curriculum in Doctor of Pharmacy programs is experiential education in the clinical learning environment. These clinical learning opportunities include introductory pharmacy practice experiences (shadowing) in years 1 and 2 and advanced pharmacy practice experiences in diverse settings in the final academic year. Though there are predefined and measurable learning outcomes associated with IPE, we know less about our preceptors' pedagogical standard, and ability to teach interprofessional practice outside the classroom. This study was designed to evaluate our preceptors' baseline knowledge of IPE and collaborative practice (IPCP), the IPE core competencies students are exposed to, and any barriers to IPE and collaborative practice at their sites.

### **Methods:**

Following a preliminary, survey-based, Delphi study of pharmacist preceptors, live interviews using open-ended and Likert scale questions was conducted. The study was designed to further explore pharmacist preceptors' knowledge, perception, and experience with IPE and collaborative practice at their sites. Interviews were conducted via a web-based video conferencing platform and were recorded and transcribed. All qualitative data was de-identified and then evaluated using thematic analysis and deductive coding for areas of emphasis and consensus. Each interview was attended and analyzed by multiple members of the research team to help mitigate bias.

### **Results:**

Results reflect a strong understanding of IPE, regular participation in collaborative patient care, and participation in locally offered preceptor educational programs. Time and responsibility burden were the primary barriers affecting their ability to provide interprofessional learning experiences. Overall, there was strong support for IPE and collaborative practice in their respective sites. Most participants expressed respect for their interprofessional colleagues and stated their job satisfaction, patient outcomes, and work life balance were positively affected by these daily working relationships.

### **Discussion:**

Little has been published to describe health professions preceptor knowledge and experience with IPE and IPCP. The results of this study indicate strong pharmacist support for IPE and a need for additional resources to maximize student learning opportunities in experiential education. Further study is needed to describe the current state of IPE in the clinical environment for students in other health professions programs.



## Static and Dynamic Step Perturbation Reactions in Healthy Adults

Authors: Tiffany Salido, PT, DPT, PhD; Peggy Trueblood, PT, PhD; Darren Joffs, PT; Erik Jacobson, OMS2; Nolan Pow, OMS2; Sophia Gabor Jadzak, OMS2; Lindsey Petrelle, OMS2; Mason Burnham, SOPT

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### **Introduction:**

Adults over the age of 65 represent the fastest growing population and have an increased risk of serious falls straining the healthcare system. Our study aims to define normative static and dynamic reactive stepping responses in the medio-lateral direction among healthy adults using a perturbation treadmill system (BalanceTutor™).

### **Methods:**

Healthy adults (n=68, 47% male/53% female) ranging from 20-79 years of age with a mean age of 51 received randomized left and right lateral platform perturbations while standing in-place, as well as walking at a fixed speed of 1.11 m/s. The intensity of the perturbation was at each subject's lateral limits of stability, defined as the maximum excursion a person can shift their center of gravity in the right and left direction while standing. While standing, the intensity of the perturbations was increased or decreased to achieve at least one step and one in-place reaction in each direction. Walking included 2 trials each of left and right perturbations during stance phase for each leg, delivered in random order.

### **Results:**

A lateral step was the preferred recovery step characteristic in standing for all groups (20-39, 40-64, and over 65 and male/female). In gait, the preferred step characteristics in the young group differed from the middle and older groups. The young group preferred a cross-over step when the platform moved away from midline ( $\chi^2$ ,  $p < 0.001$ ) and a lateral step when the platform moved toward midline ( $\chi^2$ ,  $p = 0.017$ ). The preferred step characteristics also differed between males and females with females preferring a lateral step when the platform moved away from midline ( $\chi^2$ ,  $p < 0.001$ ) and cross-over when the platform moved toward midline ( $\chi^2$ ,  $p < 0.001$ ).

### **Discussion:**

Diverse step strategies are used when walking compared to standing. Step training for people at risk of falling should include lateral and cross-over steps to ensure a diverse fall recovery strategy. A focus on training non-preferred step strategies may provide the greatest fall reduction benefit. Future studies could look further into dynamic strategies with a focus on people with neurological or muscular deficits leading to gait abnormalities to further characterize step reaction to direct clinical training and treatment.



## Does Use of Stroboscopic Goggles Lead to Improved Precision and Accuracy of Sutures?

Authors: Jeremy Hinton, DPT, OMS4; Steven Brantley, MPH, OMS4; Ekaterina Berulava, OMS3; Sean Kim, OMS3; Nate Lungstrom, OMS3; Makrina Kamel, OMS3; Katelyn Martin, OMS3; Kyle Mealand, OMS3; Joseph Walters, OMS3; Ronald Walser, DPT; Daniel Selski, PhD

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### **Introduction:**

Basic suturing skills allow medical students to participate in laceration and wound closure opportunities, and the suture results can affect healing and cosmesis. Many studies have shown that suturing instruction and practice enhance the quality of trainee sutures and confidence in their ability to suture live patients. Further studies have shown that use of stroboscopic goggles, which rapidly and temporarily occlude vision to alter the task difficulty, can lead to subjective improvements in suturing quality. No studies have objectively measured the impact of stroboscopic goggle use on suturing accuracy and precision. The aim of this study is to quantitatively measure the impact of using stroboscopic goggles on the accuracy and precision of student suturing.

### **Methods:**

72 current graduate students at PNWU with fewer than 50 hours of suturing experience were recruited for this randomized crossover trial and assigned to groups initially training with or without stroboscopic goggles. Participants completed two suture training sessions with five total tests of suture accuracy, precision, and self-efficacy separated by one week intervals. Photos of each set of sutures were analyzed using ImageJ (version 1.53) to measure both accuracy and precision of the sutures. Data were analyzed using R (version 4.2.2) for both inter- and intra-group trends.

### **Results:**

Suture accuracy, precision, and confidence in ability all showed statistically significant improvements among all participants. Participants in the group that started training with the stroboscopic goggles experienced a small but significant increase in short-term precision, improving by 40.9% compared to 23.6% during weeks 1-3 (p-value: 0.025). Participants in the group that started without stroboscopic goggles experienced a small increase in accuracy retention, improving by 8.6% during weeks 3-4 compared to a reduction of 31.4% in the other group (p-value: 0.016). All other measurements of accuracy and precision were non-significant.

### **Discussion:**

Practicing with stroboscopic goggles early in suturing training leads to more appreciable short-term benefits in suture precision compared to practicing without stroboscopic goggles. Further study would help elucidate optimal dosage and timing of training with stroboscopic goggles as part of a comprehensive suture training regimen.



## Pimozide Promotes Apoptosis in the MCF7 Breast Cancer Cell Line

Authors: Will Henzler, OMSII; Kristen Senior, OMSII; Janelle Mapes, PhD

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### Introduction:

Human mammary adenocarcinomas arise from uncontrolled proliferation of the mammary epithelium. Cuzd1, a cofactor in the prolactin-JAK/STAT signaling pathway, has been studied for its participation in mammary gland tumorigenesis. Pimozide, a neuroleptic medication indicated for psychiatric disorders, has been shown to prevent activation of STAT5 in MCF7 cells, resulting in inhibition of proliferation. Additionally, pimozide induces apoptosis, a programmed death, in osteosarcoma cells. This study examines the role pimozide in apoptosis and the resulting cell death pathways activated in human breast cancer cells in vitro.

### Methods:

MCF7 human breast cancer cells stably overexpressing CUZD1 and control MCF7 cells overexpressing LacZ were maintained in DMEM with 10% FBS and antibiotics. A crystal violet assay was utilized for optimization of pimozide concentration. Cell viability and induction of apoptosis following pimozide incubation was measured using an MTT assay to assess mitochondrial function. Apoptotic gene expression and protein activity were analyzed via qPCR and Western blot, respectively. Confirmation of programmed cell death via apoptosis was obtained using an assay measuring endonuclease activation and subsequent DNA fragmentation.

### Results:

Both CUZD1- and LacZ-overexpressing MCF7 cells treated with 10 $\mu$ M pimozide displayed reduced growth, decreased viability, and decreased metabolic activity in vitro. CUZD1-overexpressing cells showed increase in apoptotic gene expression in comparison to the LacZ-overexpressing cells. The MTT assay showed that treatment with 10 $\mu$ M pimozide resulted in a decrease in the number of viable cells, with LacZ cells trending towards a further reduction in viability as compared to Cuzd1 cells. Mechanisms regulating apoptosis were activated in CUZD1-expressing cells when exposed to pimozide, as evidenced by increases in pro-apoptotic and anti-apoptotic gene expression, caspase activity, and activation of the apoptotic execution pathway.

### Discussion:

This study has demonstrated pimozide induces apoptotic cell death in CUZD1-overexpressing MCF7 breast cancer cells. This may serve as an individualized breast adenocarcinoma treatment in subtypes overexpressing CUZD1. Employing cancer therapies that solely target diseased tissues minimizes adverse effects typically elicited with systemic treatment modalities. Pimozide is currently FDA-approved for psychiatric conditions; therefore, studies exploring additional clinical applications would streamline approval of additional indications.



## Finite Element Analysis of Masticatory Strains in Pediatric and Adult Crania

Authors: Hannah Little, OMS4; Justin A. Ledogar, PhD; Amanda L. Smith, PhD

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### **Introduction:**

Finite Element Analysis (FEA) is an engineering modeling technique that examines how complex structures respond to forces. Craniofacial biomechanics using FEA have been characterized, but previous work focused on adults. As a result, little is known about how developmental stages affect masticatory biomechanics. Here we present the first pediatric masticatory FE model and compare it to a baseline of previously studied adults.

### **Methods:**

Using the New Mexico Decedent Image Database, a CT-scan of a 7-year-old female without cranial deformity was selected. Imaging data of the cranium was reconstructed as a surface model using the Biomech FE protocol, edited, and remapped as a volumetric model. Proximal and distal insertions for muscles of mastication were mapped and physiological muscle forces applied. Restraints were placed at both temporomandibular joints and on the left M1 deciduous molar to simulate a bite. The resulting strain pattern and magnitudes were analyzed and compared to an adult model.

### **Results:**

Strain patterns are similar between the adult and pediatric crania with a few notable differences. Both models exhibit elevated strains extending superiorly from the bite point along the nasal margin to the medial orbital wall and zygomatic arch. Strains at the zygomatic root of the pediatric model are elevated, with von Mises strain magnitudes greater than 270% than the adult. Examination of deformation and strain regimes reveals greater facial torsion in the adult and greater facial shear in the pediatric model.

### **Discussion:**

This pediatric cranium demonstrates differences in strain location and character compared to adult models. Further work will examine additional pediatric crania throughout life stages to determine if observed patterns correlate with facial developmental stages. Constructing a baseline for masticatory biomechanics in the pediatric population will act as a foundation for future research of craniofacial abnormalities, one of the most common groups of birth defects. Surgical repairs are done before permanent canine eruption, while facial development, especially reliant on tensile strains, is still occurring. Utilizing FEA allows for disease specific modeling without subjecting patients to unethical in vivo experimentation. Comparing diseased to typical crania of equivalent developmental stages could help guide therapies that ensure optimal outcomes.





## Inflammatory Response to OMT: A Preliminary Report

Authors: Colin Behl, OMSII; Paula Swiercz, OMSIV, MS; Janelle Mapes PhD; Kelly Noyes, DO, FACOI; and Kathaleen Briggs Early PhD, RDN, CDCES

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### **Introduction:**

Inflammation plays a key role in the pathogenesis of chronic diseases such as diabetic peripheral neuropathy (DPN), which is the most common microvascular complication among people with diabetes. Previous work found rapid changes in serum circulating cytokines and leukocytes following osteopathic manipulative treatment (OMT). This preliminary analysis of an ongoing pilot study sought to characterize temporal changes in TNF- $\alpha$  levels within healthy subjects following one session of lymphatic protocol OMT.

### **Methods:**

Prior to coming in for the research visit, participants completed the Perceived Stress Scale (PSS) and consented to the study. On the research day, demographics and a medical screening, including the SF-36 (a quality-of-life measure) and anthropometric measurements were completed, followed by baseline blood draw. Participants then underwent a 10-minute lymphatic OMT protocol, as this has been previously shown to improve inflammation in some settings. Additional venipuncture was performed at 5, 30, and 60-min-after OMT. TNF- $\alpha$  levels at baseline and each post-OMT time point were quantified and subjected to one-way ANOVA with significance at  $p < 0.05$ .

### **Results:**

Participants ( $n = 9$ ) were mostly white (89%), female (56%), with an average age of 31 years, and a mean BMI of 25.5 kg/m<sup>2</sup>. PSS scores in five participants indicated moderate stress while four indicated low stress for an average score of 13.1(SD=8.1). An ANOVA of TNF- $\alpha$  for all time points and post-hoc t-tests between timepoints 30 and 60 minutes both failed to achieve statistical significance ( $p = 0.598$ ) and ( $p = 0.307$ ; CI 95, -0.112-0.039), respectively.

### **Discussion:**

This brief OMT protocol did not alter TNF- $\alpha$  between all 4 time points, although a declining trend was observed between 30 and 60 minutes post-OMT. Potential confounders include differences in inflammatory response following OMT as a function of somatic dysfunction severity and the stress of multiple venipunctures. Future work will include larger sample size, evaluation of somatic dysfunction parameters, and measurements past 60 minutes. Further analysis will explore the effects of OMT treatment on chronic conditions, such as DPN, through the mitigation of inflammatory cytokines.



## Mastication in monkeys: A biomechanical analysis of the capuchin mandible and implications for modern clinical care

Authors: Rachel M. Stout, OMSII; Gavin Caruso, OMSII; Evangelina O. Olivera, OMSII; Sarah E. Baumgarten, MS MA; Kristen A. Wright, PhD; Barth A. Wright, PhD; Robert S. Scott, PhD; Callum F. Ross, PhD; David Strait, PhD; Amanda L. Smith, PhD

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Relationships between human craniodental form and orofacial function have been studied experimentally in primate models for over half a century because they have similar mandible structures to humans. Capuchin monkeys, often used in biomedical research and the film industry, are an ideal model for exploring links between diet, feeding mechanics and mandible shape. They exhibit craniofacially robust (*Sapajus*) and gracile (*Cebus*) genera with different mechanical properties based on their varied diet. Understanding how variation in mandible shape affects bone strain and osteogenesis in capuchins can provide a framework for understanding a range of healthy and pathological orofacial functions in humans. Digital techniques combining statistical shape analysis and finite element analysis (FEA) are less invasive than traditional primate experimentation and allow for a broader testable range of shape variability.

As a first step, we address the hypothesis that robust craniofacial features are adaptive for hard food diets. We expect gracile species to experience higher bone strain than robust species. Geometric morphometrics were used to statistically assess the main patterns of shape variation across a sample of 480 capuchin skulls. Sixteen mandibles across four robust and gracile species were selected to bracket variation in our sample: *S.apella* (n=4), *S.libidinosus* (n=4), *S.nigritus* (n=4), *C.olivaceus* (n=4) and finite element models were built from CT scans. Experimentally derived muscle forces, bone properties and joint and bite constraints were applied to simulate biting. Finite element models were solved, strain patterns assessed using colormaps (histograms) and magnitudes sampled at homologous nodes.

Preliminary results show similar strain pattern and magnitude across specimens, but robust specimens generate higher bite forces with greater masticatory mechanical advantage. This indicates the combination of robust anatomical features provides an advantageous increased bite performance and efficiency (the ratio of muscle force to bite force).

As technology advances, computer-based modeling programs are a cost-effective option for experimentation of expanded samples and broad variable data sets with minimal harm. This study demonstrates the advantages of using FEA and morphometric data in biomechanical modeling and offers solutions to longstanding technological problems that have previously limited its use in clinical research.



## Factors That Motivate Women's Participation in STEM Education in Higher Education in the United States: Interviews with Female Chemical Engineers

Authors: Emmanuel Femi Jaiyeola, PhD; Olusola Adesope, PhD; Xiao Zhang, PhD

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### **Introduction:**

There is a huge investment made in research, policies, and models to encourage the participation of more women at undergraduate, graduate, and work levels in STEM fields, but the outcome is still low in the United States of America. A study in 2017 showed that only 29% of engineers are women. Given the fact that few women have successful careers in STEM educations, it is critical to understand the key factors that motivates such women to participate in STEM education in higher education which led to their chosen careers.

### **Purpose:**

This study is to identify some of the key factors that motivated women in the chemical engineering career to understand how to improve women's involvement in STEM education.

### **Methods:**

This study uses a qualitative approach to understand from the women's perspectives, what motivated them to remain in STEM field.

The study used purposeful sampling to interview five female chemical engineers: two chemical engineering graduate students, two graduates working in industries, and one professor of chemical engineering. Data were collected through virtual in-depth interviews and were analysed using thematic qualitative analysis.

### **Results:**

Three themes emerged from the data: the few women that are motivated to study chemical engineering chose to do so because of self-motivation, and support from mentors, family members, and teachers; women desiring to study chemical engineering encounter different barriers that demotivate them from getting and remaining in the field; and women in the engineering profession experience a lack of support needed to advance their careers. Barriers include lack of flexibility to accommodate important life issues besides careers including home life, the transition into motherhood, and taking care of children and extended family.

### **Discussion:**

The women in this study possess intrinsic and extrinsic motivation to push against all odds. They received huge support from their teachers and family to choose and remain in the chemical engineering profession. The barriers cited in this study offer a roadmap for helping STEM professions become more welcoming for women and possibly others that don't fall into the gender binary.

# Quality Improvement



## Real-world Validation of Rapid PCR Strep Testing in Urgent Care

Authors: Supreet Ghumman, OMS4; Justin Bowles, MD

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### **Introduction:**

Point-of-care PCR testing for Strep pharyngitis is a newly available technology to Indigo Urgent Care. Despite high published accuracy (Sen 94.2% and Spec 98%), many medical providers continue ordering confirmatory throat cultures.

### **Methods:**

This multi-site chart review identified 258 patient charts with a resulted Strep PCR and throat culture to validate the accuracy of the POCT Strep PCR in a real-world setting.

### **Results:**

A false negative PCR result (PCR-, culture+) was identified in only 6 cases (2.3%). True negative PCR findings (PCR -, culture -) resulted in 247 charts (95.7%). Specificity was calculated to be 99.3% (NPV= 97.6%), very near the industry reported data. Five patients were identified as having a true positive test (PCR +, culture +) and two had a false positive (PCR+, culture -). Sensitivity was 30% (PPV 60%). Non-group A strep, not testable with this PCR strep test machine, was revealed on 7% (26/383) of all throat cultures. An antibiotic was prescribed presumptively in 42% (159/383) of case. Oral steroids were given for symptomatic treatment in 129 of the 383 (33.6%) patient charts reviewed. Of note, 38% of the total number of corticosteroid and 25% of the antibiotic prescriptions were ordered by a single medical provider, emphasizing practice style differences. Centor scores were calculated for all patients. No difference in the average scores were identified when calculated for the several subcategories of patients identified to have GAS, non-GAS, true positive, true neg, false positive, or false negative. Each category scored approximately 2 out of 5 (range: 1.8 - 2.2) suggesting that throat cultures were being used for confirmation on the least obvious cases.

### **Conclusion:**

Both ordering confirmatory throat cultures and presumptive antibiotic treatments suggests a lack of trust in the validity of a negative PCR strep test result. This chart review supports the industry published specificity of POCT strep PCR testing and should reassure acute care providers as they incorporate this new technology into their practice.



## Pap Smear Screening Rates and Barriers in Women with Opiate Use Disorder

Authors: Sabrina Do, OMS2; Amer El-Haddad, MD

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Community health centers are crucial in helping women, who are below the poverty line, stay up to date on cervical cancer screenings. Because cervical cancer can be prevented with early screening, it is imperative to identify obstacles to receiving these screenings. This is a cross sectional correlational study evaluating the presence of overdue pap smears, completion of HPV vaccination, and diagnosis of abnormal pap smears in women aged 21-65 with and without a history of opiate use disorder in the Lynn Community Health Center database. Risk ratios with confidence intervals and X<sup>2</sup> values were calculated. To identify potential barriers, women with a history of opiate use disorder and with overdue pap smear screenings were asked to identify factors limiting them from receiving the screening.

Women with opiate use disorder did not have an increased risk for overdue pap smears (0.938, 95% CI: 0.910-0.967), and there was no significant difference in HPV vaccination rates (0.871, 95% CI: 0.634-1.180). There was a significantly increased risk for having an abnormal pap smear diagnosis (3.449, 95% CI: 3.001-3.963). Reasons identified for not completing their pap smear screenings were "scheduling difficulties and lack of time", "unaware of overdue screening", "medical conditions", and "fear". The results indicate there is a barrier that is preventing all women from receiving their HPV vaccination and cervical cancer screenings, but women with opiate use disorder face a greater consequence of increased risk for cervical cancer, especially if follow up for their abnormal pap smears is not well structured.

Future public health efforts should increase cervical cancer screenings and HPV vaccinations for all women. One alternative method is self-administered vaginal swabs looking for the HPV virus. Furthermore, special consideration should be taken to increase pap smear rates for women with opiate use disorder due to their higher risk of cervical cancer. Women with opiate use disorder face many barriers to receiving adequate care due to fear of healthcare, history of trauma, and already having many other appointments to attend. To combat this, all clinics should implement trauma informed care and look into ways to decrease barriers for attending and scheduling appointments.



## Improving Obstetrical Care Workflow at Summit Pacific Medical Center

Authors: Amanda Achterman, DO, MPH; Laynee Laube, OMS III; Molly Anderson, OMS III; Lizzie Lamb, MPH

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### **Introduction:**

Summit Pacific Medical Center (SPMC) is comprised of small, rural hospital and two family medicine clinics in Elma, WA, SPMC's family medicine physicians constitute the sole source of prenatal care for residents of Elma and the eastern part of Grays Harbor County. Because of SPMC's small size, finding an affordable electronic medical record (EMR) that adequately tracks prenatal care milestones is a challenge but developing a solution is urgent. Some patients have missed critical interventions because of the imperfect tracking system provided by the current EMR.

### **Methods:**

This team created an internal registry to track 14 standards of care for prenatal and obstetrical care as a work-around for the EMR. The registry is stored on an internal shared drive which all providers can access and edit across the multiple clinic sites. The registry populates when a procedure/screening is due based on expected due date and whether the procedure has been completed, declined, or wasn't offered by the provider. The completion of the 14 standards of care for deliveries in January-March of 2021 to deliveries in January-March of 2022 were compared using simple descriptive statistics.

### **Results:**

Twenty-three deliveries were attended by four physicians from January to March in 2021 and 24 deliveries by seven physicians in 2022. The percent of interventions completed rose from 88.5% in 2021 to 93.2% in 2022. Providers who have been practicing for longer than ten years are less likely to offer CBC (100% completion for newer physicians and 25% and 62% completion for senior physicians) with similar results for RPR and Group B Strep. As providers started using the registry, they requested missing tests and combed through patient charts to find misplaced notes which may explain why percentage completion only improved slightly between 2021 and 2022.

### **Discussion:**

This registry offers a simple solution for lower-resource settings and has improved communication within Summit Pacific's care teams while highlighting areas for education. Guidelines for CBC, RPR, and Group B Strep were updated in recent years, highlighting the challenge of keeping broad-spectrum care physicians up to date with revised guidelines after they leave training.



## Concordance between Provider Opinion and Medical Record Evaluation on Incidences of Emergency Department Representation within 72 Hour

Authors: Spencer Goering, OMS-II; Adam Dawson, DO; John Ashurst, DO; Anthony Santarelli, PhD

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### **Introduction:**

The rate at which patients discharged from emergency departments return within 72 hours is a Center for Medicare and Medicaid quality metric that directly influences a facilities reimbursement. These rapid return visits are often dubbed "bouncebacks" by physicians, nurses, and mid-level providers. In the community setting, opinions of providers are the primary driver for interventions targeted at reducing bouncebacks.

### **Objective:**

To determine the accuracy of provider opinion on patient characteristics which predict representation to the emergency department within 72 hours and identify characteristics which may influence the acuity of the patient upon bounce back.

### **Methods:**

We conducted a mixed qualitative and quantitative design consisting of an eleven item survey and retrospective chart review from January 01, 2022 through June 30, 2022. Provider surveys were administered to nurses and physicians working day or night shift and were completed during the shift. The survey addressed views on access, social determinants of health, chronic conditions, and laboratory Values. Data abstracted from the medical record included patient comorbidities, admission to inpatient or observation, index diagnosis, return diagnosis, timing between presentations, and length of stay if admitted to inpatient. Results: A total of 32 emergency staff (40.6%, physician; 25.0%, registered nurses; 6.3% mid level providers, and 28.1% medical assistant staff). 59.1% (18/32) of respondents identified bouncebacks as a problem in the emergency department, however only 26.7% (8/32) agreed that bouncebacks at the index emergency department are of greater magnitude than peer hospitals. The most agreed with social determinant of health contributing to bouncebacks was a lack of primary care (75.0%, 24/32) followed by a lack of insurance (25.0%, 8/32). The comorbidity and abnormal laboratory value identified as most likely to contribute to a bounceback were COPD (40.6%, 13/32) and GFR (15.6%, 5/32).

### **Conclusion:**

Emergency department staff recognize the necessity for access to primary care as a important driver of patient re-presentation. The lack of primary care contributes to a higher frequency spurious bouncebacks. However when predicting clinical signs and symptoms, providers were unable to unitary or multimodal influences of which patients are likely to return.





## Preventing Health Disparities during COVID through Perinatal Home Screening as Authoritative Knowledge: A Feasibility Study

Authors: Rachel R. Chapman PhD, Sumaya B Mohamed MPH, Hodan Rage, Ayan Abdulahi, Jan Jimenez, OMS-1, Amelia R. Gavin PhD, Jasmine Zetell, Kavya N. Chatterjee, Susie Valderrábano, Savita Sundar, Halima Madey, James T. Pfeiffer PhD

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### **Introduction:**

Prior literature suggests eclampsia continues to be a primary cause for maternal and infant morbidity & mortality. This risk is higher for medically underserved BIPOC pregnant patients who share increased associated risks for hypertension. Low health literacy remains a barrier to effective screening and risk mitigation, especially throughout the COVID-19 pandemic as more patient monitoring and communication moved to telehealth. Through this study, we aimed to observe the practicalities and feasibility of the home screening kit as a tool for improving patient adherence to self-monitoring, self-care, and self-advocacy.

### **Method:**

Patient participants >24 weeks gestation (n = 27) seeking antenatal care services were recruited from four clinics in south King County between 10/2020 and 4/2021. Patient participants were given training to use the home screening kit, which included a novel, symbol-based screening tool and a blood pressure cuff. To normalize patient conversation surrounding well-being with their provider, the tool bundles the metric for blood pressure screening with metrics for mental/emotional health and domestic safety/security. Providers received training on the tool to give additional assistance to patients on how to interact and utilize the tool. Participant and provider perceptions of the home screening kit were collected through surveys, mid-way and at the end of the pilot's run. Closed question survey responses were collected for descriptive statistics. Open-ended question survey responses were collected for closed coding and qualitative theme analysis.

### **Results:**

117 patients were enrolled for the pilot study. Of 82 participants that completed the survey, 81 reported utilizing the blood pressure cuff, and 78 reported using both the blood pressure cuff and screening tool. Survey results and findings confirm the feasibility of the bundled home screening kit as a means for improving antenatal monitoring under COVID restrictions. Patients addressed improvement in their understanding of mindfulness and bodily awareness. Providers noted the increase in patient-provider contact.

### **Discussion:**

Moving forward, we seek to continue expanding the home screening kit distribution to more clinics and study how medically underserved patients engage with their antenatal care through ongoing improvements to health literacy training.

# Literature Reviews



## Do Older Adults Who Engage in Physical Activity have Better Cognitive Assessment Scores?

Authors: Pearl Dykstra, OMS2; Ronald Walser, DPT

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### Introduction:

Dementia is a common disorder among older adults. Interventions that help prevent or slow the progress of dementia may improve the quality of life for older adults, indicating the need to measure the effect of those interventions. The objective of this review is to determine if cognitive assessments show changes in cognition in older adults who are physically active compared to those who are not physically active.

### Methods:

For this literature review a PubMed search was completed with the search term "cognitive assessment scores and mobility," which yielded 155 results. Filters included full text, randomized control trial, and clinical trial. Exclusion criteria, after application of the PubMed filters, were systematic reviews, average patient age less than 65 years old, and papers that did not use cognitive assessments at baseline and follow up.

### Results:

A total of 4 research papers were included in this review. Two studies(1,2) demonstrated a significant difference between patients who performed exercises compared to those who did not with the Mini Mental Status (MMS) assessment. These differences between the activity and control group were 0.8 (p=0.012)(1) and 2.6 (p=0.001)(2). The Weschler Memory Scale-Revised-Logical Memory II (WMS-LMII) also demonstrated a significant difference of 1.0 (p=0.004)(1).

Two studies(2,3) included the Alzheimer's Disease Assessment Scale-Cognitive Sub-Scale (ADAS-Cog); and noted between group differences of 7.1 (p=0.001)(2) and 6.953 (p=0.012)(3).

Two studies(1,4) included the Verbal Fluency Test-Letter (VFT-Letter) and Verbal Fluency Test-Category (VFT-Category). For VFT-Letter, the between group differences were 3.6 (p=<0.001)(1) and 0.66 (p=0.009)(4). For VFT-Category, the between group differences were 2.2 (p=0.002)(1) and 0.54 (p=0.04)(4).

### Discussion/Conclusion:

The results suggest that older adults engaging in physical activity can score significantly better on the MMS, WMS-LMII, ADAS-Cog, and VFT-Letter and VFT-Category cognitive assessments than those who do not engage in physical activity. Older adults who exercise may be able to maintain their general cognitive function, memory, and verbal fluency skills. It is possible that some assessments are more sensitive and/or specific than others as to the specific cognitive impairments related to aging. Continued research should be done to identify which assessments should be used for patients with specific cognitive impairments.



## Diabetic Peripheral Neuropathy Inflammatory Markers And Osteopathic Manipulative Therapy: A Scoping Review

Authors: Lekaa Elhajjmousa, MSc, OMS-III & Kathaleen Briggs Early, PhD, RDN, CDCES

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### **Introduction:**

Diabetic peripheral neuropathy (DPN) is the most common microvascular complication among diabetic individuals. A principle in osteopathic medicine involves techniques that stimulate the body's innate ability to mend itself via Osteopathic Manipulative Treatment (OMT), offering the potential to aid in pain management and provide symptomatic treatment for individuals with DPN. The primary aim of this scoping review is to provide a summary of currently available data regarding OMT effects on inflammatory markers in diabetic neuropathy patients; a secondary aim to apply a methodological approach to this scoping review was additionally executed.

### **Methods:**

PubMed was queried for relevant resources with the exclusion criteria being missing abstracts, or non-English publications. Each citation was then assigned a unique identifier and its corresponding abstracts were imported into Excel and NVivo for analysis. Four main keywords were assigned ("Osteopathy," "Inflammation," "Diabetes," and "Neuropathy" including their stems) and coverage among sources was analyzed and quantified.

### **Results:**

The search yielded 64 results, 3 of which were excluded. In Excel, mention of each keyword per source abstract was coded, with duplicate mentions excluded. The keyword "Diabetes" showed the most coverage at 91.80% amongst all sources. "Inflammation" showed the second most coverage at 77.05%, "Osteopathy" at 11.48%, while "Neuropathy" demonstrated the least coverage at 8.20% amongst sources. In pooling total keywords per abstract, 21.31% of source abstracts included 1 of the keywords, 67.21% had 2 keywords, 6.56% had 3 keywords, and only 3.28% included all 4 keywords. Additionally, we created a table that outlined potential markers for DPN that were demonstrated in the studies found to be relevant to the primary aim of this review.

### **Discussion:**

Our results illustrate a unique approach to scoping reviews for topics with limited data, relying on the selection and analysis of keywords for studies that demonstrate the most relevance to the initial research question. None of the studies identified any explicit link specifically between OMT, diabetic neuropathy, and inflammation. These results point toward a severe lack of scientific literature on this complex and clinically important topic.



## Disorders of the Brain-Gut Axis: A Review of Comorbid Mood Disorders and Implications of Alternatives to Current Standards of Clinical Management

Authors: Molly Anderson, OMSIII; Hannah Kirk, OMSIII; Mark Baldwin, DO, FACOI, FASN

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### **Introduction:**

Disorders of the brain-gut axis (DBG) consist of gastrointestinal conditions subject to bidirectional communication of the bowel, enteric and central nervous systems, innate immunity, and microbial metabolites. Contributing to homeostasis and autoregulation, microenvironmental factors (e.g. serotonin, tryptophan) maintain effective gut motility, secretion, immune modulation, and nociception. The knowledge base describing the function of the gut-brain axis has led to novel investigations regarding its relationship to anxiety and depression, illuminating a consistent and reciprocal relationship. Considering the prevalence of brain-gut associated conditions, such as IBS (9-22% US; 3-25% WW) and increasing incidence of anxiety/depression, research efforts are now examining co-management with probiotics, selective receptor-targeted pharmacotherapy, fecal transplants, and adjunct dietary and cognitive behavioral therapies.

### **Methods:**

A database search was employed compiling articles referencing the gut-brain axis with or without associated exploration of psychiatric comorbidities and treatment modalities yielded hundreds of publications. Fifty of the most pertinent articles demonstrating the relationship between the gut-brain axis, psychiatric comorbidities, and the standards of diagnostic criteria, current treatment modalities, and future avenues of management were selected for inclusion.

### **Results:**

The literature indicates a significant, bidirectional correlation between DBGs (and its relative components; e.g., dysbiosis, immune dysregulation, visceral hypersensitivity, etc.) and neuropsychiatric conditions. Individuals with baseline evidence of mood disorders are at significantly greater risk for developing IBS and other DBG, in so much that 50% of individuals that meet clinical criteria for anxiety have symptoms of IBS. Conversely, individuals with underlying IBS show a 3-fold risk for developing anxiety. It was further illustrated that 60% of comorbid patients developed IBS prior to disorders of mood dysregulation.

### **Discussion:**

The literature illuminates an interrelationship between the gut-brain axis, IBS, and neuropsychiatric disorders, evidenced by persistent comorbidities therein. This relationship demonstrates a clinical rationale for identifying manifestations of DBG and anxiety/depression, considering the dual impact of their symptomology, and employing a multimodal, synergistic intervention. It stands to reason that treatment modalities should trend towards co-management and targeted therapies. A provisional groundwork for inclusive alternatives to current care standards would serve a greater patient population and reduce the healthcare burden for both gastrointestinal and psychiatric disciplines.



## TGFB1 Regulation of Epithelial to Mesenchymal Transition in Breast Cancer

Authors: Johan Velo, MAMS; Maggie Goniwiecha, MAMS; Oanh Nguyen, MAMS; Janelle Mapes, PhD

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### **Introduction:**

Breast cancer is the most frequently diagnosed cancer in women, with about 13% of women expected to develop invasive breast cancer in their lifetime and 287,850 new diagnoses reported in the US alone for 2022. Epithelial-to-mesenchymal transition (EMT) is a biological process in which an epithelial cell undergoes extensive biochemical changes to become a mesenchymal cell. Previous studies have demonstrated that transforming growth factor beta1 (TGFB1) is an integral transcription factor in activating EMT. The purpose of this literature review is to identify the signaling pathways through which TGFB1 disrupts cell-cell adhesion and promotes cytoskeletal remodeling during EMT in breast cancer cells.

### **Methods:**

A literature search was conducted in PubMed and ClinicalKey, searching for articles written in English and published January 2007 – January 2023. A total of 32 papers were included in this review using the following search terms: “transforming growth factor beta1”, “epithelial to mesenchymal transition”, “breast”, “e-cadherin”, “vimentin”, “Snail”, “SMAD2”, “SMAD3”.

### **Results:**

EMT plays essential roles in normal physiological processes, such as cell growth and repair, and in pathological processes, including tissue fibrosis and cancer progression. Recent data indicate that TGFB1, through the SMAD signaling cascade, promotes the activity of transcription factors such as Snail1 and ZEB1. These transcription factors suppress the expression of epithelial cell-cell adhesion molecules, such as e-cadherin, and promotes cytoskeletal remodeling through alterations in cytoskeletal proteins, such as vimentin. Collectively, these alterations in gene expression result in cell-cell adhesion loss and cytoskeletal remodeling associated with tumor cell invasion and intravasation.

### **Discussion:**

Overall survival rates for breast cancer treatment have improved in recent decades as a result of therapeutic advancements. However, the prognoses for metastatic breast cancers continue to be of poor outcomes. Activation of the TGFB1 signaling pathway culminates in repression of epithelial markers and expansion of mesenchymal-like characteristics by affecting cell-cell adhesion and cytoskeletal remodeling, often with concomitant increase in capability for metastasis. This review identifies the need for exploring potential targets within the TGFB1 signaling pathway to find novel therapeutic approaches for invasive breast cancers.



## Disproportionate Risk Factors Associated With Non-Small Cell Lung Cancer in Non-smoking Female Asian American, Native Hawaiian, and Pacific Islanders

Authors: Amelia T. Huynh, OMSII; Jinzheng Li, OMSII; Khoa Pham OMSII; Megan Benfield, MLIS, MHI; Janelle Mapes, PhD

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### **Introduction:**

Asian American, Native Hawaiian, and Pacific Islanders (AANHPI) are among the fastest growing sub-populations in the USA. Lung cancer has the highest rate of cancer deaths and second highest incidence in AANHPI females, despite having one of the lowest rates of tobacco use. The purpose of this literature review is to investigate the non-tobacco related risk factors contributing to the disproportionate incidence and mortality of lung cancer among never-smoking AANHPI females in the United States.

### **Methods:**

We queried PubMed, Wiley Online, and ClinicalKey from inception through December 2022 using the text search terms: "Asian American," "Native Hawaiian," "Pacific Islander," "U.S.," "lung cancer," "health disparities," "incidence," and "risk factors." Exclusion criteria include "treatments," "outcomes," "survival," and "male." Primary literature on lung cancer incidence and risk factors in AANHPI populations that were conducted in the U.S., published in English, and reported data separately based on gender and ethnicity were included. Studies that focused solely on treatments or outcomes were excluded. We carefully evaluated each study's full text to ensure that only the most relevant and high-quality sources were included in the review.

### **Results:**

The search returned 167 studies; 13 met the inclusion criteria and were manually reviewed by all authors. Non-tobacco use risk factors for AANHPI females developing lung cancer include occupational and environmental exposures (n = 7), increased rates of EGFR mutations (n = 3), sociolinguistic barriers (n = 3), cultural barriers (n = 3), and educational barriers (n = 3). N is equivalent to the number of articles relating to proposed risk factors. These risk factors are largely reflective of labor conditions, geographic locations, and socioeconomic status experienced by AANHPI females.

### **Discussion:**

AANHPI females face a disproportionate incidence, morbidity, and mortality rate from lung cancer, despite lower rates of tobacco use. Elimination of health disparities in these sub-populations requires additional research to address occupational and environmental exposure concerns, community and professional interventions to overcome identified barriers, and increase access to cancer-screenings. Solutions may include increased use of professional interpreter services, multilingual consumer health information resources, and AANHPI representation in professional occupations.



## Efficacy of Psilocybin in Treating Major Depressive Disorder

Authors: Joe Yates, MAMS; Carl Brown, MAMS; Clayton Lauba, MAMS

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### **Introduction:**

In 2020, an estimated 21 million adults experienced at least one major depressive episode. Treatment for similar disorders has traditionally been dependent on SSRIs (Selective Serotonin Reuptake Inhibitors) which can take weeks to months to take full effect. SSRIs are usually accompanied by a variety of adverse effects. Psychedelic compounds have been identified as a potential treatment and interest has only continued to climb in recent years. Psilocybin, a naturally-occurring psychedelic compound found in certain species of mushrooms, has shown promise in the treatment of Major Depressive Disorder (MDD), and advantages over traditional treatment regimes.

### **Methods:**

We conducted a database search of PubMed (NCBI), Cochrane Library, and CINAHL Complete. We searched for articles that included both "Psilocybin" and "major depressive disorder." Treatment-resistant depression was excluded.

### **Results:**

A total of 145 papers were found across the selected databases and deduplicated. A manual review was conducted for topic relevance. Ongoing clinical trials were excluded. The results were further subdivided into completed clinical trials, meta-analyses, hypotheses, and expert opinion pieces. Seventy-three unique papers remained, all of which support the efficacy of psilocybin as a treatment for MDD. All fifteen clinical trials of psilocybin found similar results, identifying rapid and long-lasting improvements in symptoms of MDD after psilocybin administration. Additionally, the adverse effects of psilocybin were reported to be less severe and easily reversed when compared to common SSRI treatments.

### **Discussion:**

All articles demonstrated that the use of psilocybin improves symptoms of MDD. There is minimal homogeneity of dosing, control groups, and scales to measure depressive symptoms varied between studies. As a Schedule 1 controlled substance, psilocybin research is burdened with legal and ethical objections. This political environment will continue to change as Oregon has become the first state in the US to legalize the use of psilocybin within licensed treatment centers beginning January 1, 2023. Standardized research metrics will be required by future investigations to ensure comparable results.





## Bibliometric Network Analysis of National and International Hormone Replacement Therapy Guidelines for Menopause

Authors: Montana Hawksford, OMS III; Harsukh Deol, OMS III; Megan Benfield, MLIS, MHI, AHIP; Janelle Mapes, PhD

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### **Introduction:**

The Women's Health Initiative (WHI) conclusions were first published in 2002 and historically served as the primary source for guidelines regarding hormone replacement therapy (HRT) in women for treatment of vasomotor menopausal symptoms (VMS). The objective of this literature review is to analyze international guidelines on VMS and determine how the WHI results have been utilized.

### **Methods:**

Because the US does not have federal guidelines, UpToDate and American College of Obstetrics and Gynecology (ACOG) guidelines were analyzed and compared to Dynamed guidelines including the United Kingdom (UK) and New Zealand/Australia (NZ/A). Backwards citation searching was utilized to determine primary literature sources for each guideline. Articles were included if the title and/or abstract compared HRT and the effects on VMS. Articles were excluded if the title and/or abstract focus was on HRT use for non-VMS relief or preventative care.

### **Results:**

A total of 76 articles were included in this review after excluding duplicates. The WHI accounted for 5 articles referenced in UpToDate, ACOG, and NZ/A. The UK did not reference WHI as a source for VMS as it was not a primary endpoint of the study. All guidelines concluded the WHI is a significant factor contributing to the declined use of HRT. ACOG, NZ/A, and UK consistently recommend HRT as the most effective treatment of VMS and encourage physicians to consider it as a primary option within reasonable clinical judgment. UpToDate acknowledges the efficacy of HRT but presents it as "second line" behind extensive lifestyle modifications.

### **Discussion:**

The WHI has significantly influenced how HRT is utilized to treat VMS, despite its primary endpoint of cardiovascular outcomes. Using the WHI as the primary guideline to educate physicians does a disservice to menopausal patients who could otherwise benefit from HRT. This is further demonstrated by UpToDate's failure to promote more current standards of practice while both ACOG and other countries utilize additional sources of primary literature. Establishing more inclusive US guidelines for management of VMS would ensure that medical students and physicians can appropriately evaluate all available options for their patients and ultimately improve quality of life.



## Racial Disparities in Opioid Distribution Amongst Pediatric Patients

Authors: Daniel Jennings, MAMSc; Ashley Lagrou, MAMSc; Henry LeMaster, MAMSc, Phil Mattocks, PhD; Kimberly Taylor, PhD

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### **Introduction:**

Racial disparities are commonly seen throughout the country in the delivery of healthcare. The standard of care may deviate with the race of the patient despite the fact that the patients are suffering from a similar injury. We aim to look at the racial disparities amongst pediatric patients (0-18 years old) via the unequal distribution of opioid prescription and administration across different racial groups. A systematic review was conducted to evaluate the distribution of opioid prescriptions to pediatric patients based on race in inpatient settings. We will analyze a variety of sources that emphasize the difference in standard of care based on pediatric patient race in terms of opioid distribution.

### **Methods:**

A literature review was performed on encounters of opioid distribution for pediatric patients based on race. 48 potential articles were found on PubMed and NIH databases. Key terms used in our search included race, opioid, emergency and pediatrics. Articles evaluating adults or outpatient prescriptions were excluded.

### **Results:**

23 articles were reviewed in this study. In the distribution of opioid medications to pediatric patients based on race, 12 articles showed statistically significant bias and 4 articles showed no statistically significant bias. 7 articles had unrelated conclusions, but had relevant data to use in our analyses. These articles reveal that there is an overall bias in the distribution of opioids to pediatric patients based on race.

### **Discussion:**

Race is a factor in patterns of distribution of opioid medications to pediatric patients. A common barrier in the existing literature was that the race of a patient is often determined by the intake staff rather than race being communicated to the provider by the patient or legal guardian. This may lead to discrepancies in data from institutions that do not have well-implemented patient intake and portal systems. Further studies would be needed to come to more concise conclusions. Comparing the results from similar studies in areas that are a significant distance from one another may help resolve the issue and find the areas that need to be more readily aware of the deviations in care that patients are receiving.



## A Literature Analysis of Coping Mechanisms for Stress in Medical Students During the COVID-19 Pandemic

Authors: Cameron Williams, MAMS; Austin Pense, MAMS; Luke Sharaf, MAMS

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### **Introduction:**

Medical school within the United States is considered one of the most difficult and stressful curriculums. The COVID-19 pandemic has added additional stress and challenges for medical students. This literature review examines the coping strategies that medical students use to manage the stress and anxiety of medical school and the COVID-19 pandemic. It is important for students to have the resources to cope with the increased stress of medical school amid the current and future pandemics.

### **Methods:**

A literature analysis was done utilizing relevant search terms including "Coping strategies, stress management, medical students, United States, COVID-19, stress rate, burnout rate" to elicit publications for review. Searches were completed using Boolean operators to limit or expand the search. PubMed, CINAHL, and the PNWU library database were used to identify evidence-based publications. Articles included in the review contained data about coping strategies used by US medical students for stress, depression, and anxiety, published between 2007 and 2022. Articles were excluded if they did not contain information relating to coping mechanisms for stress and other mental concerns, if they were done outside of the US, or if they did not study students in allopathic or osteopathic medical school.

### **Results:**

37 articles were reviewed; 23 published during the COVID-19 pandemic, and 14 published prior. This literature shows that before the pandemic, most common mechanisms of coping with stress included mindfulness-based interventions (15), practicing emotional intelligence (10), and prosocial behavior were most used (7), but there is little evidence of the effectiveness of these strategies. Research has not shown a change in those patterns or improvement of stress during the pandemic.

### **Discussion:**

Most of the studies were small and only obtained data from one institution at a time. A variety of stress coping mechanisms were analyzed in these studies, and mindfulness interventions showed some improvements in mental issues for medical students. Data were unclear on what coping mechanisms, if any, were most effective before or during the pandemic. Findings suggest that more discovery on coping mechanisms and their implementation with medical school students needs to be completed.



## Evaluation of the Low-Carb Mediterranean Diet as a Dietary Intervention for Diabetes in the Adult Hispanic Populations

Authors: Hsinhui Li, MAMSc; Susana Lopez-Aguilar, MAMSc; Xueying Zhen, MAMSc

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### **Introduction:**

According to recent U.S. censuses, the Yakima County population is composed of more than 50% Hispanic or Latino population, which within the greater U.S. population is at higher risk for diseases such as Type 2 Diabetes Mellitus (T2DM). This narrative review seeks to evaluate the use of the low-carb Mediterranean Diet as a dietary intervention for diabetes management, focusing on its feasibility of implementation within the adult Hispanic population.

### **Methods:**

Publications for this review were located through the use of PubMed, Clinicalkey, and CINAHL. Search terms included "Mediterranean diet", "type 2 diabetes", "blood glucose", "glycemic control", and "GLP-1" to form a search string on intervention efficacy, and results were filtered for clinical trials and randomized control studies. Search terms related or equivalent to "Mediterranean diet", "food insecurity", "low-income" were further used to isolate publications concerning accessibility of the intervention. Similarly, terms related to "Hispanic or Latin", "dietary patterns", "regional diet", "traditional diet" were used to assess acceptability for the dietary intervention. Inclusion criteria included papers in English, with adult participants aged 19+, published after 2008.

### **Results:**

61 articles were reviewed. Several clinical trials showed favorable effects on diabetic patients with the implementation of a Mediterranean diet. The efficacy was evaluated based on primary outcomes such as HbA1c and blood glucose and other secondary outcomes. Most articles on accessibility demonstrate a correlation of adherence with income; however, most articles relating the two were not conducted within the US. In addition, the literature suggests that compared to other ethnic groups, certain Hispanic subgroups might find the diet components more acceptable, and that culturally adapted implementation might increase receptiveness.

### **Discussion:**

Results suggest that the Mediterranean diet has a positive effect on the management of T2DM, though providers should be mindful of patients' food accessibility when prescribing the dietary intervention, as the effect might not be reflected within low-income populations. However, the intervention appears to be generally compatible with typical Hispanic diets. Limited articles on the subject warrants additional studies on the efficacy of dietary intervention in T2DM management, especially implementation in a non-Mediterranean population.



## Gestational Exercise and Labor Duration: A Meta-Analysis of the Body's Ability to Prepare for "The Marathon of Labor"

Authors: Sholeh Sharif, MAMS; Rylie McGinnis, MAMS; Kaelin Young PhD

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### **Introduction:**

Exercising while pregnant is sometimes viewed as dangerous for the fetus, as it is believed that it can lead to a longer and more painful labor. However, many women express a desire to continue exercising throughout their pregnancy. Therefore, the primary objective of this investigation was to examine the effect of moderate-level gestational exercise on delivery duration of healthy women by performing a meta-analysis using the current body of scientific literature.

### **Methods:**

After applying strict search criteria to three electronic databases (PubMed, TripPro, and CINAHL), using the inclusion term "exercise during pregnancy" NOT "gestational diabetes" and selecting for only randomized controlled trials, 329 articles were returned. Articles were excluded that utilized women with a prior health condition or that underwent a cesarean section procedure, were not available in English, did not include a non-exercise control group, or did not utilize a moderate level of exercise (defined below). After these exclusion criteria, 14 trials were analyzed. To determine the effect of moderate-level exercise on labor duration, Cohen D effect sizes (ES) were calculated for each study using the following formula:  $([\text{control group mean} - \text{exercise group mean}] / \text{pooled SD})$ . Furthermore, the mean difference between groups for labor duration was calculated with a 95% confidence interval. An ES of 0-0.5, 0.51-0.7, and  $>0.71$  was considered a small, moderate or large effect, respectively.

### **Results:**

Moderate-level exercise was defined as any activity lasting 30-60 minutes and elevating the heart rate above resting, performed 2-3 times per week. Our findings suggests this type of exercise has a moderate effect on labor duration in the first stage (mean difference = -90.9 minutes, 95% CI  $\pm 8.007$ , ES= 0.56, CI  $\pm 0.0948$ ) and a large effect on overall delivery time (mean difference = 90.8 minutes, CI  $\pm 8.999$ , ES=0.84, CI  $\pm 0.0088$ ).

### **Conclusions:**

Analysis of the current literature suggests that moderate-level exercise has a positive effect on duration of labor and should be encouraged by physicians in healthy pregnant women. Future meta-analyses using other forms/intensities of exercise are warranted.



## COVID Outcomes Based on the Use of ACE-2 Inhibitors and DPP-4 Inhibitors in Type 2 DM Patients in COVID Cases

Authors: Sukhmoney Athwal, MAMS; Emma Saint-Preux, MAMS; Talitha Smythe, MAMS

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### **Introduction:**

Uncontrolled diabetes is correlated with severe COVID-19 infections. Two of the multiple targets of the SARS-CoV-2 virus are dipeptidyl peptidase (DPP-4) receptor and angiotensin-converting enzyme-2 (ACE-2) receptor. DPP-4 is highly expressed throughout the lungs, and ACE-2 is found in alveolar epithelial cells, increasing the risk of COVID-19 entering cells in the lungs. This literature review aims to investigate the benefits of DPP-4 inhibitors and ACE-2 inhibitors in diabetic patients diagnosed with COVID-19.

### **Methods:**

PubMed, CINAHL, and Cochrane library databases were utilized to assess articles. The inclusion criteria: 'COVID' OR 'COVID-19' AND 'type 2 diabetes mellitus' OR 'diabetes mellitus' AND 'DPP-4 inhibitors' OR 'ACE-2 inhibitors.' Exclusion criteria: type 1 diabetes and articles discussing pediatric patient cases as patients were likely to have type 1 DM. Articles published in 2019 through 2023 were included to focus on the COVID-19 pandemic. From the 58 total articles yielded (PubMed = 34, CINAHL = 7, Cochrane = 4, and MEDLINE = 4), these were evaluated through inclusion and exclusion criteria resulting in a total of 32. A forward and backward citation search was used to find 9 additional research articles. The relationship of ACE-2 inhibitors and DPP-4 inhibitors in COVID patients comorbid to type 2 diabetes was assessed.

### **Results:**

18 articles discussing DPP-4 inhibitors and 8 articles discussing ACE-2 inhibitors showed associations with less severe COVID mortality risk compared to patients without the use of these inhibitors. 9 articles mentioned that there was no difference in mortality risk using DPP-4 inhibitors in diabetic patients with COVID.

### **Discussion:**

ACE-2 and DPP-4 inhibitors are a potentially safe treatment option in diabetic patients hospitalized for COVID. Studies linked the use of DPP-4 and ACE-2 inhibitors to shorter hospital stays and did not increase the severity of COVID in patients with type 2 DM. The results identify the need for potential detailed clinical experiments evaluating the efficacy of ACE-2 versus DPP-4 inhibitors in COVID cases to confirm these benefits.



## Gastroesophageal Reflux Disease (GERD): A review of diet & lifestyle for people under 21

Authors: Nathan Nguyen, MAMS; Joshua Arias, MAMS

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### **Introduction:**

Gastroesophageal reflux disease (GERD) is a common clinical problem, increasingly affecting young adults and adolescents. The purpose of this literature review is to obtain information from published articles in relation to GERD and its commonly correlated variables. Our goal is to synthesize this information by expanding the research revolving around GERD as well as its correlated variables to educate and inform the population.

### **Methods:**

We used data from Google Scholar and PubMed filtering for diet or lifestyle, and GERD, and filtering out alcohol to avoid confounding variables. We checked the box labeled "free full text" found within PubMed to narrow our search and obtain accurate, precise and easily accessible information regarding GERD: a review of diet & lifestyle for people under 21.

### **Results:**

The primary explanation for the increase of GERD in this population is an increase in poor diet and lifestyle as well as a decrease in time between bedtime and meals for these age groups. Previous research has demonstrated that smoking, obesity, late night snacking, liquid food intake prior to bedtime, and certain sleeping positions are correlated with GERD. We included a small number of articles that claim a sharp contrast to these findings in relation to patients with obesity and GERD, stating that the main treatment for GERD is weight loss, denying the majority of other treatments found in related research such as diet alterations.

### **Discussion:**

Contrary to some publications, our main findings have shown that there are additional factors affecting GERD beyond obesity. These factors include smoking, intake of food less than 3 hours prior to bedtime, caffeine intake, sleeping positions, diet, and tobacco usage. We hope to expand this research by looking into varying pharmaceutical/surgical treatment as well as the effects of these treatments on the population. We also aim to explore alternative treatment approaches via diet and lifestyle alterations.



## Literature Review of Definitions, Models, & Measurement Tools of Clinical Empathy in Medicine

Authors: Lauren Morgan, MA, OMSI; Sage Chase, MA, OMSI

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### **Introduction:**

Physician empathy in medicine is deemed a very important aspect of patient care and has been associated with positive clinical outcomes. Physician empathy is considered a multidimensional construction and there is no one universal standard definition. Prior literature about physician empathy in medicine, however, has generally characterized empathy as a capacity, ability, personality trait, cognitive attribute, and/or emotional experience whereby one is able to perceive and respond appropriately to cues, patients' situations and emotions and communicate in ways patients value. Given the multidimensional nature of physician empathy it is not surprising that multiple tools have been developed to measure the construct. The purpose of this review was to conduct an informal survey of the literature on physician empathy to identify measurement tools that may be appropriate to use in medical education as well as the most common conceptual underpinning of those tools.

### **Methods:**

Keyword search terms were entered into the PubMed database and included: "physician empathy," "clinical empathy," "empathy measurement tools," and "empathy in clinical medicine." In our review, we included systematic reviews and papers investigating physician or nurse empathy in a clinical medical setting and which described the use of an empathy assessment tool. We excluded studies that did not include a measure of empathy that was intended to be used with healthcare providers in clinical settings.

### **Results:**

Eight papers including three systematic reviews were included in this review. Eight dimensions of empathy as well as eight associated measurement tools were identified. Some most common tools identified in our review were the Jefferson Scale of Physician Empathy, Interpersonal Reactivity Index, Consultation and Relational Empathy Measure.

### **Discussion:**

This review suggests the majority of tools use to assess clinical empathy are based on different measurable criteria. Multiple dimensions are used for each method and make it difficult to compare across studies. However, the studies analyzed in this review did come to a similar conclusion that when patients perceived their physician as being empathetic it allowed for better adherence, interpersonal trust and partnership between clinicians and patients.





## Investigating Semaglutide as an Adjunct to Weight Loss Management in Adults without Diabetes

Authors: Korlu Bosillo, MAMS; Rani Sharaf, MAMS

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### **Introduction:**

Semaglutide, a glucagon-like peptide-1 receptor agonist (GLP-1 RA), is a treatment for Type 2 Diabetes Mellitus (T2DM). The Food and Drug Administration (FDA) approved this diabetes treatment for weight loss therapy in June 2021, and it has shown promise. Semaglutide promotes weight loss regardless of diabetes status by decreasing appetite via centralized effects on appetite regulation in the hypothalamus and delayed gastric emptying. We conducted a narrative literature review to assess Semaglutide as an adjunct for weight loss management, possibly reducing the need for surgical intervention in obese adults without diabetes.

### **Methods:**

A literature review of peer-reviewed publications was retrieved from PUBMED, Cochrane, and CINAHL Complete. The following Boolean search string was applied, containing the terms: "semaglutide" AND "subcutaneous" AND "weight loss" NOT "Type 2 Diabetes". Inclusion criteria were English language publication, randomized controlled trial (RCT), meta-analysis, and published after 2017. Reported outcomes include the mean weight loss and/or the total percentage of weight change from baseline until the end of treatment.

### **Results:**

The initial search identified 14 relevant articles and ultimately retained eleven RCTs and one systematic review/meta-analysis that utilized subcutaneous semaglutide as the primary variable. Nearly all the studies ran their RCTs for at least 68 weeks. The pooled mean weight loss reported was -14.1 kg and the pooled total percentage of weight change from baseline to the end of the study was -12.7%. The commonly reported adverse effects were nausea, vomiting, constipation, and diarrhea.

### **Discussion:**

Weight loss for obese and overweight individuals is highly recommended to reduce the risk of obesity-related diseases. Semaglutide as an adjunct for weight loss in patients without diabetes in combination with lifestyle intervention is an effective choice for adults. Since the FDA's approval for weight loss in patients without diabetes, semaglutide has soared in popularity and clinical use, despite the high cost. As a result, the U.S. has been experiencing drug shortages since 2022, affecting diabetic patients' accessibility to their medications. Semaglutide also produces adverse effects involving the gastrointestinal system. Further studies are warranted to optimize semaglutide treatment for obesity in adults and potentially adolescents.



## Telemedicine Services and Access to Primary Care in Rural and Underserved Areas

Authors: Vanessa Ferguson, MAMS; Oswaldo Moreno, MAMS; Amy Pisan, MAMS

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### **Introduction:**

This narrative review seeks to provide a comprehensive understanding of the impact of telemedicine services on access to primary care in rural and underserved areas before and during the COVID-19 pandemic and its implications for the future of healthcare delivery in the United States.

### **Methods:**

Methods used included a literature review using Boolean operators to include telehealth or telemedicine in primary care in our literature search at the PNWU library website. The databases that were used to search for the literature were CINAHL, PubMed, and Cochrane Library. The timeframe specified was 2010-2023 so that we could review data for telemedicine prior to, during, and post COVID-19 shutdown. The article's introduction and abstract were reviewed to verify criteria such as policies, data, outcomes, impacts of access to care, and perceptions of telemedicine. The reviewers reviewed 28 articles.

### **Results:**

The benefits of telemedicine in rural and underserved areas include improved access to care, increased convenience and privacy, and cost savings for both the patient and provider. Additionally, telemedicine allows patients to connect with providers who may not be available in their area, providing access to specialized or out-of-area care. The obstacles of telemedicine in rural and underserved areas include technological and infrastructure issues, such as lack of reliable internet access and access to compatible devices, as well as provider mobility and reimbursement issues. Additionally, there may be cultural and socio-economic barriers to access, such as language, literacy levels, and cultural norms around access to care. In our review, we found that rural and non-urban areas were less likely to use telemedicine services during the COVID-19 pandemic.

### **Discussion/Conclusion:**

COVID-19 allowed telemedicine services to be utilized because of policy changes in insurances due to the shift to remote care to limit the spread. Further research is needed to explore the impact of telemedicine services on access to care, healthcare costs, and healthcare outcomes in rural and underserved areas.

Keywords: telemedicine, telehealth, COVID-19, primary care



## Whole-Food, Plant-Based Diet to Treat and Prevent Illness in Adult Patients: A Literature Review

Authors: Isabel Richter, MAMS; Wyatt Borman, MAMS

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### **Introduction:**

The popularity of the whole-food, plant-based (WFPB) diet has increased in recent years, especially after the release of the New York Times Bestseller "How Not to Die" by Michael Greger MD and Gene Stone. A WFPB diet encourages ad libitum intake of whole foods including fruits, vegetables, legumes, seeds, and limited nuts (typically restricting total fat intake), and excludes all animal products. The diet eliminates foods with added sweeteners and sugars, refined carbohydrates, and other highly processed foods. Advocates of the diet cite exceptional health benefits observed after implementation, including weight loss and disease reversal. We performed a literature review of studies that evaluate the efficacy of the WFPB diet to treat and prevent disease.

### **Methods:**

We compiled articles from PubMed, CINAHL Complete, ClinicalKey, Cochrane Library, and the Directory of Open Access Journals (DOAJ). We searched for the intact phrase "whole food plant based" to eliminate other plant-based diets from our search. Case studies, call-to-action articles, and speculative works were excluded. The selected papers evaluate the effect of a WFPB diet on the comorbidities of a specific disease (e.g., joint stiffness in osteoarthritis) and anthropometrics.

### **Results:**

Fourteen articles met inclusion criteria. Across the board, WFPB diets were effective in decreasing BMI (all significant against controls, if present), regardless of timeframe (15 days to 10 years). This effect remained true for people with chronic conditions and comorbidities. Total cholesterol, HDL, LDL, were reduced in the majority but not all studies. Patients with osteoarthritis reported significant reduction in pain, stiffness and physical function compared to controls. These same measures were not improved in one study examining rheumatoid arthritis risk.

### **Discussion:**

Regardless of the demographics, all studies demonstrated decreases in BMI and overall positive health outcomes. The pain, stiffness, and physical function of people with osteoarthritis were markedly improved with a WFPB diet and this deserves further study. Between individual studies, the definition of "WFPB" varied more than we anticipated. Future studies may include further criteria to include similar low-fat vegan diets and evaluate the variability of diet guidelines and definitions among plant-based diets.



## The association between air pollution and ADHD

Authors: Omar Hasan, MAMS; Karandeep Rai, MAMS; Ebadur Rahman, MAMS

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### **Objective:**

Attention-Deficit/Hyperactivity Disorder (ADHD) is thought to be caused by environmental and genetic factors. Many environmental factors are correlated to ADHD, especially toxins exposed to children and infants. A combination of higher air pollutants and lower amounts of green spaces shows an association with a higher prevalence of the rates of ADHD. The goal of this literature review is to compare the effects of air pollution on the prevalence of ADHD.

### **Methods:**

A qualitative and quantitative analysis with a combination of observational data was used comparing children from areas with various pollution levels. The PubMed search, "(pollution[Title]) AND ADHD[Title]" was used to collect data, and that data was analyzed furthermore to determine plausible associations with the link between air pollution and ADHD.

### **Results:**

A collection of 12 articles from PubMed and Cochrane Library was obtained. The literature suggests that air pollution is heavily correlated with a higher prevalence of ADHD rates in adolescents when exposed during prenatal and postnatal periods. More specifically the research indicated that a substantial increase in environmental toxins in the air is correlated with higher rates of ADHD. Particularly, a higher amount of particulate matter in the air from Nitrous Oxide, Carbon Monoxide, Oxide, and Sulfur Di-Oxide was found to be correlated with higher incidences of ADHD. The data suggest that the increase in these particulate matters shows a higher correlation with ADHD.

### **Conclusion:**

The increased rates of ADHD are associated with increased environmental risks such as air pollution. The combination of the aforementioned chemical compounds has also been related to other neurodevelopmental disabilities. It may be considered to conduct more research on the lack of healthcare access along with air pollution contributing to a greater rate of neurodevelopmental disabilities such as ADHD.

# Case Reports



## Pyoderma Gangrenosum as a Manifestation: Case Report

Authors: Jasmeen Pooni OMS III, Sumeet Aujla OMS III, Randolph Fish DPM

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### **Introduction:**

This case presentation focuses on the diagnosis of pyoderma gangrenosum. Pyoderma gangrenosum is unique as it is rare, occurring in approximately 1 in every 100,000 persons in the US population, and is associated with systemic rheumatologic disease. This case report suggests exploration for underlying systemic disease is needed in order to heal the wounds, a dermatologic presentation.

### **Case Description:**

A 47-year-old female presented to a wound clinic for a recurrent left shin wound. In 2016 she initially presented to the wound clinic with a left shin ulcer complicated by staphylococcal infection. In April 2021, she was seen by a naturopath for burning abdominal pain, upper abdomen, decreased oral intake, nausea, occasional constipation, and cramping and was started on omeprazole and sucralfate for presumed gastritis. In March 2022 she developed a recurrent painful left shin wound that healed and reopened, treated with Neosporin, cephalexin, pressure bandages, and compression therapy. This new wound, which began as a small blister, worsened over time and the patient was once again referred to a wound clinic in July 2022. She was started on multiple steroids as well as antibiotics given her gram stain results. During this time, her autoimmune markers showed an RF of 18 (reference range of <14) and a CRP of 15.08 (reference range of 9). The patient was seen in the clinic from July 2022 through January 2023 when she was discharged due to approximate closure of the wound. She has been seen by rheumatology and gastroenterology with a workup of colitis in progress.

### **Discussion:**

Pyoderma gangrenosum typically presents as a small inflammatory pustule or papule that expands and creates an erosion or ulcer. More than 50% of patients have an associated underlying disease process present, often inflammatory bowel disease, and this patient has underlying markers that suggest an autoimmune disease may be present. Though this case is limited in that there is a danger of over interpretation, it showcases the importance of a holistic approach, speciality consultation, and follow-up in order to begin a wound healing process and diagnose and treat associated conditions for care of the whole patient.



## Aberrant Right Subclavian Artery Presentation in a Cadaver

Authors: Kristen Senior, OMS II; Tyler Lulich, OMS II; Estevan Yopez, OMS II; Ericka Von Hoy, OMS II; Ronald Walser, DPT

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### **Introduction:**

Variations in course of the right subclavian artery (RSA) is one of the most common embryonic aortic arch anomalies, occurring in approximately 0.19-2.52% of the population. The aim of this report is to present a case of an aberrant RSA and identify concomitant anomalies.

### **Case Description:**

The RSA of 89 year old male donated body was dissected and examined. Under normal conditions, the aorta gives off the brachiocephalic trunk containing the RSA and right common carotid, left common carotid, and left subclavian artery. The cadaver being examined did not have a brachiocephalic trunk, but a right common carotid artery branching directly off the aortic arch and the RSA originating as a direct branch off the posterior portion of the aortic arch. The RSA then passed posterior to the esophagus and anterior to the cervical vertebral column within the prevertebral fascia, forming an indentation into the vertebral bodies.

Additional arterial abnormalities found on this cadaver include the right vertebral artery being substantially smaller than the left upon entrance of the vessels into the C6 foramen transversarium; and a berry aneurysm at the bifurcation of the basilar artery into the bilateral posterior communicating artery. All distal branches of the right subclavian artery were found to be present, but divergent from their normal course. Atherosclerotic changes were not able to be identified due to post-mortem blood clotting. A transvenous pacemaker was present in the left subclavian artery, so the aberrant artery would not have interfered. No additional obvious anomalies were noted upon examination of the vasculature.

### **Discussion:**

An aberrant RSA is the most common embryonic aortic arch anomaly, and the retroesophageal course has been found to be the most common course, in approximately 83% with those identified. It is unknown if other arterial abnormalities, as seen in this case, are commonly found with an aberrant RSA. The known clinical manifestations of an aberrant RSA include dysphagia, shortness of breath, laryngeal nerve compressions, retrosternal pain, cough, and low weight. The lack of extensive medical history and demographic information on this cadaver limits the ability to infer any clinical manifestations.



## Transient Fecal Incontinence following Sacrococcygeal Fracture

Authors: Steve Sorensen, OMS-III, PT; Grace Zhang, MD; Stephen Dechter, DO, FAAPMR

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### **Introduction:**

Acute fecal incontinence can be a sign of cauda equina syndrome. This clinical case highlights a sacrococcygeal fracture that resulted in transient fecal incontinence.

### **Case Description:**

A 53-year-old female teacher went to the emergency department (ED) after a chair was pulled out from under her while playing "musical chairs" at school. She reported pain in her tailbone, difficulty sitting, and she had an "accident in [her] pants when [she] fell." The "accident" was her first episode of fecal incontinence. She subsequently was able to stand, walk, and drive herself to the ED.

She denied bladder incontinence or saddle paresthesia and did not have radicular pain or neurologic deficits in the lower extremities. Lumbar x-rays were negative. Pelvic x-rays found a fracture of the sacrococcygeal junction with mild displacement. She was discharged from the ED with pain medication and a muscle relaxant, and she was referred to her primary care physician, who then referred her to an interventional pain physician.

Four weeks after the accident, she reported loose stools and deficient control of defecation for three weeks following the trauma. By week four she had regained bowel control. MRIs of the lumbar spine and pelvis were performed to determine if a hematoma or compressive neuropathy may have contributed to the incontinence. The lumbar MRI was negative. The pelvic MRI showed no central canal or neural foraminal narrowing but found a presacral hyperintense collection consistent with a hematoma at S3-5 measuring 1.1 x 3.2 x 4.8cm. The patient recovered without exacerbation of symptoms, and she had a gradual resolution of coccygeal pain.

### **Discussion:**

Transient fecal incontinence in this patient appeared in the absence of cauda equina syndrome, but rather from compression of the anterior sacral nerve roots or peripheral nerves to the rectum and anal sphincter. This presentation may be more common than it is reported, but requires specific questioning by providers, as patients may be embarrassed to admit the "accident." We recommend that an MRI be performed if fecal incontinence does not improve within 4 weeks after trauma.





## Treatment resistant depression and transcranial magnetic stimulation: mixed success in a 72-year old woman

Authors: Termeh Khoshniat, OMS- III; Lizzie Lamb, MPH; Veda Varada, PA-C; Farroukh Hashmi, MD; Kishore Varada, PA-C, MD

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Over 16 millions Americans deal with depression, and 30-35% of that number experience treatment resistant depression (TRD). Repetitive transcranial magnetic stimulation (rTMS) is a noninvasive technique where electric pulses are sent to specific areas of the brain through a magnetic coil attached temporarily to the scalp. New protocols for rTMS are continually emerging, but the complexities of mental health make developing effective treatment plans a challenge before the patient begins to lose faith in psychiatric care. This case discusses a 72-year old woman with TRD who has undergone two types of rTMS treatments, NeuroStar and MagStim.

The patient, a 72-year old Caucasian woman, has dealt with TRD since 1990. She has tried several interventions over the past 30 years with little effect, including electroconvulsive therapy, Spravato esketamine, psychotherapy, and multiple pharmaceuticals. The patient currently declines psychotherapy because she does not find it beneficial.

In 2021, the patient completed forty sessions of rTMS with a Neurostar machine, using Neurostar's standard protocol. Her standardized scores before this treatment were: PHQ-9 at 15, HAM-D at 23, and MADRS at 20. Her scores after treatment were: PHQ-9 of 15, HAM-D of 20, and MADRS of 20, indicating only a slight improvement. At her fortieth treatment, the patient reported she was not motivated and felt more hopeless.

In 2022, the patient completed 35 sessions of standard MagStim rTMS treatment. Before treatment, her PHQ-9 was 11, HAM-D was 12, and MADRS was 18. After treatment, her PHQ-9 was 11, HAM-D was 15, and MADRS was 14. At her 35th treatment, the patient reported, "I am less anxious, less depressed, and no mood swings."

The patient took and continues to take Klonopin, Mirtazapine, Seroquel XR, and Wellbutrin XL at the time of these rTMS treatments and started taking Pristiq after completing the NeuroStar rTMS treatments.

Older patients with longer mental health histories benefit from thoughtful and nuanced care. Some evidence indicates that older adults take longer to achieve remission with rTMS. While this patient is not yet in remission, experimenting with rTMS, pharmaceuticals, and not pressuring her to partake in psychotherapy allow some hope for recovery.