

NOTES:

# **Medical Partnership**

## **Student Research Symposium**

**September 28, 2015**

*Sponsored by*

**GRU/UGA Medical Partnership**

# #19

Welcome to the fifth annual GRU/UGA Medical Partnership Research Symposium! This event is an opportunity to showcase the activities of our students during the summer between the first and second year of their medical studies. Students were encouraged to engage in a scholarly activity which could include laboratory science, clinical, or other research. Students more interested in a participatory clinical experience were encouraged to also engage in “inquisitive observation and reflection” in order to derive a more complete understanding of the health problems within the context of the greater community.

The posters represent the results of the students’ endeavors. We are grateful to all of the faculty members at GRU, UGA, and other institutions, who have mentored the students and to the community clinicians, both in Athens and elsewhere who have shared their expertise with the students and provided the clinical settings in which to learn both the art and science of doctoring.



## DIFFERENTIAL NEURAL RESPONSES DURING AUDITORY ODDBALL TASKS IN BIPOLAR PATIENTS WITH AND WITHOUT PSYCHOSIS

Kathryne N. Wood<sup>1,2</sup> and Brett Clementz PhD<sup>3</sup>

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**Background:** The P300 is an event-related potential component that peaks ~300 ms after stimulus presentation and relates to attention and working memory. Studies have reported increased latencies and reduced amplitudes in P300s among patients with bipolar I disorder (BD) as compared to healthy controls. However, most studies of BD do not differentiate between patients with and without a history of psychosis. Teasing out the interaction between psychosis and BD may have important implications for understanding differential pathophysiologies and treatment for patients with this heterogeneous disorder.

**Objective:** The purpose of this study was to use an auditory oddball task to compare neural responses in bipolar patients with psychosis, bipolar patients without psychosis, and healthy controls.

**Methods:** The neural responses of bipolar with psychosis (BD-P), bipolar without psychosis (BD-NP) and healthy (H) subjects on an auditory oddball task were compared using multisensor electroencephalography. Principal component analysis (PCA) was used to aggregate and reduce multisensor data into components based on variance before differences in voltage over time were evaluated between groups.

**Results:** Data was averaged within 10 ms bins and a one-way ANOVA was run. Significant group differences in waveform amplitude were found. Follow-up t-tests revealed significant differences between groups.

**Summary/Discussion:** The P300 response differentiated BD-P and BD-NP groups. Further characterization of the difference between BD-P and BD-NP neurophysiology and pathology, as defined by objective biomarkers, may ultimately lead to more effective, tailored treatment approaches.

# #18

## **PAD PATIENT ADHERENCE TO SUPERVISED EXERCISE: WHAT ARE THE BARRIERS?**

**C. Allen Witt<sup>1,2</sup>, Jared Brizendine<sup>3</sup>, and Jonathan R. Murrow MD<sup>2,3</sup>**

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Patients with peripheral arterial disease (PAD) have higher rates of functional impairment that can be alleviated by supervised exercise regimens as opposed to exercise prescription alone. Lack of adherence to exercise regimen and sedentary behavior accelerates functional decline and is common in those with PAD. Our study examined the relationship between adherence to a supervised exercise program and potential barriers to exercise in PAD patients participating in supervised exercise as part of a larger study. Likert scale questionnaires assessing self-efficacy and perceived barriers to exercise were administered via telephone to 16 patients classified as adherent (72.4±9.5 y.o., n=8) or non-adherent (72.4±5.7 y.o., n=5). 80% completion of 36 total sessions was required to be in adherent group. A two-tailed t-test was used to examine associations between patient responses and adherence. Preliminary data suggests increased self-efficacy in the adherent group across all 6 parameters measured; the strongest association being with increased patient confidence in his/her ability to do things other than just taking medication to control the effect of illness (adherent: 7.9 ±1.6; non-adherent: 4.8 ±4.2; p-value 0.0613; 10 = total confidence). Pain is the strongest perceived barrier to exercise (adherent: 3.9 ±2.1; non-adherent: 7.5 ±5.9; p-value 0.0682; 10 = profound barrier). Data analysis is still ongoing but trends suggest that self-efficacy may be a positive predictor of adherence while pain may predict lack of adherence. Strong correlations between patient factors and adherence may direct supervised exercise program design, potentially increasing participation and decreasing functional impairment in PAD populations.

## **POSTER PRESENTATIONS**

<b><u>NO.</u></b>	<b><u>STUDENT</u></b>	<b><u>ADVISOR</u></b>
1	Amarchi Anukam	Laurel Murrow, MD, MSc
2	Stephen Ballis	David Sailors, MD
3	Justin Belk	Catherine Apaloo, MD, FACP
4	Matthew S. Broggi, MS	Viraj A. Master, MD, PhD
5	Liam J. Chung	Jonathan Murrow, MD
6	Amelia Donlan	Laurel Murrow, MD, MSc
7	Angela Holder	Lynn B. Bailey, PhD
8	Louis Kerkhoff JD	Neal Dickert, MD, PhD
9	Kevin J. Lee	Robert J. Schmitz, PhD
10	Hamzah Mansoura	Kevin K. McCully, PhD
11	Jordan Maxwell	Laurel Murrow, MD, MSc
12	Bradley Parke	Nancy Manley, PhD
13	Kayla Perry-Walker	Thomas R. Ziegler, MD
14	William Saunders	Walter K. Schmidt, PhD
15	Jonathon Seawright	Jonathan Murrow, MD
16	J. William Thomas	Ricardo H. Alvarez, MD
17	Alexandra Vagasi, MS	Athos Patsalides, MD, MPH
18	C. Allen Witt	Jonathan Murrow, MD
19	Kathryne N. Wood	Brett Clementz, PhD

# NOTES:

## #17

### ROLE OF INTRAVASCULAR ULTRASOUND (IVUS) IN THE MANAGEMENT OF THE DURAL VENOUS SINUS (DVS) STENOSIS

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**Background:** The role of intravascular ultrasound (IVUS) in the evaluation of cerebral venous sinus diseases remains largely unexplored, with only five reported cases in the literature. The concerns regarding its feasibility, safety, correlation of IVUS measurements compared to the conventional imaging and implications on therapeutic decisions still need to be addressed in larger patient population.

**Materials and Methods:** Retrospective review of prospective database (RedCap) of all idiopathic intracranial hypertension (IIH) patients with IVUS evaluation and venous sinus stenting (VSS) over a 3-year period was performed. IVUS measurements compared against MR venography (MRV) and catheter venography (CV) measurements. Feasibility of IVUS and technical complications were noted.

**Results:** Twenty patients with VSS for distal transverse sinus constituted the study population. The mean maximum luminal diameter ( $D_{max}$ ) of stenosis on IVUS, MRV, awake CV and CV under general anesthesia (GA) in millimeters are:  $3.65 \pm 0.39$ ,  $3.11 \pm 0.79$ ,  $3.29 \pm 0.99$  and  $4.75 \pm 1.46$  respectively. Compared to IVUS, the  $D_{max}$  of stenosis was underestimated by MRV (0.545mm or 15%;  $p=0.013$ ) and awake CV (0.37mm or 10%;  $p=0.163$ ), but overestimated by the CV under GA (1.092mm or 30%;  $p<0.005$ ). CV under GA significantly overestimated the stenosis when compared to the awake CV (1.462mm or 31%;  $p<0.0001$ ).

**Conclusion:** We report the largest intracranial venous system IVUS experience in the literature. In our experience, IVUS is a feasible, safe and reliable diagnostic tool; provides valuable supplemental information in the diagnosis and treatment planning of cerebral dural venous sinus stenosis.

# #16

## CLINICAL ANALYSIS OF PATIENTS WITH FIBROBLAST GROWTH FACTOR RECEPTOR ABERRATIONS IN ADVANCED CANCER

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**Background:** Aberrations in the fibroblast growth factor receptor (FGFR) pathway are linked to tumor angiogenesis, motility, invasiveness, and drug resistance. FGFR aberrations have been a target of clinical trials, but it is unclear what other targetable genetic aberrations are commonly coexpressed with mutant FGFRs. The purpose of this study was to explore FGFR expression in a large group of patients (pts) with various tumor types and to identify common coexistent aberrant genes.

**Methods:** Tumor samples were collected from 2617 pts with advanced cancer from 12/24/2012 to 03/11/2015 at Cancer Treatment Centers of America (CTCA). Samples were sent to Foundation Medicine, Inc. for analysis of more than 330 cancer-related genes through the FoundationOne (FO) test. 172 pts (6.6%) with various tumor types had FGFR aberrations. Their charts and FO reports were reviewed for demographic data and coexistent alterations.

**Results:** 178 FGFR aberrations were found in 172 pts with advanced cancer. FGFR aberrations were found in 77 pts with breast tumors (median age (MA) 50, 98.7% female, 54.5% living), 21 with colorectal tumors (MA 53, 33.3% female, 33.3% living), 15 with lung tumors (MA 60, 33.3% female, 40% living), and 10 with ovarian tumors (MA 58, 100% female, 60% living). FGFR1 was most commonly altered FGFR subtype (65.7%), and amplifications were the most common alteration type (73.6%). TP53 was the most common coexistent mutation overall (64.5% pts) and in each tumor type except colorectal, in which APC was more frequently altered (APC 81%, TP53 76%).

**Discussion:** FGFR alterations were found in a variety of tumor types, with FGFR1 amplifications and TP53 aberrations being the most common coexistent pairing. This may be an opportunity for research into a combination therapy treatment in the future.

# #1

## HEALTH LITERACY AMONG DIABETIC PATIENTS AT MERCY HEALTH CENTER

Amarachi Anukam<sup>1,2</sup> and Laurel Murrow MD, MSc<sup>2,3,4</sup>

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**Background:** Low health literacy among diabetics may lead to increased complications. Addressing the health literacy of diabetic patients is a key initial step in improving their condition and decreasing the likelihood of adverse outcomes.

**Objective:** To characterize patient knowledge, attitudes, and beliefs about diabetes; identify patient barriers to diabetes management; assess the medical literacy level of diabetic patients at Mercy Health Center (Mercy); and evaluate the effectiveness of the diabetes education program at Mercy.

**Methods:** Seventeen diabetic patients were identified through query of electronic medical records or in real-time as they presented for appointments at Mercy. Face-to-face questionnaires and the Rapid Estimate of Adult Literacy in Medicine – Short Form (REALM-SF) were administered at the end of patient appointments.

**Results:** Although 82% of patients interviewed had attended at least one diabetes education course, 65% could not accurately define diabetes. When asked to describe a normal blood glucose range, the mean response was 92-126 mg/dL. The majority of patients identified “managing medication/treatment” (71%) and “diet” (65%) as parts of diabetes care that they struggled with. The average medical literacy grade level was 9<sup>th</sup>-12<sup>th</sup> grade, as defined by the REALM-SF.

**Conclusion:** The majority of patients interviewed were well-versed in the day-to-day management of their condition; however, there were notable gaps in basic knowledge of diabetes. The most popular suggestion to improve the diabetes education program was to make classes one-on-one and tailored to each patient. Due to the low response rate, further evaluation should be considered before making permanent changes at Mercy Health Center.

## #2

### DETERMINATION OF VASCULAR INJURY INCIDENCE IN COLLEGE ATHLETES

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Vascular injuries, while often associated with aging and disease, can also occur in athletes. These injuries have consequences ranging from loss of function to loss of life. Assumed rare, these types of injuries have not been well-studied in highly functioning athletes. The purpose of this study was to determine the incidence of vascular injuries in college athletes by surveying the athletic trainers that deal with such injuries. Data was collected from 126 respondents at 104 different colleges throughout the country. Each respondent noted if the injury in question had occurred. If it had, they stated how many instances there were and in what sports. The data was pooled and calculations were made to determine both general incidence and incidence of certain injuries. Given the numerous variables involved, it is difficult to calculate the likelihood of any one athlete sustaining a vascular injury. However, we can estimate that, on average, a trainer will see 1 vascular every 3.5 years (426 injuries in 1,485 years of training). Also of note, the most common injury was acute compartment syndrome (22.1%) and football players incurred the most injuries (27.4%). Vascular injuries are not something that will be encountered often, but they do occur and can have severe consequences if not identified and treated early. There is a need for research on how to most effectively prevent, screen for, and treat these injuries, especially those most prevalent in each respective sport.

## #15

### CARDIOMEM MONITORING OF CHRONIC HEART FAILURE IN CLINICAL PRACTICE

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**Background:** Standard of care for heart failure patients has evolved and improved throughout the years however, congestive heart failure holds the highest readmission rate (24.7%) amongst the most frequently treated conditions. Previous research has shown that increases in pulmonary artery and intracardiac pressure rose independently of weight changes, which suggests that monitoring of weight alone was inadequate to detect congestion in time to alter the symptoms associated with heart failure. We assessed the impact of pulmonary artery pressure (PAP) monitoring in the setting of a community practice.

**Methods:** We studied 6 U.S. patients implanted with a CardioMem device within the past year. Clinicians used daily measurements of pulmonary artery pressures in combination with standard of care treatment to treat the patients. We analyzed daily pressure readings collected from the CardioMemHF database to assess patient pulmonary artery systolic pressure, diastolic pressure, and heart rate. Pressures and heart rates were analyzed from baseline pressure readings and collected at 30 day, 60 day, and 90 day intervals.

**Results:** 6 patients were enrolled in the study consecutively who were implanted with the CardioMem device within the past year and receiving standard of care treatment for heart failure. All patients were diagnosed with NYHA III heart failure. Baseline hemodynamic information was taken at time of CardioMem implantation (n=6, mean systolic PA pressure-63mmHg ( $\pm 15$ ), mean diastolic PA pressure-32mmHg ( $\pm 7$ ), mean heart rate-74 bpm ( $\pm 9$ )). Analysis done at a 30 day interval yielded a significant decrease in the mean systolic pulmonary artery pressure as compared to the baseline readings (n=6, mean systolic PA pressure-59mmHg ( $\pm 15$ ), mean diastolic PA pressure-29mmHg ( $\pm 7$ ), mean heart rate-76 bpm ( $\pm 12$ )). In comparison to baseline readings the systolic PA pressure at a 30 day interval and 60 day interval yielded a significant difference in pressure readings (.0059 and .01; p value < .05). Diastolic PA pressure readings and heart rate readings showed no significant difference from baseline readings. No heart failure related hospitalizations were observed in patients enrolled in the study.

**Conclusion:** Our results are consistent with previous studies by showing conclusive evidence of significant decreases in pulmonary artery pressure thus significantly reducing hospitalizations in patients diagnosed with NYHA class III heart failure who were managed with an implantable hemodynamic CardioMem device. This information in regards to pulmonary artery pressure in the management of heart failure patients improves the standard of care and management of these individuals.

# #14

## EVIDENCE FOR A SHUNT PATHWAY IN THE PROCESSING OF CAA X PROTEINS

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Proteins with a CaaX motif are believed to enter a well-characterized processing pathway. CaaX box proteins are involved in many cell processes including the mis-folded protein response, nuclear membrane stability, and most notably cell signaling and cancer (Ras proteins). We propose that not all CaaX motifs are subjected to the same treatment as was previously thought. Further, we postulate that proper functioning and localization of certain proteins requires deviation from the canonical pathway onto a proposed “shunt pathway” avoiding proteolysis and carboxymethylation. This experiment investigates the activity and localization of the chaperone Ydj1p, normally a shunted CaaX protein, in the context of altered CaaX sequences that are cleaved and carboxylmethylated. **Results & Discussion:** Ydj1p is necessary for normal growth at elevated temperatures. If the CaaX box native to Ydj1p, CASQ, is changed to other CaaX boxes that can be cleaved and carboxylmethylated, some or all of the functionality of Ydj1p is lost. This hypothesis was investigated by monitoring the association of Ydj1p with membranes by differential fractionation of total lysates. **Conclusions:** Ydj1p and possibly other proteins are shunted out of the canonical processing pathway. The C-terminal CaaX box sequence influences Ydj1p function but does not appear to have a large effect on its localization based on differential centrifugation methods. The underlying reason for the functional differences observed for Ydj1p in the context of uncleaved (i.e. shunt pathway; natural) and cleaved CaaX motifs remains under determined. Nevertheless, the results from this study should force reevaluation of drug design and targeted to inhibit the pathway.

# #3

## HALTING THE BOOMERANG: HOSPITALIZATIONS, THIRTY-DAY READMISSIONS, AND EMERGENCY DEPARTMENT USE OF PATIENTS IN A TRANSITIONAL CARE CLINIC

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**Background:** Thirty-day readmissions (30dRs) cost over \$17 billion annually. The Affordable Care Act calls for penalization of hospitals with high 30dR rates, spurring interventions to address this issue. One such intervention is the transitional care clinic (TCC), which bridges medical coverage between the hospital and primary care.

**Objectives:** Reduce hospitalizations, 30dRs, and ED visits for discharged patients through intervention of establishing care at a TCC.

**Methods:** Retrospective chart review was done for 41 Athens Regional Medical Center TCC patients (65.9% male, 48.80±12.95 years old). Mean numbers of hospitalizations, 30dRs, and ED visits were calculated for equal time periods before and after the first TCC visit, based on how long the subject had been a patient at the TCC. Data were analyzed using a t-test.

**Results:** Mean number of pre-intervention hospitalizations per patient was 0.878±0.249, decreasing to 0.439±0.336 post-intervention (p=0.0024). Mean number of pre-intervention 30dRs per patient was 0.122±0.156, increasing to 0.171±0.204 post-intervention (p=0.421). Mean number ED visits per patient fell from 1.829±0.479 pre-intervention to 1.390±1.145 post-intervention (p=0.314).

**Conclusion:** TCC attendance had mixed effects on healthcare use, significantly reducing hospitalizations, non-significantly increasing 30dRs, and non-significantly reducing ED visits. These results are clinically relevant because patients established care that allowed for detection and management of disease.

## #4

### ONODERA'S PROGNOSTIC NUTRITIONAL INDEX AS AN INDEPENDENT PROGNOSTIC FACTOR IN CLEAR CELL RENAL CELL CARCINOMA

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**Background:** Kidney cancer is the 12<sup>th</sup> most common malignant cancer worldwide, with approximately 338,000 new cases each year and increasing global incidence rate.

**Objectives:** To evaluate the relationship between the Onodera Prognostic Nutritional Index (OPNI) and survival outcomes in clear cell renal cell carcinoma (ccRCC) patients following nephrectomy.

**Materials and Methods:** 341 patients who underwent nephrectomy for ccRCC were analyzed. The optimum OPNI cut off score of 44.7 was determined by ROC analysis and patients were placed in either the low or high OPNI group, with OPNI values of  $\leq 44.7$  and  $\geq 44.8$ , respectively. Kaplan-Meier analysis was performed to evaluate the univariate impact of the OPNI groups on survival. OPNI's association with survival, with adjustments for other patient and tumor qualities, were assessed with univariate and multivariate analysis.

**Results:** Median survival for the low and high OPNI groups were 21.1 months and 37.9 months, respectively. OPNI was determined to be an independent prognostic factor in multivariate analysis and after controlling for patient and tumor characteristics, the low OPNI group experienced a 1.67 fold increased risk of mortality.

**Conclusion:** Preoperative OPNI is a valuable independent prognostic factor of survival in patients with ccRCC following nephrectomy. This simple, inexpensive and readily available index can assist physicians in identifying patients in need of more intensive testing and/or adjuvant therapy trials.

## #13

### IMPACT OF SUPPLEMENTATION OF HIGH-DOSE VITAMIN D<sub>3</sub> ON THE PLASMA METABOLOME OF CRITICALLY ILL ADULTS: A PILOT STUDY

Kayla Perry-Walker<sup>1,2</sup>, Douglas I. Walker<sup>3</sup>, Jessica A. Alvarez<sup>4</sup>, Jenny E. Han<sup>3</sup>, Jenni L. Jones<sup>4</sup>, LouAnn Brown<sup>5</sup>, Vin Tangpricha<sup>4</sup>, Gregory M. Martin<sup>5,6</sup>, Dean P. Jones<sup>3</sup>, and Thomas R. Ziegler<sup>4</sup>

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Vitamin D deficiency is common in critical illness but the metabolic impact of vitamin D status is unknown. We performed high-resolution plasma metabolomics using liquid chromatography mass spectroscopy in ventilator-dependent adults admitted to intensive care units (ICU) and given either placebo (n=10) or high-dose vitamin D<sub>3</sub> [250,000 IU (n=9) or 500,000 (n=11)]. Non-targeted metabolite profiling of plasma obtained at baseline and weekly for up to 28 days was performed. Time series metabolome-wide association studies (MWAS) were conducted using total and bioavailable 25-hydroxyvitamin D (25(OH)D) concentrations and concomitant metabolomic profiling determined serially after initiation of high-dose vitamin D<sub>3</sub> or placebo. The impact of baseline vitamin D status on the metabolome was determined using plasma 25(OH)D concentrations, and as a function of vitamin D deficiency [ $< 20$  versus  $\geq 20$  ng/mL total (25(OH)D)]. The time-series study identified 336 metabolites significant at  $P < 0.05$  (false discovery threshold of 0.2), suggesting a dose-dependent effect on the metabolome. Identification of altered metabolic pathways using Mummichog pathway enrichment and the KEGG metabolic modeling programs indicated a significant impact of 25(OH)D status on metabolic pathways involving energy metabolism, including altered concentrations of constituents of the TCA cycle, biosynthesis and/or degradation of conditionally essential amino acids (arginine, glutamine, and tyrosine) and pathways associated with inflammation, including leukotriene and vitamin B6 metabolism. These pilot results suggest that vitamin D status is associated with alterations in nutrient and energy-related metabolic processes linked to ICU outcomes.



## #12

### POTENTIAL ROLE OF NOTCH IN THYMUS EPITHELIAL DEVELOPMENT: PRESENCE OF EPITHELIAL FREE ZONES IN NOTCH1 KNOCKOUTS

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Proper development of thymus epithelial cells (TECs) is essential for thymus immune functionality. In early experiments, Notch receptor knockout coincided with loss of early fetal TEC progenitor markers and epithelial free zones (EFZs) in the postnatal thymus. Because of the defined role of Notch signaling in the differentiation of other tissues and the presence of similar thymus EFZs in Wnt inhibitor (Kremen1) knockouts, Notch signaling could play a critical role in initiating TEC differentiation and regulating Wnt-mediated proliferation. To further define the EFZ phenotype, EFZs within the right thymus lobes from 4 week old mice were measured. Lobes from homozygous Notch1 receptor knockout (Cre+ fx/fx), heterozygous knockout (Cre+ fx/+), homozygous Notch1 expression (Cre+ +/+), and wild type mice were paraffin sectioned, stained with nuclear (DAPI) and epithelial (K8 and PanK antibodies) markers, and imaged. The tiled images were analyzed to estimate the total percentage of EFZs in each lobe. The average percentages of EFZs are: 3.954% Cre+ fx/fx (n=3); 1.938% Cre+ fx/+ (n=3); 0.899% Cre+ +/+ (n=3); 0.676% WT (n=1). T-test analysis supports a dose-dependent EFZ phenotype from Notch1 knockout ( $\alpha=0.1$ ). The similarity in EFZ phenotype between Notch1 deletion and Kremen1 deletion provides initial support for the proposed Notch receptor inhibition of the Wnt pathway during thymus development, acting to balance progenitor self-renewal and TEC differentiation.

## #5

### EVALUATION OF 3D-SEISMOCARDIOGRAPHY IN DETECTING CARDIAC WALL MOTION ABNORMALITIES

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Three-dimensional seismocardiography (3D-SCG), a technique that measures chest wall acceleration due to cardiac motion, has been shown to be more sensitive for detecting myocardial ischemia (MI) than ECG. However, SCG data has not been calibrated, and there is not enough data from patients with post-MI and heart failure to support SCG as a legitimate cardiac assessment tool. The purpose of this pilot study was to correlate SCG waveform changes in volunteers with known cardiac abnormalities at rest and after exercise with normal SCG. 3D-SCG, single lead ECG, and sphygmomanometry data were collected from one volunteer with no known cardiac abnormalities (control) and three volunteers with cardiac abnormalities (cardiac). Data were analyzed to determine the cardiac function indexes, myocardial performance index (MPI < 0.390.05) and aortic opening amplitude change following exercise (AO decrease < 50%). In the control, the AO amplitude change and pre-exercise MPI were normal. Post-exercise MPI was elevated at 0.538. In the cardiac group, MPI was elevated pre-exercise (0.863 and 0.727) in 2 volunteers and elevated post-exercise (1.101, 0.489, and .587) in all 3. AO amplitude changes were normal. The study found that 3D-SCG could be used to detect cardiac abnormalities using analysis of MPI. Further research is needed to examine significance of AO amplitude change and other features in SCG that could be used for cardiac function assessments.

# #6

## REDUCING UNNECESSARY IMAGING FOR LOW BACK PAIN IN A PRIMARY CARE SETTING

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**Background:** Most cases of low back pain (LBP) are benign conditions that do not warrant diagnostic imaging unless red flag features are present. Nevertheless, many patients routinely undergo unnecessary imaging studies, contributing to the growing costs associated with LBP. The aim of this project was to assess the appropriateness of imaging studies ordered at a free clinic based on American College of Radiology (ACR) Appropriateness Criteria® for LBP.

**Methods:** A standardized chart abstraction form was used to review 110 charts for red flag clinical indicators for diagnostic imaging. The study was limited to non-pregnant adults who underwent diagnostic imaging related to LBP from January 1, 2013 to June 1, 2015. Studies associated with red flag features were deemed “appropriate”, while studies without red flags were deemed “not clearly indicated.”

**Results:** Out of 110 imaging studies, 48 (44%) were appropriate and 62 (56%) were not clearly indicated; 23 (37%) of studies deemed not clearly indicated were associated with prior imaging studies of the lumbar spine.

**Conclusion:** The study was limited to information clearly documented in the medical record; undocumented physical exam findings may have led to misclassification of an imaging study. Imaging for LBP is frequently ordered in this free clinic setting, suggesting that improving provider adherence to recommended guidelines could help to reduce health care costs, prevent unnecessary harms, and improve patient outcomes.

# #11

## ASSESSING DERMATOLOGICAL CARE IN A LOW INCOME, UNINSURED PATIENT POPULATION

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**Background:** Mercy Health Center is a free clinic serving low income, uninsured patients almost exclusively through volunteer providers. Given a long wait list for its dermatology clinic, Mercy sought to quantify and categorize the most common dermatological conditions of its patients, to understand patient concerns and questions regarding these, and to identify ways to improve the treatment of skin conditions in the primary care clinic.

**Methods:** Patients seen in Mercy’s dermatology clinic between January 2013-July 2015 or on the current dermatology wait list were selected for a retrospective and prospective chart review and also invited to participate in a telephone questionnaire. A chart abstraction form collected data on the most common dermatological conditions as well as the time from referral to first dermatology visit. The telephone questionnaire gathered information on patient knowledge, questions, and concerns. A volunteer dermatologist was interviewed to solicit ideas for improvement.

**Results:** 117 charts were reviewed, and 49 patients agreed to participate in the telephone questionnaire. The most common dermatologic conditions were benign dermal and subcutaneous neoplasms (15%), actinic keratosis (13%), basal cell carcinoma (4%), benign nevi (4%), atopic dermatitis/eczema (4%), benign cyst (4%), rosacea (3%), intertrigo (3%), psoriasis (3%), and tinea infection (3%). The mean wait time for a dermatology appointment was 206 days. 33% of patients interviewed did not know the medical term for their condition. Patients are most interested in learning more about “how to prevent skin cancer” (32%). Preferred learning methods were handouts (33%) or speaking directly with a doctor or nurse (26%).

**Conclusions:** The wait time for a dermatology visit is significant. Mercy could reduce this time by encouraging volunteer providers to treat more skin conditions in primary care clinic and by reducing referrals for benign or cosmetic conditions. As such, current treatment guidelines and patient handouts were compiled for the top 10 most common dermatological conditions seen at Mercy. A lesion reference chart was also developed as a visual tool to aid in diagnosis.

# #10

## ENDURANCE INDEX AS NON-INVASIVE CLINICAL MUSCLE FATIGUE TEST

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**Background:** The purpose of this study was to test the reproducibility and validity of the Endurance Index (EI) Test using an accelerometer. The accelerometer based EI is potentially linked to physiological mechanisms and can be used practically in clinical settings.

**Methods:** The EI test was performed on young adults (n=13) using electrical stimulation to induce muscle contractions in the forearm and the trapezius muscles at different frequencies (2Hz, 4Hz and 6Hz) for five minutes. An accelerometer placed between the two electrodes measured the movements of the contractions. The EI was defined as the percentage of acceleration at five minutes compared to peak muscle contractions within the first 60 seconds.

**Results:** EI decreased with increased frequency (100+15%, 91+9.8%, 68+22%, for 2,4,6 Hz respectively). The coefficients of variation for repeated tests were 7.5%, 14.5%, and 14.0% for 2,4,6 Hz respectively. EI was not different when two stimulation current levels were used (6 Hz: 31mA and 38 mA, EI of 51% and 52% respectively). The EI of the trapezius muscle was lower than the forearm muscles (34+7% and 83+16%, respectively). The correlation between repeated tests of the trapezius was  $R^2=0.90$ .

**Conclusions:** The Endurance Index (EI) test is a practical, simple, reliable, test to measure the fatigability of almost any muscle in the body. We envision the test as being useful clinically for testing the fatigability of patients with spinal cord injuries mitochondrial injuries, or other condition affecting muscle endurance to quantify the severity of their disease and compare them to the unaffected population.

# #7

## VITAMIN B12 STATUS DURING PREGNANCY AND INFANT BIRTH OUTCOMES

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Adequate vitamin B12 intake and stores during pregnancy are necessary to provide the developing fetus enough of the vitamin to establish hepatic stores. Infants with low B12 status (<148pmol/L) can suffer permanent neurological symptoms due to delayed myelination of nerves. Additionally, since the B12 and folate metabolic pathways are closely related, a B12 deficiency can cause a functional folate deficiency, which is known to cause neural tube defects during development. This is a secondary analysis from samples collected as part of a double blind randomized-controlled study performed in collaboration with the Athens Regional Nurse-Midwifery Practice (ARMC) in which participants were randomly assigned to take daily prenatal supplements containing 400 µg or 800 µg folic acid beginning at the first prenatal visit (~6-12 week gestation). Maternal blood was taken for measurement of folate, vitamin B12 and their related biomarkers during the initial, 28 wk prenatal clinic visits and at delivery; cord blood samples were also taken. Infant outcome and growth parameters were based on standard measurements taken at birth (eg weight, APGAR score). There were no significant differences in patient characteristics such as age, race, insurance, marital status, pre-study vitamin usage, parity, dietary intake or serum folate within tertiles based on B12 status and no significant differences for birth outcomes such as weight, head circumference or APGAR Scores. There was a correlation between maternal B12 status and infant length among all the participants and a strong correlation between baseline B12 status and B12 status throughout the pregnancy suggesting that pre-conception B12 status is critical to maintain B12 status throughout pregnancy.

## #8

### ASSESSING PREDICTORS OF CLINICAL TRIAL ENROLLMENT IN CARDIOVASCULAR CLINICAL TRIALS 2001-2012

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**Background:** Cardiovascular clinical trials depend on patient enrollment and retention rates, which are often inadequate. Little is known about rates of refusal across trial types.

**Methods:** We systematically assessed predictors of patient enrollment and refusals. Specifically, we assessed the impact of acuity, trial design, settings, intervention type and patient demographics in a previously established database containing all randomized controlled trials in cardiovascular disease published between 2001 and 2012 in eight high impact journals in general medicine and cardiology.

**Results:** Our analysis is currently in progress. We hypothesize that patient refusal rates are lower for trials involving acute conditions such as acute coronary syndrome when compared to studies of chronic conditions such as heart failure. Based upon our analysis so far, 21.7% of the studies in our sample provided information sufficient to assess patient enrollment and refusals.

**Conclusion:** This analysis will improve understanding of enrollment patterns in cardiovascular trials and may help to identify solutions that will improve trial efficacy. Based upon preliminary results alone, it is clear that enrollment rates are suboptimally reported. This limits insights into the generalizability of a study and should be addressed.

## #9

### ZYGOSITY CLASSIFICATION OF CHROMOSOMAL REGIONS USING EPIGENETIC SIGNATURES IN F2 CROSSES FROM ISOGENIC LINES OF *ARABIDOPSIS THALIANA*

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**Background:** The use of recombinant inbred lines (RILs) of isogenic organisms that differ in their epigenetic character (epiRILs) makes it possible to identify the impact of altered DNA methylation on an organism's phenotype independent of their genotype. The aim of this project was to develop a computational method that uses the epigenetic signatures (in this case, DNA methylation) of isogenic lines of plants to determine the parent-of-origin across the genome of F2 crosses and recombinant inbred lines.

**Methods:** Using DNA methylation data obtained from MethylC-seq experiments, the methylation level is determined at each CpG dinucleotide across the genome for each line: the parents, the F1, and the F2 lines. The epigenome is divided into multiple windows of proximal CpG sites. Each window is then analyzed using principal component analysis followed by classification of the zygosity of each line genome-wide using k-means clustering approach followed by Bayesian classification.

**Results:** In order to test the accuracy of this method (called Classifier of Zygosity for epiRILs, "ClazEr") simulated F2 progeny with known crossing over locations were produced in silico. The classification method correctly classified the zygosity of each bin >98% of the time.

**Conclusion:** This method makes great improvements over previously reported methods. While this initial study was performed in *A. thaliana*, it is applicable to other model organisms like mice. ClazEr can be used for the epigenotyping in (epi)genome-wide association studies (eGWAS) for the mapping of medically important traits, like disease susceptibility and prognostically important epigenetic signatures.