71st Annual
Senior Scientific Session
Wednesday, May 17, 2017

Oral Presentations
1:00 PM – 4:00 PM | Biological Sciences Learning Center - Room 115

Poster Presentations
4:15 PM - 6:30 PM | Gordon Center for Integrative Science – 3rd Floor Atrium

2017 Session Chair
John C. Alverdy, MD
Sara and Harold Lincoln Thompson Professor of Surgery
Executive Vice-Chair of Academic Affairs, Department of Surgery

2017 Presentation Judges
In Alphabetical order

Francis Alenghat, MD, PhD
Department of Medicine

Sola Olopade, MD, MPH
Department of Family Medicine

Matthew Brady, PhD
Department of Medicine

Tipu Puri, MD, PhD
Department of Medicine

Marshal Chin, MD, MPH
Department of Medicine

Selwyn Rogers, MD, MPH
Department of Surgery

David Dickerson, MD
Department of Anesthesia & Critical Care

JC Rojas, MD
Department of Medicine

R. Stephanie Huang, PhD, MA
Department of Medicine

Stephen Small, MD
Department of Anesthesia & Critical Care

Scott Hunter, PhD
Department of Psychiatry and Behavioral Neuroscience

Stacie Levine, MD
Department of Medicine

Andrea Lo, MD
Department of Surgery

Audrey Tanksley, MD
Department of Medicine

Shannon Martin, MD, MS
Department of Medicine

Larry Thaete, PhD
Department of Obstetrics and Gynecology
NorthShore University HealthSystem

Micah Prochaska, MD
Department of Medicine

Anna Beaser Volerman, MD
Department of Medicine

Cathryn Nagler, PhD
Department of Pathology

Olga Zaborina, PhD
Department of Surgery
Welcome & Opening Remarks

Biological Sciences Learning Center - Room 115

1:00 PM  Holly J. Humphrey, MD’83
Ralph W. Gerard Professor in Medicine
Dean for Medical Education

John C. Alverdy, MD
Sara and Harold Lincoln Thompson Professor of Surgery
Executive Vice-Chair of Academic Affairs, Department of Surgery

Oral Presentations

Abstracts on Pages 14 - 23

1:15 PM  Dara Adams; Mentor: Jayant Pinto, MD
Nitrogen Dioxide Pollution Exposure is Associated with Olfactory Dysfunction in Older US Adults

1:30 PM  Shakeela Faulkner; Mentor: Bree Andrews, MD, MPH & Michael Msall, MD
Impact of Neonatal Morbidities on 2 Year Neurodevelopmental Outcomes of Preterm Infants

1:45 PM  Joseph Lykins; Mentor: Rima McLeod, MD
Point-of-Care (POC) Testing for Toxoplasmosis: A Paradigm Shift in Clinical Management with Global Implications

2:00 PM  Christopher Mariani, PhD; Mentor: Lucy Godley, MD, PhD
TET1 is a Novel HIF-1 Target Whose Expression is Necessary for the Transcriptional Response to Hypoxia in Neuroblastoma

2:15 PM  Shane Regnier, PhD; Mentor: Robert Sargis, MD, PhD
Effects of the Endocrine Disruptor Tolylfluanid on Global Energy Metabolism

2:30 PM  BREAK

2:45 PM  Zachary Collier; Mentor: Russel Reid, MD, PhD
A Novel Variable-Frequency Pulsed Electromagnetic Field Generator (VFPG) for Mesenchymal Stem Cell Tissue Engineering Strategies

3:00 PM  Pamela Peters; Mentor: Ernst Lengyel, MD, PhD
A Novel Germline Mutation Preventing Degradation of Lysophosphatidic Acid (LPA) Causing Familial Breast and Ovarian Cancer

3:15 PM  Sean Gaffney, M.Ed; Mentor: Vineet Arora, MD, MAPP & Jeanne Farnan, MD, MHPE
Let’s UNITE! Unit-Based Nursing Interprofessional Team Experience

3:30 PM  Megan Gunaulus; Mentor: Sola Olopade, MD
The Effects of Short Post-Delivery Stay on Infant Health Outcomes at an Urban Hospital in Ghana

3:45 PM  Jane Rivas; Mentor: Valerie Press, MD, MPH
Evaluating the Model for a Medical Student Sustained Reach Out and Read (ROR) Program
Poster Presentations

4:15 PM - 6:30 PM | Gordon Center for Integrative Science - 3rd Floor Atrium

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Presentation Judging for the Following Awards

5:45 PM

**ORAL PRESENTATIONS**

*Catherine Dobson Prize*
For the best oral presentation given by a student in the area of Scientific Investigation in Clinical Research or Social Sciences

**Leon O. Jacobson Basic Science Prize (MD/PhD students)**
Granted to the MD/PhD student whose Basic Science Research is judged to be the most meritorious from among session participants

**Leon O. Jacobson Prize (non-PhD students)**
For the best oral presentation given by a non-PhD student in the area of the Basic Biological Sciences

**Medical and Biological Sciences Alumni Association Prize**
For the best presentation made by a student in the area of Applied Scholarship (Global Health, Community Health, Medical Education, or Quality & Safety)

**POSTER PRESENTATIONS**
Award for Best Poster Describing Applied Scholarship
Award for Best Poster Describing Scientific Investigation in Basic Sciences
Award for Best Poster Describing Scientific Investigation in Clinical Research or Social Sciences

**ORAL OR POSTER PRESENTATIONS**

**Franklin McLean Medical Student Research Award**
Granted to the non-PhD student who has performed the most meritorious research in the medical field

Closing Remarks & Awards Presentation

6:15 PM  John C. Alverdy, MD
Oral Presentations

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Presentation Notes
LEON ORRIS JACOBSON  
December 16, 1911 – September 20, 1992

The annual Senior Scientific Session was founded by Dr. Leon Jacobson in 1946 to highlight the caliber of Pritzker student scholarship and the quality of their medical education. Dr. Jacobson, a native of Sims, North Dakota, received a Bachelor of Science degree from North Dakota State University in 1935 and his Medical Doctorate from the University of Chicago in 1939. His professional career—invested entirely at the University of Chicago—included serving as Director of the Argonne Cancer Research Hospital, as well as Dean of the Division of Biological Sciences.

In 1942, during his residency at the University of Chicago Hospital, Dr. Jacobson was recognized for his scholarly promise. He was tasked with the responsibility of protecting the health of the staff of the Manhattan Project. Dr. Jacobson was chosen for this important position because of his research on the biological effects of radiation, as well as his reputation as one of the first doctors to treat blood disorders with radioactive phosphorus. By the conclusion of the Manhattan Project in 1945, Dr. Jacobson and his staff had pioneered several medical advances, including testing the first forms of chemotherapy used to fight cancer. He was later credited with creating the foundation for bone marrow transplantation and initiating the search for the erythropoietin, a hormone that regulates red blood cell production. Erythropoietin is now the basis for a drug that treats chemotherapy-induced anemia in many cancer patients, a revolutionary treatment in the field of oncology.

The Senior Scientific Session is upheld as an annual tradition. By providing graduating Pritzker students with the opportunity to disseminate their research and scholarship through oral and poster presentations, the legacy of Dr. Jacobson’s commitment to innovation through research continues.
2016-2017 Calvin Fentress Fellowship Recipients

Hasenin Al-khersan
Mentor: Seenu Hariprasad, MD

Crystal Azu, MPH
Mentor: Funmi Olopade, MD

Zachary Collier
Mentor: Russell Reid, MD, PhD

Sean Gaffney, M.Ed
Mentor: Vineet Arora, MD, MAPP
Jeanne Farnan, MD, MHPE

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James Luo
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Janaki Patel
Mentor: Valerie Press, MD, MPH

César Soria Jimenez
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Shilpa Vasishta
Mentor: Anna Volerman Beaser, MD

2016-2017 John D. Arnold, MD
Scientific Research Prize Recipients

Dara Adams
Mentor: Jay Pinto, MD

Brian Schlick
Mentor: Marc Bissonnette, MD

Jackie Wang
Mentor: Lainie Ross, MD, PhD
2016-2017 JOHN D. ARNOLD, MD
MENTOR AWARD RECIPIENTS

In 2012, a grateful alumnus, Dr. Charles Pak, established the John D. Arnold, MD, Scientific Research Prize. This prize was established in recognition of the impact that his mentor had on his education and future career in research. The Arnold Scientific Research Prize recognizes students whose research accomplishments as medical students are based on ongoing, sustained work with a single faculty mentor. The goal of the Arnold Scientific Research Prize is to provide support for the continuation of the mentoring relationship and collaborative research experience during the student’s fourth year of medical school. As part of the application, students are asked to comment on the contributions that their mentors have made towards their professional growth and development. Mentors of the selected students are honored with the 2016-2017 John D. Arnold, MD, Mentor Award for sustained excellence in mentoring medical students.

This year’s John D. Arnold, MD, Mentor Awards are bestowed upon:

**Jayant M. Pinto, MD**

Dr. Jayant Pinto is a specialist in sinus and nasal diseases, including chronic sinusitis, allergic rhinitis and olfactory dysfunction. He is also an expert in minimally invasive sinus surgery and endoscopic treatments of related eye diseases as well as tumors of the nose and anterior skull base.

Dr. Pinto’s research focuses on microbial, environmental, genetic and demographic factors that underlie susceptibility to nasal diseases. He directs innovative clinical trials for chronic sinusitis, allergies, olfactory disorders, and aging of the ear, nose and throat. His research represents a first step toward designing new diagnostic tests and improved treatments for these difficult conditions.

Dr. Pinto received the John D. Arnold, MD Mentor Award for his work with fourth year student Dara Adams. Dr. Pinto and Dara investigated mechanisms connecting nitrogen dioxide pollution exposure and olfactory dysfunction in older US adults. Commenting on Dr. Pinto’s outstanding style of mentorship, Dara commented:

*Dr. Pinto has been a truly incredible research mentor during my Pritzker Fellowship year. He found the perfect balance between being ever-present and available for advice while also giving me room to ‘flap my wings’. I learned a tremendous amount about epidemiology research, biostatistics, and olfaction under his mentorship. He also gave me the opportunity to make substantial contributions to multiple grant applications, a vital experience as I prepare for a future career in academic medicine. Dr. Pinto welcomed me to the Olfactory Research Group, a collaborative group of otolaryngologists, geriatricians, social scientists, and biostatisticians. This group is incredibly productive—we are currently working on ~15 publications. I have been fortunate to work with this group and they have made a tremendous impact on my work and are, I believe, a key reason why my work has been so well received by journals. I feel very fortunate to work with Dr. Pinto, and I hope to continue to be involved in research with him for many years.*
Marc Bissonnette, MD

The research efforts of Dr. Marc Bissonnette are focused on mechanisms driving colonic tumorigenesis and discovery of chemopreventive agents. His lab employs models of colonic tumorigenesis induced by chemical carcinogens or genetically engineered mouse models of spontaneous colon cancer to dissect pathways of cancer and identify targets for chemoprevention. Current efforts include studies into CXCL12-CXCR4 signals as activators of EGFR and screening natural product libraries for inhibitors of ADAM17, an up-stream regulator of EGFR signaling.

Dr. Bissonnette received the John D. Arnold, MD Mentor Award for his work with fourth year student Brian Schlick. Dr. Bissonnette and Brian analyzed the effects of fish oil derived docosahexaenoic acid, a tumor inhibiting fatty acid, on ADAM17 localization and activity. Commenting on Dr. Bissonnette’s mentorship, Brian stated:

After meeting with Dr. Bissonnette and talking to students who previously worked with him, it was apparent he truly cared about involving all members of his lab in the research, and always had his door open to bounce ideas off of him or ask questions if we are stuck. Dr. Bissonnette has exceeded the expectations I’ve had for him and his research, and thereby aided in my professional growth. Dr. Bissonnette balances his time with his patients and in the lab without sacrificing quality in either domain. Dr. Bissonnette shaped how I approached research questions and constantly challenged my assumptions, and forced me to look at nuanced aspects of the research. This has permitted me to better formulate topics for research, and develop a clearer plan on how to solve problems. During my time shadowing him, he always took time to address the concern of the lab members, even if he has a big grant due.

Lainie Ross, MD, PhD

Dr. Lainie Ross is a general pediatrician and a medical ethicist in the MacLean Center for Clinical Medical Ethics at the University of Chicago. She currently serves on the NIH recombinant DNA advisory committee (The “RAC”), a director of the American Society of Bioethics and Humanities, and as a member of the NIH Study section for Social, ethical issues in research. Her research interests are transplant ethics, research ethics, genetics and ethics, and pediatric ethics. She combines her philosophical and clinical skills in all of her research, and will often integrate theory with empirical data. Her theoretical work often focuses on policy issues and she is adept at developing real-world solutions. Dr. Ross has written more than 100 research articles on ethical and policy issues and published two books on transplantation ethics with Dr. Robert Veatch and two single authored books on pediatric ethics.

Dr. Ross received the John D. Arnold, MD Mentor Award for her work with fourth year student Jackie Wang. Dr. Ross and Jackie work is entitled, “Are Living Donors Our Patients?”. Under Dr. Ross’ mentorship, Jackie stated:

During my first year, I was hesitant about participating in SRP, and decided that I would do so only if I found a mentor, with whom I’d be truly excited to work. Dr. Ross was that person, and our mentoring relationship has been everything I’ve hoped for and more. She provides a balance of both hands-on guidance and space for me to work through things on my own. Her high standards for the quality of her own work inspire me to make my work better. She’s deeply devoted to her students and to helping them achieve their goals. My work with Dr. Ross has helped me to gain skills in study design, qualitative data analysis, and manuscript writing. We’ve published two papers together and a proposal on ethical and policy issues in living kidney donor transplantation has been accepted for a panel presentation at the American Society of Bioethics and Humanities. All of these experiences have prepared me for a career in academic medicine. They have broadened my research experience, helping me to decide what type of research I would like to pursue in the future. More personally, Dr. Ross has been an example of a strong, successful, and fiercely independent female physician who is always living and working in alignment with her core values. She embodies in so many ways the type of doctor that I hope to become.
Oral Presentations
Nitrogen Dioxide Pollution Exposure is Associated with Olfactory Dysfunction in Older US Adults

Dara Adams

**Mentor:** Jayant Pinto, MD; Department of Surgery, Section of Otolaryngology-Head & Neck Surgery

**Co-author(s):** Gaurav Ajmani, MHS; Vivian Pun, PhD, MPH; Kristen Wroblewski, MS; David Kern, PhD; L. Philip Schumm, MA; Martha McClintock, PhD; Helen Suh, ScD; and Jayant Pinto, MD

**Background:** Olfactory dysfunction has profound effects on quality of life, physical and social function, and mortality itself. Nitrogen dioxide (NO2) is a pervasive air pollutant that is associated with respiratory diseases. Given the olfactory nerve’s anatomic exposure to airborne pollutants, we investigated the relationship between NO2 exposure and olfactory dysfunction.

**Methods:** The ability to identify odors was evaluated using a validated test in respondents from the National Social Life, Health, and Aging Project (NSHAP), a representative probability sample of home-dwelling, older US adults ages 57-85. Exposure to NO2 pollution was assessed using measurements obtained from the US EPA AIRS ambient monitoring site closest to each respondent’s home. We tested the association between NO2 exposure and olfactory dysfunction using multivariate logistic regression.

**Results:** Among older adults in the US, 22.6% had impaired olfactory function, defined as ≤ 3 correct (out of 5) on the odor identification test. Median NO2 exposure during the 365 days prior to the interview date was 14.7 ppb (interquartile range [IQR] 10.8-19.7 ppb). An IQR increase in NO2 exposure was associated with increased odds of olfactory dysfunction (OR 1.35, 95% CI: 1.07-1.72), adjusting for age, gender, race/ethnicity, education, cognition, comorbidity, smoking, and season of the home interview (n=1,823).

**Conclusion:** We show for the first time that NO2 exposure is associated with olfactory dysfunction in older US adults. These results suggest an important role for NO2 exposure on olfactory dysfunction, and, potentially, nasal disease more broadly.

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Impact of Neonatal Morbidities on 2 Year Neurodevelopmental Outcomes of Preterm Infants

Shakeela Faulkner

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Background: Many preterm infants experience developmental, physical, and social disabilities which can create significant obstacles in their lives. Understanding how neonatal morbidities impact early childhood neurodevelopmental outcomes is critical for prioritizing post-discharge resources and community supports. The objective of this project was to determine how neonatal morbidities experienced during the initial hospital stay impact neurodevelopment at 2 years of age and identify if there is an association between the number of morbidities and the infant’s neurodevelopment.

Methods: A retrospective chart review of 179 neonates admitted to the University of Chicago neonatal intensive care nursery was completed. Maternal and infant biological and social risk factors were abstracted. Neurodevelopmental function was defined by performance on the Bayley III Scales and divided into 3 groups: average-AVG (≥85), mild delay-MD (71-84), and neurodevelopmental impairment-NDI (≤70). We analyzed the impact of multiple morbidities by classifying morbidities as 'severe' or 'not severe' for the following variables: bronchopulmonary dysplasia(BPD), sepsis, intraventricular hemorrhage(IVH/PVL), seizures, retinopathy of prematurity(ROP), and necrotizing enterocolitis(NEC). Statistical analysis was performed using STATA.

Results: Infants born <= 28wks were at increased risk for developmental delays (42% AVG, 21% MD, and 37% NDI) compared to those born after 28wks (68% AVG, 21% MD, and 11% NDI). This trend is also seen when considering birth weight as infants weighing <500g, 500-750g, 750-1000g, and >1000g had 78%, 51%, 16%, and 12% of infants with NDI respectively. Next, we considered the effects of neonatal morbidities. The risk of having NDI increased in a stepwise fashion from those without sepsis (21%), to suspected sepsis (35%) to culture-proven sepsis (48%) (p<0.05). Infants with BPD had more mild delay compared to those without BPD (26% vs 11%, p<0.05). An increased severity of cranial sonographic abnormality was associated with an increased risk of NDI (no IVH: 20%; Grade I-II IVH: 46%; Grade III-IV/PVL: 67% p<0.001) Finally, we considered the effects of having multiple morbidities. There was a statistically significant association between the number of neonatal morbidities and the risk of neurodevelopmental impairment, with the largest difference occurring between those with < 3 morbidities vs those who had ≥ 3 or more morbidities. (0: 24%; 1-2: 25%; 3-4: 53%; 5-6: 67%; p<0.05 ).

Conclusion: Neonatal morbidities experienced during the first few months of life are associated with increased risk for developmental delays at 2 years of age. This effect also appears to be cumulative as an increased risk of developmental impairment is associated with an increase in the number of morbidities. This information can help better identify infant needs for therapy and resources.

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Point-of-Care (POC) Testing for Toxoplasmosis: A Paradigm Shift in Clinical Management with Global Implications

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Background: Toxoplasmosis, the disease caused by the Apicomplexan parasite Toxoplasma gondii, causes significant morbidity in the United States and globally. Disease manifestations are variable, including ocular and CNS disease, especially in immunocompromised patients. Acute infection of a pregnant woman can lead to vertical transmission, potentially resulting in devastating congenital infection. Congenital toxoplasmosis is serious, but it is also preventable and treatable. Gestational screening, as occurs in several nations, including France and Austria, facilitates early detection and treatment of primary acquisition. This has been demonstrated to reduce the risk of vertical transmission and disease severity. It has also been shown to be cost-effective. Through early detection and rapid diagnosis, fetal infection can be promptly identified and treated and outcomes can be improved. A new point-of-care test, recently developed in Lyon, France by LDBIO has been preliminarily validated in a French cohort, though the limited parasite and host diversity observed in France limits its generalizability to other nations.

Methods: We tested 180 U.S. sera with the LDBIO point-of-care (POC) test. These sera were obtained from patients in the National Collaborative Chicago-Based Congenital Toxoplasmosis Study (NCCCTS) cohort, as well as from volunteers. Parasite serotype had been previously confirmed through parasitic isolation and testing. Sera were from 116 chronically infected persons (48 serotype II, 14 serotype I-III, 25 serotype I-IIIa, and 28 serotype Atypical, haplogroup 12, 1 not typed). These represent strains of parasites infecting mothers of congenitally infected children in the U.S. 51 seronegative samples and 13 samples were from recently infected persons known to be IgG/IgM positive within the prior 2.7 months also were tested. Interpretation was confirmed by two blinded observers. An analysis of costs for POC vs commercial laboratory testing methods was performed.

Results: We found that this new LDBIO POC test was highly sensitive (100%) and specific (100%) for distinguishing IgG/IgM-positive from negative sera. Use of such reliable POC tests can be cost-saving and benefit patients. When costs are directly compared, substantial cost reduction is observed with the implementation of POC testing.

Conclusion: Our work demonstrates that the LDBIO test can function reliably as a point-of-care test to diagnose Toxoplasma gondii infection in the U.S., and that the substantial parasitic and host diversity observed in this country do not negatively impact the utility of the test. This provides an opportunity to improve maternal-fetal care by using approaches, diagnostic tools, and medicines already available. This infection has serious, life-long consequences for infected persons and their families. From the present study, it appears a simple, low-cost POC test is now available to help prevent morbidity/disability, decrease cost, and make gestational screening feasible. It also offers new options for improved prenatal care in low-and middle-income countries, where cost of conventional serological testing are prohibitive and equipment and infrastructure for testing follow-up are largely non-existent or inadequate.

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TET1 is a Novel HIF-1 Target whose Expression is Necessary for the Transcriptional Response to Hypoxia in Neuroblastoma

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**Background:** In tumors, a hypoxic microenvironment confers an aggressive phenotype that correlates with a poor clinical prognosis. Understanding hypoxia sensing and signaling pathways may therefore lead to new therapeutic targets. Previous work has identified oxygen-dependent dioxygenases that utilize Fe(II) and α-ketoglutarate as critical enzymes in hypoxia signaling. The ten-eleven translocation (TET) enzymes use these cofactors to convert 5-methylcytosine to 5-hydroxymethylcytosine (5-hmC). We hypothesized that these enzymes also regulate the transcriptional response to hypoxia.

**Methods:** Mass spectrometry and hMe-Seal were used to measure global and locus-specific 5-hmC levels, respectively. HIF-1 and TET1 knockdown was performed to identify genes regulated by these proteins. ChIP was used to identify a HIF-1 binding site at TET1. The in vitro and in vivo significance of this site is studied by CRISPR deletion.

**Results:** Hypoxia resulted in a global increase of 5-hmC levels with accumulation of 5-hmC at canonical hypoxia response genes. Hypoxia upregulated TET1, and knockdown of TET1 attenuated induction of hypoxia response genes. TET1 was identified as a direct HIF-1 target. Deletions at or near this HIF-1 regulatory region may reduce tumorigenesis in mice.

**Conclusion:** TET1 is a novel HIF-1 target necessary for induction of the hypoxia transcriptional program in neuroblastoma.

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Effects of the Endocrine Disruptor Tolylfluanid on Global Energy Metabolism

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Background: Metabolic health worldwide has been in decline over the past several decades, with the obesity and diabetes epidemics taking a serious toll on the lives of millions with associated healthcare costs amounting to hundreds of billions annually. Interestingly, both obesity and diabetes rates in the United States have correlated closely with synthetic organic chemical production. The environmental obesogen hypothesis posits chronic exposure to endocrine disrupting chemicals (EDCs) retain the capacity to modulate endogenous hormonal axes, and thus may contribute to the cardiometabolic disease epidemics. There exists a growing number of studies investigating the in vivo outcomes of EDC exposure, with multiple EDCs identified as obesogens with the capacity to augment body weight gain or adipose accumulation. Many of these studies investigate chronic adult exposure, however a growing number of EDCs have also been shown to modulate metabolism following developmental exposure. However, many studies have yet to interrogate the pathophysiologic mechanisms by which EDCs modulate metabolic homeostasis. Tolylfluanid (TF) is a member of the phenylsulfamide family of fungicides, and is commonly used in Europe, New Zealand, and China. Previously shown to promote adipogenesis in vitro and impair adipocyte insulin signaling ex vivo, the present study investigates the hypothesis that in vivo dietary exposure to TF promotes the accumulation of body fat and alters both adipocyte and global energy metabolism.

Methods: C57BL/6 mice were fed a normal chow fat diet with or without tolylfluanid incorporated at a concentration of 100 ppm for 12 weeks. Body weight and food consumption were monitored weekly, with glucose tolerance measured after 9 weeks exposure. At the time of sacrifice, each visceral fat was weighed, tissue was flash frozen for qRT-PCR, and insulin signaling was performed on perigonadal fat pads. Metabolic cage analyses were performed after 12 weeks on a separate cohort of mice. Perinatal exposure studies were performed in a similar fashion, with the study period through 20 weeks of age.

Results: In the adult exposure study, exposure to TF resulted in multiple significant metabolic perturbations. TF exposure resulted in augmented body weight gain, with a specific increase in visceral adiposity, despite no difference in food consumption. Exposed mice also exhibited impaired glucose tolerance, impaired metabolic flexibility, and impairment in adipose-specific insulin signaling. Perinatal exposure to TF in utero resulted in reduced body weight at weaning in males and females, and impaired glucose tolerance in adulthood in males, but not females.

Conclusion: The fungicide and antifouling agent TF may pose a threat to public health through the alteration of global energy metabolism and specific disruption in adipose function. In the present study, mice exposed to TF chronically in adulthood or simply during development, developed metabolic characteristics similar to those observed in humans with metabolic diseases such as obesity and diabetes. Further study of TF will further characterize the in vivo mechanisms by which this compound induces metabolic disruption, and investigate the interactions of TF with other environmental exposures such as diet or other EDCs.

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A Novel Variable-Frequency Pulsed Electromagnetic Field Generator (VFPG) for Mesenchymal Stem Cell Tissue Engineering Strategies

Zachary Collier

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**Background:** Scientists and clinicians are not entirely certain of the way in which PEMFs influence local mesenchymal stem cell (MSC) environments that are important for bone healing processes. As a result, PEMF-based tissue engineering therapies cannot be optimized for clinical effect. Because of this knowledge gap, elucidating the underlying mechanism through which PEMFs induce MSC osteogenesis promises to enhance the therapeutic efficacy of PEMFs for bone regeneration. In addition, it is possible that further modification of the frequency, field strength, or exposure time utilized by PEMF exposure protocols could enable selective differentiation of MSCs down one of their other potential lineages (i.e. adipocyte and chondrocyte). As a result, the aims of this study were 1) to design, construct, and optimize a unique variable-frequency PEMF generator (VFPG) to selectively manipulate each PEMF parameter and 2) to use this device to explore the hypothesis that specific PEMF frequencies and/or field strengths can be preferentially selected to stimulate the terminal differentiation of MSCs into discrete cellular lineages – osteoblast, adipocyte, and chondrocyte – for regenerative medicine applications.

**Methods:** The VFPG was designed and computationally simulated possessing the ability to reliably generate PEMFs at defined frequencies. The circuit simulator LTSpice (Linear Technology, Milpitas, CA) was utilized for rapid circuit prototyping with real-time simulation feedback pertaining to component specific voltages, currents, and frequencies. Through direct analysis of individual circuit components (e.g. resistors, capacitors, transistors) within the design, it was possible to micro-engineer the desired tolerance parameters for each part. This feature allowed for improved conversion of the theoretical design which uses components of unlimited capacities to real-world components containing manufacturing limitations. The device was constructed in the Enrico Fermi Institute’s electrical engineering workshop. All customized items such as power cords, input/output sockets, and circuit housing systems were hand-crafted utilizing the machining tools in the workshop.

**Results:** A functional, programmable VFPG with the ability to reliably generate PEMFs with 40-245 μT field strengths at frequencies between 10 Hz and 1 kHz has successfully been constructed and tested for stability. To facilitate a compartmentalized and user-friendly variant of the VFPG device, a customized shielding case with grounding safety built-in to the housing mechanism was created. Theoretical-to-physical variances in circuit behavioral characteristics limited the magnetic field stability (220-247 μT) between 50 Hz and 250 Hz, so the aforementioned frequency range will be the focus of future biocompatibility assays.

**Conclusion:** The utilization of a broad bandwidth VFPG promises to deliver important insight for elucidating the frequency-dependent effects of PEMFs on osteogenesis, adipogenesis, and chondrogenesis in MSCs. Ultimately, the VFPG will facilitate the selective differentiation of readily abundant adipose-derived MSCs into desired tissue types (e.g. bone, cartilage, adipose) for clinically-relevant autologous tissue engineering therapies.

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A Novel Germline Mutation Preventing Degradation of Lysophosphatidic Acid (LPA) Causing Familial Breast and Ovarian Cancer

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Background: Breast and ovarian cancer are the second and fifth most common causes of cancer mortality in women, respectively. While several germline mutations are known to cause familial breast and ovarian cancer, such as BRCA1/2 mutations, approximately 75% of patients with breast or ovarian cancer and a family history test negative for known causative mutations. We performed exome sequencing of germline and tumor DNA in a family with breast and ovarian cancer history that tested negative on a 23-gene panel. We identified a mutation in a gene coding for a protein that degrades lysophosphatidic acid (LPA), a bioactive phospholipid that has been demonstrated to contribute to both breast and ovarian cancer initiation and tumorigenesis. The identified mutation results in an amino acid substitution from arginine to tryptophan at a highly conserved residue near the protein’s active site. We aim to determine if this mutation is functionally associated with breast and ovarian cancer and understand the clinical implications for mutation carriers.

Methods: Whole exome sequencing of germline DNA for three family members with breast or ovarian cancer was performed. Germline variants present in all family members predicted to be deleterious were selected for functional analysis. An additional cohort of 174 high grade serous ovarian cancer patients was genotyped with Sanger sequencing. Gene knockdown with shRNA was used to assess HeyA8 ovarian cancer cell migration and proliferation. Xenotransplantation of overexpression and knockdown cell lines in athymic nude mice was used to assess effects on in vivo tumor burden. LPA ELISA will be used to measure LPA levels in breast and ovarian cell lines overexpressing wild type or mutant enzyme (OVCAR3 and MCF7) and after shRNA knockdown (TykNu, HeyA8, MB231). Phosphate production assays will be used to compare the activity of wild type and mutant enzyme.

Results: The candidate mutation is enriched in a cohort of ovarian cancer patients, with a mutant allele frequency of 4.0% overall and 8.9% in those with a family history, versus 2.2% in the general population. In vitro knockdown of the gene in ovarian cancer cells causes increased proliferation and migration. In vivo knockdown of target gene activity trends towards an increase in tumor burden (p =0.16) while overexpression decreases tumor burden (p=0.003).

Conclusion: This gene represents a novel germline variant that increases risk of breast and ovarian cancer likely by preventing degradation of LPA. After knockdown, increased migration and proliferation in vitro and increased tumor burden in vivo support its role as an important mediator of breast and ovarian carcinogenesis. Increased frequencies of this mutation in ovarian cancer patients, especially those with a family history, suggest that the variant may be clinically actionable. Further exploration of mutant allele frequency in a cohort of breast cancer patients and characterization of the mutant enzyme’s ability to degrade LPA will elucidate how this protein may contribute to breast and ovarian cancer tumorigenesis. (Castera 2014, La Duca 2014, Stratton 2008). Mills 2003, Yu 2008, Murph 2009, Liu 2009).

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Let’s UNITE! Unit-Based Nursing Interprofessional Team Experience

Sean Gaffney, M.Ed

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**Background:** In 2014, the AAMC identified collaborating as a member of an interprofessional team as a core Entrustable Professional Activity (EPA) for entering residency. Despite the expectation that medical students should be able to work effectively as team members, there are few opportunities in medical school curricula for students to receive structured and robust interprofessional training. After conducting a needs assessment at the University of Chicago, it was determined that only 32% of rising MS4s were satisfied with their Interprofessional Education (IPE).

**Description of program/innovation:** Develop and implement an immersive-learning curriculum that: (1) Allows medical students to experience and appreciate the role of nursing professionals and (2) Provide nurses and future physicians with an opportunity to learn how to communicate with each other and to build interprofessional trust. In collaboration with nursing leadership at the University of Chicago, eleven high performing nursing units were identified based on patient satisfaction and nurse engagement ratings. Over ten weeks, students were assigned in pairs to shadow a nurse for 3-4 hours. To introduce the project, all nurse managers and students were invited to a “Meet and Greet” Orientation where the objectives of the experience were described. Students also received a lecture about interprofessional collaboration and were required to review UNITE materials and complete a pre-survey on iTunesU prior to their shift. After the shift, students asked the nurse to complete an immediate evaluation on iTunesU and students completed a post-survey and reflection exercise.

**Evaluation of program/innovation:** Eighty-eight MS1s completed the curriculum. Seventy-two students completed the pre-survey. The pre-survey indicated that 67% of students understand the role of a nurse, 33% understand how communication takes place between nurses and physicians, and 45% feel prepared to communicate effectively with nurses. Despite these low numbers, 100% of students agreed that teamwork skills are essential to learn and 99% agreed that learning from nurses would make them more effective team members. 84 trainees completed the post-survey following shadowing experience. Most (93%) of participants agreed that they had a better understanding of the role of a nurse after the experience. 94% reported being more open to learning from nurses and 96% stated that they had greater respect for the skills that nurses provide. Wilcoxon Signed Rank Sum tests were used to directly compare pre- and post-survey items. A statistically significant increase was found in student’s preparedness to communicate with nurses ($p<0.000$). Lastly, learner feedback about the experience was positive with 93% agreeing that they were glad they spent time shadowing nurses and 82% reporting overall satisfaction with the experience.

**Conclusion:** Positive learner-feedback about the experience indicates that this intervention was well received by learners and is a promising, low-cost, strategy for providing medical students with meaningful interactions with nurses. Statistically significant improvement in preparedness to communicate with nurses suggests that the experience accomplished its objective of encouraging collaborative communication. However, qualitative comments indicate that there are improvements that would be made. Nurses would have liked more preparation and some students would like even more opportunities to shadow healthcare professionals.

**Acknowledgements/Disclosures:** The University of Chicago Calvin Fentress Fellowship Recipient.
The Effects of Short Post-Delivery Stay on Infant Health Outcomes at an Urban Hospital in Ghana

Megan Gunsaulus

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**Background:** The World Health Organization recommends that all women remain in a health facility for at least 24 hours following an uncomplicated vaginal delivery. However, in Ghana, many women are discharged sooner than recommended due to insufficient resources including bed space and staff. The objective of this study was to determine if discharge within 8 hours of delivery negatively affected early infant health.

**Methods:** The study included 461 women with low-risk pregnancies and uncomplicated deliveries at Maternal and Child Health Hospital (MCHH), a small, urban hospital in Kumasi, Ghana. Oral consent was obtained and the study was approved by Komfo Anokye Teaching Hospital and the Ethics Committee of the University of Chicago. The time each woman remained in the hospital determined if she was retroactively assigned to the early discharge group (<8 hours) or normal discharge group (>8 hours). Information on the pregnancy, delivery and the health of the newborn was recorded at birth. Additional health information about the mother and infant was obtained at follow-up appointments 1, 6, 10, and 14 weeks following delivery.

**Results:** The median post-delivery hospital stay at MCHH was 8.1 hours. The duration of hospital stay was not dictated by measures of the newborn’s health, such as birth weight or Apgar score. There were only 2 infant deaths and nearly 100% completion of immunizations. There was no difference in the mean weight of the early and normal discharge cohorts of infants at 1, 6, 10, and 14 weeks of life (P = .83, .94, .68, and .21, respectively). Early discharge was not associated with increased incidence of infant cough, rhinorrhea, vomiting, diarrhea, or fever.

**Conclusion:** For low-risk pregnancies with uncomplicated deliveries, early discharge does not adversely affect infant health at MCHH. We suspect that this outcome is partially due to an effective triage system between MCHH and a much larger neighboring tertiary care center, which suggests that such triaging systems can promote efficiency and cost-reduction in maternal health care delivery settings.

**Acknowledgements/Disclosures:** Global Health Scholarship through the Margaret P. Thorp Nutrition Fund.
Evaluating the Model for a Medical Student Sustained Reach Out and Read (ROR) Program

Jane Rivas

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**Background:** Reach Out and Read (ROR) is a national evidence-based program that partners with physicians to promote early literacy and school readiness. By giving books at well child visits from 6 months to 5 years, physicians provide anticipatory guidance about the importance of book sharing. ROR is a successful program with over 4500 sites nationwide. However, not all sites are able to maintain consistent funding & engagement due to administrative turnover.

**Description of program/innovation:** The Pritzker Reach Out and Read program is a medical student lead organization that partners with the local ROR clinic site to provide financial and logistical aid. The innovation’s settings consist of medical students at the University of Chicago (U of C) Pritzker School of Medicine, pediatric residents and attendings at the U of C Comer Children’s Hospital, and an established Reach Out and Read site at the Friend Family Health Center (FFHC), a Federally Qualified Health Center (FQHC). Site needs assessments identify areas lacking support, and medical student assistance is directed to these regions. Medical students organize fundraising efforts, create ties with the local community, order books, and track the number of books distributed by the clinic. This then frees clinic physicians and residents to solely focus on early literacy education and distribution of books. The specific aims of this innovation are 1) to provide a sustainable Reach Out and Read program for improved early childhood exposure to literacy; 2) create a working partnership between pediatric residents, clinic staff, and medical students for improved program function; and 3) to assess the integration of medical students into the existing ROR model.

**Evaluation of program/innovation:** During the period of March 2014 to March 2016, 5,838 books were distributed. Out of 24 months, only 5 were recorded with no book distribution. An unpaired test of periods from March 2014 to February 2015 and March 2015 to February 2016 resulted in a p-value of 0.052 (95% CI: -508.42-2.82). Post-intervention survey data of student perceptions demonstrated frustration with securing sustainable funding, but emphasized strong support of medical student involvement overall (n=11, 68.7% response rate). Anecdotal data supported these results with an overall positive perception of student involvement in reestablishing the ROR site at FFHC.

**Conclusion:** The Pritzker Reach Out and Read student run organization resulted in the reestablishment and sustainment of a Reach Out and Read program at the Friend Family Health Center, an FQHC. While not statistically significant, the study was likely underpowered, and further evaluation may show significant results. The integration of medical students into the current ROR model provides additional assistance in logistic and financial support. This intervention could be translated to undergraduate and high school students, with the ultimate goal of continuing and expanding early childhood literacy programs.

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Applied Scholarship
Impact of a Novel Asthma Curriculum on Knowledge and Attitudes Among Schoolchildren

Shilpa Vasishta

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Background: Asthma is the most common chronic pediatric disease, with rates of 8% among US children and 17% among African Americans. Traditionally, school-based asthma education has engaged students with asthma to improve their knowledge and outcomes. However, there is increasing recognition of the role of peers in fostering asthma-friendly school environments and assisting classmates with asthma. Few programs have addressed peer groups, and the impact of these programs on knowledge and behavior is largely unknown. We have piloted a novel curriculum to engage students with and without asthma and assess impact on knowledge and attitudes.

Methods: A 45-minute asthma curriculum was piloted in four Grade 4-5 classes in Chicago charter schools, with a 98% African American student population. Curriculum was delivered by asthma educators during the Physical Education/Wellness class. Students completed an Asthma Knowledge and Attitudes survey immediately before and after the session. Survey items were adapted from validated tools in the literature and tailored to Grade 3-5 literacy. Asthma knowledge was assessed using multiple-choice questions regarding pathophysiology, symptoms, triggers, medication use, and management of episodes. Asthma attitudes were assessed using Likert-scale questions regarding empathy and willingness to help during an episode. Student’s t-test was used to evaluate changes in knowledge and attitudes before and after the session.

Results: Ninety-one students received the curriculum and completed pre/post-curriculum surveys; 25 had asthma and 66 did not. Comparison of pre/post-curriculum responses demonstrated significant increases in knowledge of pathophysiology (p < 0.001), triggers (p < 0.001), and management of episodes (p=0.002). Subgroup analysis revealed that knowledge increases occurred primarily in students without asthma (p < 0.001, p < 0.001, and p=0.002, respectively). Students with asthma had greater knowledge than their peers at baseline (p < 0.001 for triggers, p=0.006 for episode management) and did not improve significantly during the session. Asthma attitudes were moderate at baseline (mean score=3.5/6 with 1=negative, 6=positive) and did not change significantly during the session.

Conclusion: This pilot study demonstrates the potential for a classroom-based asthma curriculum to improve knowledge among elementary-school students, particularly those without asthma. This knowledge includes identification of asthma triggers and management of asthma episodes, and is therefore of interest as schools work to improve trigger control and asthma management community-wide. Although this study does not show improvement in asthma attitudes, it is unclear whether this reflects a lack of curricular impact or the inability of a brief survey to capture such changes. We conclude that asthma education can be feasibly integrated into a school health curriculum for all students, with immediate impact on knowledge, and encourage further study of the intermediate and long-term impact on health behaviors and outcomes.

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Readiness to Perform Cervical Cancer Screening Among Community Health Workers in Ibadan, Nigeria

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Background: Cervical cancer is the second most common type of cancer in women worldwide with approximately 500,000 cases per year and over 230,000 deaths per year. Over the last several years, Papanicolaou (Pap) cytology screening has dramatically reduced cervical cancer mortality in most high-income settings. In low to middle income countries like Nigeria, cervical cancer incidence rates have remained relatively stable, which may be due, in part, to inadequate screening. Screening rates in Nigeria remain relatively low and women are often diagnosed late in the disease course, contributing to the high mortality rate of 58% based on most recent cancer registry data. While previous literature has demonstrated barriers to screening uptake, such as fear of results and lack of awareness, there is limited investigation as to the health system barriers to cervical cancer screening access. Given the limited coverage of peri-urban and rural regions by nurses and physicians, community health workers serve as frontline agents at primary health centers. We sought to assess knowledge and readiness of community health workers at urban and peri-urban primary health centers in Ibadan on topics of cervical cancer etiology, prevention, and screening methods.

Methods: This study used a cross-sectional survey of 228 community health workers at 6 randomly selected urban and rural local government areas of Ibadan, Nigeria. Total sampling of all available community health workers at all primary health centers within each randomly selected local government area was performed.

Results: Our findings revealed that less than 5% of community health workers surveyed could correctly answer all 8 basic knowledge questions about cervical cancer. While slightly over half of health workers were familiar with the Pap smear (50.7%), 9.0% had received training in this screening method, compared to 8.6% familiar with VIA screening method and 4.0% who had received training.

Conclusion: These findings suggest that significant knowledge gaps exist for community health workers regarding their knowledge of etiology/cause, prevention, and screening of cervical cancer. Community health workers in Ibadan currently have limited readiness to perform cervical cancer screening. This reveals an opportunity to educate and train community health workers in appropriate screening methods to reduce cancer burden and late stage diagnosis.

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Impact of an Ethanol Stove Intervention on Pulmonary Function in Pregnant Women Exposed to Household Air Pollution - a Randomized Controlled Study in Nigeria

Vishan Dhamsania

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Background: About 33% of COPD and 25% of pneumonia deaths are attributable to exposure to household air pollution (HAP) from incomplete combustion of traditional cooking fuels. Biomass and kerosene, which are widely used for cooking in Nigeria, are known to impair pulmonary function. Despite this knowledge, there are few randomized controlled trials that have investigated the ability of an intervention cookstove to improve pulmonary function and exposure-related pulmonary complaints.

Methods: We conducted in homes a randomized controlled trial that investigated the impact of replacing kerosene and firewood stoves with ethanol stoves on pulmonary function in 324 pregnant women from Ibadan, Nigeria. Participants were randomized to an intervention group using an ethanol stove or control group consisting of kerosene and biomass. Pulmonary function testing was performed at three unique time points and primary variables analyzed were FVC, FEV1, FEV1/FVC, FEF25-75, and PEFR. Primary analysis fit mixed effects regression models to model changes over time for each spirometry variable. A subset of participants was followed through an extended period to evaluate the long-term effect of using the intervention stove. Changes in spirometry variables for extended follow up groups were stratified according to initial stove type and compared by ANOVA. Periodic surveys were administered to assess exposure-related symptoms and were compared with appropriate hypothesis testing.

Results: 162 participants were randomized to the bioethanol intervention, of which 51 originally used firewood (EF) and 111 used kerosene (EK). The control group consisted of 104 kerosene and 58 firewood users. Spirometry was performed in 300 participants at baseline, 282 at 26 weeks gestational age and 189 at 6 weeks post-partum. Mean values for FVC and FEV1 were consistent with normal limits for Nigerian women. FVC, % predicted FVC and % predicted FEV1 demonstrated significant changes over time with lower predicted mean values at the second compared to first and third evaluations, however, the magnitudes of the changes were fairly small. The FEV1/FVC ratio was flat over time in the Ethanol group, but quadratic in the Firewood users (p=0.034) with values increasing from baseline and then falling back at the third visit. Changes over time were generally small and not significant for FEV1, FEF25-75, PEFR. 182 participants were evaluated during the extended follow up period. Average time to follow up was 696.26±133.49 for firewood users, 722.43±133.86 for EF users, 888±144.93 for kerosene users, and 866.34±139.75 for EK users. ANOVA did not reveal any significant differences between these groups. Ethanol users demonstrated lower prevalence of itchy eyes when compared to kerosene and firewood users. When compared to only firewood users, ethanol users demonstrated decreased shortness of breath, headache and dizziness.

Conclusion: Despite significant improvement in exposure-related pulmonary symptoms, no significant differences were observed in pulmonary function indices between the intervention and control groups. Larger studies with measurement of post bronchodilator changes are needed for better understanding of the impact of HAP exposure on pulmonary function.

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Perceptions of Wuhan University Medical Students on Instruction in the Social Aspects of Medicine

Hannah Roth

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Background: Healthcare marketization in China has taken a grave toll on the doctor-patient relationship with dissatisfaction leading to distrust, disputes, bribery, vandalism and physical injury to physicians. Lack of humanities education for medical students may be partially responsible. In 2008, Wuhan University Medical School and the University of Chicago PSOM partnered to design a reform curriculum for Wuhan based on the newly implemented Pritzker initiative. Pritzker dedicates a significant portion of the preclinical curriculum to the social aspects of medicine, in the curricular thread Physician-Patient-Society-Systems (P2S2): Health Care Disparities, Clinical Skills, Doctor-Patient Relationship, and Social Context of Medicine & the American Healthcare System. This study focused specifically on the state of implementation of Pritzker’s P2S2 courses into Wuhan’s reform curriculum and medical students’ perceptions about them. We hypothesized that students from the reform group would have had greater exposure to these topics than the students in the traditional group and therefore would be more likely to report having learned about them.

Methods: Descriptive analysis of curricular content was conducted to assess inclusion of the social aspects of medicine in reform and traditional curricula. A 13 question Likert scale survey was administered to 192 4th & 5th year medical students to assess student perceptions of the importance of learning about topics in the social aspects of medicine (i.e. doctor-patient relationship, healthcare disparities, healthcare system and insurance) and whether they perceived having learned about them in their preclinical curriculum.

Results: Analysis of curricular content showed that of the P2S2 courses, an ethics course had been implemented in the reform curriculum at Wuhan. Analysis of the Likert scale survey showed that while a majority of both reform and traditional students (>79%) perceived these topics to be important to learn about, in neither group did a majority report having learned about them (<42%). Comparison of data from reform and traditional students using Mann-Whitney U Test showed statistical significance with students in the reform class scoring significantly higher than the traditional group in the following categories: Learned about healthcare system U=2490 p=0.002; Feel confident in role in healthcare system U=2827 p=0.044; Learned about insurance and payment U=2238.5 p<0.001; and Learned about health care disparities U=28.02, p=0.040.

Conclusion: That more reform than traditional students report having learned about the healthcare system, health insurance, and healthcare disparities, suggests that the reform curriculum has provided improved instruction on these topics. However, despite the reform students’ higher scores in each of these cases, it was still a minority of reform students overall who reported having learned about these topics, and therefore there remains room for improvement. As medical schools across China work to reform their curricula, it is important that they consider the inclusion of the social aspects of medicine. Beyond academic consensus surrounding inclusion of social aspects of medicine in medical school curricula, our study shows that medical students themselves feel that these topics are important to learn about and that there is room for development and improvement with respect to their current presence in curricula.

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Comparison of Male vs Female Resident Milestone Evaluations by Faculty During Emergency Medicine Residency Training

Arjun Dayal

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Co-author(s): Daniel O'Connor, Usama Qadri, Vineet Arora, MD, MAPP

Background: Although implicit bias in medical training has long been suspected, it has been difficult to study using objective measures, and the influence of gender in the evaluation of medical trainees is unknown. The emergency medicine (EM) milestones provide a standardized framework for longitudinal resident assessment, allowing for analysis of resident performance across all years and programs at a scope and level of detail never previously possible. This study aims to compare the evaluation of male vs female residents by faculty throughout training using a novel longitudinal, multi-institutional data set that consists of EM milestone evaluations based on direct observation.

Methods: In this multicenter, longitudinal, retrospective cohort study, evaluation data were collected from 8 community and academic EM training programs across the United States from July 1, 2013, to July 1, 2015. All evaluations were collected using InstantEval, a real-time, mobile-based, direct-observation evaluation tool. Milestone attainment for male and female EM residents as observed by male and female faculty throughout residency were analyzed using multilevel mixed-effects linear regression modeling.

Results: A total of 33,456 direct-observation evaluations were collected from 359 EM residents (237 men [66.0%] and 122 women [34.0%]) by 285 faculty members (194 men [68.1%] and 91 women [31.9%]) during the study period. Female and male residents achieved similar milestone levels during the first year of residency. However, the rate of milestone attainment was 12.7% (0.07 levels per year) higher for male residents through all of residency (95% CI, 0.04–0.09). By graduation, men scored approximately 0.15 milestone levels higher than women, which is equivalent to 3 to 4 months of additional training, given that the average resident gains approximately 0.52 levels per year using our model (95% CI, 0.49–0.54). No statistically significant differences in scores were found based on faculty evaluator gender (effect size difference, 0.02 milestone levels; 95% CI for males, −0.09 to 0.11) or evaluator-evaluatee gender pairing (effect size difference, −0.02 milestone levels; 95% CI for interaction, −0.05 to 0.01).

Conclusion: Although male and female EM residents are evaluated similarly at the beginning of residency, the rate of milestone attainment throughout training is higher for male than female residents, leading to a wide gender gap in evaluations across all EM subcompetencies by graduation. Although the specific factors that drive these outcomes remain to be determined, this study highlights the need to be cognizant of gender bias and the necessity of further research in this area.

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#EMconf Social Media Curriculum

Oliver Hulland

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**Co-author(s):** Kenneth Young, MD; James Ahn, MD; N. Seth Trueger, MD, MPH

**Background:** Responsibly and effectively using social media in the professional and academic settings is increasingly instrumental in the Emergency Medicine community. However, many areas for improvement and potential threats to professionalism persist, including ensuring the responsible sharing of accurate and well-resourced information. Fluency and literacy in social media may benefit residents, and there is little formal training in place to ensure this competency. With this project, we hope to develop a role for exposure to and experience with social media as an adjunct to our formal residency conference curriculum.

**Description of program/innovation:** During weekly didactic conferences, residents on the Teaching Resident month-long rotation will use the residency twitter account (@UChicagoEM) to live-tweet two didactic lectures, sharing educational pearls, major points, and relevant questions. After the conference, the residents compile the tweets from each lecture to be reviewed by a faculty member for accuracy, critical feedback and corrections will be given when necessary. Tweets including relevant associated online conversations are collated in Storify and, posted to the residency website (em.uchicago.edu/media/emconf) to create a permanent online repository.

**Evaluation of program/innovation:** Residents will complete a post-participation survey, assessing the intervention’s effect on their attitudes towards the new curriculum. This will address topics including prior experience and attitude toward social media, perceived value of a social media component in ongoing education, and improvement of understanding of the educational content.

**Conclusion:** By utilizing a social media curriculum in conjunction with our weekly resident conferences, we hope to teach residents how to responsibly and effectively use social media within a professional and academic setting, as well as improve resident engagement with the online emergency medicine community.

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Eating Disorders: Are Medical Students Informed?

Kathryn Kinasz

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Background: Research suggests that nearly half of eating disorder (ED) cases go unrecognized. While patients may present to primary care providers before presenting to a mental health professional, data suggest that many providers lack confidence in diagnosing and treating this disorder. Limited research exists at the physician level and, to the best of our knowledge, no studies in the U.S. have investigated this topic in medical students.

Description of program/innovation: This study examined medical students’ knowledge of EDs and their attitudes towards patients with EDs. Some students were exposed to a patient with an ED during lecture, and attitudes of these students were compared to their peers. 141 medical students across all years of undergraduate medical training from the University of Chicago responded to survey questions. 34 percent were first years, 34% second years, 18% third years, 12% fourth years, and 2% identified as “other.”

Evaluation of program/innovation: Students indicated relatively positive attitudes towards EDs: 87% disagreed that symptoms will resolve without treatment, 87% agreed the illness is severe, 88% disagreed that patients are responsible for their own condition, 100% agreed the illness has a consequence on quality of life, and 96% agreed EDs impact patient’s family and friends. Students demonstrated more pessimism regarding ED outcomes with 47% disagreeing that patients can do a lot to control symptoms and 88% believing the illness to be chronic. Interestingly, 93% agree they are likely to see a patient with an ED in their future practice but only 24% feel comfortable treating them. In terms of knowledge, when asked about physical complications of anorexia nervosa (AN), most respondents knew osteoporosis (87%) and cardiac arrhythmias (83%), but fewer knew neuromuscular abnormalities (69%) and cerebral changes (65%), and 16% said they did not know. In terms of diagnostic criteria, 50% of respondents knew fear of fatness was a criteria, but less than half correctly answered any other criteria and 23% said they did not know. In terms of bulimia nervosa (BN) complications, 82% knew metabolic changes, 77% esophageal tears, and 70% enlarged parotid glands, but only 40% recognized delayed gastric emptying and 20% did not know. Approximately one third of respondents did not know the duration of AN or BN and another third showed relative pessimism, believing it to be at least 10 years. About one third recognized correct treatment therapy but another third said they did not know. Only 10 (7%) respondents had worked with more than 2 patients with EDs during medical school and only 13 (9%) had experience prior to medical school.

Conclusion: These results indicate that medical students demonstrate attitudes that reflect an understanding of illness severity, but they show less optimism about outcomes for patients. Students show some familiarity with physical complications, but are less confident on diagnostic criteria or treatment. Thus, undergraduate medical training should focus on helping students obtain knowledge while continuing to encourage compassionate attitudes. Providing students with a competency base will help these physicians-in-training gain confidence detecting EDs when they present in the primary care setting.

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Comparison of Medical Student Self Assessment and Faculty Assessment of Personal and Professional Development Skills

Christopher Mattson

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Background: In 2013, the Association of American Medical Colleges (AAMC) included “Personal and Professional Development (PPD)” as a competency domain to be taught in medical school. While most schools have elements of PPD programming in place, assessment of student progress towards competency attainment has not been well studied. In addition, little research has focused on assessing differences between student self assessment and faculty assessment of PPD skills.

Methods: After conducting a literature review on core PPD competencies, we developed a 48-question survey consisting of Likert scale questions and open-ended questions assessing PPD goals that was given to MS2 students in February 2016. A parallel 8-item survey was developed for faculty to evaluate relevant PPD domains during the MS2 Clinical Skills (CS) course and Scholarship and Discovery (S&D) experience in the spring and summer of 2016. For our data analysis, we compared the student self-assessments to matched faculty assessments from their CS preceptors and S&D mentors. Using paired t-tests, we analyzed the data for agreement between student self-ratings and faculty ratings. We also analyzed the data for agreement between the two different faculty raters.

Results: There were 28 students for whom there was a self-assessment, a CS assessment and a S&D assessment. Self-assessment scores were significantly lower than CS assessments for each of the 8 PPD competencies assessed. Self-assessments were significantly lower than S&D assessments for 7 of the 8 competencies. There was no statistically significant difference found for “Complying with rules and regulations”. There was also no statistically significant difference between CS assessments and S&D assessments for any of the 8 PPD competencies. Of the 28 S&D mentors included in the data set, 17 (60.7%) rated the student as being “Highest performance (top 10%)” in comparison to other medical students with whom the mentor had worked previously. Eight (28.6%) rated the student as being “Above average performance (11-25%)”, 1 (3.6%) rated the student as being “Average performance (26-50%)” and 2 (7.1%) said they had never before mentored a medical student on a scholarly project. Thirty-five out of fifty six (62.5%) total faculty assessments gave a rating of 5 out of 5 for all competencies.

Conclusion: Over half of the S&D mentors rated their students as being in the top 10% of students which suggests that grade inflation contributes to the discrepancy in student and faculty assessments. This is supported by the fact that the majority of CS and S&D faculty uniformly rated students 5/5 for all domains. The data is consistent with trends in the literature, which have shown grade inflation in other aspects of medical education. The data also makes it difficult to provide meaningful PPD feedback to students. Future work should focus on faculty training to improve PPD assessment skills and also on providing opportunities for students and faculty to review and discuss discordant scores.

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Physician’s Beliefs Regarding Spiritual Care at the End of Life

Christopher Smyre, MA

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**Background:** Despite the Health and Medicine Division (formerly Institute of Medicine) stating that all psychosocial concerns be addressed in the clinical plan for cancer patients and studies demonstrating the benefits of addressing spiritual concerns at the end of life, no study has examined the extent to which physicians believe they should address spiritual concerns, and their willingness to incorporate spiritual practices.

**Methods:** In 2010, mailed a questionnaire to a stratified random nationally representative sample of 2016 practicing US physicians from the AMA Physician Masterfile.

**Results:** 138 were ineligible due to retirement or incorrect address. 1156 (62%) responded. 65% of physicians affirmed addressing patients’ spiritual concerns at the end of life is essential to good medical practice. 88% believe praying frequently has a positive psychological impact on the patient, 55% stated that would pray with the patient if asked but 62% reported not praying with a patient over the past year. Appropriateness (Appropriate Always/Usually vs Appropriate Rarely/Never) for doctors to encourage patients to: “talk with a chaplain or pastoral care provider” (81% vs 3%), “reflect on their lives and prepare for death” (61% vs 13%), “focus less on the possibility of miracle” (47% vs 23%), “seek reconciliation with their God” (39% vs 33%). Hematologist/Oncologist and Pulmonologist/Critical Care physicians were less likely than primary care physicians to believe that spiritual care is essential to good medical practice (OR: 0.5, CI: 0.2-0.8) or that it is appropriate to encourage patients to reflect or seek reconciliation (OR: 0.5, CI: 0.2-0.8) but more likely to believe it is appropriate to focus less on a miracle (OR: 1.7, CI: 1.1-2.8).

**Conclusion:** Despite a difference between specialty’s dispositions towards addressing spiritual concerns, majority of physicians believe a chaplain’s involvement is appropriate and will pray with the patient if asked. Future studies should evaluate primary care providers as an indirect means for ensuring that patient’s spiritual concerns are addressed at the end of life, by educating and empowering patients and their families to make their spiritual concerns known or at the least request a chaplain.

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Provider and Non-Provider Perceptions of Diabetes Quality Improvement: A Case Study of Six Chicago Clinics

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Background: Coordinating the actions of clinical staff and providers is crucial for improving care delivery in the patient-centered medical home (PCMH) setting, but few have examined how work role might be associated with internal assessment of quality improvement (QI) measures. Using data from a multi-site, multi-intervention project that included QI collaboratives working on dimensions of diabetes care mirroring PCMH domains, we investigated differences between providers’ and non-providers’ perceptions of QI implementation efforts.

Methods: We mailed cross-sectional surveys with closed-coded questions with Likert type response options for QI domain ratings at three time points (2010, 2012, 2014) to all eligible providers (e.g.) nurse practitioners, physicians, physician assistants, residents, and all eligible non-providers (e.g.) counselors, licensed practical nurses, registered nurses, administrative workers, at six diabetes clinics serving a working class African-American community in Chicago (n = 773). Four QI domains ((i) access and communication with patients, (ii) data tracking, (iii) care management, (iv) QI) based on previously peer-reviewed PCMH evaluations were assessed. Domain scores were averaged to generate a total PCMH score. Two-sample t-tests were used for preliminary comparisons of provider and non-provider assessments over the three surveys. Linear mixed models (LMM) were performed to compare provider and non-provider responses, test time trend, and examine interaction between time and survey results, adjusting for effects of providers/staff characteristics and clinical sites as a random effect. In-depth semi-structured interviews were conducted with clinic providers and staff. All analyses were performed using commercially available software (ATLAS.TI, Microsoft Excel 2010, RStudio, SAS).

Results: Our response rate was 73.1% (565/773). Over the three surveys, the means of most provider (n = 184) assessments of QI domains were statistically significantly lower than those of non-providers (n = 381) (i: Provider mean (PM): 53.67, Non-provider mean (NM): 55.58 (p = 0.170); ii: PM: 57.04, NM: 65.25 (p < 0.001); iii: PM: 44.21, NM: 63.89 (p < 0.001); iv: PM: 57.04, NM: 65.25 (p < 0.001); Total PCMH Score: PM: 51.61, NM: 61.33 (p < 0.001)). LMM analysis showed average provider assessments of access to care and communication with patients were 3.7 points lower than average non-provider assessments, but the difference was not statistically significant (p = 0.153). For this domain, the interaction of survey response and time of administration was statistically significant (p = 0.012). Average provider assessments were 9.9 points lower (p < 0.001) for data tracking, 18.1 points lower (p < 0.001) for care management, 10.3 points lower (p < 0.001) for quality improvement, and 8.1 points lower (p < 0.001) for the total PCMH score. Qualitative review of interviews is underway.

Conclusion: Divergent QI perspectives of workers with different roles could impact clinic dynamics and culture at sites transitioning to PCMH-inspired models. Addressing the issues in care transformation identified from surveys and interviews of providers and non-providers at such locations could lead to more consistent success with QI pilots and consequently improve patient care.

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Daytime Physical Activity and Mental Status Assessment in Hospitalized Patients

David Hamilton

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Co-author(s): Dana Edelson, MD, MS; Vineet Arora, MD, MAPP

Background: Altered mental status (AMS) is a complex spectrum of cognitive deficits that is common in hospitalized patients and is associated with longer hospital length of stay, as well as the risk of stroke, myocardial infarction, and mortality. AMS can be difficult to detect in hospitalized patients, and many of the common tools of screening for AMS are time-consuming or notoriously inaccurate. One example, the Richmond Agitation and Sedation Scale (RASS), is a frequently used tool for altered mental status screening that assesses a patient’s arousal and consciousness through short subjective clinician-directed observations. However, even with the popularity and increasing access to actigraphy monitoring devices, there is yet to be a study that investigates the relationship between objectively monitored patient arousal, activity, and mental status in the hospital. Thus, we sought to identify a rapid objective actigraphy-based mental status screening tool directed at monitoring activity and arousal that would correlate that with current mental status tests like the RASS, Confusion Assessment Method (CAM), and digit span test.

Methods: We conducted a prospective cohort study on ambulatory community-dwelling general medicine inpatients 50 years and older at a tertiary care medical center. For these subjects, research assistants collected demographic information upon enrollment as well as digit span and CAM with daily screenings. RASS scores and Charlson Comorbidity Index were obtained from medical records. Physical activity was monitored with a wrist accelerometers. Random-effects linear regression was used to examine the association between CAM, digit span, and RASS with daytime physical activity.

Results: We collected 587 individual patient days from 229 enrolled subjects. For all individual patient days, the median average activity was 85 counts/minute (Interquartile Range [IQR], 52.1-136.6 counts/minute). Utilizing random effects linear regression, we were unable to identify independent association between daytime physical activity and the CAM (Coefficient= -22.9 [95% CI -62.5 to 16.8] p-value=0.26), digit span (Coefficient= -4.5 [95% CI -20.6 to 11.7] p-value= 0.59), or RASS (Coefficient= 15.1 [95% CI -15.4 to 45.6] p-value=0.33). However, decreased activity was correlated with older age (Coefficient= -1.7 [95% CI -2.8 to -0.6] p-value=0.003), male gender (Coefficient= 23.9 [95% CI 0.1 to 47.8] p-value=0.049), and increased preexisting comorbidities as measured by the Charlson Comorbidity Index (Coefficient= -11.7 [95% CI -18.5 to -4.8] p-value= 0.001).

Conclusion: These results indicate that with our limited sample size we were unable to identify an association between daytime physical activity and mental status as assessed through RASS, digit span, and CAM but decreased activity was correlated with older, sicker, male patients. Future studies will need to continue to investigate the role of physical activity in the assessment of mental status with more accurate measures and large sample size.

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Rapid Response Team Characteristics in U.S. Academic Hospitals

Michael Kang

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**Co-author(s):** Matthew Churpek, MD, PhD, MPH; Kathryn O'Shaughnessy; Ashley Snyder, MPH; Ken Taylor

**Background:** Many patients who experience an adverse outcome on the hospital wards exhibit abnormal vital signs hours to days before the event. US hospitals have implemented Rapid Response Teams (RRTs) in an attempt to provide early intervention. However, little is known about their characteristics across different hospitals and the association between those characteristics and patient outcomes. We sought to characterize rapid response teams across academic hospitals in the U.S.

**Methods:** We conducted an observational cross-sectional survey of Vizient hospital members. A 20-item electronic questionnaire was emailed to organizational quality leaders on November 23, 2015 and kept open until February 5, 2016. Respondents were asked about the average number of adult ward cardiac arrests and rapid response calls in their hospitals per month, as well as additional information regarding the composition and protocol of their RRT.

**Results:** Among 160 hospitals, completed surveys were received from 49 (31%), with a mean of 24,227 (SD 10,996) annual admissions and a median length of stay of 5.7 (IQR 5.16 – 6.12) days. Responders reported a median of 31.1 (IQR 19.3 – 82.4) rapid response calls per 1000 admissions. Just under half (49%) had dedicated personnel without other clinical responsibilities and 53% reported doing proactive rounding as a component of their system. Over 90% of the hospitals had a critical care nurse as a mandatory member of the team and 47% were led by a physician or nurse practitioner. Nearly half of responding hospitals (49%) reported use of an early warning score and 16% reported computer-automated activation of the team. Seventy-six percent of hospitals allowed patient or family activation of their RRT. In addition to traditional medical-surgical ward locations, RRTs were deployed to ambulatory areas in 61%, non-clinical areas in 55%, intensive care units in 29% and emergency departments in 20%. The unadjusted mortality rate for the hospitals was 0.023 (SD 0.008), with a reported adult ward cardiac arrest rate of 1.97 (IQR 1.00 – 3.98) per 1000 adult admissions and 4.46 (IQR 2.46 – 7.21) per 10,000 adult ward bed-days. Hospitals with a below average mortality index (mortality adjusted for illness severity) had employed a median of 5 quality measures, while those with an above average mortality index had a median of 4 quality measures after outlier hospitals were removed. No other significant association was found between individual RRT quality characteristics and cardiac arrests rate or adjusted hospital mortality.

**Conclusion:** There is wide variation in RRT characteristics and outcomes. A larger sample size is required to determine if there are further associations between the two.

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Total Body Photography & Dermoscopy: Patient Risk Criteria and Procedure Utilization

Sasank Konda

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Co-author(s): Arlene Ruiz de Luzuriaga MD, MPH

Background: Total body photography (TBP) and dermoscopy -- also known as ‘mole mapping’ -- is a well-established procedure in which the entire skin surface is digitally photographed at set time intervals, with particularly suspicious lesions examined under a type of specialized microscopy. The primary goal of the technique is the detection of malignant cutaneous melanomas at the earliest possible stage with the secondary aim of reducing unnecessary biopsies. Although the practice of TBP and dermoscopy continues to rise in significance, data on the patient population utilizing these services in actual clinical practice is profoundly lacking in the literature. An array of factors including physician discretion in making individual referrals and unpredictable insurance coverage of the procedure may result in substantial discrepancies between target and actual populations.

Methods: The primary objective was to determine the risk criteria most commonly indicated by providers when referring patients for mole mapping. The secondary objective was to determine whether any significant differences in risk criteria could be identified between patients that were approved versus denied for the procedure by health insurance providers. All patients who underwent a prior authorization for TBP and dermoscopy at The University of Chicago between January 1, 2014 and March 31, 2017 were screened via retrospective chart review in order to parse the risk criteria cited by physicians as justification for referrals. In addition, the health insurance provider and whether the procedure was approved or denied was recorded.

Results: A total of 51 patients were referred for TBP and dermoscopy during the specified time period; of these, 23 received approval from health insurance providers and 28 were denied. Collectively, physicians referred patients with the following risk criteria at the following frequencies: multiple melanocytic nevi (94%; 48/51), history of biopsy-proven atypical nevi (65%; 33/51), history of blistering sunburns (43%; 22/51), Fitzpatrick Skin Type I or II (41%; 21/51), family history of melanoma (29%; 15/51), personal history of melanoma (27%; 14/51), clinically atypical nevi (24%; 12/51), history of tanning bed usage (24%; 12/51), family history of non-melanoma skin cancer (14%; 7/51), predisposing condition (10%; 5/51), personal history of non-melanoma skin cancer (8%; 4/51), and chronic sun exposure (8%; 4/51).

Conclusions: Patients referred for mole mapping almost universally had numerous melanocytic nevi that could not realistically be monitored without TBP and dermoscopy. In addition, physicians appear to be more inclined to recommend mole mapping if patients have a history of a previous biopsy-proven atypical nevus, past blistering sunburns, or are Fitzpatrick skin type I or II (pale white skin or fair skin). No single risk criteria reliably predicted whether insurance providers would approve or deny the procedure for a given patient.

Acknowledgements/Disclosures: The University of Chicago Calvin Fentress Fellowship Recipient
Joys and Tribulations of a Third-Year Medical Student: N of 1 Trial

Richard Newcomb

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**Co-author(s):** David Newcomb, MS; Vineet Arora, MD, MAPP

**Background:** Research has demonstrated the third year of medical school is associated with a concerning loss of empathy. The increased incidence of depression, suicidal ideation, and burnout among medical trainees have made wellness curriculum development a top priority for medical schools. However, the impact of individual third-year clerkships on student wellness is not well described. This N of 1 Trial aims to determine association between individual clerkships and self-rated wellness and to find physical, emotional, and structural factors associated with a good clerkship day.

**Methods:** This was a prospective N of 1 trial to determine the impact of third year clerkships on self-rated student wellness. The research subject was a third-year medical student at an academic medical center in the Midwest United States. Authors collected fitness and sleep data from FitBit® device and self-reported data from Reporter, a smartphone survey application. Sentiment analysis using the National Resource Council (NRC) Emotion Lexicon was performed on free text responses to map words to ten sentiments: positive, negative, joy, anticipation, trust, surprise, fear, anger, sadness, and disgust. The primary outcome of interest was self-daily rating. Covariates included daily weather, eagerness to begin the day, tiredness in the morning and evening, work day status, meaningful event(s), exercise, reading, daily steps, distance walked, hours of sleep, and daily positivity and negativity scores. Simple linear regression identified significant univariate associations for inclusion in multivariate analysis. To account for auto-correlation, an Autoregressive Integrated Moving Average (ARIMA) model was used for final multivariate analyses.

**Results:** One medical student tracked self-data for 243 days across 5 clerkships during his third year of medical school. Median self-daily rating was 7 [6-8]. Self-daily rating did not vary significantly among clerkships. Surgery, Medicine, and Neurology were associated with increased work hours, increased step counts, decreased sleep, and increased morning tiredness. Anticipation, joy, and trust were the most commonly expressed sentiments across all clerkships. In multivariate analysis, meaningfulness of the day, high daily activity (greater than 12,500 steps), and the second half of a clerkship were positively associated with self-daily rating, while workdays, insufficient sleep (less than 5.5 hours), and use of negative words in daily reflection were negatively associated with self-daily rating.

**Conclusion:** The clerkship year was an overall positive experience for the medical student. Individual clerkships were not associated with self-reported daily rating. However, inpatient-heavy rotations were associated with differences in work hours, sleep, and physical activity, and variation in sleep and physical activity were significant features of the final wellness model. The multivariate wellness model offers trainees and training programs six simple features to track in wellness curricula. Emotional reflection produced the strongest model features and can be useful for trainees to parse out positive and negative aspects of each day. Larger prospective studies are needed to externally validate the wellness model and demonstrate generalizability of results.

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Contraceptive Counseling and Shared Decision Making: Knowledge and Attitudes amongst Internal Medicine Residents and Faculty

Rebeca Ortiz Worthington

Mentor: Jennifer Rusiecki, MD; Department of Medicine, Section of General Internal Medicine

Co-author(s): Julie Oyler, MD; Amber Pincavage, MD; Jennifer Rusiecki, MD

Background: Internal Medicine (IM) and Medicine/Pediatrics (Med/Peds) physicians are responsible for providing primary care to women of reproductive age, yet there is little research evaluating their contraception knowledge, counseling, and prescribing practices. In academic institutions many patients have complex medical conditions that may require teratogenic medications and it is crucial that PCPs be able to perform contraception counseling. Long-acting reversible contraceptives (LARCs) are highly efficacious, have lower failure rates than combined hormonal contraceptives, and few contraindications. Counseling is an important element of helping women make decisions regarding effective methods of contraception, and shared decision-making promotes adherence. Despite this, past research has shown that PCPs do not commonly prescribe contraception or initiate counseling. This study is an element of a larger QI initiative to assess contraception counseling and prescribing practices amongst the IM and Med/Peds residents and PCG faculty at the University of Chicago. Our goal is to assess residents' knowledge of and attitudes towards contraception methods and shared decision-making, and to utilize the results to create an educational development curriculum.

Methods: Cross-sectional surveys were created and administered to University of Chicago IM and Med/Peds residents. The survey was designed after extensive review of the literature on shared decision-making, contraception counseling and resident education in contraception. A panel of women's health and medical education experts at the Universities of Chicago and Pittsburgh vetted this survey, and it was piloted with one of the IM chief residents. Paper surveys were distributed to residents at educational conferences. Data analyses were performed using Excel 2011.

Results: A total of 38 residents from PGY1-3 completed the survey, of which 66% were female. On a Likert scale from 1 to 5, residents reported a median comfort level of 3 (IQR [2-3]) for prescribing contraception, discussing side effects, and efficacy. Residents report the following barriers to contraception counseling: lack of adequate training (37%), lack of time (66%), overwhelmed by the options (32%). 100% of residents recognize the Mirena IUD and tubal ligation as highly effective forms of contraception. 73% incorrectly related Nexplanon as the third-most efficacious form in a list of 5. Roughly half of respondents correctly identified: bleeding as a side-effect of Nexplanon (54%), risk of stroke in patients with migraine with aura on COCPs (58%), and IUDs as safe to place in patients with history of PID (59%). Residents correctly identified isotretinoin (97%), warfarin (87%), and enalapril (84%) as teratogens, but few recognized atorvastatin (11%). 95% of residents correctly identified a scenario describing an element of shared decision making.

Conclusion: Residents value shared decision-making and contraception counseling. However, they report lack of knowledge as a barrier to performing contraception counseling, and low contraception knowledge scores reflect this. LARCs received the lowest comfort scores by residents, and they under-recognized the efficacy of the hormonal implant. Residents demonstrated difficulty identifying teratogens and contraception side-effects. Based on these results, LARCs and teratogens are concepts that we will emphasize in the curriculum we develop. Residents are overwhelmingly able to identify an appropriate shared decision making clinical situation.

Acknowledgements/Disclosures: None
Standardization of Disposable Instruments in Microvascular Breast Reconstruction: A Case Study in Cost Reduction

Brady Still

**Mentor:** Alexander Langerman, MD; Department of Surgery, Vanderbilt University

**Co-author(s):** Laura Christianson, BA; Julie M. Mhlaba, MD; Ian O’Malley, MS; David Song, MD, MBA; Alexander Langerman, MD, SM

**Background:** A key avoidable expense in the surgical setting is the wastage of disposable surgical items, which are discarded after cases even if they go unused. A major contributor to wastage of these items is the inaccuracy of surgeon preference cards, which are rarely examined or updated. The authors report the application of a novel technique called cost heatmapping to facilitate standardization of preference cards for microvascular breast reconstruction.

**Methods:** Preference card data was obtained for all surgeons performing microvascular breast reconstruction at the authors’ institution. These data were visualized using the heatmap.2 function in the gplot package for R. The resulting cost heatmaps were shown to all surgeons performing microvascular breast reconstruction at our institution; each surgeon was asked to classify the items on the heatmap as “always needed,” “sometimes needed,” or “never needed.” This feedback was used to generate a lean standardized preference card for all surgeons. This card was validated by all surgeons performing the case and by nursing leadership familiar with the supply needs of microvascular breast reconstruction prior to implementation. Cost savings associated with implementation were calculated.

**Results:** Implementation of the preference card changes will lead to an estimated per annum savings of $17,981.20 and a per annum reduction in individual items listed on preference cards of 1,693 items.

**Conclusion:** Cost heatmapping is a powerful tool for increasing surgeon awareness of cost and for facilitating comparison and standardization of surgeon preference cards.

**Acknowledgements/Disclosures:** University of Chicago Medicine Innovation Award grant
Scientific Investigation in Basic Sciences
Activation of Bacteroides Fragilis Toxin by a Novel Bacterial Protease Contributes to Anaerobic Sepsis

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Co-author(s): Julien Herrou, PhD; Aaron Hecht, PhD; Wei Ping Teoh, PhD; Sean Crosson, PhD; Jerrold Turner, MD, PhD

Background: Bacteroides fragilis is the leading cause of anaerobic bacteremia and sepsis. Enterotoxigenic strains producing B. fragilis toxin (BFT, fragilysin) contribute to colitis and intestinal malignancy, yet are also isolated in bloodstream infection. It is not known whether these strains harbor unique genetic determinants that confer virulence in extra-intestinal disease.

Methods: Genetic manipulation of bacterial strains, generation and testing of purified recombinant protein, protein crystallography, and animal modeling were used to define the role of BFT in sepsis and to identify and characterize fragipain (Fpn), a protease required for BFT activation.

Results: We demonstrate that BFT contributes to sepsis and identify a B. fragilis protease, Fpn, which is required for endogenous activation of BFT through removal of its auto-inhibitory prodomain. Structural analysis of Fpn reveals a His-Cys catalytic dyad characteristic of C11 family cysteine proteases that are conserved in multiple pathogenic Bacteroides spp and Clostridium spp. Fpn-deficient enterotoxigenic B. fragilis is attenuated in its ability to induce sepsis, however Fpn is dispensable in B. fragilis colitis wherein host proteases mediate BFT activation.

Conclusion: Our findings define a role for B. fragilis enterotoxin and its activating protease in the pathogenesis of bloodstream infection, indicating a greater complexity of cellular targeting and action of BFT than previously appreciated. The expression of fpn by both toxigenic and non-toxigenic strains suggests this protease may contribute to anaerobic sepsis beyond its role in toxin activation, potentially serving as a target for disease modification.

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Morphine Promotes Colonization of Anastomotic Tissues with Collagenase-Producing Enterococcus Faecalis and is Associated with Impaired Anastomotic Healing

James Luo

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**Co-author(s):** Baddr Shakhsheer; Sanjiv Hyoju; Luke Versten; Kristina Guyton; Natalia Belogortseva; Sara Gaines; Olga Zaborina, PhD; John Alverdy, MD

**Background:** The safety and efficacy of gastrointestinal surgeries have improved dramatically over the past half century. However, despite the emergence of new techniques, technologies, medications, and recovery pathways, anastomotic leak still represent a clear and present danger. Emerging evidence suggests that the intestinal microbiome may play a key and causative role in the pathogenesis of leak. Our laboratory has previously described a bacterial “leak phenotype” characterized by high collagenase production. However, the detailed regulation and mechanism underlying this phenotype remains under-elucidated.

**Methods:** We hypothesized that the commonly used analgesic morphine promotes tissue colonization of Enterococcus faecalis, a gut bacteria capable of expressing the “leak phenotype,” and cause anastomotic leak. Rats were given slow-released morphine or placebo following a lower colonic resection followed by primary anastomosis. They were observed for six days and sacrificed on postoperative day 6. The anastomoses were visually inspected for signs of leakage, and the anastomotic tissues were harvested. Microbial analyses, including 16S sequencing, in vitro collagenase and adherence assays were then performed.

**Results:** When compared with placebo-treated rats, morphine-treated rats exhibited significantly more impaired anastomotic healing. Treated rats also demonstrated gross leaks that correlated with the presence of high-collagenase-producing E. faecalis that were adherent to the anastomotic tissues. To more completely elucidate the role of morphine as well as the “leak phenotype,” various isolated of E. faecalis from rat anastomotic tissue were incubated with morphine. In vitro morphine incubation is associated with increased tissue adhesion and collagenase production in four E. faecalis isolates.

**Conclusion:** Our results herein reaffirmed our previous findings that intestinal bacterial displaying the “leak phenotype” play an important and causative role in anastomotic leak. They further show that a commonly used postoperative analgesic, morphine, is associated with impaired anastomotic leak in our animal model. The in vitro experiments suggest that morphine’s role in anastomotic leak may involve a direct phenotypic interaction with the microflora; however, further work will be needed before morphine’s precise role can be fully elucidated. Taken together, these results provide a mechanistic rationale for the use of enhanced recovery after surgery pathways that advocate the decrease of morphine usage in gastrointestinal surgery.

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A Thymic Precursor to TCRαβ⁺ CD4⁻ CD8β⁻ Intestinal Intraepithelial Lymphocytes

Benjamin McDonald, PhD

Mentor: Albert Bendelac, MD, PhD; Department of Pathology

Co-author(s): Jeffrey Bunker; Isabel Ishizuka; Bana Jabri, MD, PhD

Background: Conventional CD4 or CD8αβ T cell receptor αβ (TCRαβ) cells develop in the thymus and circulate through the blood and lymphatics in search of signs of infection. They acquire the ability to migrate to tissues—usually the initial site of an infection—such as the skin and intestine only after they have been activated. In contrast, there are several populations of T cells including NKT cells, TCRγδ cells, and TCRαβ CD8αα intestinal intraepithelial lymphocytes (unconventional iIEL)—together referred to as innate-like T cells—that are endowed with the ability to traffic directly to tissues based on their unique development. Our knowledge of the developmental pathways and specificities of innate-like T cells has lagged behind our understanding of conventional T cell biology. In particular, the literature regarding unconventional iIEL was fraught with indirect, and frequently contradictory, experiments. Importantly, better understanding of unconventional iIEL biology may lead to further advances in the study of diseases in which iIEL are implicated including celiac disease.

Methods: Based on the overarching hypothesis that TCR specificity drives developing thymocytes into a particular T cell lineage, we generated two cohorts of TCR transgenic mice with TCR cloned from either unconventional iIEL or conventional T cell populations. We compared the phenotype of thymocytes and peripheral T cells between the two cohorts of mice. Further, using mice deficient in MHC class I, MHC class II, or both MHC classes I and II, we identified the selecting ligand for several unconventional iIEL TCR.

Results: We identified immature CD4ᵈᵘˡˡ CD8ᵈᵘˡˡ (DPᵈᵘˡˡ) CD6⁹ʰⁱᵍʰ PD-1ʰⁱᵍʰ thymocytes as the earliest post-selection precursors for unconventional iIEL. Although these precursors displayed multiple signs of elevated TCR signaling, including high levels of the apoptosis mediator Bim, a sizeable fraction of them escaped deletion to selectively engage into unconventional iIEL differentiation. Conversely, we found that all TCR cloned from DPᵈᵘˡˡ CD6⁹ʰⁱᵍʰ PD-1ʰⁱᵍʰ thymocytes, a population enriched in autoreactive thymocytes that accumulate in apoptosis-deficient (Bim⁻/⁻ or Bcl-xL transgenic) mice, consistently and selectively gave rise to unconventional iIEL upon transgenic expression.

Conclusion: Our results identified the signaled unconventional iIEL precursor and demonstrated its overlap with the DPᵈᵘˡˡ population undergoing negative selection for both MHC class I and class II-autoreactive cells. More generally, our study revealed that, concomitant with the downregulation of both CD4 and CD8 coreceptors induced by agonist self ligands, a close balance between apoptosis and survival signals results in alternative outcomes as divergent as clonal deletion vs. clonal diversion to the unconventional iIEL lineage.

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Expression of Dominant-Negative Mutants of the Insulin-Like Growth Factor 1 Receptor Reduces Tumorigenic Phenotypes of an Osteosarcoma Cell Line in Vitro and in Vivo

Maryam Mohammed

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**Co-author(s):** Zhan Liao, MD, PhD; Hue Luu, MD; Rex Haydon, MD, PhD; Tong-Chuan He, MD, PhD

**Background:** Human osteosarcoma (hOS) is the most common primary skeletal malignancy with an overall 5-year survival rate of 50-70% that is limited by resistance to conventional treatment. Pathologic insulin-like growth factor 1 (IGF-1) signaling has been associated with development and chemoresistance of OS. Experimental methods of targeting IGF-1 signaling, including human monoclonal antibodies against the IGF-1 receptor (IGF-1R) and small molecule inhibitors of IGF-1R, have had limited clinical success and have been associated with a myriad of side effects.

**Methods:** Dominant negative mutants were constructed from the IGF-binding domain of the extracellular α subunit (sa-IGF1R), soluble β subunit (sb-IGF1R), and membrane-bound β subunit (mb-IGF1R) of IGF-1R, then cloned and packaged into recombinant adenoviruses. Viral constructs were shown to express the mutants by Western blot and qPCR and shown to transduce 143B (metastatic hOS) cells with high efficiency. Effects on cell proliferation were tested using crystal violet cell viability assay. 143B cells were plated at 30% confluency in serum-containing (10% fetal bovine serum, FBS) or serum-free Dulbecco’s Modified Eagle Medium (DMEM) with IGF-1 (5 ng/mL) and transduced with control RFP or mutant IGF1R. Cells were stained and absorbance (570 nm) was measured at 48, 72, and 96 hrs. Cell migration was assessed using a standard wound-healing assay under IGF-1 stimulation (5 ng/mL). Bright-field images of gap closure were obtained at 12-hour intervals. Quantitative cell cycle analysis was completed using flow cytometry. 143B cells infected with IGF1R mutants or RFP were seeded in 96-well plates (7.5×10^4 cells/well) under IGF-1 stimulation (5 ng/mL). Following 48 hours of growth, cells were stained with propidium iodide. Cells in early and late apoptosis were sorted using propidium iodine and annexin V. To test in vivo anti-tumor activity, 143B cells transduced with IGF1R mutants and control RFP were injected intramuscularly (IM) or subcutaneously (SQ) into 6-wk old male athymic nude mice (5 mice/group). Tumor size was measured every three days using bioluminescent imaging (Xenogen IVIS 200). D-Luciferin sodium salt was given by intraperitoneal injection. Tumor size, volume, and doubling rate were calculated using Xenogen software.

**Results:** IGF-1-stimulated cell proliferation was effectively inhibited by dominant-negative mutants as shown by crystal violet cell viability assay (p<0.05 for all mutants). Differences in anti-proliferative activity between mutants were not statistically significant. Results of cell migration assay showed decreased cell migration with all mutants (Fig. 1A). In quantitative cell cycle analysis, IGF-1R mutants reduced the percentage of cells entering S/G2 phases upon IGF-1 stimulation. In vivo anti-tumor activity of mutants was assessed by injecting 143B cells transduced with mutant IGF1R intramuscularly (IM) and subcutaneously (SQ) into athymic nude mice. All mutants inhibited subcutaneous tumor growth and to a lesser extent, intramuscular growth. Xenogen imaging showed persistence of this effect 2 weeks post-injection. Histologic examination demonstrated significant necrosis and reduced proliferation among the mutant IGF1R-transduced 143B cells.

**Conclusion:** Thus far, our work shows that dn-IGF1R inhibit tumorigenic phenotypes in 143B human OS cells in vitro and in vivo and suggest that dn-IGF1R inhibit activation of downstream targets of IGF-1R signaling.

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ZO-1 Interactions with Occludin Direct Single Lumen Specification in 3D Culture

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**Co-author(s):** Wangsun Choi, PhD; Aaron Buckley; Nitesh Shashikanth, PhD; Nora Joseph, MD; Yitang Wang; Michael Warren; Mary Buschmann, PhD; Roman Pavlyuk, PhD; Jeffrey Hildebrand, PhD; Ben Margolis, MD; Alan Fanning, PhD; Jerrold Turner, MD, PhD

**Background:** Tight junction assembly is crucial to epithelial polarization, but the contribution of specific tight junction proteins to epithelial lumen formation is undefined.

**Methods:** We assessed morphometry of three-dimensional (3D) cultures of wild type (WT) MDCK cells and cells lacking the tight junction scaffolding protein ZO-1 (ZO-1KD) using immunofluorescence and live cell imaging. ZO-1 deletion mutants lacking the ABR and U5-GuK domains were expressed in ZO-1KD cells, and 3D growth was compared to WT and ZO-1KD cysts. Finally, we generated MDCK cells lacking Shroom2, occludin, and alpha-catenin to test a role for U5-GuK binding partners in 3D morphogenesis.

**Results:** Epithelia lacking ZO-1 are defective in the earliest phases of polarization and form cysts with multiple lumens. Expression of ZO-1 domain-deletion mutants demonstrated that the U5-GuK region is crucial to single lumen development. Analysis of the U5-GuK binding partners showed that only occludin deletion led to multi-lumen cysts. Like ZO-1-deficiency, occludin deletion led to mitotic spindle orientation defects. Single lumen formation required the occludin OCEL domain, which binds to ZO-1.

**Conclusion:** We conclude that ZO-1–occludin interactions regulate multiple phases of epithelial polarization by providing cell-intrinsic signals that are required for single lumen formation.

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The Effect of Polyunsaturated Fatty Acids and Natural Products on ADAM17 Localization and Activity in Relation to Colonic Tumorigenesis

Brian Schlick

Mentor: Marc Bissonnette, MD; Department of Medicine, Section of Gastroenterology

Co-author(s): Reba Mustafi, PhD; Marc Bissonnette, MD

Background: Dietary N-6 polyunsaturated fatty acids (PUFAs) exert pro-inflammatory effects in the gut, whereas N-3 PUFAs play inhibitory roles in gastrointestinal inflammatory processes. ADAM17 is localized to membrane lipid rafts and acts as a metalloproteinase that cleaves many membrane bound proteins releasing their ectodomains, including amphiregulin (AREG) that is involved in inflammation and up-regulated in colorectal cancer (CRC). It is unknown whether there is a link between N-3 or N-6 fatty acids and ADAM17 activation and localization. In addition to PUFAs, gelastatin – endogenously produced by fungi – inhibits ADAM17. The discovery of natural products in human diets with ADAM17 inhibitory activity may open new pathways to decrease the incidence of colorectal inflammation and subsequently CRC through their use as chemopreventative dietary additives.

Methods: For the PUFAs studies, AREG cDNA was inserted into alkaline phosphatase cDNA on a pRc/CMV vector transfected into HT-29 colon cancer cells. These cells were then incubated with either DHA (N-3 PUFA) or linoleic acid (LA, N-6 PUFA) to determine the effect of PUFA exposure on ADAM17 activity following PMA stimulation – an ADAM17 inducer. Centrifugation of a sucrose density gradient was used to isolate lipid rafts from cells incubated in either BSA or DHA to determine ADAM17 localization. To study the effect of natural products on ADAM17, a FLAG-tag was inserted in frame 5’ to a nuclear localization signal (NLS) in AREG. This construct was inserted into a lentiviral vector, which will transform HT-29 cells to express this tagged AREG, permitting high-throughput screening of natural products to test their ADAM17 inhibitory ability.

Results: Incubation of HT-29 cells with LA and subsequent stimulation with PMA was found to significantly upregulate the degree of both shed AREG and AREG present in the cell lysate after 72 hours. These changes were not observed after either 24 or 48 hours. In contrast, DHA pre-treatment for 72 hrs down-regulated ADAM17 in cell lysates and in lipid rafts. We compared PMA inducible ADAM17 activity in cells transfected with vectors that were labeled on either 5’, 3’, or both ends of the NLS of AREG. We found a two-fold increase in PMA inducible AREG in cells transfected with 5’ tagging. Initial transfectants lost inducible shedding of AREG. We are developing a reporter cell for ADAM17 activity using HT-29 cells infected with Lentivirus carrying 5’-labeled AREG.

Conclusion: DHA, but not LA, decreased ADAM17-induced AREG shedding and down-regulated ADAM17 in lipid rafts. DHA’s ability to sequester ADAM17 may explain its effects on AREG release. These data provide mechanistic understanding for the observed decreased incidence of CRC in carcinogen treated mice fed a diet rich in N-3 PUFAs versus western diet. With regards to high-throughput screening of natural substances for ADAM17 inhibitory activity, a functional vector has been created that will be used to prepare a reporter cell line to measure ADAM17 activity in a high throughput format using lentiviral transfected HT-29 cells.

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Signaling through FcRγ-Associated Receptors on Dendritic Cells Drives IL-33–Dependent Th2-Type Responses

Melissa Tjota, PhD

**Mentor:** Anne Sperling, PhD; Department of Medicine, Section of Pulmonary/Critical Care

**Co-author(s):** Jesse Williams, PhD; Cara Hrusch, PhD; Nora Barrett, MD; Kelly Blaine, MS

**Background:** Although allergic sensitization can be generated against various allergens, it is unknown how such a diversity of antigens is able to promote Th2-mediated inflammation leading to atopy. Our previous studies demonstrated that allergen-specific IgG immune complexes (ICs) and house dust mite (HDM) extract both induced dendritic cells (DCs) to drive Th2-mediated inflammation, but the mechanism by which these diverse stimuli produce similar responses is unknown. We sought to identify the DC signaling pathways used by Th2 stimuli to promote allergic airway inflammation.

**Methods:** C57BL/6, FcγRIII−/−, FcRγ−/−, and ST2−/− mice were sensitized and challenged with HDM, and inflammation was assessed based on flow cytometry, histology, and cytokine production. Bone marrow–derived DCs from these strains were used in signaling and adoptive transfer experiments.

**Results:** Our findings indicate that two distinct Th2 stimuli, ICs and HDM, use the FcRγ-associated receptors FcγRIII and Dectin-2, respectively, to promote Th2-mediated lung inflammation. In this study we demonstrate that both ICs and HDM induce DCs to express IL-33, a critical mediator in asthma pathogenesis. Upregulation of IL-33 in DCs is dependent on FcRγ, Toll-like receptor 4, and phosphoinositide 3-kinase signaling. Exogenous IL-33 is sufficient to restore the development of Th2 responses in FcRγ-deficient mice. Finally, adoptive transfer of allergen-pulsed FcRγ+/− bone-marrow derived DCs restores the development of Th2-type inflammation in FcRγ-deficient mice, demonstrating the necessity of this signaling pathway in DCs for allergen-induced inflammation.

**Conclusion:** These data identify a mechanism whereby distinct Th2 stimuli signal through FcRγ-associated receptors on DCs to upregulate IL-33 production and induce Th2-mediated allergic airway inflammation.

**Acknowledgements/Disclosures:** Medical Scientist Training Program (MSTP)/Interdisciplinary
Enhancing the Cytokine Production Capacity of Natural Killer Cells through the Novel NK Receptor, CD160

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Mentor: Yang-Xin Fu, MD, PhD; Department of Pathology

Co-author(s): Nicholas Brown, PhD; Kyung-Mi Lee, PhD; Yang-Xin Fu, MD, PhD

Background: The natural killer (NK) cell is a critical component of the immune system that serves as an early responder to multiple threats, including cancer and infection. NK cells have long been known for their ability to kill targeted cells, and as such, have been utilized in many experimental cancer therapies. Because NK cells are early responders that respond with exquisite sensitivity to cytokine signals, we became interested in whether NK cells create cytokines themselves. While it is known that NK cells do produce cytokines, which types of cytokines, where they come from, and how they are regulated all remain unclear.

Methods: In this project, we investigated a novel NK surface protein, CD160, which is highly expressed on the most cytotoxic fraction of NK cells. And as not all NK cells are created equal, we approached CD160 from the perspective of cytotoxicity. We generated CD160-deficient (CD160-KO) mice, as well as engineered CD160-recombinant proteins to demonstrate necessity and sufficiency. We began with a broad hypothesis that CD160 was critical for NK cytotoxic function based on its expression only on the most lethal of NK cells.

Results: Interestingly, while CD160-KO mice had completely normal gross immune development, despite having completely normal CBCs including NK cell counts, these mice could not control NK-sensitive tumors such as mouse mammary tumors. Surprisingly, the NK cytotoxic functions were completely intact, but the proinflammatory cytokine, interferon-gamma (IFNg), was significantly impaired in CD160-KO mice. Furthermore, when we specifically targeted CD160 in wildtype mice using CD160 monoclonal antibodies, we also saw similar impairment in IFN-g production corresponding to impaired tumor control. Furthermore, we performed reciprocal bone marrow transfer between CD160-KO and wildtype mouse, and found an intrinsic role of CD160 on NK-IFNg production. Finally, we demonstrated sufficiency by repleting CD160-KO mice with recombinant CD160 protein and restored tumor control and IFNg production. In our experimental mammary tumor model, we were able to treat late-stage metastatic disease by transferring CD160+ NK cells intratumorally.

Conclusion: This study demonstrates that the surface protein CD160 plays a mission critical role on NK cells through regulating IFNg production.

Acknowledgements/Disclosures: Medical Scientist Training Program (MSTP).
Generation and Characterization of an IL13Rα2-Tropic Modified Adenovirus for the Personalized Treatment of Glioblastoma

Jacob Young

Mentor: Maciej Lesniak, MD; Department of Neurological Surgery, Northwestern University

Co-author(s): Julius Kim, PhD; Irina Balyasnikova, PhD; Maciej Lesniak, MD, MCHM

Background: Glioblastoma (GBM) is the most common malignant brain cancer in adults and carries a poor prognosis. Some GBM patients have cells that aberrantly express IL13Rα2 on their cell surface, a protein not found on normal neural tissues. More importantly, IL13Rα2 expression is associated with a particularly aggressive tumor phenotype. Therapeutic agents like oncolytic virotherapy and immunotherapy have shown preclinical promise, but the translational potential of these biological treatment modalities can be improved by targeting this cancer specific marker to enhance their tumor specificity and limit off-target side-effects.

Methods: The cDNA of a single-chain monoclonal antibody specific for IL13Rα2 (called scFv47) was inserted at the C-terminal of fiber fibrin by using standard molecular technique, to generate a modified fiber shuttle vector. With this fiber shuttle vector, recombinant HAd5 backbones containing green fluorescence protein (GFP) under the control of the CMV promoter in the place of the deleted E1 region (i.e., replication incompetent), named Ad5scFv47FF-CMV-GFP, were generated. After generating Ad5scFv47FF-CMV-GFP, infectivity analyses were performed on glioma cells. The cells were infected with Ad5FFscFv47-CMV-GFP at a multiplication of infection (MOI) of 300 vp/cell. Flow cytometry analysis was performed to check for GFP expression as a marker for viral infection. In vivo experiments were performed in male athymic mice that had been implanted intracranially with a glioma xenograft of IL13Rα2+ U251MG or IL13Rα2.KDU251MG cells tumors via a burr hole and stereotactic injection. Ten days later, mice were injected using the same coordinates with 10^9 viral particles of Ad5FFscFv47-CMV-GFP and sacrificed 3 days later. Flash frozen brain tumor tissues were fixed and stained to visualize with a confocal microscope the human glioma cells. To analyze infection of glioma cells with Ad5FFscFv47-CMV-GFP, transgene GFP expression was revealed using the anti-GFP antibody.

Results: Ad5scFv47FF tropism was redirected away the primary wild-type adenoviral receptor, coxsackievirus and adenovirus receptor (CAR), and the novel adenovirus successfully infected glioma cell lines that express IL13Rα2. Viral infectivity was proportional to the level of target expression. Furthermore, using either an IL13Rα2 knockdown cell line or an anti-IL13Rα2 mAb abolishes Ad5scFv47FF infectivity. Moreover, when a human glioma cell line, U87, was cultured as neurospheres to mimic a stem-like state, the expression of IL13Rα2 actually increased, as did the Ad5scFv47FF infection in U87 neurospheres compared to infection in adherent U87 cells. Finally, in vivo, Ad5scFv47FF infects IL13Rα2+ U87 cells, but does not infect IL13Rα2 knockdown U87 cells or off-target normal brain tissue in a murine glioma model.

Conclusion: Our results validate Ad5-scFv47FF as a novel adenovirus that specifically targets IL13Rα2 expressing glioma cells and stem-like glioma cells in vitro and in vivo and justify further development of scFv47-modified therapeutics for the treatment of IL13Rα2-expressing gliomas and other malignancies.

Acknowledgements/Disclosures: This project has been published: Kim, JW, Young, JS, Solomaha, E, Kanojia, D, Lesniak, MS, Balyasnikova, IV. (2015). A novel single-chain antibody redirects adenovirus to IL13Rα2-expressing brain tumors. Scientific Reports. 5:18133. PMID: 26656559. Neurosurgery Research and Education Foundation Medical Student Summer Research Fellowship (from the American Association of Neurological Surgeons.)
Scientific Investigation in Clinical Research or Social Sciences
Predictors of Positive Findings in Patients Undergoing CT Angiography for Lower Gastrointestinal Bleeding

Jad AbiMansour

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Background: CT angiography (CTA) is a rapid and effective diagnostic tool in patients with lower gastrointestinal bleeding (LGIB). However, there is limited data to guide which patients undergoing CTA have positive findings leading to subsequent angiographic interventions. Our aims were to determine which variables predict positive CTA studies and to determine whether clinical outcomes were altered based on the results of the CTA.

Methods: We retrospectively identified 137 patients undergoing CTA for LGIB using a validated machine learning algorithm which identified patients hospitalized with LGIB at a single-center, tertiary care center. Of these, 94 patients underwent CTA due to suspected LGIB at initial presentation. Chart review was used to determine admission labs, vital signs, and CTA findings of active extravasation. Traditional angiography reports were reviewed for presence of extravasation and performance of embolization. Length of stay (LOS), ICU care, need for transfusion, units transfused, surgical intervention, in-hospital mortality, and 30-day mortality were evaluated as clinical outcomes.

Results: Out of the 94 patients who received CTA for LGIB, 24 (25.5%) had positive findings. Those with successful localization underwent CTA earlier in admission (40.2 hours vs 71.8 hours, P = .02). There was no difference in presenting vital signs, laboratory values, or comorbidities among patients with positive and negative CTA findings. Those successfully localized were more likely to undergo angiography within 72 hours of CTA (58.3% vs 8.6%, P = <.0001). Embolization rates were slightly higher in those who underwent angiography after positive finding on CTA (64.3% vs 16.7%, P = 0.14). While the localized group was more likely to have received ICU care during admission (79.2% vs 51.4%, P = 0.03), no significant difference in length of stay (11.0 days vs 10.0 days, P = 0.73), transfusion requirement (54.2% vs 58.6%, P=0.70), units transfused (5.6 units vs 4.3 units, P = 0.60), surgical intervention (4.2% vs 5.7%, P = 0.99), or 30-day mortality (16.7% vs 11.4%, P = 0.52) was seen.

Conclusion: CTA early in admission was associated with successful localization. No additional clinical variables were associated with positive finding on CTA. Those with findings on CTA were more likely to undergo angiography and embolization, however no significant difference in clinical outcomes was observed.

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Ozurdex in the Treatment of Diabetic Macular Edema: Outcomes from the Real-World Clinical Setting

Hasenin Al-khersan

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**Co-author(s):** John Charles, MD; Seenu Hariprasad, MD; Jay Chhablani, MD

**Background:** Diabetes is a leading cause of blindness in the developed world. Diabetic macular edema (DME), swelling of the retina, is a complication resulting in devastating vision loss. Intravitreal dexamethasone implants (Ozurdex) have been approved for the treatment of DME. The benefits of Ozurdex have been studied in clinical trials among a curated patient population. However, outcomes remain to be studied in the real-world clinical setting. The aim of the present study is to assess outcomes and complications of Ozurdex treatment in DME in the clinical setting as well as to characterize any baseline factors that may be associated with response to treatment.

**Methods:** Retrospective multicenter data of eyes with DME treated with Ozurdex with minimum eighteen-months follow-up after the first implant was gathered. Data included demographic details, diabetes history, past treatment history, visual acuity, measurements of retinal thickening, and treatment details. Paired sample t-test was used to measure mean differences between pre- and post-implant visual acuity. Logistic regression was performed to assess factors associated with need for cataract surgery after treatment. Multiple linear regression was performed to determine baseline characteristics associated with change in visual acuity.

**Results:** A total of 117 eyes were included. 102 eyes had been previously treated for DME; 15 eyes were naive. In naive eyes, the visual acuity changed from baseline 0.65 to 0.68 logMAR at last follow-up (p=0.77). In eyes that had been previously treated, improvement was from 0.55 at baseline to 0.38 logMAR (p=0.002). The change in visual acuity at three months correlated with the overall change in visual acuity (coefficient=0.437, p=0.002). Twenty-nine of the seventy-two phakic eyes at baseline required cataract surgery. Duration of total follow-up was found to be associated with need for cataract surgery (OR=1.13, p=0.03) as well as treatment with four or more Ozurdex injections (for four injections, OR=18.73, p=0.024). Of 110 eyes with reported intraocular pressure data, 46 required treatment for elevated pressures. Among these eyes, mean intraocular pressure decreased by -1.1mmHg at last follow-up (p=0.021).

**Conclusion:** The present study demonstrates that Ozurdex leads to significant visual acuity improvement in DME recalcitrant to other treatments. While no significant change in visual acuity was observed in naive eyes, the sample size was limited. Response to Ozurdex at three months was directly associated with overall visual acuity change suggesting this measure may be clinically useful in predicting response to treatment. Need for cataract surgery was associated with duration of follow-up, as expected, given increased incidence of cataracts with age. However, four or more Ozurdex injections were also greatly associated with cataract surgery. While many eyes required treatment for elevated intraocular pressures, topical therapy led to a significant decrease in pressure by the end of follow-up. Ultimately, Ozurdex is an important clinical adjunct in the treatment of DME, particularly in eyes recalcitrant to other therapies.

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Preventing Awareness: The BIS Monitor and Perioperative Memory Formation

Daniel Blech

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Co-author(s): Robin Wagner, MD; Dan Alexander, BA, MAPP; Xiwen Zheng, MD; Katherine Palmer, BA; Patrick O'Connor; Michael O'Connor, MD; David Glick, MD, MBA

Background: Intraoperative awareness with recall occurs when patients become conscious during general anesthesia and retain memories from the event. Such occurrences are uncommon, but they can result in extremely negative or traumatic patient experiences. The problem of intraoperative awareness has intensified the effort of the scientific and medical device communities to discover and classify biological indices that correlate with the depth of anesthesia. These pursuits have given us the bispectral index (BIS) monitor, which interprets electroencephalographic information and outputs a single dimensionless integer meant to represent the depth of the anesthetic state. Initially adopted with great enthusiasm, the BIS has yielded a mixed array of clinical efficacy data, with more recent research demonstrating non-superiority when compared with simpler, more cost-effective methods. Because intraoperative awareness is rare, it is very difficult to study and our best understanding currently comes from large, multi-center trials that review the incidence of awareness events among different groups. The present study takes a different approach, using a perioperative model to directly assess the relationship between the brain’s electrical signature as interpreted by BIS and a patient’s ability to form memories of events.

Methods: 281 subjects were enrolled in this IRB-authorized study at the University of Chicago. All subjects were patients 18 or older undergoing surgery with general anesthesia and without contraindication to standard forehead BIS monitoring. An informed consent procedure was used to enroll each subject, who was then fitted with a BIS monitor in the preoperative area. The subject was asked to remember a unique word at six specific intervals relative to pre-medication with midazolam. For each word, a BIS value was recorded. On the day following surgery, subjects were invited to list all the words they could recall from before the operation. Subjects were also asked if they remembered traveling to the operating room and to describe their last memory before surgery. A logistic regression was used to assess the relationship between BIS scoring and subject recall.

Results: Results differed relative to the point of midazolam administration. For the words spoken prior to midazolam administration, no statistically significant relationship between BIS and recall was identified. For the words spoken after midazolam administration, a statistically significant (p < 0.001) correlation existed between BIS score and the probability of recall. For a 5 point increase in BIS, the odds of recall increased by a factor of 2.23 (95% CI 1.73-2.88)

Conclusion: The findings are consistent with the current role of BIS in the clinical setting—accepted as reasonable by most, but entirely optional for use. BIS does appear to track the phenomenon in question, but not to an extent that allows for improved clinical information gathering from minute to minute. Like other techniques, BIS appears to track memory formation and awareness only in aggregate, so it cannot yet be employed solely in any individual clinical situation.

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Trends in Post-Operative Opioid Pain Medication Usage Among Oculoplastic Surgery Patients in the Post-Operative Period

Patrick Differding

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*Co-author(s):* Shehzad Qayum, MD, Hassan Shah, MD

**Background:** To assess the post-operative use of opioid analgesia in patients undergoing oculoplastic surgery.

**Methods:** Retrospective chart review and online survey of members of the Association of Ophthalmic Plastic and Reconstructive Surgery (ASOPRS).

**Results:** A retrospective chart review of eyelid and orbital surgery performed in the operating room by one surgeon (HAS) between July 2016 and March 2017 was performed, and revealed a total of 125 patients. Of these, 25 patients were of appropriate age (above 18 years or above), lacked comorbidities precluding opioid analgesia and had adequate documentation with follow-up for inclusion in this series. The average patient age was 43.4 years (range: 19.2 to 80.6 years). There were 12 males and 13 females. Each patient was prescribed a total of 10 tablets of hydrocodone-acetaminophen (5-325mg) for post-operative pain management after oculoplastic surgery. The mean number of hydrocodone-acetaminophen tablets used in the first post-operative week among all patients was 1.72. There was a lower number of tablets used by patients undergoing orbital surgery (mean = 1 tablet) versus eyelid surgery (mean = 2.15 tablets) in our cohort (p < 0.05). A survey of ASOPRS members revealed a large range in the prescription of opioids for postoperative pain management.

**Conclusion:** Most patients undergoing oculoplastic surgery in our series utilized less than 3 tablets of hydrocodone-acetaminophen in the first postoperative week. There was a slightly higher amount of medication used by patients undergoing eyelid compared to orbital surgery but there was no correlation between patient reported post-operative pain score and opioid usage. This information may be useful for oculoplastic surgeons who wish to adequately manage post-operative pain, while also reducing the over-prescription of opioid analgesics, particularly given the risk of dependence.

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Predictors of Stroke Mimic in Black Patients with a Code Stroke Activation

Jessica Marot

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*Co-author(s):* Tania Rebeiz, MD; Christopher L. Kramer, MD; Cedric McKoy, MSN, ACNP; Seon-Kyu Lee, MD, PhD

**Background:** Nineteen to thirty percent of patients presenting with stroke-like symptoms are found to be stroke mimics. African-American (AA) patients have a higher incidence of acute ischemic stroke and higher stroke-related mortality than white patients. Thus, prompt identification of stroke mimics in AA patients might facilitate appropriate and timely management of true acute ischemic stroke, which may improve clinical outcome.

**Methods:** Consecutive AA patients who had Code Stroke activations from January 1 to December 31, 2013 were retrospectively reviewed. Stroke mimics were defined as patients who had Code Stroke activation, but the discharge ICD-9 codes did not include ischemic or hemorrhagic stroke or transient ischemic attack. Real stroke and stroke mimic patients were compared in univariate analyses and in a multiple logistic regression to identify independent predictors.

**Results:** Of 311 events in AA patients, 154 (49.5%) were stroke mimics and 157 (50.5%) were real strokes. Of real strokes, 129 (82.2%) were ischemic only, 26 were hemorrhagic only (16.6%), and 2 were both ischemic and hemorrhagic (1.3%). The most common causes of stroke mimics were seizure disorders (13.6%), other malaise and fatigue (5.2%), and migraine (3.9%). Univariate analysis found that age and vascular risk factors were not predictive of stroke mimics. Rather, seizure history, seizure at onset, negative findings on neurological exam, and lower scores on three different stroke scales/screens, were associated with a greater odds of stroke mimic. Multiple logistic regression analysis showed seizure history, seizure at onset, and signs which did not equal vascular territory were the strongest independent predictors of stroke mimics.

**Conclusion:** AA patients have a higher rate of stroke mimics. History of vascular risk factors is not useful for differentiating stroke mimic from real acute stroke in the black population. A thorough neurological exam and the potential role of imaging studies could be more important to identify stroke mimics in black patients.

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Utilizing Fluoroscopy to Identify the Position of the Endotracheal Tube Prior to Catheterization: A Quality Initiative

Ala Soofian

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Background: Inaccurate hemodynamics due to inadequate oxygenation and ventilation can lead to increased fluoroscopy and anesthesia time during a cardiac catheterization. A quality initiative of fluoroscopically verifying and correcting endotracheal tube (ETT) position before obtaining hemodynamics during catheterization was implemented. We describe the frequency of ETT repositioning with this practice.

Methods: All patients undergoing cardiac catheterization since implementing this practice were retrospectively reviewed. Primary outcome of the study was the frequency of ETT repositioning.

Results: Of the 66 patients who underwent catheterization, 3 had a tracheostomy tube or ETT already in place. Of the remaining 63 patients, 17 (27%) required repositioning due to high or low placement. The mean weight and age for those requiring repositioning was 15.0 kg (2.9 – 78) and 3.3 years (0.1 – 20) and for those who did not require repositioning was 23.3 kg (3.1 – 104.8) and 5.7 years (0 – 37) respectively.

Conclusion: Our study demonstrates that high or low ETT position is common prior to cardiac catheterization. Implementing a fluoroscopic check and correction of the ETT position prior to starting the procedure may improve the quality of hemodynamic data. Therefore, we will continue this practice at our institution and recommend it become standard for all laboratories.

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Correlating Surface ECG to Histopathology of Cardiac Bundle Branch Blocks in Post-Mortem Patients

César Soria Jimenez

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Co-author(s): Gaurav Upadhyay, MD

Background: Although the anatomy of the atrioventricular node (AVN) and His bundle has been well-described for patients with narrow QRS, there is a relative paucity of data regarding AVN-His anatomy and its variants in patients with wide QRS, particularly with respect to the nature of proximal versus distal left bundle branch block (LBBB) and right bundle branch block (RBBB).

Description of program/innovation: To define the anatomical and histopathological variations of AVN-His in patients with baseline complete LBBB or RBBB. Methods: All autopsies at UCMC from July 2016 to March 2017 were reviewed for inclusion in this study. Eligible cases included all adults whose heart was analyzed during routine autopsy, and who had available surface electrocardiograms (ECGs). For patients with complete LBBB or RBBB noted on the ECG, the AVN-His Bundle was dissected and sectioned for histopathologic studies. H&E, Mason’s Trichrome, and elastin stains were used to identify various cardiac structures and corresponding sites of conduction block.

Evaluation of program/innovation: There were a total of 113 autopsies performed, of which 70 were adult autopsies with available ECG data. Patients had an average age of 64 ± 14 years, 46% female, 76% with HTN, 34% with T2DM, 43% with CHF, 80% with CAD and 39% with history of prior MI. The average QRS width across all patients was 99 ± 29 ms; of these 62 patients had narrow QRS (94 ± 25 ms), and 6 RBBB patients (149 ± 20 ms). No patients with LBBB or IVCD were autopsied. In anatomical and histopathology study, two patients with narrow QRS (<120 ms) were dissected and H&E stained as controls, selecting one with known infiltrative cardiomyopathy and one with no known cardiomyopathy. Of the 6 cases with RBBB (QRS>120 ms), only two were available for review. At the level of the interventricular septum, we found that there appeared to be discrete bundles of specialized myocardium without obvious disease in both patients with narrow versus wide QRS. Of staining methods utilized, Mason’s Trichrome appeared to provide the best definition.

Conclusion: The overall incidence of LBBB and RBBB at autopsy is low. There are no differences in gross anatomy between narrow and wide QRS. In this initial cohort, no differences were found proximally at the AVN-His to explain RBBB. With respect to approach, specialized myocardial conductive cells are better stained with Mason’s trichrome. Future approaches with molecular staining of conduction-specific proteins may provide better definition of these structures.

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Utilization and Cost of Hyaluronic Acid Injections in Advanced Osteoarthritis of the Knee

Jack Weick

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Co-author(s): Harpreet Bawa, MD; Douglas Dirschl, MD

Background: In 2008, over 615,000 total knee arthroplasties (TKA) were performed in the US and the number rises each year. The increase is driven largely by an increasing prevalence of symptomatic osteoarthritis (OA). Guidelines for management of advanced knee OA prior to consideration of TKA have been well described. The efficacy and cost-effectiveness of hyaluronic acid (HA) injections in this patient population has become highly debated. There is a paucity of evidence on a population level for trends in use and costs associated with HA injections for end-stage knee OA. The purpose of this study was to assess the utilization of HA and its costs in order to quantify the role it has played in knee OA management in the year prior to TKA. Additionally, we sought to compare the costs associated with HA injections to other forms of OA-related healthcare including corticosteroid injections, medications, office visits, and knee imaging.

Methods: The Truven Health MarketScan® database was reviewed from 2005-2012. Subjects were included if they had a Current Procedure Terminology (CPT) code for TKA, had an associated diagnosis of OA of the lower leg, and were continuously enrolled in the database for at least 12 months prior to the TKA. Patient specific OA-associated healthcare utilization (including medications, steroid injections, hyaluronic acid injections, imaging, and office visits) were identified and analyzed. Trends in utilization and costs associated with HA injections in relation to all other forms of knee osteoarthritis care were studied.

Results: A study cohort of 244,059 patients (55.7% commercial insurance coverage, 44.3% Medicare coverage) with an average age of 64.8±10 years met inclusion criteria. At least one claim for an HA injection in the 12 months immediately prior to TKA was noted in 14.7% of subjects. These subjects averaged 3.6 injections during the 12 months prior to TKA. Overall annual prevalence of HA injections remained stable throughout the study period. Total payments associated with HA injections were $40,547,881. Average payment per injection claim was $310.26 with an average out-of-pocket payment of $34.82. HA injections were responsible for 16.4% of all knee OA-related healthcare payments and 11.4% of out-of-pocket payments in the 12 months prior to TKA. Corticosteroid injections accounted for 11.9% of total payments and 12.5% of out-of-pocket payments. Analgesic medications (both non-narcotic and narcotic) accounted for 21.2% of total payments and 25.1% of out-of-pocket payments. Office visits accounted for 16.0% of total payments and 23.6% of out-of-pocket payments. Imaging (X-ray and MRI) accounted for 18.2% of total payments and 17.0% of out-of-pocket payments.

Conclusion: Despite controversy on the efficacy and cost-effectiveness of HA injections, utilization did not appear to change between 2005 and 2012 in a population of end-stage knee OA patients. Costs associated with HA injections make up a substantial proportion of insurance payments in the 12 months prior to TKA, roughly equivalent to office visits and imaging studies. The study results highlight a potential source of improvement in efficiency and cost of care of end-stage OA of the knee.

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The Effect of Spouses on Consumption of Dietary Supplements in a Nationally Representative Sample of Older Married Couples

Victoria Gillet

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Co-author(s): Elbert Huang, MD, MPH

Background: Dietary supplements are consumed by the majority of the US population in the face of mounting evidence that they are not beneficial for most people. Despite this, investigation into why patients continue to purchase and consume supplements is lacking. Our objective was to assess the concordance of supplement use in married, cohabitating couples, and determine if husbands or wives are driving use of dietary supplements within couples.

Methods: Eight hundred and ninety-one male–female married couples were drawn from a total sample of 3,137 US nationally-representative community-dwelling adults aged 55–90 years old, through the second wave of the National Social Life, Health, and Aging Project (NSHAP). In-home interviews, including medication logs were administered between August 2010 and April 2011. Supplement use is defined as use of dietary supplement, including vitamins, herbal products, and nutraceuticals used “on a regular schedule, like every day or every week.” Supplements not commonly prescribed by a physician were defined as all supplements except those containing formulations of calcium, vitamin D, and potassium, as well as multivitamins.

Results: The overall unconditional response rate for the Wave 2 panel was 74%; the conditional response rate of Wave 1 respondents was 89%; the conditional response rate of partners was 84%. Using a logistic regression model in the full sample (N = 3137), we first find that neither men’s nor women’s rates of dietary supplement usage differ by marital status. In the couples’ sample (N = 891 couples), we use a bivariate probit regression model to estimate multiple regression equations for the two spouses simultaneously as a function of individual and spousal covariates, as well as the adjusted correlation within couples, using three stepwise models. We find that there is significant residual association (rho=0.38) between husband’s and wife’s use of dietary supplements when adjusting for demographics, individual health characteristics and relationship strength characteristics. Adjusted Wald tests of the bivariate probit model reveals that the husband’s individual characteristics are more predictive of his own supplement use than his wife’s use (p=0.038). Wald tests on the wife’s individual characteristics did not reveal a difference between their effect on her own versus her husband’s use of dietary supplements (p=0.099). Sensitivity analysis that restrict dietary supplements to only those not commonly prescribed by physicians show similar results across all analyses.

Conclusion: In this sample of community-dwelling older adults, marriage is not associated with use of dietary supplements. However, marriage to a user of dietary supplements is more predictive of own use of supplements than all other characteristics previously identified as associated with dietary supplement usage. This data strongly suggests that choosing to consume supplements occurs at a household level, and largely independent of other characteristics, such as household assets.

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One Week of Sleep Extension in the Laboratory: Impact on Diabetes Risk

Laurie Nosbusch

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**Co-author(s):** Erin Hanlon, PhD; Kristen Knutson, PhD; Eve Van Cauter, PhD

**Background:** Diabetes affects more than 29 million people in the United States, and millions more are at risk for developing the disease. One of the risk factors for the development of type 2 diabetes is insufficient sleep duration (< 8 hours per night), which affects about 80% of American adults. Our novel study investigated whether one week of sleep extension in the laboratory could reverse the effects of habitual sleep loss, resulting in improved glucose metabolism.

**Methods:** This was a within participant interventional study. 11 shift and day workers aged 23-46 completed the study. A two-week at-home session to assess habitual sleep duration was immediately followed by a 48-hour baseline lab session with 8 hours in bed per night. Subjects then began the weeklong intervention, which consisted of 5 nights sleeping in the lab with 10 hours in bed per night followed by a 48-hour lab session with continued extended bedtimes. During the two lab sessions, carbohydrate metabolism was assessed via intravenous glucose tolerance tests (ivGTT) and hormone levels were assessed via 24 hour blood sampling. Sleep duration was recorded by wrist actigraphy throughout the study. Non parametric statistical analysis was performed with STATA.

**Results:** On average, subjects slept 147 ± 48 minutes more with extended bedtimes as compared with habitual bedtimes (p<0.01). Every subject extended his/her sleep, with extension ranging from 40 to 198 minutes. Disposition index (DI) improved significantly (p=0.03). Glucose tolerance (Kg), insulin sensitivity (SI), acute insulin response to glucose (AIRg), and glucose effectiveness (Sg) improved but not significantly. 24 hour mean insulin increased significantly (p<0.01) but there was no significant change in 24 hour mean glucose or 24 hour mean cortisol levels.

**Conclusion:** Sleep extension was associated with improved markers of glucose metabolism, including a statistically significant improvement in Disposition Index, a marker of diabetes risk. The increase in 24 hour mean insulin levels may suggest improved beta cell function that led to increased insulin production. Therefore, sleep extension may represent an intervention to reduce the risk of developing type 2 diabetes in individuals that habitually do not obtain sufficient sleep.

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Eye-Dentifying a Need: Evaluating Hospitalization as a Potential Opportunity for Missed Diabetes Vision Screening

Janaki Patel

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**Co-author(s):** Vineet Arora, MD, MAPP; Seenu Hariprasad, MD; David Meltzer, MD, PhD; Valerie Press, MD, MPH

**Background:** Despite strong recommendations for regular outpatient ophthalmologic evaluation for patients with diabetes, diabetic eye disease remains an important contributor to preventable low vision and blindness among Americans. Nationally, 4 million adults with diabetes self-reported difficulty seeing even with corrective lenses, but almost 40% had not received a dilated eye exam in the past year. The main objective of this study was to determine the prevalence of poor vision among inpatients with diabetes, and identify demographic characteristics of those with diabetes based on their vision status. Secondary aims included knowledge regarding management and prevention of diabetic eye disease as well as vision care attainment.

**Methods:** Research assistants enrolled participants as part of an ongoing prospective, observational study of quality of care (the hospitalist questionnaire). Eligible participants were English speaking and cognitively intact adult (≥18 years) inpatients, and were identified via chart review. Sufficient vision was determined as presenting acuity of at least 20/40 in the better eye. Participants with diabetes were identified by chart review or self-report. Surveys included the vision care questionnaire that evaluated perceptions and attainment of vision care and needs and diabetes history to evaluate related vision problems and management. The diabetes and vision knowledge test (DVKT) is 4 multiple-choice questions assessing participants’ knowledge regarding risk and prevention of diabetic eye disease.

**Results:** The study comprised 2,133 participants, nearly a third of who had diabetes (n=681). Of those with diabetes, the mean age was 59 years. Over half (58%, 396/681) were female, and 84% (555/681) were African American. Those with diabetes were more likely than those without diabetes to have insufficient vision (59% vs 39%, p<0.001). Of the 402 diabetic participants with insufficient vision, 79 had no corrective lenses, 139 had prescribed lenses but did not bring them to the hospital, and 180 were wearing their lenses. Thus, over a quarter (26%, 180/681) of those with diabetes were wearing corrective lenses at the time of the vision assessment, but still had insufficient vision. The majority of participants incorrectly answered at least one question on the diabetes and vision knowledge test (61%), and there was no difference based on vision status.

**Conclusion:** Insufficient vision during hospitalization affected nearly half of inpatients in this study and three out of five participants with diabetes. These participants were unable to pass a simple near visual acuity, and for many of them, while wearing their corrective lenses. Indeed, common markers of adequate vision including wearing corrective lenses and reporting regular vision care were inadequate in our study. Notably, the majority of participants, three of every five, were unable to correctly answer four multiple-choice questions, including the frequency of vision screens. Given these findings, the hospital may be an important, though missed, opportunity to educate patients with diabetes regarding appropriate preventative care, specifically vision care.

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Adding Another Voice to the Living Donor Transplant Discussions at the Ciba Symposium of 1966

Jackie Wang

Mentor: Lainie Ross, MD, PhD; Department of Pediatrics, Section of Academic Pediatrics

Co-author(s): Lainie Ross, MD, PhD

Background: Fifty years ago, the Ciba Foundation sponsored a seminal international conference on the ethics of transplantation. Attendees included physicians, legal professionals, a minister, and a reporter, but the living donor’s voice was missing.

Methods: Qualitative interviews were completed with 11 living donors who were uninsured at donation and later developed end stage renal disease. Two interviewees donated in the early 1960s. Their stories were separated because both donated at a time when kidney donation was experimental and therefore outside the realm of insurance. They consented to and underwent follow-up phone interviews to explore their experiences. These stories were interpreted in light of the transplant community’s concerns at the time, as documented at Ciba.

Results: FB, an 18-year-old white man, donated to his identical twin brother. His donation interfered with both employment and insurability. He maintained a decades-long relationship with his surgeon. He developed ESRD 20 years later and ultimately received two cadaveric kidneys. He did not seek a living donor himself because it might complicate family dynamics.

PS, a 21-year-old black man, took a bus from Michigan to Mississippi to donate to his sister, using his savings to do so. He received no pre-transplant counseling and only saw his transplant team once after discharge. He developed ESRD 30 years later and learned after five years on the waitlist that he had never received his “prior donor” priority status points. He would have accepted a living donor, but did not want to ask.

Conclusion: The donors’ narratives provide insight into five issues discussed at the Ciba meeting: 1) Pressure to donate: Ciba participants were concerned about familial pressure and described extensive pre-transplant counseling to prevent potential coercion. Both interviewees denied feeling pressured to donate but did describe being chosen, either by the family as an unmarried sibling or by the transplant team as an identical twin. Both received minimal counseling. 2) Special donor categories: One donor was an identical twin and a minor (<21 years). Ciba members were divided about the participation of minors and acknowledged the unique pressures placed upon identical twins. The other donor was African-American. Minority solid organ donors were not mentioned at Ciba. 3) Socioeconomic consequences of donation: Both interviewees reported out-of-pocket costs, and one also reported issues with employment and insurability after donation. Ciba attendees discussed these potential adverse consequences, and felt that more was owed to living donors. 4) Donor health: Ciba participants discussed perioperative risks but not long-term health risks of donation. Both interviewees developed ESRD decades later. 5) Lack of regret/ambivalence: Both interviewees denied regret, but expressed unspoken ambivalence by not seeking living donors for themselves. Ciba attendees also felt ambivalent, stating that living donation should be a temporary solution. The donors’ stories affirm many of the Ciba attendees’ concerns, but raise questions about race and ambivalence. Their long-term trajectory forces us to appreciate that living donors must be viewed as patients for life.

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Cardiac Resuscitation in an Academic Emergency Department: A Quality Improvement Initiative

James Watson

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**Co-author(s):** Jenifer Goldberg, AB; Willard Sharp, MD, PhD; David Beiser, MD, MS

**Background:** Cardiac arrest is a common pathology in the University of Chicago Adult Emergency Department (ED), with a total of 115 resuscitations for cardiac arrest (codes) occurring in 2015. National survivorship for out-of-hospital cardiac arrest was 10.6% in 2015, whereas it was 7.3% for patients treated in the University of Chicago ED. Interventions targeting provider-identified barriers to effective code management have been successful at other healthcare institutions in improving provider perceptions of care quality.

**Description of program/innovation:** Using Focus-Analyze-Develop-Execute (FADE) Quality Improvement (QI) methodology, we identified codes to be high-intensity, high-complexity events requiring rapid action and strong communication from ED physicians, nurses, and technicians (stakeholders). A survey was developed using Likert-scale and free-text responses to gauge opinions on both overall code quality as well as severity of commonly identified barriers, and was then administered to all stakeholders. Responses were analyzed by stakeholder category (nurse/technician/resident/attending), and key barriers to effective care were identified. A panel of stakeholders then convened to identify possible interventions to mitigate these barriers, from which role-clarification and debriefing tools were developed and implemented in the ED.

**Evaluation of program/innovation:** Overall, 16 technicians, 68 nurses, 34 residents, and 17 attendings were surveyed, for response rates of 100% and 81% for physicians and non-physicians, respectively (total 135/152, 89%). Mean overall quality of codes was 3.77/5. Mean overall communication quality was 3.40/5. Mean clarity of nursing roles was 3.40/5 (3.5/5 amongst nurses), and mean clarity of resident roles was 3.11/5 (3.35/5 amongst residents). Mean perceived frequency of interference by nonessential providers was 3.73/5 (5=always); and mean perceived frequency of noise as a distraction was 3.92/5 (5=always). Mean importance of post-code debriefing was 4.35/5 (5=very important), and mean perceived frequency of post-code debriefing was 2.19/5 (1=rarely).

**Conclusion:** Overall code quality in the ED was perceived to be moderately high by its provider stakeholders, but room for improvement exists. Specifically, respondents identified poor role clarity, excessive distractions, and a lack of regular debriefing as areas of weakness. As such, a group of key stakeholders (one technician, three nurses, and two attendings; as well as one research associate and one medical student) convened to identify possible interventions to mitigate these barriers. From this dialogue, two key interventions were developed for piloting. The first, targeting role clarity and distractions, are pre-printed nametags assigning one of 12 specific roles to providers. Those without tags are expected to stay outside the patient room. All ED providers are given a document outlining the specific tasks for each role, along with recommended positioning around the patient’s bed. The second intervention is a novel rapid-debrief form housed in an online data-collection application, which must be actively completed or deferred following every code. Both interventions, following active editing and feedback from key stakeholders, will be rolled out in Spring 2017, with a plan to re-survey stakeholders for changes in perceptions of resuscitative care following a 6-month pilot period.

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