INSIGHT

Indiana University Medical Student Research Journal

Insight is an annual student-run medical student research journal that serves as a medium to showcase the research and creative excellence at Indiana University School of Medicine (IUSM). By highlighting the talented works of peers and faculty, our journal serves to ignite research interest early in medical education as well as promote creativity outside of medicine. We invite you to approach our journal with an open inquisitive mind and to pass forward the wisdom and knowledge that you will gain through medical school. Finally, we invite you to join the medical community at IUSM in the journey towards becoming physicians who strive to create a better future for our patients through compassionate care and scientific curiosity.

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In this Issue:

Respecting the Limits of Method

Richard Gunderman, MD, PhD

The triumph of method in contemporary medicine is well captured by the "prayer of the scientist" in Sinclair Lewis's Pulitzer Prize-winning 1925 novel, "Arrowsmith," a portion of which reads, "God give me a restlessness whereby I may neither sleep nor accept praise till my observed results equal my calculated results." In a strong rebuke to method, Lewis himself declined the Pulitzer, citing the fact that literary merit is nowhere mentioned in its terms. He did, however, accept the 1930 Nobel Prize for Literature, the first awarded to an American. In his acceptance speech, he wrote that "the American novelist or poet or dramatist or sculptor or painter must work alone, in confusion, unassisted save by his own integrity."

Arrowsmith was written on the heels of Abraham Flexner's 1910 report on medical education in the United States and Canada, prepared for the Carnegie Foundation for the Advancement of Teaching. As medical historian Kenneth Ludmerer has pointed out, the Flexner report did not so much initiate reform as crystallize changes that were already well underway, a trend toward centralization and standardization that persists in American medical education to this day. Generations of idealistic young physicians have supposed that Lewis's novel aims to glorify science and the scientific method, but in fact Lewis is raising probing questions about method itself.

Consider Lewis's novelistic personification of pure science, Max Gottlieb. He has devoted his life to scientific research. You might say that he has made the scientific method his god. Like the German university system he represents, he believes that knowledge should be pursued for its own sake, and he regards rigorously controlled experiments as the only source of true knowledge. Specifically, he believes in a quantitative approach to science, telling the young Arrowsmith that, "In this veil of tears there is nothing certain but the quantitative method." Like his real-life inspiration, Jacques Loeb, he never doubts that living organisms can be boiled down to the inorganic processes studied by physical scientists.

Human beings, in other words, are to be comprehended according to physical chemistry, and physical chemistry is in turn to be comprehended in terms of mathematics. In the final analysis, humanity and each human person – whether a scientist, a physician, or a patient – must be understood as an equation. Here we glimpse both the essence of pure science and the meaning of the scientist's prayer – that "I will neither sleep nor accept praise until my observed results equal my calculated results." That my mathematical model should conform to the real world matters less than that the real world, however finely it must be sliced to be fit for purpose, fit my mathematical model.

This marks the triumph of method. I will build an apparatus, and only its measurements will count as knowledge. I will weave a net, and only what my net catches will count as fish. Contemporary medicine is filled with examples. The only correct answer on a multiple-choice examination is the one identified in advance by the author and psychometrician who developed the question. The work of physicians only counts if it corresponds to established ICD-10 and CPT codes. And hospitals only pass muster if they follow accreditation guidelines. The only way to do anything, from passing a test to caring

"One can show the following: given any rule, however "fundamental" or "necessary" for science, there are always circumstances when it is advisable not only to ignore the rule, but to adopt its opposite. "

Paul Feyerabend, "Against Method"

for a patient to operating a hospital, is to conform to the model.

Yet what if Max Gottlieb does not see the whole picture, and his version of the scientific method is but one way of knowing? What if multiple-choice questions capture only part of what medical students really need to know, if physicians know things beyond what the ICD and CPT codes recognize, and hospital staff members do all kinds of good work that accreditation guidelines fail to dream of? What if, in other words, the prayer of the scientist is misguided, or at least incomplete? What if it is ultimately more important not that reality conforms to our models but that we remain true to the full richness and complexity of our patients, our colleagues, the profession?

If mere adherence to method cannot take us to where we really need to go, then we must treat methods not as ends in themselves but as mere means, always subordinate to a larger reality. Perhaps the student has a good question, an important question, a question that could lead to real understanding, that has never even occurred to the instructor. Perhaps what the patient needs most is not to be assigned to the one best preexisting diagnostic or procedural category, but genuinely seen and listened to and empathized with. Perhaps what a thriving hospital needs above all is to foster deep and potentially inspiring conversations among the members of its community.

Some hope that by developing and adhering to the best methods, we can make our work fully predictable, assessable, and controllable. In an ideal world, we would develop precise metrics and make all of our numbers. But the impulse to quantify and measure can blind us to all sorts of things that really matter. Suppose, for example, that we had not only to describe but to live out the most important relationships in our lives in purely quantitative terms – how satisfying would friendship, marriage, or parenthood prove to be if we could see and feel and know only in terms of quantities? "How are you today?" "Oh, about a seven." "In the end, what did your life amount to?" "6.45, +/- 0.35."

I enjoyed the honor of serving as president of a medical staff organization. Early on, it became readily apparent that the overarching concern of such organizations is policy. If we do not have a policy, we need to make one. If our policy contains holes or mistakes, we need to revise it. And if any practical question arises, it should be resolved with respect to established policies. So long as we follow our policies, we are on solid ground. If we ever act against policy, our goose is cooked. Yet the allegiance to policy can blind us to deeper truths. Those who wrote the policies could not anticipate every real-world case, and ultimately, in at least some cases, it is less important to follow policy than to do what is right.

Consider a physician's angry outburst in clinic. By failing to conform to professional conduct guidelines, he had clearly violated policy. But his anger was honorable. Adherence to hospital policies had delayed indicated radiation therapy for a patient with a mediastinal mass by a full week, and by the time treatment was finally authorized, the patient had developed respiratory failure and required intubation in the intensive care unit. The hospital followed all its policies to a T, including holding

a medical staff hearing and requiring the physician to enroll in an anger management course. What it failed to do, however, was to make any effort to understand the physician's perspective or express any genuine collegial concern.

What might have appeared to Max Gottlieb an intractable problem – that many aspects of our work and life do not lend themselves to numbers, models, and methods – may turn out to be one of their greatest charms. The things in life that most of us find most attractive, engaging, and fulfilling – learning, collaborating, being friends and lovers, creating, excelling, and striving to embody excellences of both intellect and character – turn out to be vexingly difficult to reduce to any method. We can, of course, share stories and even, on occasion, some useful advice, but ultimately there are no shortcuts to becoming good at them that would not deprive us of the joy of them. This is what Lewis meant by integrity.

We need to avoid allowing our allegiance to method to blind us to reality. Instead, we should regard all methods as resources that, if kept in proper perspective, can be of assistance, but which must never become ends in themselves. We need, in other words, to resolutely avoid becoming the tools of our tools. Method exists for human beings, not human beings for method. To be sure, challenges will persist – there will be undeniable complexities, tensions, and all-but-inevitable failures to see for what it really is what is right in front of our noses. But it is from this ambiguity and the powers of discernment it calls forth that our full humanity emerges.

Spotlights

Articles written by our editorial board members

Opinion: Sleep Should be at the Forefront of Improving Wellness in Medical Students

by Samuel Kaefer, MS3

Without question, our beloved medical school has invested considerable time and effort into incorporating student wellbeing into our formal and informal curricula. As evidenced by the plethora of mental health and wellness resources offered by the school, such as the Wellness Coalition, lectures during our third-year Sessions to Enhance Physician Success (STEPS) course, and Wellness Corner component of the weekly student newsletter, establishing effective and efficient methods to cope with stress is one of the key skills Indiana University School of Medicine (IUSM) hopes to equip all graduates with. Everyone's process for improving their own wellness is unique and develops at different rates; this is one of the great aspects of personal development. However, one objective metric that can improve everyone's wellness is better quality sleep.

Every year various healthcare trainees make the decision to dedicate their careers towards improving patient lives by identifying and treating sleep pathology. Per the American Academy of Sleep Medicine, there are just under 100 sleep medicine fellowship programs in the United States, with just under 200 positions available each year to graduating internal medicine or pediatrics residents (and even other residency pathways). IUSM offers such a one-year program with two positions that provides a diverse educational experience, encapsulating the entire breath of sleep medicine. Within the past few decades, the emergence of sleep surgery fellowship programs through otolaryngology-head and neck surgery has afforded new opportunities to improve sleep with technology (eg, Inspire which stimulates the hypoglossal nerve and helps keep the airway open at night). The continued growth of sleep medicine programs and emergence of sleep surgery not only embodies the healthcare advancements that have been made, but they also serve as a reminder to how vital quality sleep is for overall human health.

As medical students, we see how the importance of sleep is routinely emphasized across multiple healthcare settings, and we are continually educated about sleep patterns and abnormalities throughout our coursework (i.e. dedicated lectures during the third-year neurology rotation). Given how demanding the training for a career in medicine can be, it is not always easy to dedicate the time to follow the same advice that we give patients and loved ones, and sleep regularly falls into this category. There has been extensive research conducted on the sleep quality of medical students. It has been shown that sleep disturbance is higher in medical students compared to students in other fields, and perhaps more enlightening, decreased sleep quality in medical students has been associated with increased rates of anxiety and depression, which leads to decreased academic performance.[1] Although the literature provides mixed results regarding physician sleep deprivation and patient outcomes (work performance, medial errors), the fact that multiple studies did demonstrate a correlation highlights the importance of this subject.[2] Furthermore, sleep impairment has been linked to increased rates of physician burnout and decreased fulfillment, which in and of itself impacts physician productivity.[3] Thus, we owe it not only to ourselves but also our patients to improve our own sleep so that we can ultimately provide the best care possible.

The notion of foregoing essentials like meals and sleep in service of our patients was commonplace and even celebrated many years ago among members of the healthcare community. Certainly, a career in medicine often requires one to put the needs of others above their own, however, the idea that healthcare providers cannot themselves benefit from the positive effects of sleep is far from the truth. Although one cannot dismiss the fact that the demanding nature of medical training can impact the quantity of sleep, trainees can still improve on the quality of sleep they obtain. Interestingly, it has been argued in the literature that quality of sleep is more important that quantity.[4] This provides an actionable item for medical students to work on. Decreasing nighttime distractions, improving sleep cycle regularity, and limiting afternoon caffeine are just a few small changes that can lead to big improvements. Through this, medical students can still gain the various

positive cardiovascular, cognitive, and metabolic benefits of good sleep.[5]

In medical training, the idea of delayed gratification remains prevalent: "things will be better when I am in medical school" quickly turns into "things will be better when I am in residency… when I am in fellowship… when I am an attending." If there is one thing we can all agree on is that our lives will continue to evolve, leading to great new opportunities but also some increased responsibility. And as the (necessary) emphasis on wellness and work-life balance in healthcare continues to grow, I argue that sleep deserves a central role in the conversation. Additionally, since good sleep hygiene can be seen as a form of preventative medicine, we as trainees must work to lay the proper foundation right now by improving our own sleep. The benefits extend beyond our own health to our patients, allowing us to become the best physicians we can be for our community. We must first help ourselves in order to help others.

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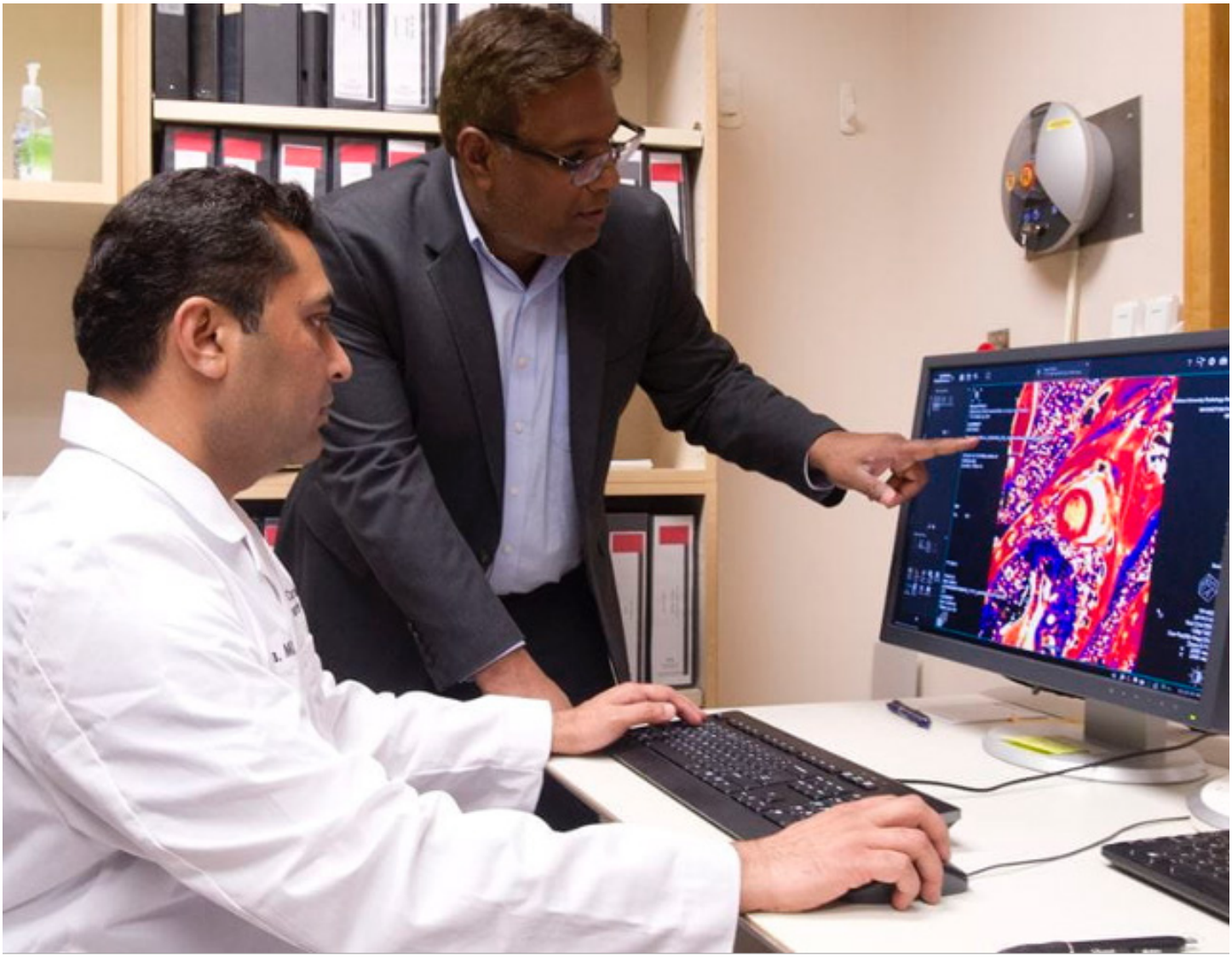
Heart to Heart: A Journey in

Interview with Rohan Dharmakumar, PhD

by Maryam Sabir, MS4



Cardiovascular Research

Maryam Sabir: *Can you tell me about your background and what brought you to IU?*

Rohan Dharmakumar: What brought me to IU was the start of a new cardiovascular research center, Krannert Cardiovascular Research Center (KCVRC), as it is known now. As an undergraduate, I specialized in physics and physiology. In graduate school, I completed a Master's in Mathematics and a PhD in Medical Physics with a focus on cardiovascular physiology. After my doctoral work, I went on to do a postdoctoral fellowship in the Department of Radiology at Northwestern University and became faculty there. I was at Northwestern for about 6 to 7 years before I was recruited to Cedars-Sinai Medical Center and UCLA in 2011, and there I grew through the academic ranks to become full professor in 11 years. At Cedars-Sinai, I served as director of the Translational Cardiac Imaging Research Program and associate director of the Biomedical Imaging Research Institute. I also served as co-director of the PET/MRI Research Program. I was then recruited to Indiana University School of Medicine as the inaugural director of KCVRC, which comprises many different research areas and faculty that work in cardiovascular research. KCVRC is really an enterprise with the goal of translating new discoveries into improved cardiovascular care. In that sense, we're a little bit unique in that our major focus is translational research. It's not just about discoveries. It's about going from discoveries to the detection of pathophysiology through imaging, biomarker technology, genomics or proteomics and then designing therapies based on the understanding we have developed of the disease process to then ultimately deploy it to patients. A lot of our translation is run through IU Health, but that's not where we stop. We run basic and clinical trials with the support of our collaborators worldwide. A lot of our partners are in Canada, India, China, South Korea, the UK and other parts of the world, which allows us to be connected to the rest of the world in the research sphere of cardiovascular research.

"The goal should be to learn and then use that experience to build other goals that are greater...more challenging. That's how you grow in research."

MS: *At what point in your career did you develop an interest in cardiology and what experiences led you to focus specifically on myocardial infarction (MI) and mortality post-MI?*

RD: Studying the heart is something that I've always been interested in. Instead of pursuing a clinical career, I chose to focus more on basic scientific research because that's what I'm passionate about. So, this fixation with the heart, I can't remember exactly when

it started, but I can tell you that excitement began in elementary school and continued to grow over the years. So, this has always been something that I'm very excited about and interested in. My early exposure to running clinical trials was driven by technology development. My team has run trials that are more imaging-driven, sort of developing the technology, testing in patients and asking, "Is this good diagnostic technology?". But because of my blended background in both in physics and physiology, in the later years of my career, I have been gravitating more towards the development of drugs and therapies. Iron chelation therapy is one that we're testing out right now, but we are exploring and investing in many other trials. Some of them are diagnostic trials, while others are outcome trials. Many are first in-human trials that are FDA-approved. So even with trials, there are so many different kinds. We might develop a technology to see how it works and whether it's better than previous techniques. Or we might have a novel drug that we need to get through, and those are the first in-human trials that I referred to. Or we have diagnostic strategies where we go back into large registry databases and look at how some patients fair after myocardial infarction, and those are some of the outcome trials. And most recently, we released a novel classification scheme, the Canadian Cardiovascular Society (CCS) Classification for Acute MI that identifies MI into four stages. It's a landmark publication and classification that allows us to now stage the level of tissue injury for MI which did not exist previously. So, before the CCS Classification, clinicians would consider therapies that were not specific to any level of tissue injury. Now, we are able to develop therapies that are far more targeted. For example, an aborted MI could receive a more appropriate level therapy.

"The roads are not always paved with gold, but you have to travel through them."

MS: *What advice do you have for medical students interested in getting involved with basic or clinical research?*

RD: If you want to get into research, I think it's good to start early and have a curiosity to broadly explore a variety of specialties.. Then, go into a lab that cares about your development. It's not always the case, just that some labs don't have the resources. When I say resources, I'm not only talking about money, but time with senior investigators. If you're able to get into a lab that has that and asks very interesting questions, probing questions, those are places where medical students can get early exposure to research. So that's what I would recommend, and it gives you the freedom to operate, get involved and start thinking about what it is that's going on and start contributing. Research is very different from clinical practice. I find that some medical students are trying to get a line on their CV, that they did "x" amount of research, and that should not be the goal. The goal should be to learn and then use that experience to build other goals that are greater, and maybe more challenging. That's how you grow in research. The process is more important than a line on the CV. There are a lot of things that you learn that may not be on the CV but are going to be helpful for expanding your career and going into research if that's what you want to do. But you need to learn the process, and I think getting experience early-on in medical school and working with people that are excited about research can really give you great exposure to that.

MS: *In your career as a researcher, with clinical trials or academia in general, have you faced any challenges, and if so, what lessons have you learned from them?*

"Nobody can teach you anything better than your own failures and your desire and resilience to get up and walk again."

RD: Clinical trials are always challenging, and it depends on the trial that you're running. If you're trying

to run a drug trial, there's all sorts of challenges. The observational trials are less challenging, but when you're trying to run a first in-human trial, there are a lot more considerations. You can have adverse effects that you have to deal with and there are a lot of things in the system that make it very difficult to run trials. I'm not saying that it's bad necessarily, because you want to be very careful when you're running these trials. To excel in research, the key is to be persistent and resilient; there are no two other words that can describe research. So, if you really want to do research, it's going to take a lot out of you to do it. The roads are not always paved with gold, but you have to travel through them. There are challenges that arise with running clinical trials that can vary from one trial to the next. For instance, study participant recruitment can be a challenge in both building awareness among referring physicians for eligible patients and creating awareness in general to a patient population. If you recruit 10 patients, that's 10 patients, right? But you see some of these trials have thousands of patients. How do you build that, how do you expand that? You might want to do that, but really you need the money, so then you need people to fund that. So, there are a lot of those sort of thoughts that you need to consider prior to taking on clinical trials. You might see a 10,000 patient study, but you don't know that there's $50 million behind that trial that's taking place. So, you need to have resources set up to be able to run those trials. These are things that you learn, and if you want to do it, then you go and get the money and you do the study. But one important thing is also being a good communicator, bringing people together, having a common purpose or identifying a common purpose. These are all very important because a lot of this is not how smart you are; it's really about inspiring those around you and being able to bring people together to get things done. I mean you're not going to run a 10,000 patient study when you're starting out. You're going to help somebody run a 100 patient trial and learn about all the mechanics involved. But then as you grow, as you go through the process and you learn, you fail, you get up, you fail again, you get up and you keep moving, you start to make progress, and that's where you start to learn. I think the most important message here is to allow failures to happen and learn from them. There's no substitute for that. Nobody can teach you anything better than your own failures and your desire and resilience to get up and try again. It will happen. If you want to go through things and make progress, you're going to have to learn to live with failures and make use of them in how you might approach a study the next time. I think you learn more from failure than success.

MS: *As Executive Director of KCVRC, what are you looking forward to most in the coming years?*

RD: Well, there are a lot of exciting things going on at KCVRC. As executive director, my goal is to make sure that the faculty and other researchers are well supported even in the midst of challenges. Despite challenges such as economic decline, competitive funding etc., we need to keep things moving. But what I'm excited about is that there is a

"...a lot of this is not how smart you are, it's really about inspiring those around you and being able to bring people together to get things done."

lot of very, very interesting and diverse research that is going on at KCVRC. I think you will see probably in a year or two that the work we are doing is highly impactful and it will really change how we manage heart disease in patients. And not just managing patients, but allowing them to live free of pain and suffering and live for a longer period of time. And so, that's what I'm excited about and it's happening in my own Ischemic Research Program team and also outside of my research team within the KCVRC. One of the things that I'm trying to do is make this place the hub for innovations in cardiology, not just operating run of the mill clinical trials, but really starting with organic ideas and then moving things forward. So, there are a lot of exciting things happening and I'm really looking forward to seeing how all of this is going to make a difference in patients' lives.

To learn more about Dr. Dharmakumar's work and KCVRC, you can visit https://medicine.iu.edu/krannert-heart and follow @KrannertHeart on X.

Arts and Humanities

The following works were submitted by IUSM medical students and include artwork, narratives, poems, opinion pieces, critiques, and more.

Voting as a Vital Sign

by Olwen Menez MD/PhD track and Joey Ballard MS4

Election Stress Disorder affects individuals from both sides of the aisle and has been affecting more and more people in recent election cycles. In 2016, 52% of Americans indicated that the election was a source of significant stress in their lives. In 2020, this number jumped to 68%.[1] With the upcoming 2024 presidential election, thinking of the future can seem stressful and beyond our control. However, voting outcomes affect our patients, our public health systems, and our health policies. It is our duty as physicians to care for our patients holistically, and this means getting involved with the systems that guide our country.

Added stress from election cycles can manifest through fractured friendships and emotional instability, and even somatically, most commonly through acute respiratory infections and gastrointestinal conditions.[2] However, studies have found that political participation can contribute to patients' mental health recovery by increasing social inclusion.[3] When patients feel isolated from the outside world due to their confinement to a hospital bed, this can be a tremendous benefit. In fact, higher political participation, including voting and registering to vote, is strongly correlated with lower mortality among American women.[4]

Unfortunately, there is a tragic cycle at play. Gerrymandering has demonstrated its devastating effects by hindering Medicaid expansion, resulting in preventable morbidity and mortality for millions of Americans.[5] These votes lost to morbidity and mortality in marginalized populations may impact electoral and policy outcomes, including public health policy.[6] Disappointingly, between 2004 and 2018, physician voting rates were 12% lower than the general public, with physicians who did not register to vote being 70% more likely to report that they were "too busy" or have "conflicting work or school."[7] This is on top of the fact that Indiana ranks 39th in terms of voter turnout with only 58.9% of the eligible population participating in voting.[8]

Fortunately, healthcare interventions aimed at increasing voting rates have emerged within nursing, social work, and medicine[9]. The Health Resources and Services Administration has released guidance encouraging Federally Qualified Health Centers to engage in nonpartisan voter registration efforts.[10] Hospitals and other healthcare institutions facilitating nonpartisan voter registration efforts have legal protections to do so according to the National Voter Registration Act of 1993 and existing IRS code10. In our very own Indianapolis student outreach clinic, we have incorporated voter registration efforts into clinic flow with the help of our local League of Women Voters chapter, who held a session on voter registration.

In recent years, medicine as a whole has been more willing to embrace talking about the social determinants of health (SDOH), which include education, health care, neighborhood environment, social/community context, and economic stability. It is widely accepted that outside factors disproportionately affect a person's health aside from their interactions with the healthcare system. While having an awareness of the SDOH is an important first step, it is often treated as the only step. Instead, we embrace reframing this concept and instead calling it for what it really is - the political determinants of health.[11] All of the SDOH are directly tied to politics and cannot be addressed without acknowledging this reality. Politicians are most responsive to the concerns of those who are civically engaged and vote in elections. As is, we have a vicious cycle where those who are underserved by our healthcare system are the same people who are less likely to vote in elections. This is in large part intentional and due to structural barriers that limit voting rights and result in health policy that continues to exclude our underserved populations.[12]

At the American Medical Association Medical Student Section (AMA MSS) 2023 Interim meeting, Resolution OF010 - Supporting The Health Of Our Democracy passed. This means that in June 2024, the AMA House of Delegates will vote on whether or not the AMA supports efforts to engage physicians and other healthcare workers in nonpartisan voter registration efforts in healthcare settings, including emergency absentee ballot procedures for qualifying patients, visitors, and healthcare workers. The resolution also calls on the AMA to support nonpartisan

and independent redistricting efforts. This resolution originated from the IUSM Voter Coalition as a grassroots movement and passed the AMA's MSS without any opposition, which is a point of hope, as we look to the future healthcare leaders. As with so many societal issues our country, we can't fix healthcare without strengthening our democracy.

In recent years, politicians have inserted themselves between physicians and their patients to a staggering and alarming degree. Healthcare professionals must become more actively politically involved instead of continuing to be reactive and letting politicians practice medicine without a license. Learn about the emergency absentee ballot procedures at your facilities. Emergency absentee voting is an important (but often underutilized) mechanism that allows hospitalized patients and healthcare workers to vote in instances that they wouldn't otherwise be able to. Request a free VotER badge through the website to have quick access to voter registration links. Ask about patient voter registration status while performing an HPI. Help cover your peers' shifts so that they can make it to the polls. Get to know your local chapter of League of Women Voters and consider ways you can support their efforts financially or through volunteering. Explore more information about voting by visiting vote411.org and selecting your state. The health of our patients is tied to the health of our democracy, and it's time we take a stronger stand to protect both.

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Blue Collar, White Coat

by Luci Hulsman, MS3

I didn't grow up with any family members in medicine. Quite the contrary, my mother worked at the local Dairy Queen and my father worked repairing furnaces and air conditioners. Entering medical school, I was surprised at how many of my fellow classmates had physician parents or family members in healthcare. I couldn't help but feel like I was already lagging behind at the start of medical school. I hadn't grown up hearing about interesting medical cases. I didn't have parents prepping me for the rigors of medical school. I was starting from square one trying to grasp the vast medical lexicon and disease rolodex. I allowed my modest upbringings to be carried like a heavy weight on my shoulders, crushing my confidence, making me believe every passing exam score must have been a fluke.

It wasn't until late in my third year of medical school that I realized the value my father's career provided in my future as a physician. Working in heating and air, my dad was often on call for emergencies. Like our health, people don't fully appreciate their air conditioning until it's not working at full capacity. He was responsible for troubleshooting these machines and fixing their ailments. I came to realize how similar his thought process was to that of physicians—how he systematically approached each malfunctioning unit, ruling out diagnoses based on physical exam findings. He checked the vitals of the thermostat. Was the air coil frozen? There may be a refrigerant leak. Does the draft fan start? The flues clogged.

Many of these "blue collar jobs" have a thought process analogous to that of physicians. My father, the pulmonologist of a home, specializes in airflow. The construction worker, such as an orthopedist, assures the home's bones are strong. Electricians, like neurologists, assess the electrical synapses throughout the dwelling. Plummers are naturally the gastroenterologists and urologists checking for leaky pipes. Each of these professions portray problem solving skills that I now rely on in my medical education to convert physical findings and assessments into treatment plans.

I believed I was severely behind starting medical school in comparison to my peers, destined to never catch up. As I reflected on my dad's professional role, I realized how he encouraged an analytic mindset even from a young age, taking special interest in my science fair projects. He didn't need a formal science education to understand the importance of control or dependent variables—it was something he practiced every day. He was able to encourage my problem-solving skills, something that would serve me for the rest of my life.

Imposter syndrome can originate from many different parts of our lives—our race, gender, age, and upbringing. As we confront the basis of our insecurities, we have a chance to see how these experiences shape us into physicians capable of communicating with diverse patient populations and approaching issues from a unique perspective. When considering my own imposter syndrome, I began to understand that medicine involves more than memorizing the right combinations of facts. It depends on the synthesis and application of all the information inputs. While anyone can be lectured on the material, being a doctor requires a trouble shooting mindset to discover root causes of presenting symptoms. This was something my father, although not a doctor himself, encouraged and I thank him for his role in teaching me how to practice medicine.

The American Obsession with Interventionism Produces Global Health Crises

by Yasmin Ali, MS2

This past July, I came across a New York Times report entitled "A Climate Warning from the Cradle of Civilization" discussing the drastic climate changes and water scarcity in modern-day Iraq (1). The work caught my interest due to my own Iraqi heritage, and the author's descriptions about the nation's former rich and fertile soil growing date palms "so thick and close together that their leaves blocked the sunlight" complemented my own family's narratives about the flourishing land they grew up on. However, I realized that the author missed an opportunity to provide crucial context regarding the impact of consecutive wars on the country, instead alluding to "weak governance and the continued reliance on wasteful irrigation techniques that date back millenniums to Sumerian times" as the reasoning for the country's challenges today. The description paints Iraq as a backwards country that has consistently struggled to support its people, but this could not be further from the truth.

I find many Americans fail to recognize the prosperity of Eastern countries and how foreign imperial involvement hindered the livelihood of these nations. Research published in The Lancet describes Iraq among nations with the highest living standards in the Middle East prior to the Gulf War of 1991, boasting first-class healthcare facilities, where 97% of its urban population had access to primary care services and 95% received sanitary water (2). My own family was incredibly fortunate to echo this sentiment. Many Iraqis like to refer to the "old Iraq" as a time before the invasions (1991 & 2003) by the United States which have destroyed the country's infrastructure, leading to many of the public health concerns faced today. Regrettably, wars waged by the U.S. have weakened several Eastern nations, which is especially evident when evaluating the public health crises faced by these countries.

Many of the public health crises in Iraq today are rooted in the destruction of the country's infrastructure, dating back to the Gulf War of 1991. A United Nations mission concluded that the invasion resulted in "near-apocalyptic" destruction of economic infrastructure that had previously been a "highly urbanized and mechanized society" (3). Most electricity-generating plants were destroyed, and power distribution lines were again targeted during the 2003 Iraq War (4). The absence of electricity interfered with hospital operations, water distribution, and agricultural demands. Similarly, the United States carried out an operation destroying Iraq's water purification system knowing that it would cause increased deaths from water-borne disease, resulting in a series of cholera outbreaks that continue to devastate Iraqis as recently as 2022 (5,6). The economic crises resulting from U.S. interventionism have caused many doctors to flee the country, leaving a shortage of physicians and resources to provide for a struggling population (2).

Iraq is not the only country that has faced deteriorating health conditions due to American interventionism. Since 2014, the United States has been intervening with the Syrian Civil War, imposing sanctions against the Syrian people that have exacerbated the trauma that ordinary citizens have been experiencing since 2011. In 2022, a United Nations expert urged for the lifting of unilateral sanctions due to shortages in medicine, medical equipment, and material for the rehabilitation of water distribution networks, as well as serious concerns for food security (7). While humanitarian exemptions exist for emergency situations, exemptions for the 2023 Turkey-Syria earthquakes were met with poor execution, requiring ample documentation and paperwork (8). General licenses for earthquake relief were only authorized for six months, which aid workers criticized as being too short for long-term rehabilitation projects. Unfortunately, these tactics are still implemented despite the lack of evidence supporting their effectiveness.

The brutal impacts on global health due to U.S. military tactics are not a recent development in modern history. During the Vietnam War, the U.S. military sprayed approximately 49.3 million liters of Agent Orange, an herbicide, to defoliate forests over 2.6 million acres from 1961 until 1971, when suspicions of birth defects began to rise (9). Later, research studies concluded that the use of Agent Orange is associated with multiple adverse health outcomes, including birth defects, diabetes, and cancer. Decades later, Vietnamese populations are still facing the health and environmental impact of of the toxic herbicide. Nevertheless, the U.S. government has yet to take accountability for the destruction caused by

Agent Orange (10).

Many countries impacted by U.S. military tactics are still facing disastrous public health consequences today. Every time I learn more about the health conditions in Iraq, I consider how much of it could have been prevented without U.S. interventionism, and I apply a similar lens when learning about other countries impacted by war. I urge others in medicine to uphold the responsibility of prioritizing human life over political interests by critically considering the implications of the tactics that our country, a nuclear superpower, uses in armed conflicts abroad. A basic knowledge of history allows one to recognize how hegemonic powers play a significant role in impeding developing nations from providing adequate health and living conditions for their population. Unfortunately, this ill-guided practice has destroyed far more lives than it has saved. As future physicians, recognizing these harmful implications and advocating for human lives will be essential for preventing unnecessary losses and adverse health outcomes worldwide.

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Jackson Sawyer, MS2

My great-grandmother had advanced dementia when she died not too long ago. In this poem, I like to imagine her as a hummingbird (her favorite animal) going through the different seasons of her life. Spring is her early beginnings of life and winter is her inevitable decay with dementia. I think this poem highlights the finality of her life and addresses both her and our general mortality.

Hummingbird

Hummingbird of the youthful spring,
dew droplets resting on your inert wing.
Lively, into rays you have begun,
powered rapid beat by sun.

Onto heat of summer, you fly
spirits within you created and come by.
Guiding flowers tunnel you to a path,
begone of any felines or snakes of wrath.

In autumn, I am blessed by your beat,
under sunnier situation I wish we could meet.
The leaves of change provide their color of choice,
collages of brown, orange, and yellow rejoice.

By winter your beat and temperament have changed,
your wings continue to fly in a path estranged.
Beauty of once so quickly beguiled,
as an angel, personality of absence on you remains mild.

Oh hummingbird, why must you go?
Oh hummingbird, I will miss you so.
The raven stoops full on my window.
Time is fed, the door is shut by its blow.

The next two haiku poems are synonymous with each other and are rather self-explanatory. I always find it absurd when people suggest that wrinkles, specifically those associated with smiling and laughing, are a bad thing.

Crow's Feet

To smile means wrinkles?
If so, I want my crow's feet
to spread wings and fly.

Laugh Lines

To laugh seeds wrinkles?
If so, I want my laugh lines
to sprout roots and grow.

Jackson Sawyer, MS2

The feelings of loss and growing up can conjure up difficult feelings. Although losing something or someone is difficult, it is also important to understand its value. If things lasted forever, their sentiment and value wouldn't be as important, and I think a big part of growing up is understanding that.

One Day

One day you'll notice the burden of your pack
is heavy with the weight of books.
The crayons and paintbrushes
never caused this strain on your back.

You'll notice the faces of your old friends change
and how often you don't see them.
Until they all mix and coalesce together
into a collage of disarrange.

You'll notice that the black hairs of your cat
are no longer strewn upon your bedsheet.
He's been gone for over a year and
the couch pillow is warped from where he always sat.

You'll notice outside your bedroom window
the view isn't what you've been used to.
The scenery and smells have changed,
a far cry from what you used to love and know.

You'll notice change within yourself,
for the better or for the worse.
The innocent and innocuous face now
hardened and weathered within itself.

Maybe it won't be just a singular day,
but a collection of days, weeks, or months.
Time passed which you to a conclusion
that you wanted certain things to stay.

You'll find that it is difficult to take
that the past is inert but, in its state,
You can learn and have a good plan
for your new memories and stories to make.

This poem was after a sickle cell panel we had, and I was reminded of the stories my aunt used to tell me of her time at a sickle cell unit in Memphis. It is unfortunate to hear all the trials and tribulations persons with sickle cell must go through, both physically and mentally.

Lifeforce Against You

Lifeforce against you
Bridged gaps blocked, with accumulated sickles.
Excruciating and debilitating
pain only mediated by narcotic miasmas.
Normal life disruption
upheaval and revolutionary war from within.
All these battles
and yet you question their pain?
Lifeforce kills you.

Upper Cataract Falls, Bloomington

Oil Paint

8x10”

Feature: Visual Art

Kathleen Ho, MS3 showcases her various artworks

Painted ‘en plein air’ (*in the field*) at one of my favorite Bloomington spots, this painting depicts a gentle waterfall. Despite the slow trickle of water, my focus was on the interplay of light through the droplets and the subtle hues of the surrounding limestone. It is a humble homage to the simple yet captivating beauty found in this peaceful corner of Bloomington.

Venice, Italy

Oil Paint

8x10”

Kathleen Ho, MS3

During my undergraduate studies, I had the privilege of studying abroad in Italy, delving into the world of Renaissance art and plein air painting. This marked the beginning of my journey in capturing life in real time paintings, creating artworks amidst bustling streets and passersby. The practice is challenging, demanding precision and concentration amid constant motion. This process, I believe similar to the practice of medicine, teaches the art of discerning what’s essential in a situation, drawing parallels between the focused brushstrokes on canvas and the nuanced decisions in the field of medicine. This remains one of my favorite forms of art, simply enjoying the outdoors and connecting with the ever-changing scenes around me.

Kathleen Ho, MS3

Downtown Indianapolis

Oil Paint
18x24”

This painting aims to embrace the beauty of Indianapolis bathed in the warm hues of golden hour. The color palette was carefully selected to evoke a sense of comfort and warmth that this city holds in my heart. A visual tribute to the enchanting moments that make Indianapolis special to me.

Kathleen Ho, MS3

Flower Market

Oil Paint
18x24”

This plant market was visually stimulating and brought me joy and relaxation in painting. Trying to capture the vibrant colors and intricacies of the flower beds was both challenging and fun, adding to the overall enjoyment of the creative process.

Kathleen Ho, MS3

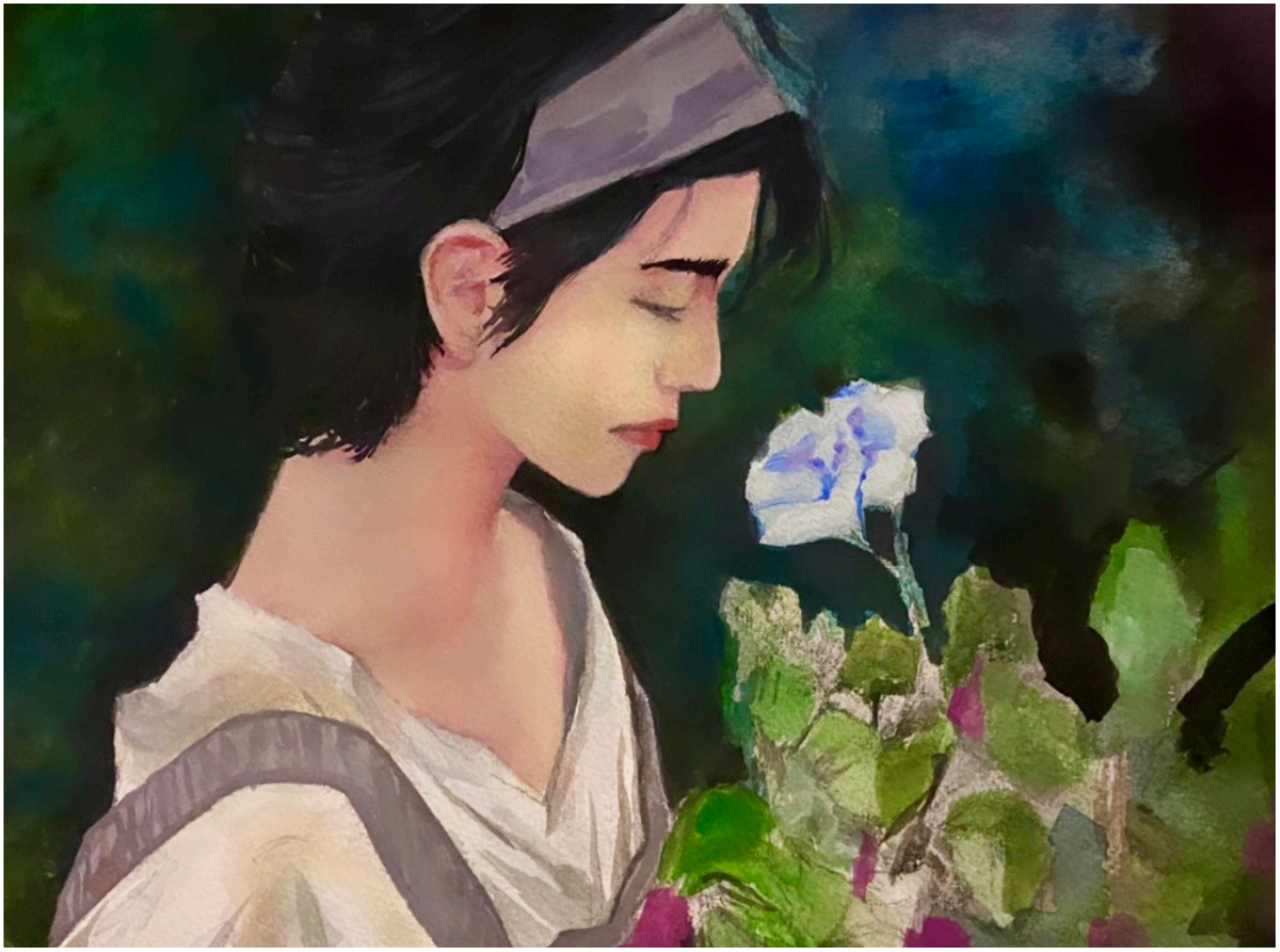
Fort Harrison State Park, Indianapolis

Oil Paint
10x12”

I was fortunate to have some extra time during my 3rd year Psychiatry rotation to spend a half day painting at a local state park. This project provided me time to reflect on the difficult challenges and backgrounds witnessed of my patients during this rotation. The ripples in the calm water symbolize the ripple effect of our actions, a reminder of the interconnectedness of our experiences.

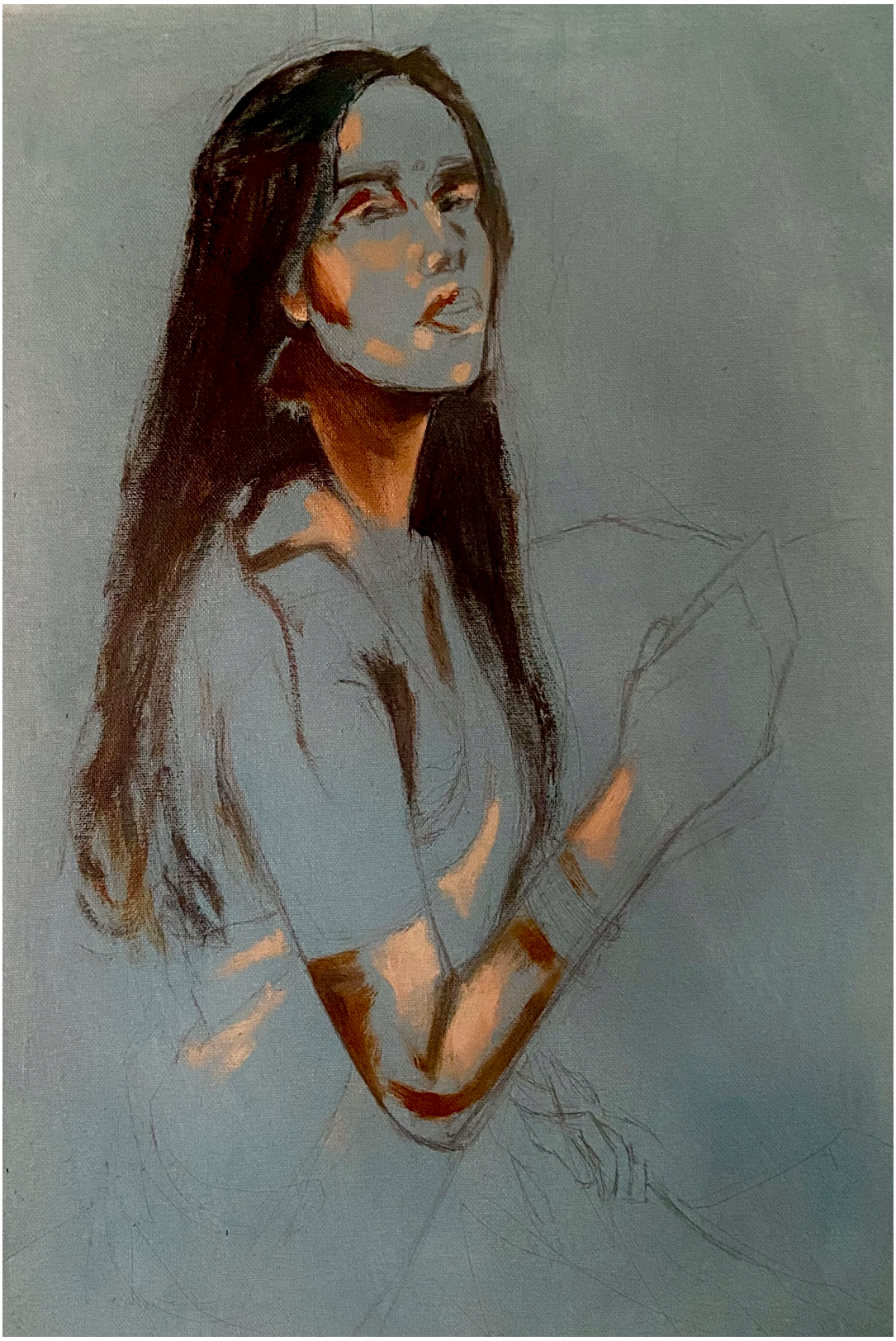
Feature: Visual Art

Ritu Gangadhara, MS1 showcases her various artworks



Unfinished Gardens

Gauche and Watercolor on Paper



Ritu Gangadhara, MS1

18%

Self-Portrait

Oil on Canvas

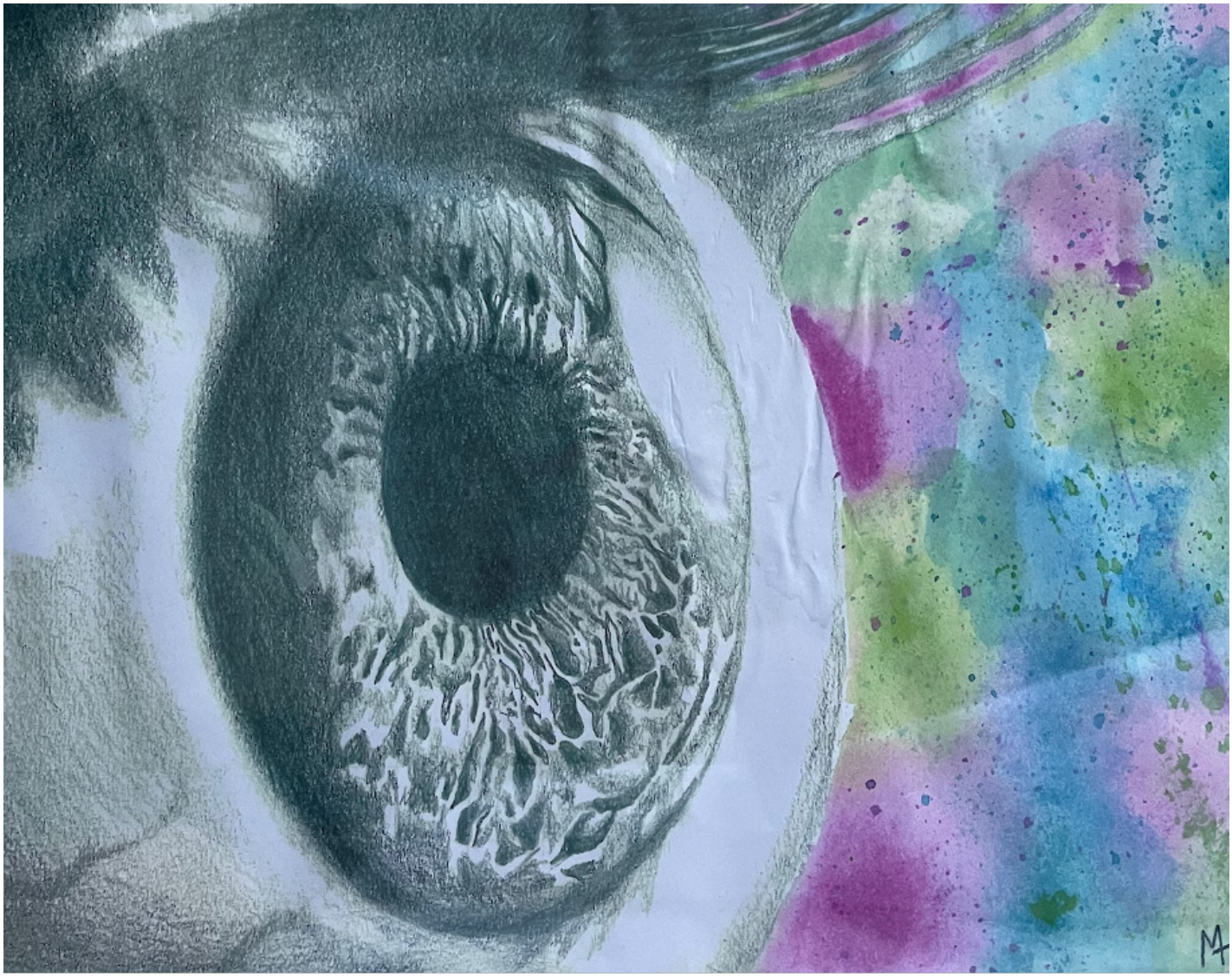
Ritu Gangadhara, MS1

A Difficult Respite

Ink on paper

Feature: Visual Art

Margaret Tharp, MS3 showcases her artwork



Watercolor Teardrops

watercolor, pencil

Searching for Rain

Feature: Visual Art

Justin Yu, MS1 showcases his artwork

Feature: Visual Art

Jeffery Miller, MS4 showcases his artwork

Red-Eye Tree Frog

photograph

taken in Bijagua, Costa Rica

IMPRS

Indiana Medical Student Program for Research and Scholarship

The following works represent a selection of the student research that took place during the 2023 IMPRS summer internship program- a collaboration of the Indiana University School of Medicine and the Indiana CTSI

IMPRS Award Winners

Brain activation during scene encoding fMRI in the Alzheimer's disease continuum: Association with amyloid and tau burden in PET

Mia S. Trueblood, Andrew J. Saykin, Shannon L. Risacher

Background and Hypothesis: This project assessed brain activation during a scene encoding task in 4 groups: older adults who were cognitively normal (CN), subjective cognitive decline (SCD), mild cognitive impairment (MCI), and dementia due to Alzheimer's disease (AD). Associations between scene encoding related brain activation and tau, amyloid, and other biomarkers were analyzed. Our hypothesis was that higher levels of cerebral tau and amyloid would be associated with reduced scene encoding activation. In addition, we hypothesized that scene encoding activation would be significantly different between cognitively normal and cognitively impaired groups.

Methods: 234 individuals from the Indiana Memory and Aging Study (79 CN, 67 SCD, 70 MCI, and 18 AD) completed structural and functional MRI, clinical/cognitive assessment and biomarkers; 155 underwent amyloid ([18F] florbetapir/[18F]florbetaben) PET, while 111 also underwent [18F]flortaucipir PET. For the fMRI scene encoding task, participants were asked to view and remember a set of images. A one-way ANOVA test was used to analyze scene encoding related activation differences among the 4 groups. Regression was used to identify associations between scene encoding activation and tau and amyloid deposition.

Results: Significant differences in activation were observed between the MCI and CN groups, including less activation in widespread regions during the task and reduced deactivation in the default mode network (DMN) in MCI participants relative to CN. Significant associations between higher amyloid and tau deposition and altered scene encoding activation were also observed.

Conclusion and Potential Impact: Cognitive decline is associated with activation changes during scene encoding, as well as reduced deactivation in the DMN, especially in the posterior cingulate region. Higher cerebral amyloid deposition predicted decreased scene encoding related activation. These findings are consistent with models linking cognitive status, functional brain activation during episodic encoding, and pathophysiological processes in the AD continuum. The positive association with tau is a new finding that should be explored with further studies.

The Phillip A. Hoskins Foundation Award

Enzyme Assay Development for Hormonally Up-regulated Neu-associated Kinase (HUNK) Protein: A Target in EGFR+ (HER2+/ErbB2+) Breast Cancers

Brieanna Bell, Elizabeth Yeh

Background: Breast cancer is the second leading cause of cancer death among women in the United States, with about 264,000 cases of breast cancer diagnoses and 42,000 deaths per year. For many drug-resistant metastatic breast cancers, epidermal growth factor receptor (EGFR) is highly expressed with a conferred resistance to HER2/ErbB2 inhibitors. Hormonally up-regulated protein kinase (HUNK) is a protein kinase that has been evidenced as a target in EGFR+ (HER2+/ErbB2+) breast cancers, presenting a potential for targeted treatment.

Methods: To determine its efficacy as a target, we implemented ADP enzyme assays to test the amount of phosphorylation of HUNK, both alone and in the presence of various HUNK inhibitors.

Results: The activity of specific drug inhibitors was found to be inconclusive. However, HUNK does demonstrate affinity to EGFR when combined with additional DTT, suggesting its potential for further study as a target for drug-resistant breast cancer therapy.

WH and FL Hardiman Fellowship
Brieanna Bell

Year: Class of 2026
Specialty Interest: OB/GYN or pediatrics
Biggest takeaway: Enzyme assay development not only requires the achievement of replicable results, but also sheds light on the importance of optimizing conditions in a way that delivers replicable results in a timely manner.
As a result, the time I spent with IMPRS research optimizing an enzyme assay for novel breast cancer drugs deepened my ability to problem solve, trouble shoot, and become a master of the essence of trial and error. Working in Dr. Yeh's lab, which focused on all stages of drug discovery , also created an impactful connection between laboratory science and the clinical relevance and pathology of breast cancer. Above all, I am appreciative to have had such a supportive and welcoming team to learn from.

Clinical Applications of Next-Generation Sequencing for Cancer Diagnostics and Targeted Cancer Therapy

Alexander Mosteller, Ashiq Masood

Background: Next-generation sequencing (NGS) is a revolutionary technology that has effectively sequence massive quantities of genomic DNA or RNA at a shorter time and a lower cost. The NGS is routinely used in oncology to tailor care for individual patient. In this review, we discuss the role of NGS how it can provide a more personalized approach to targeted cancer therapy.

Methods: A literature review was conducted via PubMed and articles were screened for publication dates within the past 10 years. Primary literature consisting of clinical trials and review articles were utilized. Search terms included "(next-generation sequencing) AND (cancer)", "(next-generation sequencing) AND (cancer diagnostics)", and "(next-generation sequencing) AND "(cancer therapy)".

Results: From the literature review, we found that NGS is indicated for daily practice as a diagnostic tool for advanced NSCLC, colon cancer, prostate cancer, cholangiocarcinoma, and some advanced rare cancers. We also found evidence suggesting that NGS is helpful in identifying actionable mutations that will, in turn, allow the patient to be matched to a more individualized cancer treatment.

Conclusion: As oncology care continues to move in the direction of more personalized care, the potential applications of NGS in the field of oncology will continue to evolve. Our review will help further the understanding of NGS and provide context for its value in patient care and its ability to provide an avenue for targeted therapy.

WH and FL Hardiman Fellowship

Decoding the Link Between XPC and Lung Cancer Susceptibility: A Study of Cigarette Smoke-Induced DNA Damage in the Setting of XPC Deficiency

Marie Karam, Huaxin Zhou, Nawar Al Nasrallah, Catherine Sears

Rationale: Despite the known mutagenicity of cigarette smoke, only 10-15% of smokers will develop lung cancer in their lifetimes. What determines a smoker's susceptibility to lung cancer is poorly understood. We identify the nucleotide excision repair (NER) protein Xeroderma pigmentosum Complementation Group C (XPC) as a tumor suppressor that may contribute to lung tumorigenesis when mutated and combined with cigarette smoke (CS). Micronuclei, which are chromosome fragments and/or lagging chromosomes separated from the main nucleus, occur in many cancers, and indicate genomic instability. We hypothesize that cigarette smoke and XPC knockdown will cause genomic instability that will activate the DNA Damage Response (DDR) and increase the frequency of micronuclei and nuclear aberrancies.

Methods: A human bronchial epithelial cell line (Beas-2B), and two lung adenocarcinoma cell lines (H1299 and A549) with stable XPC lentiviral knock-down (shXPC) or control shRNA (shCtrl) were treated with cigarette smoke extract (CSE) or air control (AC). DNA Damage Response (DDR) proteins were analyzed via immunoblot (Western). Micronuclei and nuclear aberrancies were quantified through the cytokinesis-block micronucleus assay (CBMT) using immunofluorescence microscopy (DAPI).

Results: Both CSE and XPC knockdown independently amplify expression of DDR proteins in H1299, Beas-2B, and A549 cell lines. Nuclear aberrancies increased significantly ($p<0.05$) with CSE in all three cell lines. Micronucleus frequency increased significantly with CSE in H1299 and Beas-2B cells ($p<0.05$) and with XPC knockdown in Beas-2B cells compared to shCtrl ($p<0.001$). XPC deficiency was associated with cell-type specific alterations in activation of the DDR.

Conclusions: We identified a previously uncharacterized role of XPC deficiency in augmenting cigarette-smoke induced chromosomal breaks manifesting as micronuclei, particularly in non-cancerous Beas-2B cells. These findings offer insight into tumorigenesis in cigarette smoking and shed light on mechanisms of continued DNA damage in cancer cells. Future research should clarify the mechanisms of micronucleus formation in human translational specimens and pinpoint additional functions of XPC beyond NER, including in replication repair.

Marvella Bayh Memorial Scholarship

Silencing COQ8B in Aortic Smooth Muscle Cells Reveals Cellular Dysfunction Related to Changes in Cell Proliferation

Joshua Davis, Benjamin Landis

Background/Objective: Thoracic aortic aneurysm (TAA) is a prevalent disorder that predisposes to aortic dissection. Prior work identified the ubiquinone biosynthesis gene COQ8B as a genetic modifier of TAA progression. We sought to determine the impact of decreased COQ8B on global transcription in aortic smooth muscle cells (SMCs).

Methods: Primary human aortic SMCs from a healthy donor were seeded in 12-well plates. Six experimental conditions were created, each with 3 replicates: 1) siRNA targeting COQ8B (siCOQ8B); 2) siRNA targeting the dominant TAA gene SMAD3 (siSMAD3); 3) negative control siRNA (siNeg); 4) siCOQ8B and siSMAD3; 5) siCOQ8B with Angiotensin II (AngII) stimulation (siCOQ8B+AngII); 6) siNeg+AngII. RNA was extracted approximately 48 hours post-siRNA transfection and, for AngII conditions, after 1 hour of incubation with AngII (100 nM). mRNA-sequencing was performed and downstream analysis utilized R packages EdgeR and topGO.

Results: Multidimensional scaling identified distinct clustering of samples by experimental condition. Downregulated genes in siCOQ8B were enriched for Gene Ontology pathways related to cell proliferation including cell cycle regulators, DNA replication, and mitosis. MYOCD, a master regulator of SMC homeostasis, was downregulated. Similar proliferation-related pathways were enriched in siCOQ8B+siSMAD3 and siCOQ8B+AngII compared to siNeg. Pathways related to cell proliferation in siCOQ8B+AngII cells were downregulated when compared to siCOQ8B which indicates that AngII infusion in the context of COQ8B silencing may further dysregulate cell proliferation pathways.

Conclusion/Implications: The results indicate that COQ8B has an important role in cell cycle processes in aortic SMCs, including when SMCs are exposed to stressors associated with TAA development. Stimulation of angiotensin receptors may exacerbate the effects of decreased COQ8B in these processes. To investigate these experimental results in human pathology, bulk RNA samples and intact nuclei have been isolated from frozen human aortic specimens and prepared for transcriptomic analysis.

Hazel and Tommy Thompson Cardiac Research Scholarship

Importance of Per2 in Cardiac Mitochondrial Function during Stress

Meghana Bhaskara, Olufisayo Anjorin, Arris Yoniles, Jean Liu, Meijing Wang

Background/Objective: Ischemic heart disease is the worldwide leading cause of death. Cardiac cellular damage from ischemia is mainly inflicted in the form of mitochondrial dysfunction by inflammatory cytokines and reactive oxidative species (ROS). Mitochondria are critical for metabolic function to maintain cardiac activity. Interventions against inflammatory cytokines and ROS are therefore cardioprotective during ischemic damage. Period Circadian Regulator 2 (Per2) is a circadian rhythm protein involved in metabolic regulation as a time-responsive gene in cardiomyocytes during ischemic damage. Overexpression of Per2 has been shown to decrease infarct size following myocardial infarction. In this study, we hypothesize that Per2 protein plays a regulatory role in the mitochondrial response to inflammatory cytokine TNFα and oxidative stressor H2O2 in human cardiomyocytes.

Methods: AC16 Human Cardiomyocytes (HCM) transfected with Per2 or control siRNA were subjected to stress treatment of 100ng/mL TNFa or 100μM H2O2. RT-PCR and Western blot were used to detect Per2 expression. After two hours of treatment, mitochondrial membrane potential (ΔψM) was detected using JC1 fluorescence probe and mitochondrial respiration capacity was evaluated via Seahorse Mito Stress Test. After four hours of treatment, cell death was measured using Annexin V and propidium iodide (PI) apoptosis kit via flow cytometry.

Results: Per2 siRNA significantly reduced Per2 mRNA and protein levels in HCM. Increased cell death and decreased ΔψM were observed in HCM treated with TNFa or H2O2. Knockdown of Per2 potentiated TNFa-induced cell death, TNFa- or H2O2 -disrupted ΔψM, and TNFa- or H2O2- impaired mitochondrial maximal respiration.

Conclusion/Implication: Per2 knockdown increases apoptotic susceptibility and mitochondrial dysfunction in human cardiomyocytes exposed to TNFa or H2O2. Delivery of Per2 may serve as a promising therapeutic strategy to protect cardiomyocyte mitochondrial function during periods of stress, such as myocardial infarction, organ transplantation, and cardiac surgery.

NIH NHLBI-T35 Award
Meghana Bhaskara

Year in school: Class of 2026
Specialty interest: procedurally oriented
Biggest takeaway: Working in Dr. Wang's lab this summer was a very productive and rewarding experience. I was able to work on our project from initial stages doing background research to gathering and analyzing data to publishing an article. This experience has been formative in my understanding of the research process in medicine and the involved logistics. I also enjoyed further developing my lab skills and using advanced instruments to collect data.

Viability of Transplanted de Novo Retinal Ganglion Cells in Human Donor Eyes Maintained Under Elevated Intraocular Pressure

Salil Gupta, Shahna Shahul Hameed, Tasneem Sharma

Purpose: Glaucoma is a group of optic neuropathies characterized by visual field loss, classically due to increased intraocular pressure (IOP) and retinal ganglion cell (RGC) degeneration. Current treatment options reduce IOP, but existing RGC degeneration is irreversible. RGCs can be differentiated from reprogrammed human corneal fibroblasts and transplanted into the retina to potentially restore vision in patients with late-stage disease when most RGCs are irreversibly damaged. We investigate the survival of these human induced pluripotent stem cell (IPSC) derived RGCs after culturing them in human donor posterior eye cups under conditions of elevated and normal IOP using the ocular translaminar autonomous system (TAS) pressurization chamber.

Methods: Human iPSCs were generated by reprogramming human donor corneal fibroblasts using Sendai virus vectors with Yamanaka factors. These iPSCs were then differentiated into retinal organoids from which RGCs were obtained. The RGCs were then transduced with AAV2-GFP and transplanted into donor posterior eye cups obtained from control individuals. They were pressurized for approximately 5 days, with the left eye maintained at normal IOP and right eye at elevated IOP. Viability was measured by expression levels of pro-survival pathways via qRT-PCR, fluorescent microscopy, and electroretinography for retinal function (ERG).

Results: We successfully transplanted human RGCs into human donor eyes and visualized them after GFP transduction. We maintained a pressure differential between the two eyes for approximately 5 days using the TAS model. Differential expressions of survival, inflammatory and apoptotic genes were identified between normal and high IOP. We identified retinal function changes under normal and high IOP after iPSC derived RGC transplantation.

Conclusions: Human iPSC derived RGCs provide a potential strategy to regenerate vision in patients with diseases that damage RGCs like glaucoma, Parkinson's, Alzheimer's, multiple sclerosis, and traumatic optic neuropathy. Future work involves directing the transplanted RGC axons toward visual centers of the brain.

NIH NEI-T35 Award
Salil Gupta

Year: Class of 2026
Specialty interest: Ophthalmology
Biggest takeaway: Thanks to my colleagues in Dr. Sharma's lab I learned a tremendous amount about glaucoma, induced pluripotent stem cells (iPSCs), and scientific communication. This was my first experience doing cell culture, so learning how to take care of stem cells and differentiate them into retinal ganglion cells for transplantation into donor eyes was very interesting and challenging. The most special part of my summer was working with human cadaveric donor eyes and pressurizing them to simulate glaucoma to measure the survival of our transplanted iPSCs. I am now preparing my project for publication.

Investigating the Effects of Tirzepatide on NAFLD/NASH Progression Using 3D Human Liver Organoids

Barry Wei, Thi M.U. Le, Evan J. Catron, Robert P. Passarelli, Ping Li, Wenjun Zhang, Burcin Ekser

Background: Nonalcoholic fatty liver disease (NAFLD) is a disease characterized by the accumulation of lipids in the liver that ultimately progresses to nonalcoholic steatohepatitis (NASH) and cirrhosis. Currently, there is no known FDA-approved treatment for NASH. Tirzepatide (brand name Mounjaro), a glucagon-like peptide 1 (GLP-1) agonist, has been hypothesized to have potential effects in reversing NAFLD/NASH progression and restoring liver function. However, this hypothesis remains untested in current literature. The aim of this study is to use 3D human liver organoids (3D-HLOs) as an ex vivo model system to determine the potential effects of tirzepatide on the progression of NAFLD/NASH.

Methods: 3D-HLOs were constructed by incorporating 5 major human hepatic cell types isolated from NAFLD livers, including hepatocytes, hepatic stellate cells, liver endothelial cells, cholangiocytes, and Kupffer cells. NAFLD 3D-HLOs were maintained in the hepatocyte medium supplemented with 50mM free fatty acid (FFA) only (control group) or FFA+tirzepatide (100nM, 200nM, or 500 nM) for 14 days. By the end of the treatment, 3D-HLOs were subjected to BODIPY493/503 staining to determine lipid droplet accumulation. Immunofluorescence staining and confocal microscopy analysis were performed to confirm hepatocyte function (ALBUMIN) and fibrosis (COL1A1). qPCR was performed to determine the relative expression markers of hepatocyte function (ALBUMIN, HNF4A), angiogenesis (PECAM-1, VCAM-1, ICAM-1), and fibrosis (ACTA2, COL1A1).

Results: BODIPY 493/503 revealed no significant difference in lipid deposition between 3D-HLOs in all treatment groups. Mean immunofluorescence staining intensity for albumin in controls, 100nM, 200nM, and 500nM tirzepatide were 154.4, 181.4, 221.1, and 236.4, respectively ($p>0.05$). Dose-dependent quadratic regression revealed a strong correlation between dose and albumin fluorescence intensity ($R2 = 0.963$). qRT-PCR analysis revealed that tirzepatide treatment did not significantly alter transcriptional levels of ALB, HNFA4, ACTA2, PECAM-1, VCAM-1, and ICAM-1 compared to the control group.

Conclusion: Although there is no statistically significant difference in liver cell function markers at different tirzepatide dosages in the setting of NAFLD/NASH, the highest dose of tirzepatide improved ALB expression despite ongoing FFA exposure, indicating a potential hyperbolic relationship between tirzepatide concentration and albumin production. Future investigation with altered treatment duration and dosage will elucidate whether there are any direct modulating effects of tirzepatide on NAFLD/NASH progression.

NIH NHLBI-T35 Award

Improvement in Nocturia Frequency After Holmium Laser Enucleation of the Prostate (HoLEP)

Catherine Adaniya, RJ Caras, Austen D. Slade, Christopher A. Rogers, Andrew Adeola, Thomas Shelton, Tim Large, Marcelino E. Rivera

Background/Objective: Benign prostatic hyperplasia (BPH) is a common urinary pathology in older men resulting in lower urinary tract symptoms such as nocturia, urinary frequency and urgency, and outlet obstruction. Holmium enucleation of the prostate (HoLEP) is a bladder outlet procedure used to improve BPH symptoms by enucleating the prostate's transitional zone. HoLEP has been demonstrated to improve obstructive urinary symptoms, but little research has investigated the improvement of irritative symptoms like nocturia.

Methods: A retrospective chart review of Indiana University HoLEP procedures between October 2018 and November 2021 was conducted. Participants were men with a pre-operative American Urology Association Symptom Score (AUASS). At least six months after surgery, patients completed the AUASS to compare pre- and post-operative symptoms. We identified participants with high frequency nocturia (HFN), a nocturia frequency ≥ 3, low frequency nocturia (LFN), a nocturia frequency < 3, and dominant nocturia (DN), a nocturia frequency ≥ 3 and an AUASS score < 20. Averages and paired two-tailed t-tests were conducted.

Results: We identified 220 patients who completed surveys and follow-up. Overall, nocturia was reduced by 0.92 points and quality of life (QOL) scores improved by 2.51 points post-HoLEP ($p<0.05$). HFN patients experienced a 2.01-point decrease in nocturia scores ($p<0.001$) compared to a 0.12 increase in LFN patients ($p=0.43$) and a 0.85 decrease in DN patients' scores ($p=0.002$) after HoLEP. When comparing QOL scores, HFN patients displayed a 2.98-point improvement, LFN participants improved by 2.34, and DN patients indicated a 2.12-point improvement after surgery ($p<0.001$).

Conclusion/Implications: In patients with high occurrences of nocturia pre-operatively, HoLEP demonstrated significant improvements in nocturia frequency. LFN patients did not demonstrate a significant improvement in nocturia scores. Despite this, all groups displayed improved QOL scores post-operatively. This suggests that HoLEP helps reduce irritative symptoms such as nocturia. Further investigation is needed to evaluate this on a larger scale.

General Excellence Award
Kate Adaniya
Year: Class of 2026
Specialty interest: Urology

Biggest Takeaway: This summer was my first experience with clinical research, and I loved being able to spend quality time interviewing patients and understanding how their urinary symptoms changed following holmium laser enucleation of the prostate (HoLEP). Clinical research highlighted to me the necessity of gathering long-term surgical outcomes in order to understand the benefits and adverse effects of these procedures. This research is critical so that we can better inform future patients on the results they can expect and ensure patients feel knowledgeable and comfortable with their procedure. I am so grateful to have learned from my mentors throughout this project, and I am excited to continue conducting research in the future.

Reduced Endocochlear Potential in vivo Prevents Hair Cell Degeneration in Tmprss3-deficient Mice

Nicole Bianca Libiran, Ernesto Cabrera, Yu-an-Siao Chen, Rick Nelson

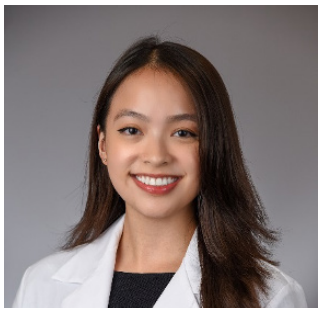
Background: Transmembrane serine protease 3 (TMPRSS3) is a transmembrane serine protease with proteolytic activity essential for normal auditory function in mice and humans. While Tmprss3 mutations are the most common gene variant adain cochlear implant recipients, details behind its cellular mechanism remain elusive. Tmprss3-mutant mice exhibit normal hair cell (HC) development until postnatal day 12 (P12), followed by rapid HC degeneration within 48 hours, resulting in deafness. The HC degeneration temporally correlates with the rapid rise in endocochlear potential (EP) that is required for hearing. This phenotype mirrors other mouse models with defects in genes expressing tight junctions (TJs). Thus, we hypothesize that TMPRSS3 regulates tight junctions and cell death is mediated through high EP.

Methods: Our laboratory has previously demonstrated that performing cochlear explants at P7 followed by in vitro cultures for an additional 7 days leads to complete preservation of HCs in Tmprss3-mutant mice. It is unknown if the observed HC survival is due directly from removing EP or from other extracellular factors. Here we investigated the role of EP in Tmprss3-deficient mice using in vivo experiments. We crossed the Tmprss3-mutant mice with Pou3f4-mutant mice, which fail to generate EP. Cochlear whole mounts were dissected, fixed, and stained for four groups of mice: wild-type, Tmprss3-mutant, Pou3f4-mutant, and double-mutant mice. Inner and outer hair cells were quantified within a span of 125 μm and compared between groups.

Results: We found significant preservation of HCs ($p<0.001$) in double mutant mice with reduced EP compared to Tmprss3-mutant mice. Thus, HC degeneration in Tmprss3-deficient mice is due to endocochlear potential driven K+ toxicity. Tmprss3-deficient mice likely have faulty apical TJs that result in leakage of K+ ions from the endolymph to the basolateral side of HCs, leading to HC degeneration.

Concluson: Future research should work to elucidate TMPRSS3's proteolytic target and its mechanism of TJ-related regulation.

General Excellence Award
Nicole Libiran
Year: Class of 2026
Specialty Interest: Anesthesiology with a potential fellowship in Neuroanesthesia or Obstetric Anesthesia.



Biggest takeaway: My research experience this past summer taught me how to analytically create tangible results from microsurgical procedures and meticulous benchwork technique. The process of thoroughly isolating the cochlea and Organ of Corti from mice served as direct hands-on-experience and insight to the precision and patience that the surgical field necessitates. I distinctly remember feeling proud to see the hair cells that I stained being visualized underneath the microscope. Most gratifying of it all was to know that I, with the help of my lab mates, contributed a small part in the current understanding of the cellular dysfunction behind Tmprss3-related deafness.

"There's Healing in Music": Veteran Perceptions of Music Interventions for Their Chronic Musculoskeletal Pain

Claire Whalen, K. Maya Story, Matthew J. Bair

Background/Objective: For veterans suffering from chronic musculoskeletal pain, finding alternative treatments to analgesics is critical for safer, more effective pain management. While music interventions have shown promise for acute pain, their acceptability for chronic pain and telehealth delivery needs more rigorous examination.

Methods: The Feasibility and Acceptability of Music Imagery and Listening Interventions for Analgesia (FAMILIA) study randomized 60 veterans with chronic musculoskeletal pain to receive usual care, telehealth music listening (ML), or telehealth music imagery (MI). ML involved independent listening to songs of each participant's choosing, while MI consisted of one-on-one music therapist-led sessions combining ML, imagery, and verbal processing. To complement quantitative analysis of patient-reported outcomes, qualitative interviews of participants were conducted to understand perceived benefits, acceptability, barriers, and facilitators of study interventions. We analyzed 15 interviews using thematic analysis to assess acceptability of the music interventions.

Results: All interviewees perceived mental-emotional benefits and almost all experienced physical pain relief during their music listening or therapy sessions. However, many noted that the pain relief was short term, and for some veterans randomized to ML, certain songs evoked negative associations. Participants also benefited from study participation and its formal structure, in contrast to their prior informal music listening experiences. Planned study activities like participant check-ins with staff and interactions with therapists fostered a deeper understanding of how music can be therapeutic and increased veterans' confidence in their own ability to use music therapeutically. Study acceptability was further evidenced by interviewees' intention to continue using music listening and imagery techniques after study completion and their strong support for expanding access to music interventions to other veterans.

Conclusion/Implications: The FAMILIA study not only supports telehealth music interventions as acceptable treatments for chronic musculoskeletal pain, but the reported physical pain and mental-emotional benefits necessitate a larger, fully powered study.

General Excellence Award
Claire Whalen

Year: Class of 2026
Specialty Interest: Internal Medicine
Biggest takeaway: As a musician and the relative of a veteran with chronic pain, this research was the perfect opportunity to learn more about non-opioid treatments for chronic pain, particularly in veterans. I was extremely encouraged by our findings that music therapy alleviated physical pain and provided mental-emotional benefits for research participants. I also learned so much from observing how Dr. Bair's research directly stemmed from his clinical compassion; he took the initiative to seek better options for a prevalent problem his patients experience. Ultimately, my IMPRS experience deepened my understanding of what research can be, excited me about the future of chronic pain management, and challenged me to think about how I could contribute to similar efforts as a future physician.

IMPRS Abstracts

A Case Study on the Relationship Between a Multimodal Approach to Opioid Treatment and Opioid Cessation in Low-Income BIPOC Communities

Adaobi Okolocha, Jasser Khairallah

Background and Hypothesis: In the United States, the opioid crisis has been centered around white individuals in suburban and rural areas. However, communities of color who have a low socioeconomic status (SES) are facing an increasing amount of opioid overdose related deaths. Even with pharmacological opioid agonist therapy, this specific population still does not have the support to remain abstinent from opioids. We have conducted a case study with Mr.G, a 32 year old black male patient with opioid use disorder (OUD) who is from a low SES. Mr. G suffered from four overdoses over a six-month period (two of them occurring within 24 hours). He was treated for each overdose at three different large academic medical centers. The first three academic medical center offered him solely Buprenorphine-Naloxone, whereas the current medical center took a multimodal approach. We hypothesize that populations of color with opioid use disorder who are from a low socioeconomic class will benefit more from a multimodal approach to OUD treatment.

Methods: In this work, we conducted a literature review to construct a multitude of questions to assess Mr.G's experience at his previous academic medical centers versus his current academic center and why his current treatment has resulted in successful opioid cessation.

Results: Thus far, we have not received a response from Mr. G. However, since a multimodal approach was taken towards his treatment, he has enrolled in college courses, has gained employment, and has maintained sobriety.

Conclusion and Potential Impact: Patients like Mr. G who come from communities of color and lower socioeconomic status may benefit from a multimodal approach when treating their OUD. This study will potentially lead to more research focusing on how to address the holistic needs for communities of color with opioid use disorder who come from a lower socioeconomic status.

A Comparison of the Effectiveness Between Trabeculectomy and Minimally Invasive Glaucoma Surgeries

Esa Syed, Louis Cantor

Background/Objective: Glaucoma affects 3 million Americans and is the second most common cause of blindness globally, after cataracts. It involves the degeneration of the optic nerve, often associated with increased eye pressure, leading to vision loss. Trabeculectomy was traditionally the standard surgical approach for managing glaucoma progression once medication and laser had failed. Recently, minimally invasive glaucoma surgeries (MIGS) have gained FDA approval for mild and moderate cases and are being implemented in practice. We hypothesize that MIGS procedures are just as effective as trabeculectomy in mild, moderate, and severe cases of glaucoma.

Methods: Using data from IU Health, patients that underwent either a MIGS procedure or a trabeculectomy for open-angle glaucoma at least a year ago were identified. Visual field data was used to stage their glaucoma. Any future glaucoma surgery was noted. Using this information, three separate Kaplan-Meier curves at 95% confidence intervals were created corresponding to each stage of glaucoma with a second surgery defined as a failure, and a survival analysis was done to visualize the difference between these surgical approaches.

Results: The sample included 119 patients and 179 eyes with a mean age of 80 and 57% females. The study had 80% power at a two-sided 5% significance level. Based on the survival analysis, there were no significant differences between trabeculectomy and MIGS in mild and moderate glaucoma (p=0.69 and 0.97 respectively). In severe glaucoma, MIGS had a lower failure rate com-

pared to trabeculectomy (p=0.026).

Conclusion/Implications: The research comparing trabeculectomy to MIGS is still relatively new and this study shows the safety and efficacy of MIGS procedures. If confirmed, this study could potentially change the standard of care to MIGS for all stages of open-angle glaucoma.

A QI Initiative: Assessing Predictive Value of Jewelry Sensitivity for Patch Testing Outcomes in a Medium Sized Hospital System

Katey Bell, Majed Koleilat

Background/Hypothesis: Nickel, chromium, and cobalt are common allergens seen with metal-induced allergic contact dermatitis (ACD) and prevalence is increasing. True prevalence and patient morbidity remain obscure because vague practice parameters create variability in history collection. Practice parameters acknowledge the importance of history for diagnosis with "moderate" strength but give no definite guidelines for which historical indicators best signify positive patch test results. The Deaconess Clinical Research Institute aims to assess the prevalence of jewelry sensitivity and if such sensitivity impacts the days when tests turn positive. We hypothesize that by identifying if jewelry sensitivity correlates with test results, physicians can prioritize specific questions to optimize visit efficiency.

Methods: A blinded retrospective chart review of 157 patients in an Indiana Allergy Clinic from 7/2020-7/2023 referred for ACD evaluation. A chi-square analysis with Yates correction will determine the association between assessment day and positive results in jewelry sensitive patients.

Results: Patients with jewelry sensitivity (71.3%) were more likely to test positive on day 2 and 7 (5.2%, 1.9%) and less likely to test positive on day 3 (7.1%). There was no significant difference in days tests turned positive between patients with or without history of jewelry sensitivity (p=0.3383). Patients with jewelry sensitivity were 25.5% more likely to test positive than those without jewelry sensitivity but were not significantly associated with a positive test result for all or specific metals (p>0.05). This observation indicates clinical but not statistical significance.

Conclusion/Implications: History of jewelry sensitivity cannot reliably predict the days when tests turn positive or likelihood of positive results, although low sample size likely caused the latter observation. Less clinical significance can be tied to jewelry sensitivity history than previously assumed, allowing providers to save time taking histories.

A Review of SNAP Nutritional Incentive Programs

Dylan Sogocio, Antonia Sawyer, Dennis Savaiano

Background/Objective: There are over 40 million Americans enrolled in the Supplemental Nutrition Assistance Program (SNAP), formerly known as the Food Stamps Program. SNAP is a program aimed at addressing food insecure individuals who fall 130% below the federal poverty line. Despite program attempts to increase food access, SNAP does little to prevent nutrition related health disparities between SNAP participants and people who are more financially secure. Aiming to alleviate these nutritional health disparities that SNAP does not currently address, nearly every state has initiated nutrition incentive programs. They facilitate participant choice, where they can purchase and consume more fruits and vegetables, focus on nutrition, and financially support local farmers markets and supermarkets. The goal of this review is to analyze the literature about SNAP nutrition incentive programs.

Methods: To synthesize a literature review of nutrition incentive programs, a search was conducted in PubMed, PubAg, and Google Scholar databases using terms such as "SNAP" and "nutritional incentive program," along with date restrictions for 2013 or later. This search identified a total of 54 articles, and 35 were used following screening. Included articles were screened first by abstract and then article content to determine relevancy.

Results: There were three categories of interventions that were suggested by the literature: incentives, discounts, and restrictions. The literature suggests that these programs address nutritional health disparities by providing financial interventions for SNAP participants to make nutritionally conscious decisions about the food they purchase and consume. Regardless of the intervention, each of these categories of intervention were praised by SNAP participants. Participants were able to stretch their

Electronic Benefit Transfer (EBT) funds further and they had high program satisfaction.

Conclusions/Implications: This review discusses these different interventions to allow for new or existing programs to be developed to best address nutritional health disparities using scholarly evidence.

Analysis of Perioperative Events in Bilateral vs Unilateral Staged Percutaneous Nephrolithotomy

Kyle Edwards, Thomas Shelton, Marcelino Rivera

Background/Objectives: Kidney stones are a common medical condition that impact approximately 10% of US population. Management of stone disease is based on size and location of stones. Percutaneous nephrolithotomy (PCNL) is typically indicated in patients with large renal stone burden (typically >2 cm) or complex anatomy. In the setting of complex stones, multiple, staged PCNLs are required. We hypothesize that there is no significant difference in the perioperative change in lab values in bilateral PCNLs compared to unilateral PCNLs.

Methods: The data was gathered by retrospectively reviewing the electronic medical record of 50 patients in the IU health system who underwent planned staged PCNLs between January and December 2018. We identified patients who underwent both bilateral and unilateral staged procedures. Data for BMI, sex, ethnicity, hemoglobin, estimated glomerular filtration rate (GFR) (typically formula CKD-EPI or MDRD), urine and stone cultures, stone composition, and bilaterality vs. unilaterality was collected. Two-tailed T-tests were performed to analyze data between bilateral and unilateral cases.

Results: We identified a total of 50 patients, 19 men vs. 31 women; 9 men and 10 women underwent bilateral PCNLs, while 11 men and 20 women had unilateral PCNLs. BMI ranged from 14.2 to 62.3, and age ranged from 15 to 81. Significant differences were found between the changes in hemoglobin levels in patients who underwent bilateral PCNLs when compared to unilateral PCNLs (p value 0.018). No significant differences were noted when comparing changes of estimated GFR, BMI, age or any other variables.

Conclusion/Implications: Patients who underwent bilateral staged PCNLs demonstrated a greater drop in perioperative hemoglobin compared to unilateral PCNLs without an increase in blood transfusion. This finding suggests that Bilateral PCNLs requiring multiple stages are safe in complex stone patients.

Analysis of the Binding Partners of Clusterin in their Role in Increased Intraocular Pressure in Glaucoma

Clay Hepp, Anoop Magesh, Avinash Soundararajan, Padmanabhan Pattabiraman

Background/Objective: Elevated intraocular pressure (IOP) is a risk factor for primary open-angle glaucoma (POAG). Clusterin (CLU) is a secretory chaperone protein found in trabecular meshwork tissue that is implicated with POAG risk. In this study, we aimed at understanding the role of CLU and its binding partners in IOP homeostasis and POAG pathology.

Methods: Normal trabecular meshwork (NTM) cell lines were used. Half of the NTM cell lines were transfected with adenovirus empty (AdMT) while the other half of the NTM cell lines were transfected with adenovirus clusterin with histidine tag (AdCLUHIS). AdCLUHIS allows for the overexpression of CLU HIS in the NTM cells. After 72 hours of transduction, the media and cell lysate were collected. As CLU is a secretory chaperone protein, the media was analyzed. Immunoprecipitation (IP) was conducted to isolate CLU HIS and all the proteins bound to it. Western blot analysis was conducted to confirm IP worked successfully. Once it was confirmed that CLU HIS with all its binding partners was isolated successfully using IP, the media samples were sent to proteomics to determine all the specific proteins that are bound directly to CLU.

Results: Western blot analysis confirmed that the overexpression of CLU HIS was successfully accomplished through adenovirus transfection. In addition, Western blot analysis confirmed that IP worked successfully. Proteomic data will show the specific binding partners of CLU.

Conclusion/Implications: Our preliminary study suggests that CLU can be overexpressed via adenovirus and

analyzed via IP. Understanding this allows for the purification of the protein and its attached binding partners. Identifying these binding partners can be novel targets for improving aqueous humor outflow through trabecular meshwork to decrease IOP and decrease one's risk for POAG.

Aortic Valve Repair in Adult Patients: An Institutional Review

Sathvik Madduri, John Brown, Larry Markham, Aeleia Hughes, Emily Freeman, Mark Rodefeld, Mark Turrentine, Jeremy Herrmann

Background/Objective: Aortic valve (AV) repair has become more commonly utilized for adults at our center, but the outcomes and durability remain unknown. We aim to evaluate AV repair outcomes in patients ≥18-years.

Methods: A single-center retrospective chart review of patients who underwent AV repair between 2010 to 2022 was conducted. Patients undergoing valve repair for congenital defects were included. Short-term outcomes (<30-days) included immediate complications and hospital length of stay. Long term outcomes (≥30-days) included survival, freedom from reintervention, and complications.

Results: A total of 54 patients underwent AV repair at a mean age of 35.7±14.1 years. Four additional patients had attempted repairs which were converted to AV replacement. Median follow-up was 6.0 years (IQR: 3.6-8.2). Indications for repair included aortic stenosis (n=39, 72.2%), aortic regurgitation (n=49, 90.7%), and bicuspid AV (n=50, 92.6%). Ascending aortic replacement and aortoplasty were the most common concomitant procedures (n=33, 61.1%). Survival for the entire period was 96.3% with 1-, 5-, and 10-year survival being 100%, 97.2%, and 75%, respectively. The most reported long-term complications were ascending aortic arch dilatation (n=15, 27.8%) and aortic root dilatation (n=14, 25.9%). Four patients (7.4%) underwent surgical reintervention including one valve re-repair, two ascending arch replacements, one Ross procedure, one Bentall procedure, and one transcatheter aortic valve replacement. Median times to reintervention were 6.1-, 4.9-, 3.8-, 1.9-, and 3-years, respectively.

Conclusion/Implications: Aortic valve repair can be performed for patients ≥18-years of age with low rates of morbidity and reintervention. AV repair is a suitable operation that helps increase the duration of native aortic valve use and delays the need for possible valve replacement. Further research will evaluate risk factors for reintervention.

Assembly of the Drosophila melanogaster mitochondrial reference genome using fifty-five strains collected from diverse global locations

Mirindi T. Kabangu, Adam Fischer, PhD, Patrick Gillespie, MS, Makayla S. Lancaster, PhD, Dylan W. Todd, MD, PhD, Brett H. Graham, MD, PhD

Background and Hypothesis: Mitochondrial DNA mutations are commonly linked to various human diseases and disorders. However, various "non-pathogenic" mutations may be advantageous for adaptation and survival. This finding highlights the potential significance of natural mitochondrial genome variation in stress adaptation mechanisms. We hypothesize that natural variation in the mitochondrial genome would impact mitochondrial respiration, DNA copy number, and citrate synthase activity.

Methods: In this study, fifty-five wild-type D. melanogaster strains were selected based on their geographic region. Respiration was measured using custom respirometers, each containing five flies in an eosin and water solution for approximately six hours. Citrate synthase activity was assessed by monitoring the increase in absorbance of the thionitrobenzoate ion produced by reacting oxaloacetate with whole fly homogenate. Mitochondrial DNA (mtDNA) copy number was determined using qPCR to amplify both mitochondrial and nuclear DNA, calculating the ratio for relative mitochondrial DNA abundance. The mitochondrial genome was amplified by long-range PCR on six flies from each strain, followed by PCR product purification, and Illumina sequencing. Reference-guided mitochondrial genome assembly was then performed for each strain using BWA-MEM2, and multiple sequence alignment was performed on consensus sequences using ClustalOmega.

Results: Four mtDNA haplogroups were established based on a maximum likelihood analysis of mtDNA coding region sequence variation across all fifty-five strains. We found that mtDNA copy number and

respiration were significantly higher in the haplogroups dominated by strains originating from the US and France, respectively. We also found that the CYTB gene contained more missense mutations per basepair than any other mitochondrial gene. Additionally, we discovered that the published reference mtDNA sequence had several minor alleles in ATP6 and ND4.
Conclusion/Implications: This study contributes valuable insights into the significance of natural mitochondrial genome variation in stress adaptation mechanisms, including the impact of minor alleles in ATP6 and NAD4. Further research into the locations and effects of the single nucleotide polymorphisms unique to each haplogroup will be needed to elucidate the relationships between the strains and their physiological phenotypes.

Assessing Prevalence of TBI in a Community Setting

Pranav Haran, Allie Thomas-Fannin

Background/Objective: Traumatic brain injury (TBI) is often under-reported and thus under-recognized by clinicians. Reports of TBI prevalence have been widely variable based on the methods of data collection and definition of TBI. This study investigates the prevalence of TBI using the Ohio State University TBI Identification Method (OSU TBI-ID), a reliable and valid structured interview designed to elicit lifetime history of TBI. We also assessed relationships between TBI and psychiatric illnesses. Identifying prevalence and effects of TBI on mental health is critical to providing personalized, higher-quality care for psychiatric patients in community settings.

Methods: Patients receiving mental health care at the IUSM Psychiatry Residency Clinic in Vincennes, Indiana were asked to participate in a research study assessing history of head or neck injuries. Patients attended their regularly scheduled appointments with resident physicians, and 2–5-minute TBI screenings were conducted during or immediately after their appointment. Following the interview, patient charts were reviewed for documentation of prior TBI and all current psychiatric diagnoses.

Results: Prevalence of TBI was reported at 62.3% among patients receiving psychiatric care. 87 total TBI events were recorded, including repetitive TBI events, after 77 patient interviews. The most common cause of acute TBI was vehicular accidents. The most common cause of repetitive TBI was sports injury. Of the 87 TBIs, only 5 TBI events were recorded in patient charts. History of TBI was more likely in patients with PTSD as well as substance use disorders, and this was especially evident in patients with repetitive TBI.

Conclusion/Implications: This study shows that TBI is quite common among psychiatric patients and is vastly under-reported in patient charts. Increasing clinician awareness of TBI history in their patients is critical to providing high-quality care, and the OSU TBI-ID provides an efficient way to screen patients for TBI.

Assessing the Severity of Portal Hypertension: Is Liver or Spleen Stiffness Measurement an Alternative to the Gold Standard, Hepatic Vein or Porto-Systemic Pressure Gradient

Yasmin A Ali, Paul M Haste, Raj Vuppalanchi

Background/Objective: Liver stiffness measurement (LSM) and spleen stiffness measurement (SSM) are increased in patients with cirrhosis and portal hypertension (PH). However, increased SSM values are associated with presence of esophageal varices. Currently, the gold standard for risk stratification in patients with compensated advanced chronic liver disease (cACLD) is by measurement of portal pressure through assessment of hepatic vein or porto-systemic pressure gradient (HVPG and PSPG). However, these procedures are invasive, and either LSM or SSM may be a non-invasive alternative. We aimed to investigate the relationship between LSM or SSM and HVPG/PSPG and examined the diagnostic accuracy for identification of clinically significant PH (≥10 mm Hg) or severe PH (≥12 mm Hg).

Methods: A retrospective study (IRB Protocol #19230) allowed us to identify patients who had who undergone portal pressure measurements (HVPG or PSPG). A total of 36 patients also had SSM values. Of these, 29 patients carried a hepatic cause of PH, while the remaining had pre-hepatic (n=4) and post-hepatic (n=3) etiology.

Results: The median age was 58 years (range: 25-71) with 52% male and 83% with cirrhosis. The median LSM and SSM were 35.7 kPa (range:7.4-75.0, normal ≤7.0 kPa) and 43.8 kPa (range: 20.7-100, normal ≤ 21.0 kPa). Both LSM (r = 0.42, P-value = 0.02) and SSM (r =

0.45, P-value: 0.01) correlated significantly with HVPG/PSPG. The diagnostic accuracy for both LSM and SSM for clinically significant PH was good for LSM (AUROC 0.76, 95% CI:0.58-0.94) and excellent for SSM (AUROC: 0.81, 95% CI:0.65-0.98). The diagnostic accuracy of LSM and SSM was lower for severe PH [AUROC 0.71 (P-value = 0.06) and 0.67 (P-value = 0.1) for LSM and SSM, respectively.]

Conclusion/Implications: Both LSM and SSM correlate with portal pressure measurements and provide diagnostic accuracy to identify patients with clinically significant, but not severe, PH.

Association of Case Duration with Late vs. Early Physical Therapy Initiation in Treatment of Work-Related Musculoskeletal Injuries: A Retrospective Analysis

Grant Sawyers, Amelia Roebuck, Amanda Coupe, Michael Knipp, Tungyun Wu

Background/Objective: Occupational medicine providers treat patients who are injured while working. Conservative management with over-the-counter anti-inflammatory medicines, physical modalities (ice/heat), and activity restrictions are first-line treatment strategies. Physical therapy (PT) is often added to assist with patients' return to baseline through symptom reduction and restoration of function. PT efficacy on outcomes and healthcare costs has been described in other patient populations but less described in injured worker populations. This study focused on associations between PT timing and case duration for treating musculoskeletal injuries in a regional injured worker population.

Methods: A retrospective chart review of 795 patients receiving care at Parkview Occupational Health (POH) for musculoskeletal injuries from 2017-2023 was conducted to determine if early PT was associated with case duration. Patients employed in Indiana and referred to PT within Parkview were included in the study. Age, BMI, and case duration were compared between early vs. late PT groups using two-sampled t-test. Race, sex, smoking status, and injury type were compared using chi-squared tests.

Results: The mean case duration (73.41 days) when PT was initiated early (≤ 30 days after date of injury, DOI) was significantly shorter compared to the mean case duration (104.21 days) when PT was initiated late ($p<0.0001$). Case duration was even shorter (67.61 days) when early PT was defined as ≤14 days after injury ($p=0.001$). There was no significant difference in case duration (mean difference=9.5 days) between patients initiating PT within 14 days and within 15-30 days ($p=0.15$). Injury type (back vs. other musculoskeletal injuries) was significantly associated with PT timing ($p=0.002$).

Conclusion/Implications: Future analysis should compare case duration, days of restricted work, advanced imaging utilization, and specialist referral rate between patients with early and late PT initiation. This comparison will aid in development of best practice guidance for treatment of work-related musculoskeletal injuries at POH.

Association of Socio-Demographic Factors, Social Determinants of Health, and Weekly Physical Activity in an Urban Hospital in Northwest Indiana.

Wael Gad, Brianna Chandler, Brendan Jones, Baraka Muvuka, Jonathan Guerrero, Joshua Mangum

Background: Engaging in regular physical activity has been proven to have beneficial health effects such as preventing chronic diseases and improving mental health. Recent studies have demonstrated correlations between socio-demographic factors and physical activity levels. This study determined the associations between socio-demographic factors, social determinants of health and the amount of weekly physical activity in patients occupying an urban underserved area.

Methods: This study retrospectively analyzed a dataset generated by St. Mary Medical Center from EPIC™ with demographic characteristics and physical activity levels partitioned by time per week for adult inpatient visits from January 2021 to March 2023. Patients were stratified into physical activity levels based upon published guidelines: inactive (no physical activity), insufficiently active (<150 minutes per week) or sufficiently active (≥150 minutes per week). Data analysis was conducted in SPSS 28.0 using tests of association including Kruskal Wallis H and multivariate ordinal regression model. This study was exempted by Indiana University Human

Research Protection Program (IRB # 14040).

Results: The sample of individuals from the dataset who answered physical activity questions was comprised of 1498 patients. There was a statistically significant difference in physical activity level by age group ($p<0.001$), sex ($p<0.05$), insurance category ($p<0.001$), and social connections risk score ($p<0.001$); with race ($p=0.057$) and language ($p=0.054$) approaching significance. Multivariate analysis showed that age was the only significant factor when accounting for all variables, with higher age groups reporting lower proportions of physically active individuals.

Conclusion: Determining how socio-demographic factors influence physical activity levels will direct efforts to form and implement new interventions in the Northwest Indiana urban area and support community health initiatives. This data makes it possible to inform practitioners of the demographics that are at risk of being insufficiently active and having them direct those patients to programs in place to help bridge the lapse.

Blood Culture Contaminations: Interventions and Culture Characteristics

Aimee Lee, Vanessa Schwieterman, Christine Motzkus

Background/Objective: Blood cultures are collected in patients with serious illnesses who are at risk of bacteremia. However, some blood cultures are contaminated which may lead to adverse health outcomes for patients such as an increased length of stay and the unnecessary utilization of antibiotics. The emergency department (ED) has been found to be a frequent source of blood culture contamination. We aimed to identify characteristics and consequences of blood culture contamination at IUH Bloomington.

Methods: Chart review of blood cultures collected at IUH Bloomington in January 2023 was utilized to extract variables including intravenous location and hospital location of blood draw, number and identification of antibiotics given, length of stay, and organisms identified in the blood cultures. Data was securely maintained in REDCap.

Results: The median length of stay for individuals with contaminated cultures in January was found to be 4 days which was comparable to individuals with negative cultures. Most commonly, contamination occurred from the ED with it being responsible for 33/34 contaminated cultures. The most frequently utilized antibiotic across all groups was vancomycin – with both the positive and contaminated groups having a greater percentage of individuals receiving a course of the antibiotic with a mean course of 3.43 days. The most common contaminant was found to be coagulase negative Staphylococcus.

Conclusion and Implications: Lower rates of blood culture contamination may contribute to lower length of stay and improved antibiotic de-escalation strategy. Identification of culture characteristics may guide future endeavors in infection control policies.

Characterization of a Novel Mutation in the COPI Vesicle on Binding to Dilysine Motifs

Kimberly Felipe, Sara Custer, Elliot Androphy

Background/Objective: The heptameric COPI coatomer complex is involved in the formation of vesicles and the intracellular trafficking of proteins between the Golgi and Endoplasmic Reticulum as well as throughout the cytoplasm. Members of the COPI complex bind dilysine motifs found in the C-terminal domain of the cargo protein, particularly KKxx or KxKxx. We generated a point mutation in the WD40 domain of the COPI alpha subunit (α-COP). We hypothesized that the E269V mutant α-COP would not co-immunoprecipitate (co-IP) COPI cargo proteins terminating with a dilysine domain of KxKxx (Nucleolin and Stasimon/Tmem41b) but would bind cargo proteins terminating in KKxx (FLAG- Syntaxin17). We predicted that a mutation in the α-COP C-terminus, which impairs interaction with ε–COP, would not affect its ability to co-IP dilysine-containing cargo.

Experimental Design/Project Methods: HEK-293TT cells were transfected with Myc- tagged wild-type, E269V, and triple mutant (3X)α-COP. The E269V α-COP mutant has an amino acid change at position 269 from glutamic acid to valine. The triple α-COP mutant has three amino acid changes that eliminate binding with the ε–COP COPI subunit. Transfected α-COP was immunoprecipitated using magnetic anti-Myc beads. Endogenous Nucleolin was immunoprecipitated using magnetic Protein A beads conjugated to rabbit polyclonal anti- Nucleolin antibody. Western blots of inputs and immunoprecipitates of each experiment were conducted

to determine the ability of α-COP to co-IP C-terminal dilysine-containing proteins.

Results: Endogenous Nucleolin and Stasimon co-immunoprecipitated with WT and 3X α-COP, but not E269V α-COP.

Conclusions and Potential Impact: The inability of mutation E269V to co-IP dilysine proteins implies that the WD40 domain of the COPI α-COP protein is required for binding to KxKxx- terminating proteins, as typified by Nucleolin and Stasimon.The C-terminal 3X mutation shows that ε-COP is not necessary for dilysine recognition and implies that α-COP directly binds to this KxKxx motif.

Characterization of the Function of Carbonic Anhydrase 8

Jenny Chen, Yi Zhao, Laura Smith, Benjamin Gaston

Background: Severe asthma is a complex pulmonary disease characterized by airway inflammation, bronchoconstriction, and acid-base dysregulation. In the Severe Asthma Research Program, bronchoscopies and transcriptomics showed CA8 as a gene that is strongly associated with asthma severity. CA8, however, lacks classical CA enzyme function as it does not catalyze hydration and dehydration of CO2. The function of CA8 in the airway epithelium remains unknown. We hypothesize that CA8 serves a protective role in the airway due to its downregulation in patients with severe asthma. We aim to characterize the function of CA8 by studying its potential as an enzymatic protein.

Methods: We used colorimetric assays to detect and quantify nitrogen oxides. We tested for S-nitrosothiol synthase, denitrosylase, nitrate and nitrite synthase, and nitrite reductase activities using the Griess reagent in conjunction with Saville denitrosylation reagents and with reduction using vanadium chloride. Samples were incubated for 60 minutes. We then designed a metabolomic experiment in which products will be identified by NMR. For these, we transfected Chinese hamster ovary (CHO) cells using lentivirus containing GFP-labeled CA8 or empty vector (negative control).

Results: CA8 protein does not have these following enzymatic functions: SNO synthase, denitrosylase, nitrite and nitrate synthase, and nitrite reductase. We successfully transfected with GFP-labeled CA8 and are awaiting results of the metabolomic studies.

Conclusion: Isolated CA8 does not appear to have any nitrogen oxide redox activities relevant to asthma. The next steps include confirmatory western and SNO western blots to determine protein s-nitrosylation using transfected CHO whole cell lysate. Extracellular medium pH will also be measured. We will then move on to NMR-based metabolomics. This will help us better understand the biochemical mechanisms of CA8. Ultimately, this can provide researchers with a novel approach to asthma treatments.

Clinical Features for Detecting Diabetic Macular Edema using Artificial Intelligence

Jeffrey Liu, Doaa Hassan Salem, Hunter Jill, Sarath Chandra Janga, Amir Hajrasouliha

Background: Vision is a valuable part of life: influencing our perception of the world and of memories. Diabetes, and more specifically, Diabetic Retinopathy (DR) can affect our vision, taking away sight potentially permanently if left untreated. Currently, Diabetic Retinopathy is the leading cause for adult blindness and will continue to rise with increasing prevalence of adult diabetes. Diabetic Macular Edema (DME), a complication of DR, is diagnosed by ophthalmologists using optical coherence tomography (OCT); however, the sheer amount of DME-related imaging creates a time strain on ophthalmologists, creating a demand to further optimize the image reading process. In this study, we hypothesize that increasing the rate and ease of diagnosing DME by introducing artificial intelligence-based methods in primary medical clinics will increase the long-term preservation of ocular health in diabetic patients.

Methods: Due to the nature of our retrospective cohort study, consent was not acquired and images were also de-identified. We categorized 676 patient files by HbA1c, non-proliferative diabetic retinopathy (NPDR) severity, and proliferative diabetic retinopathy (PDR). Retinal OCT images were annotated to identify central macular edema, a common feature of DME. Retinal fundus images were also annotated to identify microaneurysms and hemorrhages, two additional features commonly used for detecting either DR or DME.

Results: A lesion features dataset was prepared to train

our AI model. OCT and fundus imaging features were extracted and combined to train the AI model for DME detection. From annotations of the in-house Macular thickness dataset, it was seen that 167 patients had DME from the total 389 diabetic retinopathy patients.

Conclusion: We will continue to prepare more datasets like the macular thickness dataset for our AI. We predict that after our AI receives substantial training with the datasets, the AI will potentially demonstrate some capability of diagnosing DME, supporting its use in medical diagnostics.

Clinical Markers for Small Vessel Pathology in Alzheimer's Disease

Quinn McBride, Kwangsik Nho, Shannon Risacher, Andrew Saykin

Background: White matter hyperintensities (WMH) and cerebral microhemorrhages (MH) are common small vessel pathologies that often co-occur with hallmarks of Alzheimer's Disease (AD) including amyloid-β and tau deposition, neurodegeneration, and decreased cognition. We investigated the relationship among these pathologies to better understand their roles in AD pathogenesis.

Methods: A sample from the AD Neuroimaging Initiative (ADNI) with baseline WMH volume WMHV), MH counts, and serum lipids measurements using the Nightingale Health metabolomics platform included cognitively normal, mild cognitive impairment, and AD participants. Spearman rank correlations coefficient and rank regression models were generated to assess the relationship between vascular pathology and mean arterial pressure (MAP), history of hypertension, and serum biomarkers. Models were covaried for age, sex, APOE status, BMI, and years of education. Further analysis was conducted by dividing participants based on APOE status. False discovery rate was controlled by the Benjamini-Hochberg method.

Results: WMHV and MH were weakly positively associated (ρ=0.197, p<1*10-10). MH and MAP were positively correlated (p<.05), but MH was not related to history of hypertension, or serum lipids. WMHV was negatively associated with serum VLDL cholesterol (p<1*10-12), LDL cholesterol (p<.0001), and remnant cholesterol (p<1*10-11). In APOE4 carriers only, WMHV was negatively associated with triglycerides (p<.001) and total fatty acids (p<.001), and positively associated with HDL cholesterol (p<.002). WMHV was not related to MAP or history of hypertension.

Conclusion: Vascular imaging markers have distinct risk factors with lipid profiles most associated with WMH burden, whereas MAP was predictive of MH. Counter-intuitively, lipids associated with higher risk of systemic vascular pathology appeared protective against WMH in the ADNI sample. This phenomenon was particularly notable in APOE4 carriers. Further investigation should be conducted to better understand the relationship between serum lipids and small vessel pathology, and how these contribute to AD pathogenesis.

Clinical Uses of Nanopore Sequencing in Recurrent Acute and Chronic Otitis Media

Ben Holtzlander, Sarah Burgin, Grace Perkins, Guang-Sheng Lei, Thomas Davis

Background: Otitis Media (OM) is a widespread problem that has an incidence of 10.85% worldwide, 51% occurring under the age of 5. Emergence of drug resistant bacteria contribute to high incidence of recurrent acute OM (AOM) and chronic otitis media with effusion (COME). Despite increasing understanding of drug resistance, limited clinical diagnostic implementation has not improved treatment. Nanopore sequencing is a highly accurate method of identifying a broad range of pathogens when compared to the standard multiplex PCR. We hypothesize that clinical application of Nanopore sequencing will improve treatment outcomes for patients with recurrent AOM and COME.

Methods: Bacterial Culture, Multiplex PCR, and Nanopore sequencing were tested on 60 middle ear and nasopharynx samples across 30 distinct ears. Statistical analysis examined differences in bacterial identification among the methods.

Results: Bacterial Identification using Nanopore proves to be more sensitive in identification of 16 of the 18 when controlled with BioFire. Of the 5 most common OM bacterial infections (S. pneumoniae, M. catarrhalis, H. influenza, S. Aureus, Pseudomonas), Nanopore identified 3 at higher rates (S. pneumoniae, M. catarrhalis, Pseudomonas), 1 at the same rate (H. influenza), and 1 did not receive any readings (S. Aureus).

Conclusion: While Nanopore genomic sequencing is still in the early stages of use, it has potential to identify bacteria with more sensitivity when compared to the current clinical standards. Future studies should investigate whether the higher rate of identification of Nanopore are due to limitations in (sensitivity of) BioFire or over sensitization of Nanopore. The next step of data analyzation will include bacterial identification in Nanopore that BioFire and traditional bacterial cultures cannot test for.

Clinical Utility of Dupilumab for the Treatment of Eosinophilic Esophagitis in Pediatric Patients

Alexa Becker, Paroma Bose

Background: Eosinophilic esophagitis (EoE) is a chronic inflammatory disease of the esophagus characterized by symptoms of esophageal dysfunction and 15 or more eosinophils per high-powered field (HPF) on esophageal biopsy. Treatment options for EoE include proton pump inhibitors (PPIs), topical corticosteroids (TCS), dietary elimination, and dupilumab. Dupilumab is monoclonal antibody against IL-4 and IL-13 administered subcutaneously and was granted FDA approval for EoE in adults and adolescents recently in 2022. Outcomes of real-world, clinical use of dupilumab for EoE remains unknown.

Objective: To observe outcomes in pediatric patients with EoE treated with dupilumab.

Methods: A retrospective cohort study of pediatric patients prescribed dupilumab for EoE was conducted. Medical records were reviewed for demographic and clinical information as well as endoscopic and histologic findings before and after dupilumab treatment.

Results: A total of 28 patients were included (mean age 15y, 71.4% male). Mean baseline maximum eosinophils/HPF was 48 ± 41. 75% of patients were treated with combination therapy of EoE with diet elimination, PPIs, or TCS prior to being prescribed dupilumab. Prior authorization for dupilumab was required in 85.7% of cases. Ten patients had follow-up endoscopy with biopsy after starting dupilumab, and among these patients the mean maximum eosinophils/HPF with dupilumab significantly improved from 44 ± 37 to 13 ± 15 (p=0.027). Among 12 patients who had follow up clinic visits, two patients reported pain or swelling at injection sites, but no other adverse events were reported.

Conclusions: Dupilumab significantly improves histologic findings of EoE and is well tolerated among pediatric patients. We hope for continued monitoring of these patients to understand the clinical utility of dupilumab for EoE over time.

Coil-Assisted Retrograde Transvenous Obliteration (CARTO) for the Treatment of Gastric Variceal Bleeding in a Patient with a Gastrorenal Shunt: A Case Report

Ryan Bolda, Ramana Yedavalli, Amy Han

Background: Portal hypertension (pHTN) is primarily caused by liver cirrhosis, which can lead to varices at portosystemic anastomoses. Gastric variceal bleeding (GVB) is rare but can be life-threatening with a mortality up to 50% for each bleeding episode. When endoscopic banding is ineffective and TIPS placement is contra-indicated due to risk of post-TIPS encephalopathy, coil-assisted retrograde transvenous obliteration (CARTO), which has shown great success in some studies, can be an effective treatment. This case demonstrates successful use of CARTO to treat GVB in a patient with a gastrorenal shunt (GRS) who presented with pHTN.

Case Overview: A 62-year-old female with cirrhosis due to nonalcoholic steatohepatitis (NASH) presented with pHTN and GVB. The patient had a massive GRS, which permitted access through the systemic venous circulation to treat the bleeding varices. Furthermore, the patient had hepatic encephalopathy (HE), making TIPS placement a poor choice due to risk of HE exacerbation. CARTO was performed to treat the bleeding varices and had the added benefit of decreasing risk of HE.

Discussion/Results: This case highlights CARTO in a patient with a 22mm GRS using a dual catheter system. Eighteen detachable 035 coils were first deployed in the GRS, followed by complete occlusion with a Gelfoam slurry to obliterate the gastric varices. Studies have described CARTO, all of which have shown incredibly high technical (complete embolization by angiography and/or CT) and clinical (no variceal rebleeding) suc-

cess rates. This patient returned for follow-up CT and endoscopic imaging, which confirmed technically and clinically successful CARTO.

Conclusion and Potential Impact: CARTO appears to be a safe alternative to TIPS when treating GVB caused by pHTN, especially in patients who have HE and a GRS. Thus, CARTO should be discussed as a treatment option for these patients. Although portal pressure increases post-CARTO, the improvement of HE can lead to an improved safety profile with future TIPS.

Comparative Analysis of Body Fluids Using Multiple Next Generation Sequencing Techniques vs. Standard of Care Culture

Manav Patel, Benjamin Kistler, Thomas Davis, Guang-Sheng Lei, Danielle Schreiber, Grace Perkins

Background: New advancements in clinical diagnostics can soon allow molecular testing at the point of care. These new methods would replace the tedious and time-consuming current practices with those with higher sensitivity and accuracy to allow for quicker diagnosis and earlier treatment.

Objective: To compare standard of care body fluids culturing with data collected from the next generation sequencing and film array-based test.

Study design: Body fluids collected and initially tested at Indiana University Healthy Pathology Laboratory (IUHPL). These samples were then later collected and plated on chocolate and blood agar using 1:100 loop and incubated at 5% CO2 incubator. The plates were checked for growth at 24hr, 48hr, and 72hr. Using the results from IUHPL, those samples that tested positive were paired up with a negative sample to begin testing. All paired samples were then processed and sequenced using Oxford Nanopore MinION Mk1C system. The selected samples were also divided to run either pneumonia or blood culture panel using BIOFIRE® FILMARRAY® Torch System.

Results: Comparative analysis of the data gathered using molecular testing methods indicates a high rate of detection of cultured organisms. 34/42 (81%) positive samples were detected by Nanopore sequencing and 26/26 (100%) positive samples were detected using BioFire Filmarray. 22/26 (85%) samples shared similar results between the two molecular methods.

Conclusion: Molecular techniques and next generational sequencing methods are phenomenal at identifying bacteria quickly and accurately. Current data indicates high success rates in identifying bacteria genus with low similarity between bacteria species. This difference can be due to crude methods that allow for misidentification of bacteria in the clinical setting. Molecular testing, though limited and error prone, currently shows potential when it comes to quick diagnosis and treatment for the patient.

Comparison of Artificial Intelligence and Eyeball Method in the Detection of Fatty Liver Disease

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Background: Quantification of liver fat content relies on visual microscopic inspection of liver biopsies by pathologists. Their percent macrosteatosis (%MaS) estimation is vital in determining donor liver transplantability; however, the eyeball method may vary between observers. Overestimations of %MaS can potentially lead to the discard of viable donor livers. We hypothesize that artificial intelligence (AI) could be helpful in providing a more objective and accurate measurement of %MaS.

Methods: Literature review identified HALO (image analysis) and U-Net (deep-learning) as high-accuracy AI programs capable of calculating %MaS in liver biopsies. We compared (i) an experienced pathologist's and (ii) a transplant surgeon's eyeball %MaS estimations from de-novo liver transplant (LT) biopsy samples taken 2h post-reperfusion to (iii) the HALO-calculated %MaS (Fig.1). 250 patients had undergone LT at Indiana University between 2020-2021, and 211 had sufficient data for inclusion. Each biopsy was digitized into 5 random non-overlapping tiles at 20x magnification (a total of 1,055 images). We used HALO software for analysis and set the minimum vacuole area to 10μm^2 to avoid the inclusion of microsteatosis. Microsteatosis was excluded by the pathologist and the surgeon by the eyeball method using the same 1,055 images. Each %MaS estimation

was compared with early allograft dysfunction (EAD). EAD is defined by the presence of at least one of the following: INR >1.6 on postoperative day (POD) 7, total bilirubin >10mg/dL on POD7, or AST/ALT >2000IU/L within the first 7 days following LT.

Results: Of 211 LTs, 42 (19.9%) had EAD. The mean %MaS estimation of pathologist and transplant surgeon were 6.3% (SD: 11.9%) and 3.2% (SD: 6.4%), respectively. HALO yielded a significantly lower mean %MaS of 2.6% (SD: 2.6%) than the pathologist's eyeball method ($p<0.001$). The mean %MaS calculated by HALO was higher in EAD patients than in non-EAD ($p=0.032$), but this difference did not reach statistical significance in the pathologist's estimation ($p=0.069$).

Conclusions: Although mean %MaS measurements from all parties were mild (<10%), human eyeball estimations of %MaS were significantly higher than HALO's %MaS. The HALO-calculated %MaS differed significantly between the EAD and non-EAD LTs which might suggest a possible correlation between the AI's steatosis analysis and EAD outcomes. However, pathologic variables other than %MaS (necrosis or cholestasis) should be included in future analyses to determine whether %MaS is the dominant parameter predicting EAD. AI is a promising tool to quantify liver steatosis and will help pathologists and transplant surgeons predict liver transplant viability.

Comparison of Visual Field Fluctuation Between Myopic and Emmetropic Glaucoma Patients

Molly Barten, Louis Cantor

Background: Conflicting epidemiologic studies suggest that myopia may both increase and decrease the risk of glaucomatous visual field loss. To provide appropriate treatment to glaucoma patients, it is important to detect meaningful changes in the visual field, which requires distinguishing between visual field fluctuation and progression. Visual field fluctuation is defined as the variability between two visual field tests performed on separate days or months on the same eye that cannot be attributed to a pathologic change. We hypothesize that glaucoma patients with myopia will demonstrate more visual field fluctuation compared to emmetropic patients.

Methods: Four or more 24-2 or 30-2 Humphrey visual field tests over several visits will be analyzed per patient. Data including the VFI plot, mean deviation, and threshold sensitivity on the glaucoma progression analysis will be collected to measure fluctuation. The sample is divided into two groups: 1. emmetropic glaucoma patients with a spherical equivalent refraction between +2 to -2 diopters and 2. high myopic glaucoma patients with a spherical equivalent refraction over -5 diopters. Bland-Altman plots, Mann-Whitney U tests, Root Mean Square Error (RMSE), intraclass correlation coefficients, and generalized estimating equation models for ordinal data will be used to analyze the collected data.

Results: Thus far, 2,979 charts have been reviewed with data collected from 27 emmetropes and myopes who met the inclusion criteria. The recruitment goal is 78 per group and 156 total. Preliminary results for RMSE found a statistically significant p-value for mean deviation (0.0320), and no statistically significant difference for threshold sensitivity (0.5179) and VFI (0.0904).

Conclusion and Potential Impact: This ongoing study will help establish if glaucoma patients with high myopia demonstrate greater visual field fluctuation. It is important for clinicians to have this information so that these patients can be examined carefully to prevent misdiagnoses or delayed glaucoma treatment.

Comparison of Wound Outcomes for Absorbable versus Non-absorbable Suture after Carpal Tunnel Release

Cameron Harmon, Jeffrey N Gross, Joshua M Adkinson, Brian Christie

Background and Hypothesis: Carpal tunnel release (CTR) is a common hand surgery procedure. Despite the large volume of CTRs performed worldwide (400,000-600,000 cases/year), there is no consensus as to the optimal suture material for incision closure. In this study, we sought to compare outcomes of absorbable and non-absorbable suture for skin closure after CTR. We hypothesize that there is not a statistically or clinically significant difference in wound-related outcomes between the cohorts.

Project Methods: All patients who underwent primary

open carpal tunnel release (CTR) at a large, public county hospital in Indianapolis, IN were identified by CPT code (64721). All patients were treated by one of two fellowship-trained hand surgeons. The most recent 50 patients treated between September 2022 and May 2023 by each surgeon were identified. Surgeon "A" uses 4-0 vicryl rapide for closures (absorbable). Surgeon "B" uses 4-0 nylon for closures (non-absorbable). Adverse events (AE) were defined as infection, dehiscence, or suture granuloma observed at any follow-up appointment. This study was approved by the Institutional Review Board.

Results: 100 patients were identified - 4 patients were lost to follow-up and were excluded from the study. Of the remaining 96 patients, 46 received absorbable suture and 50 non-absorbable suture. Of the 46 patients who received absorbable suture, 8 experienced AE (17.4%). None of the 50 patients who received non-absorbable suture experienced an AE. There was a statistically significant difference in AE between the absorbable and non-absorbable suture cohorts (p=0.002). Patients with absorbable suture averaged 1.61 follow-up appointments, whereas those with non-absorbable suture averaged 2.32 (p=.0008).

Conclusion and Potential Impact: In this study, absorbable suture resulted in more wound-related complications after CTR. However, patients with non-absorbable suture had more post-operative follow-up appointments. These findings should be considered when selecting suture material for skin closure after CTR.

Delayed prescribing of non-vitamin K antagonist oral anticoagulants (NOACs) in patients with low socioeconomic status

Gillian Coffey, Puja Unni, James Butler

Background/Objective: Atrial fibrillation (AF) and venous thromboembolism (VTE) are conditions with significant morbidity and mortality when left untreated. American Heart Association guidelines changed in 2019 to make non-vitamin K antagonist oral anticoagulants (NOACs) the preferred method for preventing stroke and systemic embolism in patients with AF or history of VTE. NOACs were first introduced to the United States in 2010 and now include dabigatran, apixaban, rivaroxaban, and edoxaban. There is a dearth of research concerning the speed with which new treatments are prescribed to those in different socioeconomic status (SES) groups. We hypothesized that patients with lower SES were prescribed NOACs later than higher SES counterparts following the introduction of NOACs in 2010.

Methods: The IU Cardiovascular Research Consortium/Sidus Dataset was mined for AF and VTE patients prescribed a NOAC between 2010 and 2022. The SES groups were determined using 2020 U.S. Census income data that correlated to patients' zip codes.The yearly number of patients in each SES group were compared to assess for proportional uptake of NOAC prescribing. The primary outcome was the proportion of low SES to high SES prescribing over each year between 2010 and 2022.

Results: Low SES patients (n=101,945) were prescribed NOACs at an average of 0.65 times the rate of high SES patients (n= 89,130) from 2010 to 2012, the first three years of NOAC market availability. Prescribing rates equilibrated in 2013 and low SES prescribing has outpaced high SES prescribing since 2021.

Conclusion/Impact: Low SES patients experienced a three-year delay in receiving NOAC prescriptions at the same rate as their high SES counterparts. Systemic changes, like more frequent prescribing guideline updates and improved evidence-based education amongst providers in low-income areas, could prevent a similar delay when introducing similarly transformative treatments in the future.

Detection of Bowel and Mesenteric Injuries Using Deep Learning Computer Vision Models

Neal Mahajan, Scott D Steenburg, Peter Gunderman, John Burns, Arya Iranmanesh

Background/Objective: While only seen in 1-5% of patients who undergo a CT (computed tomography) scan, blunt bowel and mesenteric injuries (BMI) are associated with significantly increased morbidity and mortality. A significant cause of the increased morbidity of BMI is due to the difficulty of diagnosis from clinical and imaging information which leads to delay in diagnosis. Accurate and timely diagnosis is vital to reduce the morbidity of BMI.

Methods: For this project, our primary objective is to create a binary prediction model that determines if a patient has BMI based on their abdominal CT scans. Due to the importance of the early and definitive diagnosis of BMI in trauma patients, an extension of this project will seek to introduce explainability into the model to highlight which features on the CT scan caused the model to make its prediction. The patients with BMI were sourced from a trauma registry that recorded trauma cases from IU Health with relevant diagnosis codes. The images from our search will be reduced to the relevant slices for diagnosis of BMI and then used to train an ML model to make a yes/no prediction from the image. Once the model is trained, testing data will be evaluated on the model and the gradient vectors from the model during inference will be used to create a heatmap with GRAD-CAM that illustrates what portions of the image were relevant for the decision made by the algorithm.

Future Directions: Using the collected abdominal CTs, we can train our machine learning pipeline to detect BMI. Based on the performance of the model, we will determine if we need to collect more data. Then, we can evaluate the explainability of the model using GRAD-CAM and compare performance of the ML model to the performance of expert and trainee radiologists.

Development of a Novel Atherosclerotic Heart Disease Biomarker Program

John P Salvas, Cynthia Johnson, Subha V Raman

Background: Atherosclerotic cardiovascular disease (ASCVD) is the leading cause of heart attack, stroke, and sudden death worldwide. Clinical risk scores help estimate the likelihood of adverse cardiac events to guide preventative strategies. Current risk scores for atherosclerotic events like heart attack and stroke use known cardiovascular risk factors including smoking, diabetes, lipid levels, and blood pressure. However, these scores underestimate risk in certain patient populations and do not predict the atherosclerotic disease in individual patients that leads to subsequent events. Our aim is to design a novel biomarker-enabled model to predict the presence and burden of coronary artery atherosclerosis in patients with diabetes, to ultimately help personalize preventive therapies that target disease burden, not just risk factors, for more effective prevention of ASCVD events.

Methods: Patients with diabetes have been prospectively enrolled in a health plans-based screening program with co-enrollment in the Indiana Biobank, which includes coronary CT angiography, an AI-based quantitation of atherosclerosis, and biobanking of DNA, plasma, and serum. We identified candidate biomarkers based on current literature and determined which could be impactful based on cost, efficacy, and feasibility of implementation guided by interviews with potential collaborating entities.

Results: We have identified polygenic risk scores, non-coding RNAs and candidate blood biomarkers with predictive potential for atherosclerotic heart disease. Subsequent work will entail (i) direct assays of banked biospecimens for the selected minimally invasive biomarkers and (ii) computational analysis to assess incremental predictive value for disease burden over clinically available risk scores.

Conclusions and Potential Impact: We are progressing towards the development of a novel mode to predict patient-specific burden of coronary atherosclerotic disease burden in patients with diabetes. We expect that a multidimensional approach including contemporary biomarkers will improve predictive value of atherosclerotic heart disease burden, affording more tailored treatment to prevent ASCVD events.

Diffuse Midline H3 K27-Altered Gliomas in the Spinal Cord: A Systematic Review

Mohammad Faizan Khan, Mustafa Mohamed, Jennifer Manyu Wong, Bradley Estes, Christian Ogasawara, Giuseppe E. Umana, Paolo Palmisciano, Gina Watanabe

Background and Objectives: Gliomas account for 80-90% of all intramedullary spinal cord tumors (IMSCTs). Though rare compared to brain tumors, spinal cord gliomas can cause significant morbidity and mortality. Diffuse midline gliomas (DMGs) with H3 K27M-mutation, first introduced in the 2016 World Health Organization (WHO) classification, are high-grade tumors with aggressive behavior and poor prognosis. The 2021 updated WHO classification renamed them "diffuse midline glioma, H3 K27-altered" to include other molecular changes. Limited single-institution data on spinal cord DMGs (DMG-SCs) hinder comprehensive understanding and optimal treatment protocols. In this review, we summarize clinical and molecular features, management strategies, and survival impact in patients with DMG-

SCs.

Methods: A systematic review was performed following the PRISMA guidelines. PubMed, Ovid EMBASE, Scopus, and Web of Science were searched. Clinical characteristics, treatment protocols, and outcomes were analyzed.
Results: A total of 26 studies with 259 patients were included. Most patients were male (63%), diagnosed at a mean age of 32 years (range, 4-72), and tumors were predominately located in the cervical (32%) or thoracic (43%) regions of the spinal cord. Primary management included surgical resection (97%), radiotherapy (78%), and chemotherapy (62%). Most common combination of treatment included surgical resection, radiotherapy, and chemotherapy (47%). The mean overall and progression free survival were 25 (range, 0.1-48) and 14 (range, 0.1-25) months, respectively. Gene alterations included p53 mutation (61%), loss of ATRX (46%), Olig2 positive (100%), and GFAP positive (80%). The mean Ki-67/MIB-1 was 23% (12-40%).

Conclusion and Potential Impact: DMG-SCs affect mostly the adult population and appear to resemble adult DMGs in terms of molecular features, management, and prognosis.

Efficacy of Novel Bracing for Treating Sciatica and Cadaveric Dissection to Examine Excursion of the Sciatic Nerve

Kyle Callahan, Dale Dellacqua

Background and Objective: Sciatica affects nearly half of all Americans and can often become debilitating, leading to severe pain that can limit performing activities of daily living. Brace application has not been tried for alleviation of pain. In this study, we seek to find if a novel brace can decrease pain and decrease bothersome level of symptoms for those suffering from sciatica. In addition, this study utilizes a cadaveric dissection to understand how the sciatic nerve stretches and tensions upon lower limb manipulation.

Methods: Fourteen patients self-reported pain, functionality, and bothersome levels pre- and post-bracing. Excel's data analysis tool was utilized to run statistical tests. One cadaver (2 lower limbs) was dissected, revealing the sciatic nerve at the hip and knee, while tibial nerve at the ankle. Excursion was measured utilizing a fixed pin and an initial distance, the leg manipulated, and final distance from pin measured. Ultimately, excursion was deemed final distance minus initial distance from the pin. Two-sample T-test was utilized to determine statistical significance, which was deemed as $p<0.05$.

Results: The brace decreases Visual Analogue Scale (VAS) scores, increases Patient Reported Outcomes, and decreases Sciatica Bothersome Indexes. There was a significant difference in VAS pre- versus post-brace values at initial ($p=0.02$) and 7-day post-visit ($p=0.03$) but not at 2-day ($p=0.08$) or 42-day ($p=0.16$) post-visit. Sciatic nerve excursion was greatest at the ankle.

Conclusion and Potential Impact: Brace use decreases pain levels, increases functionality, and decreases bothersome level of symptoms. The distal nerve moves more upon manipulation and therefore is more prone to tensioning than the proximal nerve. Dissection data illustrates how the brace positions the limb in a way that promotes "detensioning" of the nerve, alleviating sciatica. More cadaver data is needed.

Evaluating the Utility of Procalcitonin and C-Reactive Protein to Predict Bacteremia in Children with Musculoskeletal Infections

Alex Smith, James Wood

Background and Objective: Musculoskeletal infections (MSKI; osteomyelitis, septic arthritis) are among the most common invasive bacterial infections in children, often associated with complications. Bacteremia precedes these complications; thus, early identification may prevent them. Acute inflammatory markers, C-reactive protein (CRP) and Procalcitonin (PCT) are often elevated in children with acute MSKI. PCT is understudied in children with MSKI. The primary goal of this study was to evaluate the utility of PCT and CRP in distinguishing children with MSKI with bacteremia versus those without.

Methods: Patients 6 months to 18 years with strong clinical suspicion of MSKI were prospectively enrolled at Riley Hospital for Children from July 2019 to May 2022 unless clinical evidence suggested an alternative diagnosis or if informed consent was not obtained. CRP was obtained at admission and PCT was collected within

96 hours of presentation to the hospital. Demographic data was recorded from electronic medical records. Two-sided P values of <0.05 were considered statistically significant for univariate analysis and logistic regression.

Results: Thirty-seven patients were enrolled, the majority being non-Hispanic white males (40.5%), median age of 8 years (IQR, 4-12). Median PCT in children with bacteremia was higher (0.41 ng/mL [IQR 0.14-0.8 ng/mL]) compared to those without (0.10 ng/mL [IQR 0.05-0.31 ng/mL]) (p=0.03). Median CRP in children with bacteremia was higher (13.7 mg/dL [IQR, 9.15-19.9]) compared to those without (4.1 mg/dL, [IQR 0.65-5.8]) (p<0.01). Both PCT and CRP showed good ability to discriminate those with bacteremia from those without, with an area under the receiver operating curve (ROC) of 0.75 (95% CI 0.56, 0.94) and 0.80 (95% CI 0.64, 0.95), respectively.

Conclusions and Potential Implications: Initial PCT and CRP demonstrated utility in detecting bacteremia in patients presenting with MSKIs. This study warrants further exploration into the usage of PCT and CRP as early predictors of bacteremia for more appropriate treatment and potentially fewer complications of these infections in pediatric patients.

Evaluation of the Relationship Between Collagen Matrix Damage and Proteoglycan Activity Following Submaximal Fatigue Loading

Peyton Estes, Caroline Bice, Ben Loflin, Taeyong Ahn, Roufael Hanna, Stephen Schlecht

Background and Hypothesis: Previous research indicated that fatigue loading of the anterior cruciate ligament (ACL) leads to disruption and unraveling of the collagen triple helix structure. Using a novel in vivo murine model, we have spectroscopically shown that collagen unraveling at the molecular level is associated with an increase in proteoglycan activity. Moreover, we found an increase in tissue compliance within these damaged tissue domains. We hypothesize that the increase in proteoglycan activity is largely responsible for this mechanical change. To investigate this, we first need to identify the proteoglycan(s) responsible for our biochemical spectra that indicated an elevation in activity associated with unraveled collagen domains. For this pilot project, we histomorphometrically investigated the proteoglycan activity of two potential protein candidates (decorin, versican) following sub-maximal ACL fatigue loading.

Experimental Design: The right knees of 20 mice underwent 5,000 cycles of moderate or strenuous fatigue loading. Left knees served as a control. Samples were collected 1 and 72 hours after loading. Immunohistochemistry was performed to detect decorin and versican activity in the ACLs.

Results: A greater area of the ACL was stained with decorin relative to versican in ACLs that underwent moderate fatiguing after 1-hour rest ($p = 0.02$) and 72-hour rest ($p < 0.01$). Similar differences were found in ACLs after strenuous fatiguing and 72-hour rest ($p < 0.01$). No significant temporal differences were found in versican ($p = 0.76$) or decorin ($p = 0.53$) activity in fatigued ACLs relative to controls.

Conclusion and Potential Impact: These preliminary findings suggest that versican nor decorin are the proteoglycans colocalizing with unraveled collagen. We are currently investigating aggrecan, lumican, and biglycan as other potential proteoglycan candidates to explain our spectroscopic data.

Exploring Community-Based Strategies to Overcome Barriers to Hypertension Education and Management in Underserved Areas

Ugonna Adindu, Lynn Witty

Objective: In the United States, there are over 119.9 million adults who have been diagnosed with hypertension, representing nearly half of the adult population. Of this population with high blood pressure, 75% of Americans' hypertension remains uncontrolled. Such control rates are significantly lower among individuals of racial and ethnic minorities as compared to their white counterparts, especially those in underserved areas. We hypothesize that the identification of community-based interventions and strategies to combat barriers to hypertension treatment and education could improve management in these populations.

Methods: In this study, we looked through various peer reviewed articles on community-based care and hypertension rates among minorities, exploring study design and limitations to develop a questionnaire focused

on access to hypertension education. This survey was distributed randomly during outreach events around Muncie, Indiana to anyone who wished to participate, non-minority groups included. The questionnaire asked about various hypertension and healthcare barrier identification factors with a final question of whether said participant would benefit from a hypertension education course.

Results: The participants' responses were across the board. Regarding hypertension knowledge, participants were asked about their diagnosis, as well as their level of knowledge of hypertension and its management; participants exhibited varying levels of knowledge. Understanding key aspects of management, including medication adherence, diet, physical activity, and potential complications and warning signs, also varied among participants.

Conclusion and Potential Impact: Overall, these preliminary survey results highlight the diverse characteristics and experiences of participants related to hypertension, access to healthcare, and hypertension knowledge. This study could provide information for those looking to establish community-based organizations in underserved areas. Increasing the magnitude of such teams and advocating for more interventions against barriers to hypertension education could increase not only the health of those in such communities, but also the overall wellbeing of all people in the United States.

Exploring Differentiation and TEAD Inhibition in NF2-Knockdown NES Cells

Sidrah Badar, Noah Burket, Jignesh Tailor

Background and Objective: The NF2 gene is a tumor suppressor encoding gene on chromosome 22 that is a known regulator of the Hippo pathway. When the mammalian version of the pathway is inactive, such as with a loss of NF2, downstream proteins YAP/TAZ remain unphosphorylated, enter the nucleus to form a complex with TEAD 1/2/3/4, and begin transcription. Hyperactivation of the YAP/TAZ-TEAD complex has been observed in many cancers, allowing for targeting with TEAD inhibitors. Here, we assess how the loss of NF2 in human neuroepithelial stem (NES) cells affect their differentiational development. We also seek to understand the effects of TEAD inhibition on wildtype (WT) and NF2-knockdown NES cells.

Materials and Methods: Differentiation. WT and NF2-knockdown cells were grown in media without growth factors to differentiate them. TEAD Inhibition. Non-differentiating and differentiating WT and NF2-knockdown cells were treated with TEAD Inhibitor 690 (TEADi). During both conditions, cells were harvested at 5 points throughout the growth period.

Results: Decreased NF2 in cells promoted retention of an earlier cell morphology compared to WT, which appeared to develop neuronal features, such as axons. WT cells exhibited elevated expression of genes characteristic of NES differentiation when compared to NF2-knockdown cells. Following the addition of TEADi, cell culture imaging revealed seemingly increased cell death in WT cell populations compared to NF2-knockdown cells. Interestingly, differentiating NF2-knockdown cells adhere to one another to form clusters, but with TEADi, these clusters are formed to a much lesser extent.

Conclusion and Potential Impact: Although more experimentation is needed, these are early steps in demonstrating how NF2 loss appears to halt the differentiation of NES cells. Additionally, TEAD inhibition seems to reduce the clustering seen in differentiating NF2-knockdown cells; however, experimental concentrations need to be explored in the future. Further work is needed to understand the effects of TEAD inhibition on NF2-knockdown cells.

Exploring Relationships Between Fear of Cancer Recurrence, Psychological Distress, & Mental Health Service Use in Breast Cancer Survivors

Ana Danner, Matthew Hays, Yang Li, Shelley Johns

Background: Breast cancer survivors (BCS) have an increased risk of psychological distress compared with healthy controls. Fear of cancer recurrence (FCR) is one of the most reported forms of distress, with approximately 50% of BCS reporting clinically significant FCR. Designed to give alternatives to avoidant coping, acceptance and commitment therapy (ACT) has shown promise in reducing distress and FCR in BCS. The primary objective of this study was to explore relationships between psychological distress and mental health service use in BCS with FCR.

Methods: Baseline data from 384 early-stage, post-treatment BCS with clinically significant FCR at screening enrolled in a randomized-controlled trial comparing 3 FCR interventions were analyzed. Prevalence of clinically significant FCR and symptoms of anxiety, depression, and posttraumatic stress were measured. Associations between each distress measure and mental health service use were assessed, in addition to the association between FCR and avoidant coping.

Results: Clinically significant levels of at least one form of psychological distress besides FCR were reported in 226 (58.85%) BCS. Of 298 (77.60%) BCS with at least one significant distress score including FCR at baseline, only 61 (20.47%) reported using any mental health service within the 3 months before baseline. Clinically significant anxiety ($p = 0.0027$), depression ($p = 0.0015$), and post-traumatic stress symptoms ($p = 0.0227$) were significantly associated with mental health service use. FCR was significantly associated with fewer visits to certain mental health services. FCR was strongly correlated with increased avoidant coping ($\rho = .6313$, $p < .0001$).

Conclusion: Anxiety, depression, and post-traumatic stress symptoms may be better predictors of mental health service use than FCR given the tendency for patients with fear to cope with avoidance. ACT interventions emphasizing alternatives to avoidant coping may benefit BCS with FCR. Further research is needed to identify barriers to mental health service use in BCS.

Extracranial Meningioma Metastasis: A Systematic Review of Clinical Characteristics, Management Strategies, and Outcomes

Mohammad Faizan Khan, Mustafa Mohamed, Kurtis Young, Erin Rauber, Christian Ogasawara, Giuseppe E. Umana, Paolo Palmisciano, Gina Watanabe

Background: Meningioma is the most common type of intracranial neoplasm, accounting for approximately 40% of all primary brain tumors. Although these tumors are usually benign and slow-growing, extracranial metastasis can occur in less than 1% of cases. Due to the rarity, diagnosis can pose a challenge. In this systematic review, we summarize and analyze patient demographics, clinical characteristics, management strategies, and outcomes of patients with extracranial meningioma metastasis.

Methods: A systematic review was performed following the PRISMA guidelines. PubMed, Ovid EMBASE, Cochrane, Scopus, and Web of Science databases were searched. Clinical characteristics, management, and outcomes were analyzed.

Results: A total of 127 studies with 164 patients were included. There were 51% males and mean age of primary tumor diagnosis was 48 years (range, 8-91). Primary tumors were mostly located on the convexity of the brain (52%) and WHO grade 1 (38%) or grade 2 (37%). Histological findings were predominantly atypical (37%). Mean number of intracranial recurrences was 2 (range, 0-7) and occurred in 81% of cases. Average time between primary tumor and the first extracranial metastasis was 103 months (range, 2-450). The top three most common locations of metastases were the lungs (39%), spine (15%), and liver (12%). Most often, there was no change in grade (68%) from the primary tumor to the first metastasis. Gross total resection of the primary tumor was achieved in 76% of cases. Mean survival from primary diagnosis and survival from first metastasis was 118 and 31 months, respectively.

Conclusion and Potential Impact: Mechanisms by which extracranial meningioma metastasis occur are still unclear, though do not appear to involve evolution into a more aggressive histologic type in most cases. In a patient with a history of intracranial meningioma recurrence and symptoms of lung, spine, or liver, dysfunction, extracranial meningioma metastasis should be considered within the differential.

Factors affecting General Surgery Intern Wellness: A Qualitative Study

Payton Bear, Madeline Blackwell, Dimitrios Stefanidis

Background: Surgical training is demanding and presents numerous challenges to new interns including long working hours that can threaten their well-being. The factors affecting their well-being as reported by interns themselves, however, are poorly understood. This qualitative study aimed to determine the factors contributing to the wellness of general surgery interns, and identify potential areas that could benefit from intervention and policy reform.

Methods: A comprehensive scoping review of the liter-

ature on resident wellness was initially performed, using "resident" and "wellness" as search criteria on PubMed, and encompassing articles published from 2013 onward. The results of this review were used for the development of an interview guide for in-person focus groups. General surgery interns at Indiana University participated in focus groups that were recorded and transcribed. Two coders coded the transcript independently to develop a code book. Thematic analysis was conducted using a constructivist grounded theory methodology to determine emergent themes.

Results: Ten surgical interns participated in the focus groups. Qualitative analysis revealed five predominant themes that impact intern wellness: Lack of respect, inadequate facilities and resources, lack of fulfillment, work overload, and poor communication.

Conclusions: The themes identified reveal numerous factors that impact intern wellness beyond working hours and pay and provide targets for interventions that can address them. Our results suggest that "one-size fits all" wellness solutions are unlikely to address the specific challenges faced by surgical trainees; multifaceted interventions are required to enhance intern well-being. Future research should focus on the development and implementation of targeted strategies to address these identified issues.

Factors Affecting Patient Reported Outcomes Following Tibial Plateau Fracture

Luke Haag, Erin McCoy, Sohum Patel, James Slaven, Luke Lopas, Roman Natoli

Background: Tibial Plateau Fractures (TPFs) account for ~1% of all fractures and ~8% of all fractures in the elderly. Despite the frequency and severity of TPFs there is a paucity of data evaluating factors that affect patient recovery after injury and surgical fixation. We hypothesized that patient reported outcomes are modulated by several variables including patient demographics, comorbidities, injury characteristics, and Social Determinants of Health (SDH).

Methods: In this retrospective cohort study, we collected the interval patient reported outcome scores (PROs) of patients with TPFs treated with open reduction internal fixation occurring between February 2013 and November 2020. PROs included 1) Visual Analog Scale (VAS) pain scores, 2) Patient-Reported Outcomes Measurement Information System (PROMIS) Pain Interference (PI) scores, and 3) Physical Function (PF) survey scores. Patient demographics, comorbidities, fracture characteristics, insurance status, and area deprivation index (ADI) of the patient's residence were collected via electronic medical record review. Bivariate analyses of PRO scores to the aforementioned factors were performed using generalized estimating equations to account for participant repeated measures, with $p<0.05$ being considered significant.

Results: 196 patients were evaluated with >1 year follow-up. It was determined that patients' insurance status affected their VAS ($p0<.001$), PI ($p<0.001$), and PF ($p<0.001$) scores. Patient ADI affected VAS ($p<0.001$) and PI ($p=0.0026$), with increased ADI scores resulting in worse PROs. Diabetes and depression were found to negatively impact VAS ($p=0.010$ & 0.008 respectively) and PI ($p=0.0044$ & 0.0048, respectively). Additionally, age and sex both influence VAS($p=0.0006$ & 0.0033, respectively), and compartment syndrome was associated with decreased PF ($p=0.0206$).

Conclusion and Potential Impact: To our knowledge, this is the first investigation to evaluate the effect of SDH on patient recovery following surgical fixation of TPFs—suggesting that insurance status and residence ADI scores are associated with worsened PROs. Further investigation is necessary to identify if these factors are independent of other covariates.

Factors Contributing to Potentially Unnecessary Pediatric Emergency Transfers

Kortni Clements, Nancy Glober

Background: Riley Hospital for Children receives thousands of emergency pediatric transfers from outside hospitals every year. The United States is currently facing a national EMS shortage along with increasing costs of medical care. Additionally, these transfers can be inconvenient for patients and their families. However, not all of the transfers are medically necessary. Identifying factors that contribute to unnecessary emergency transfers is essential for optimizing care for each patient.

Methods: Retrospective chart reviews of electronic medical records at Riley Hospital for Children were completed for transferred patients between 01/01/2022 to

02/20/2022. Patients were identified through the transfer center patient list. The primary objective of the study was to identify patients transferred and discharged from the emergency department without advanced imaging or specialist consult. Demographic data including age, race, ethnicity, and sex were collected.

Results: There were 404 patients included in the study. About one third of these patients were discharged from the emergency department. Of those, 38 patients (9.4%) also did not have advanced imaging or a specialist consult in the Riley Emergency Department. Age was found to be statistically different between these patients and all other patients. The median age for patients discharged without advanced imaging or specialist consult was 2.4 years old, while the median age for all other patients was 6.5 years old. Other demographics including race, ethnicity, and sex were not significantly different.

Conclusion: The results suggest that younger pediatric patients may be at a greater risk for unnecessary emergency transfer. The generalizability of this study is limited in scope due to the use of only one EMR and hospital system. Finally, as this is a retrospective study, the information is limited by what was documented.

Familial Alzheimer's Disease Mutation PSEN2 Exacerbates Toxoplasma gondii-mediated Human Blood-Brain Barrier Damage

Luke Wilson, Abigail Bitters, Angela Chamberlain, Jason Hughes, Scott Canfield, Américo López-Yglesias

Background and Hypothesis: Toxoplasma gondii is an obligate intracellular parasite that infects one-third of the global population. T. gondii transmission to humans primarily occurs from the consumption of contaminated meats, water, or produce. Unfortunately, T. gondii will evade the host clearance, allowing it to cross the blood-brain barrier (BBB), infecting neurons where it transitions into slow-growing cysts, leading to a life-long chronic infection. Recently, studies have suggested that T. gondii infection may exacerbate the decline of cognitive function. The BBB is critical for restricting neurotoxic blood-derived products, leukocytes, and pathogens from entering the brain. Studies have shown that BBB dysfunction and damage to the barrier integrity may also contribute to cognitive impairment. Alzheimer's disease (AD), the most common form of dementia, is a progressive neurodegenerative disease and its neuropathology is associated with b-amyloid plaques. Familial Alzheimer's Disease is associated with the proteins, presenilin-1 and presenilin-2, encoded by PSEN1 and PSEN2. Mutations in these two genes contribute to early onset AD. Furthermore, dementia has been linked with an increased breakdown of the BBB. Therefore, we hypothesized that T. gondii infection will exacerbate barrier damage and dysfunction in brain microvascular endothelial cells (BMECs) containing familial AD mutations compared to healthy controls.

Experimental Design: To test our hypothesis, we infected human induced pluripotent stem cell (iPSC)-derived BMECs, which display near in vivo like BBB properties, containing the familial AD PSEN2 mutation or healthy controls with T. gondii.

Results: Using immunofluorescence and transendothelial electrical resistance, our results show that BMECs containing the PSEN2 mutation have a quicker onset of barrier damage, but we observed no difference in the loss of tight junctions ZO-1, Occludin, and Claudin-5 compared to healthy controls after infection.

Potential Impact: The data suggest that a T. gondii infection can exacerbate the breakdown of the BBB in patients with the PSEN2 mutation, worsening the prognosis of familial AD patients.

FNA Diagnosis of Metastatic Solid Tumors in the Parotid Gland: Over 20 Years of Experience from a Single Institute

Aditya Bhatt, Tieying Hou

Background/Objective: Fine needle aspiration (FNA) is the primary diagnostic tool for secondary malignancies in the parotid gland. Literature regarding these tumors is limited.

Methods: FNA specimens of metastatic solid tumors in the parotid gland between 2000 and 2023 were retrieved. Histopathology and clinical history were retrospectively reviewed.

Results: A total of 77 patients were identified (58 males, 19 females) with a mean age of 65.7 years. Head and neck (H&N) primary tumors accounted for 75%

(58/77) of cases including 42 (54.5%) from the skin, 7 (9.1%) from the pharynx, 6 (7.8%) from the oral cavity, and 3 (3.9%) from the nasal/sinus cavity. Other rare primary sites included lung (5/77, 6.5%), kidney (3/77, 3.9%), and non-H&N cutaneous (2/77, 2.6%). The median interval between primary diagnosis to metastasis to the parotid was 10 months. The most common histology is metastatic squamous cell carcinoma (SCC) (40/77, 51.2%) and melanoma (25/77, 32.5%). Among 40 cases of SCC, only 7 were HPV-mediated. Less frequent metastasis included sarcoma (4/77, 5.2%) and renal cell carcinoma (3/77, 3.9%). Three cases were false positive and misdiagnosed as metastatic SCC. The prognosis of parotid gland tumors was generally poor. In this study, the survival rate after diagnosis of secondary disease was 33.8%.

Conclusion: Here we reported the largest series of FNA cases of metastatic solid tumors in the parotid gland from a single institute. The most common metastasis were conventional SCC and melanoma from the H&N region. FNA is a reliable diagnostic technique for these lesions, although rare metastatic tumors can pose a diagnostic challenge.

Impact and Implications: The distinction between a primary and secondary malignancy in the parotid is crucial for clinical management. Secondary malignancies of the parotid gland are uncommon, and it is important to identify them early due to poor prognosis. Our study helps to better understand these tumors to improve diagnostic accuracy.

Fracture-Induced Effects on the Onset & Progression of Alzheimer's Disease

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Background: Alzheimer's disease and related dementias (AD/ADRD) are multifactorial, highly heterogeneous, and complex age-dependent disorders that severely affect memory and cognitive function, impacting nearly 35.6 million people worldwide. In the elderly, dementia increases the risk of falls and fractures by 2-3 times, due in part to neurovascular instability, low bone mineral density due to pre-existing osteoporosis, and poor musculature supporting joints due to cachexia and/or sarcopenia. While the occurrence of fractures due to AD/ADRD is well documented, an association between fractures and AD/ADRD onset or progression is underappreciated and warrants additional investigation. We aim to investigate the mechanistic actions underlying fracture healing as a precipitating event for AD/ADRD pathogenesis.

Methods: Four-month-old, male, 5xFAD (AD model) and wild-type control (C57BL/6) mice were divided into 2 groups: surgically induced femoral fractures and uninjured mice. Prior to surgery mice underwent baseline AD behavior testing including: spontaneous alternation in the y-maze, light-dark exploration in the open field, and active place avoidance assays. Mice are undergoing weekly x-ray imaging to monitor fracture healing progression and longitudinal AD behavior testing. 22 weeks post-surgery, mice will be euthanized, and the femurs and brains will be collected. Femurs will undergo uCT imaging and histological assessment of bone healing and immunohistochemical assessment of inflammatory markers. Brains will be processed for histology and neuroinflammatory marker analysis, including Aβ plaque deposition, tau tangles, neuronal survival, neurogenesis, and activation/proliferation of microglia and astrocytes.

Conclusion: At the conclusion of the study, we expect to see an increase in neuroinflammatory markers and delayed fracture healing in the experimental 5xFAD group. We anticipate that compared to uninjured controls, femoral fracture results in cognitive decline, Aβ accumulation/neurodegeneration, increases in neuroinflammation, and vascular impairment. We anticipate finding a correlation between fracture and worsened AD outcomes. By uncovering the mechanisms underlying this relationship, we hope to guide future studies to develop more robust therapeutics.

HB007 Administration Inhibits LN-229 and Patient-Derived Neurospheroid Glioblastoma Cell Growth With the Degradation of SUMO1 and Cell Cycle Regulator CDK4

Carson Dougherty, Reagan Wohlford, Sunghan Jung, Chunhai Hao

Background and Hypothesis: Glioblastoma is the most common malignant brain cancer and there is no effective

therapy currently available to patients with this malignancy. Small ubiquitin-related modifier 1 (SUMO1) is a key regulator of cancer cell proliferation through its role in its modification of cellular proteins in various human cancers, especially glioblastoma. Degradation of SUMO1 through small molecule degrader, HB007, has been shown to inhibit growth in cancer cell lines and xenografts. Here, we hypothesize that HB007 can inhibit the glioblastoma cell growth through degradation of SUMO1 protein in glioblastoma cells and in cancer stem cell enriched neurospheres.

Experimental Design: LN-229 glioblastoma cell viability was measured in response to increasing concentrations of HB007. LN-229 and patient-derived neurospheroid glioblastoma cells were cultured and seeded in 4 different plates at 1000 cells/ml concentrations before being treated with HB007 at increasing concentrations encircling the previously described IC50. Cells were then subjected to a SUMO lysis buffer and analyzed via western blot with antibodies specific to SUMO1, CDK4, and actin.

Results: HB007 treated LN-229 cells exhibited an IC50 of 1.470μM. Western blot analysis confirmed the dose dependent reduction in SUMO-1-ylated proteins in HB007 treated cells. A reduction in CDK4 confirmed that cell progression is halted in a dose dependent manner in LN-229 and patient-derived neurospheroid glioblastoma cells when treated with HB007. Specificity of HB007 is towards SUMO1 with no nonspecific degradation of SUMO2/3.

Conclusion: The cell growth of LN-229 and patient-derived neurospheroid glioblastoma cells was confirmed, through western blot, to be inhibited in a dose dependent manner by HB007. These results further establish the therapeutic potential of SUMO1 degraders as a novel anticancer drug for glioblastoma therapy. In the future, it is hoped that the bioavailability, potency, and blood brain barrier permeability can be improved to make this drug a potential treatment for patients.

Host-Implant Interaction Derived Metabolite 10-HOME Mediated Dysregulation of Adiponectin Resulting in Breast Implant Associated Systemic Manifestation

Ethan Pulliam, Ethan Rinne, Imran Khan, Mithun Sinha

Background: Breast implant illness (BII) is a poorly understood systemic complication with unknown etiology. Surgical injury at the implant site initiates local inflammation, impacting adipose tissue through decreased adipose-derived adipokine expression. This acute stress responses activates lipid peroxidation pathways, generating oxylipins, causing inflammatory, nociceptive, and vascular responses to injury. One such oxylipin, (E)-10-hydroxy-8-octadecenoic acid (10-HOME), formed from oleic acid, is abundant in host-implant interaction. However, it is unclear how adipose inflammation is maintained. This study aims to elucidate how host-implant interaction metabolites effect adiponectin expression, subsequently affecting T-cell differentiation eliciting an autoimmune state.

Methods: LiSa-2 (human derived adipose tissue secondary cell line) were grown in IMDM and RPMI (4:1) until confluent, then cultured in a well plate. Cultured cells were treated with 10μM 10-HOME for 48h, then were co-cultured with naïve T-cells (PBMC derived) for 48h. T-cells were harvested and flowcytometry was performed using CD4, CD184, CD194, CD196 markers and respective isotypes to verify differentiation (Th1, Th2, Th9/22). To study adiponectin gene expression, treated Lisa-2 cells were harvested for qRT-PCR. ELISA was performed using treated LiSa-2 culture media.

Results: We showed decreased expression of adiponectin, after 10-HOME treatment of LiSa-2 cells, compared to untreated cells. qRT-PCR ($p=0.0022$) showed downregulation of adiponectin gene transcripts in treated LiSa-2 cells, highlighting changes in modulation. Using ELISA ($p=0.0006$), the culture media of treated cells showed significantly less adiponectin than untreated media. Treated LiSa-2 cells led to polarization of naïve CD4+ T cells to Th1 subtype, evaluated by flowcytometry ($p=0.0494$). No significant difference in polarization was observed for Th2, Th9 and Th22 subtypes.

Conclusion: This study provides evidence that LiSa-2 with 10-HOME treatment caused increased Th1 polarization via modulation of adiponectin expression. Adiponectin regulates many inflammatory pathways, but its effect on Th-cell-mediated responses is poorly understood. Further studies should investigate the mechanism for adiponectin modulation causing T-cell imbalance.

Hypoxia Gene Networks in Gliomas

John Muller, Luke Jackson, Elise O'Herron, Scott Cooper, Angela Richardson

Background and Hypothesis: Gliomas are the most common primary brain tumor and range from low grade to high grade, with glioblastomas (GBM) being the most aggressive. Translation of therapies for these tumors from preclinical models to clinical practice has been limited. Preclinical studies are typically performed in ambient air (21% oxygen), while physiological oxygen tension (physioxia) is 3-5%. Extracranial tumor tissue processed in physioxia demonstrates distinct gene expression profiles and chemoresistance as compared to the same samples processed in ambient air. However, the role of varying oxygen tension in gliomas has not been well studied. GBMs often have areas of necrosis with presumed low oxygen tension, while these findings are typically absent in lower grade gliomas. In this study, we examine expression of hypoxia related genes in patient samples obtained from grade II, III and IV gliomas. We hypothesize that increasing tumor grade will be associated with differential expression of hypoxia-related genes.

Methods: Gene expression in patient brain tumor samples (glioblastoma, high grade astrocytoma, low grade astrocytoma) and normal brain samples (from epilepsy surgery) was assayed using real time PCR. Hypoxia-related gene expression was examined in cBioPortal for Cancer Genomics by comparing survival in the top-expressing and bottom-expressing quartile for these transcripts.

Results: Patient samples were screened for differences in gene expression with greater than two-fold upregulation in GBM as compared to normal brain tissue. Expression level of one of these genes, ADM, was significantly associated with survival in patients with GBM ($p<0.05$). Additional differences between grades of glioma will also be presented.

Potential Impact: This work demonstrates differential expression of hypoxia-related gene transcripts in gliomas. The next step is to assess differences between patient samples processed in differing oxygen tensions to assess efficacy of chemotherapeutics and gene expression in samples that have never been exposed to ambient air.

Identifying Socio-Demographic and Behavioral Predictors of Prolonged Hospital Stay in an Urban Hospital in Northwest Indiana

Michael Yallourakis, Eric Gonsiorowski, Baraka Muvuka, Jonathan Guerrero

Background/Objective: Hospital length of stay (LOS) is a critical metric that impacts patient outcomes, healthcare resource utilization, and financial burden. In 2019 the CDC reported the average LOS in community hospitals was 5.4 days. Prolonged LOS is associated with an increased risk of hospital-acquired infections, decreased hospital bed availability limiting patient access to care, and cognitive impairment, particularly among the elderly. This indicates the importance of addressing LOS as a healthcare priority. This study examined the relationship between LOS and social determinants of health (SDOH), patient demographics, health behaviors, and health outcomes as part of a long-term Community-Based Participatory Research partnership between IUSM-NW and SMMC.

Methods: This retrospective study analyzed data from EPIC™ for adult inpatient visits at an urban hospital in Northwest Indiana from January 2021 to March 2023. Data analysis was performed using SPSS 28.0, employing descriptive statistics and tests of association ($p<0.05$) including One-way ANOVA, Independent T-tests, Kruskal Wallis H, and Simple Linear Regression. This study was granted an exemption by the Indiana University Human Research Protection Program (IRB #14040).

Results: The sample comprised 10,916 predominantly white (77.7%) patients with a median age of 65 (IQR=22) and a median LOS of 4 days (IQR= 5). Bivariate analysis revealed LOS was significantly associated with age ($p<0.001$), race ($p<0.033$), sex ($p<0.012$), insurance type ($p<0.001$), physical inactivity ($p<0.001$), and smoking tobacco ($p<0.001$). After multivariate analysis, age ($p<0.020$), physical inactivity ($p<0.013$), and insurance type ($p<0.013$) retained their significance.

Conclusion/Implications: These findings highlight the significance of demographic, behavioral, and social factors in relation to hospital LOS. Understanding these factors holds immense potential to guide the development of targeted interventions and healthcare strategies to optimize patient care and reduce LOS.

Impact of Comorbidities as Predictors on Hospital Length of Stay (LOS) and Mortality in Hip Fracture (HF) Patients in a Rural Community

Thein Zhu, Gabrielle Lutz

Background/Objective: Studies on hip fracture at a rural health system area are rare. The research question is "Among demographic, preoperative variables including comorbidities in a rural community area, which would be independent predictors of outcomes on mortality and hospital length of stay (LOS)?"

Methods: The design is a community-based cross-sectional study with risk factor analyses. We ascertained HF cases from hospital trauma center registry and Epic software. We employed both descriptive and analytic approaches including multivariable regression analyses of predictors on outcomes.

Results: Of 201 HF patients, 85.6% occurred in 65 and above years (seniors). Among the seniors, females consisted of 64.0% with mean age ± SD: 83.72 ± 7.56 years; extracapsular HF, 55.2%; specified falls, 51.7%%; obesity, 15.2%; complication, 3.5%; surgery interventions, 80.8%; mortality within 1, 9.3%; 3, 11.6%; 6, 15.1%; and 12 months, 22.1% after hospital admission. Holding all other variables constant, no surgical intervention increased mortality risks within 1 month (OR=28.87, 95% CI: 4.43; 188.16), 3 months (OR=33.47; 95% CI: 5.24; 213.88), 6 months (OR=21.78; 95% CI: 3.67; 129.48), and 12 months (OR=4.17; 95% CI: 1.33;13.04) when compared to surgical intervention; obesity increased mortality risk (OR=6.00; 95% CI: 1.06; 34.09) 1 month after hospital admission when compared to no obesity; and patients who were transferred from community hospital compared to those who were not transferred had an increased 1-month (OR= 8.54; 95% CI: 1.25; 58.13), 3-month (OR=15.31; 95% CI: 2.21; 106.16), 6-month (OR=21.19; 95% CI: 3.34; 134.43), and 12-month (OR=5.14; 95% CI: 1.85; 14.28) mortality risk. Hospital LOS was 3.06 days higher in obese patients than non-obese patients and 2.11 days higher in surgery greater than 48 hours when compared to surgery within 48 hours, holding all other variables constant.

Conclusion/Implications: We believe that surgical intervention decreases, and obesity increases HF mortality. Obesity increases and early surgical interventions decrease hospital LOS. The results of this study have the potential benefit for improving community health of rural, elderly populations in northeast Indiana.

Impact of Connective Tissue Matrix Products and Critical Size Defects on Gut Microbiome and Fracture Healing in Mice

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Background/Objective: Approximately 6.2 million people in the USA alone suffer from some form of fracture annually. Depending on the intensity of trauma and complexity of the fractures, some fractures will not heal without medical intervention. It is imperative to develop novel therapies that target fracture healing. Connective Tissue Matrix (CTM) Biomedical is a company that develops human placenta, amnion, chorion, and other umbilical derived allograft products which may provide a solution to the problem of impaired fracture healing. CTM products contain structural proteins, cytokines, and growth factors that may have regenerative and anti-inflammatory properties. Although these products are already used clinically for fracture and wound healing in humans, no pre-clinical studies exist verifying their efficacy or mechanism of action. Commensal microbiota is a collection of microorganisms such as bacteria, fungi, and viruses. Gut microbiota has been implicated in various disorders, where the disruption of the gut microbiota, known as gut dysbiosis, can lead to a variety of disorders in other tissues. In fact, new studies indicate that alterations in the gut microbiota can affect bone health. This is likely due to impaired nutrient uptake and an increase in inflammation from bacterial byproducts that are not favorable to a healthy gut ecosystem. More recent studies indicate that the microbiota is also implicated in fracture healing.

Methods: Our study aims to investigate if CTM products have a positive effect on fracture healing by affecting the gut microbiota composition and bacteriome. To test this, critical sized defects (CSD) were induced in

mice and treated with various CTM implants or saline control. Fecal samples were taken on the day of surgery and weekly thereafter. Bacterial DNA was subsequently extracted from these samples and analyzed using PCR.

Results: We anticipate seeing changes in load and composition of gut bacteria following CSD surgery.

Implantation of Flexible Electrodes for Simultaneous in-vivo Extracellular Recording and Two-Photon Imaging

Alec Booth, Hammad Khan, Om Kolhe, Krishna Jayant

Background/Objective: Rigid silicon electrodes like Utah array grids and Neuropixel probes have been used in human and animal brain models to understand the dynamics of neural computation, treat neurodegenerative disorders, and act as brain-machine-interfaces. However, when implanted chronically, glial proliferation can rapidly disrupt the interaction between neurons and electrodes, drastically reducing recording fidelity. The development of flexible electrodes has the potential to minimize tissue damage and inflammation, which allows for long-term recordings over several months. In line with this objective, the Nano-neurotechnology Lab at Purdue University has developed a 6-μm thick, flexible, and biocompatible Parylene probe to facilitate chronic recordings in awake mice. However, flexible electrodes present a unique engineering challenge as the force required to insert into the brain causes the probe to buckle and fail during insertion.

Methods: Here, I designed a micropipette shuttle using a glass micropipette and custom insertion system which provided reproducible probe implantation into the cortex. The implantation device was designed in CAD software and 3D-printed for rapid prototyping. The procedure was developed on brain phantoms made of 0.6% agarose with a comparable Young's modulus to mouse brain tissue. Utilizing 3D-printed pieces and the surface tension of diluted poly-vinyl-acrylate adhesive to align the probe to a micropipette, insertion of the electrode and retraction of the shuttle was accomplished in awake mice.

Conclusion/Implication: The implications of flexible recording electrodes are extensive. Long-term implantation opens the door for understanding behavioral and learning dynamics over time. Moreover, the flexibility of these probes allows for the combination of 2-photon optical microscopy, thus enabling multimodal investigation of neuronal physiology. A low-cost, consistent procedure is the first step in the implementation of these flexible probes for further advancements in fundamental neuroscience research and its potential applications in human and animal studies.

Incidence of Venous Thromboembolism and Hematoma Following Placement of Inflatable Penile Prosthetic: Safety of Perioperative Subcutaneous Heparin

Jacob Good, Helen Bernie

Background/Objective: Patients undergoing inflatable penile prosthetic (IPP) surgery are at an increased risk for cardiovascular complications such as venous thromboembolism (VTE) following surgery due to pre-existing comorbidities associated with erectile dysfunction. The use of perioperative subcutaneous heparin (SqH) along with a surgical drain has been shown to be effective in preventing VTE in IPP patients, without increasing hematoma formation. Not all prosthetic surgeons utilize surgical drains postoperatively. In this study, we aim to assess the safety and efficacy of perioperative SqH in preventing VTE in IPP patients without the use of a surgical drain.

Methods: This was a retrospective review from January 2021-July 2023 of patients who underwent IPP placement or explant and replacement at a single institution. Patient demographics, comorbidities, Caprini risk factor scores, VTE risk factors, and 90-day postoperative complications, including hematoma formation, were reviewed. Statistical analyses were performed comparing these variables in men who received SqH and those who did not.

Results: We reviewed data for 240 patients; 53% (n=127) received perioperative SqH. The incidence of VTE was 0.9% (1/113) in the non-SqH group, and no VTE was recorded in the group receiving SqH. There was no statistical significance in hematoma formation between groups (SqH 5.5% vs. non-SqH 6.2% p=.898). Beyond hypertension prevalence (SqH 74.8% vs. non-SqH 62.8% p=.045), there was no difference between comorbidities or Caprini risk factor scores (SqH 6.79 vs.

non-SqH 6.82 p=.474) between groups (Table 1). 94% of the patients in this study were considered high risk for VTE.

Conclusion/Implication: Perioperative SqH use without placement of a surgical drain was found to be safe and effective in preventing VTE in patients undergoing IPP surgery. There was no increased risk of hematoma formation or post-operative complications between the groups. Perioperative SqH should be considered in all patients undergoing IPP surgery.

Indiana Contraceptive Use Metrics through PATH4YOU Program: Initial Review

Molly Ruggles, Kathleen Wendholt, Caitlin Bernard

Background/Objectives: PATH4YOU is Indiana's first state-wide contraceptive access project and provides contraceptive access via in-person and telehealth visits using a reproductive justice framework. Our objective was to evaluate outcomes of the PATH4YOU program to determine the distribution of contraceptive access among people in Indiana.

Methods: We analyzed programmatic data of reproductive-age people who received care in the PATH4YOU program from September 2021 to June 2023. All participants received pregnancy intention screening, comprehensive contraceptive counseling and decision support, and no-cost contraceptive method access, including long-acting reversible contraception (LARC). We evaluated age, location (county), primary method of contraception received, partner site visited, and in-person vs telehealth visit type using descriptive statistics. Geographical mapping analysis was used to determine areas of Indiana most impacted by the PATH4YOU program.

Results: Between September 2021 and June 2023, 1,024 people received care at 1,231 visits through the PATH4YOU program. The average age of participants was 27.6 years old. A significant (49.3%) proportion of the participants live in Marion County. The most common primary methods of contraception were the implant (27.2%), contraceptive pills (21.7%), and intrauterine devices (15.9%). The most visited partner sites included People's Health Center in Indianapolis (24.8%) and via telehealth (22.5%). Most people received contraceptive access in one in-person (66.0%) or telehealth (17.9%) visit.

Conclusion/Implication: The PATH4YOU state-wide contraceptive access project provided a range of contraceptive methods via both in-person and telehealth visits to a wide reach of people across multiple counties in Indiana. The unique PATH4YOU model of care using both in-person and telehealth visits is a novel way to increase contraceptive access throughout a state with highly variable access to traditional in-person contraceptive care. Further research is necessary to evaluate direct impacts of the program on minoritized and traditionally excluded populations to evaluate long-term outcomes like maternal mortality.

In-Theatre Simulation as a Training Tool for Laparoscopic Salpingectomy in Eldoret, Kenya

Lauren Roop, Samson Iliwa, Jenny Yang, Wan-Ju Wu

Background/Objective: Minimally invasive surgery (MIS) offers many advantages over open procedures including decreased patient safety risks and reduced burden on healthcare infrastructure. As low- and middle-income countries (LMICs) are disproportionately affected by these aspects of surgery, there is motivation to increase MIS. A multimodal training program in laparoscopic salpingectomies was piloted with a small cohort of OB-GYN registrars and consultants at Moi Teaching and Referral Hospital (MTRH) in Eldoret, Kenya. This project assesses the in-theatre simulation's (1) effectiveness in improving laparoscopic knowledge and skill confidence, and (2) feasibility for long-term implementation at MTRH and in similar settings.

Methods: Participants completed a half-day in-theatre simulation of a laparoscopic salpingectomy. The simulation required participants to demonstrate knowledge of laparoscopic setup, proper patient positioning, procedure completion, equipment troubleshooting, and peri- and intra-operative complication management. Participants completed a multiple-choice laparoscopic knowledge quiz and Likert scale skill confidence survey immediately prior to and following the simulation. Pre- and post-simulation responses were compared to assess knowledge and confidence acquisition overall and across content topics.

Results: There was a significant increase in the average knowledge quiz score from pre- to posttest (p=0.028).

A significant difference between pre- and post-test confidence was noted in four of the six skills assessed. By topic, equipment troubleshooting ($p<0.001$), and complication management ($p<0.01$) saw the most improvement. Barriers to long-term sustainability include unpredictable theatre and laparoscopic tower access and availability of supplies for uterine modeling. A modified model using nitrile gloves as fallopian tubes will be piloted in future simulations as a more accessible alternative for long-term implementation.

Conclusion/Implications: Despite limitations, in-theatre simulation has the potential to be an effective and sustainable teaching tool within a long-term MIS training program at Moi Teaching and Referral Hospital. The low-cost model and methods outlined may also be replicable in similar low-resource settings.

Intraventricular Ependymoma in Pediatric Patients: A Systematic Review of Demographics, Clinical Characteristics, and Outcomes

Mohammad Faizan Khan, Mustafa Mohamed, Andie Conching, Lane Fry, Dillon Putzer, Ammar Haider, Ali S. Haider, Gianluca Ferini, Mayur Sharma, Giuseppe E. Umana, Paolo Palmisciano, Gina Watanabe

Background: Intraventricular neoplasms are rare occurrences observed in 5 – 7% of all primary pediatric brain tumors. Pediatric intraventricular ependymomas are a complex subset of these tumors, poorly discussed across the current literature. Although surgery is generally the accepted treatment of choice, information on clinical course and outcomes is limited to heterogeneous case reports and small case series focusing on specific histologic subtypes or ventricular locations. We conducted a systematic review on pediatric intraventricular ependymomas to survey the patient population, tumor characteristics, management strategies, and associated outcomes.

Project Methods: PubMed, Scopus, Web-of-Science, and Cochrane were searched upon the PRISMA guidelines to include studies reporting pediatric patients with intraventricular ependymomas. Clinical characteristics, treatment protocols, and outcomes were analyzed.

Results: A total of 9 studies with 70 patients were included. Most patients were male (54%), diagnosed at a mean age of 7 years (range, 0.2-17), and frequently exhibited nausea and vomiting (38%), headache (31%), and ataxia (25%). Tumors were predominantly located in the fourth ventricle (79%) and most tumors were WHO grade 2 (73%). Mean tumor volume was 3 cm3 (range, 0.1-13.2). Management included surgical resection (96%), radiotherapy (87%), and chemotherapy (38%). Gross total resection was achieved in 69% of cases. Cranial nerve deficit was the most common post-surgical complication (71%). Most common combination of treatment included surgical resection and radiotherapy (53%). Mean overall survival was 50 months in these patients.

Conclusion/Impact: Pediatric intraventricular ependymomas are rare tumors with limited information on management strategies. The mainstay of treatment is complete surgical resection. Compared to ependymomas, intraventricular ependymomas appear to have a worse overall prognosis.

Investigating Post-Operative Refractive Outcomes in Patients Undergoing Cataract Surgery to Assess the Potential Impact of a Concurrent Diagnosis of Dry Eye Disease (DED)

Ateik Almalahi, Barbara Schroeder

Background/Objective: Cataract surgery is one of the most performed surgical procedures in the world. A cataract is defined as opaqueness in the interior of the ocular lens. The exact etiology of cataracts is multifactorial ranging from environmental conditions to biochemical changes induced by aging. The Intraocular lens (IOL) power calculation is an essential part of the pre-operative planning for cataract surgery as it determines the specific IOL that should be utilized for a patient. Keratometry measurements are required for this IOL power calculation, however, Dry Eye Disease (DED) has been shown to cause inaccurate keratometry measurements. We hypothesize that patients with DED undergoing cataract surgery will have a larger deviation from the predicted spherical equivalent (SE) post-operatively.

Methods: For this study, patients who were over the age of 18 and underwent cataract surgery were included. Patients who had a diagnosis of glaucoma, Herpes Simplex Keratitis, punctual plugs, undergone Laser-Assisted in Situ Keratomileusis (LASIK) surgery, Radial Keratometry, or any form of corneal scarring were excluded from

this study as these conditions can negatively impact keratometry measurements.

Results: The DED sample had a statistically significant larger SE deviation from the predicted SE compared to the healthy sample (p=0.037). The DED sample also had a statistically significant larger percentage of patients with an SE deviation of 0.50 D or greater (p=0.002). Finally, the DED had a statistically significant older age than the healthy group (p=0.028).

Conclusion/Implications: The statistically significant increased post-operative SE deviation from predicted SE within the DED sample can be the result of the increased variability in the tear film associated with DED. This can lead to inaccurate keratometry measurements, thus leading to incorrect IOL power calculations.

Maternal IVIG Administration in Rhesus Alloimmunized Pregnancies: A Systematic Review

Anna Flood, Enaja Sambutar, Hiba Mustafa

Background/Objective: Rhesus (Rh) alloimmunization occurs when an Rh negative mother is exposed to red blood cells (RBC) from an Rh positive fetus. The mother develops antibodies in the current pregnancy that attack Rh positive fetus in subsequent pregnancy, causing hemolytic disease of the fetus and newborn (HDFN). RhD is the most common antigen to result in fetal anemia requiring intrauterine transfusions (IUT). Although the traditional method of management and highly effective, IUTs carry significant risk particularly when performed early in gestation, potentially resulting in procedure-related fetal deaths. Intravenous immunoglobulin (IVIG) therapy may postpone or even replace invasive intrauterine treatment in fetuses of mothers with severe alloimmunization in previous pregnancies. To evaluate whether maternal administration of IVIG in high-risk Rhesus alloimmunized pregnancies is effective in delaying the need for IUTs as well as delaying the onset of severe fetal anemia and thus in diminishing its clinical consequences.

Methods: A systematic literature search was conducted for maternal intravenous immunoglobulin administration in pregnancies with Rh isoimmunization in the following databases: Medline, Embase and Cochrane Library from 1946 to 2 February 2023. Inclusion criteria was studies done during pregnancy in which IVIG was administered to the mother in Rh alloimmunized pregnancies/fetal anemia. All non-english papers, animal papers, systematic reviews, editorials and studies in which IVIG was administered to non-pregnant patients were excluded. Data was extracted from these full texts and analyzed for inclusion based on the quantity of usable data and patient information. Extracted data included maternal antibody type and titer, number of maternal IVIG administrations, number of IUTs, and fetal Hb levels prior to first IUT and at delivery. Time interval (weeks) between IVIG and first IUT was also included in the extracted data along with gestational age at delivery. Individual patient data extraction was done for studies that provided data.

Results: 16 studies were included in data analysis. Analysis of extracted data is ongoing.

Mental Health Assessments in Emergency Department Patients: Assessing Longitudinal Follow-up and Retest Reliability (MCAT-2) [Provisional Baseline Analysis]

Andres Alarcon, Naman Satsangi, Paul Musey

Background/Objective: The prevalence of anxiety and depression in adults in the United States is high with many experiencing ≥1 episode of anxiety or depression over a given year. Despite this, diagnoses of anxiety and depression in patients presenting to the ED for somatic complaints are seldom, relative to the population prevalence. Current fixed-item anxiety and depression screening tools have variable specificity and sensitivity, but adaptive screening tools such as the Computerized Adaptive Testing-Mental Health tool (CAT-MH) are thought to provide improved diagnostic characteristics and precision over fixed item tools. Our objective is to establish the reliability of its depression and anxiety severity assessments in patients initially screened in an ED setting and reassessed over 30 days.

Methods: We are conducting a longitudinal observational study among adult ED patients presenting with somatic, non-mental health complaints. The CAT-MH, Generalized Anxiety Disorder-7 (GAD-7), and Patient Health Questionnaire-8 (PHQ-8), are administered to randomly selected patients meeting enrollment criteria

after informed consent. Participants are reassessed at 1-, 2-, and 4 weeks after ED discharge and analyzed for longitudinal test-retest reliability and sensitivity to change in score severity over time.

Results: In this ongoing study, we present baseline anxiety and depression severity assessments for the first 49 enrolled patients (Mean age of 37, 73% female, 49% white, 47% black). Fixed item tools (GAD-7 and PHQ-8) categorized 16% and 6% of patients as moderate and severe anxiety respectively vs 19% and 15% as moderate, and moderately severe/severe depression. In comparison, CAT-MH categorized 8% and 10% as moderate and severe anxiety vs 10% and 6% were categorized as moderate and severe depression.

Conclusion: In this longitudinal observational study, we present baseline data for the first 49 out of 100 planned patients. Upon completion of the study, we hope to find that the severity assessments from CAT-MH remain stable over 30 days.

Metal Hypersensitivity Testing in Preoperative and Problematic Joint Replacement Patients: Identifying Trends for Methodology QI Initiatives

Katey Bell, Macy Happe, Sona Veeraraghavan, Trenton Goffinet, Majed Koleilat

Background/Hypothesis: Provider concern and patient prevalence of hardware rejection due to metal allergy is increasing. The variability of history collection and patch testing amplifies the misunderstanding of prevalence and patient morbidity. A comprehensive history is recommended in moderate strength by practice parameters, but uncertainty exists concerning the propensity for certain questions to predict clinical outcomes. The Deaconess Research Institute aims to assess the prevalence of metal hypersensitivity and scheduled assessment days to optimize current practices. We hypothesize that by comparing the metals testing positive, we can offer practitioners efficient historical questioning and abbreviated metal testing as a QI initiative.

Experimental Design/Methods: A blinded retrospective chart review of 157 patients in an Indiana Allergy Clinic from 7/2020-7/2023 referred for ACD evaluation. Patients referred by surgeons screened positive for history of metal-sensitivity. A chi-square analysis with Yates correction will determine if a significant difference exists between population sub-group prevalence.

Results: 40.2% of all patients, 43.7% of preoperative joint replacement (JR) patients, and 23.3% of problematic JR patients tested positive for metal allergy. Preoperative JR patients were 13.2% less likely to be allergic to nickel than post-JR patients, and in general were less likely to be allergic to metals (p=0.0441). 100% of allergic preoperative and problematic JR patients tested positive on day 7. Of the 30 problematic JR patients, 76.7% reported pain and/or swelling, 13% tested positive to any of the 31 allergens, and only 8% tested positive to a metal used in surgery.

Conclusion/Impact: Only reading tests on day 7 and testing 5/31 allergens (most prevalent: nickel, cobalt, chromium, benzoyl peroxide, and methyl methacrylate) is necessary for JR patients. Less clinical suspicion can be given to problematic JR patients because they are less likely to be allergic.

Metal Patch Testing: Quality Improvement Initiative in a Medium-Sized Healthcare System

Katey Bell, Macy Happe, Sona Veeraraghavan, Trenton Goffinet, Majed Koleilat

Background/Hypothesis: Nickel, chromium, and cobalt are common allergens seen with metal-induced allergic contact dermatitis (ACD) and prevalence is increasing. Unfortunately, the scheduled assessment, historical intake, and number of metals used in patch testing varies considerably, with no clear direction from practice parameters. The Deaconess Research Institute aims to assess their workflow and prevalence of metal-induced ACD to optimize current practices. We hypothesize that by identifying the most common allergens, ideal test reading dates, and reliable history, we can offer practitioners efficient historical questioning and abbreviated metal testing as a QI initiative.

Experimental Design/Methods: A blinded retrospective chart review of 157 patients in a Deaconess Allergy Clinic from 7/2020-7/2023 referred for ACD evaluation. A chi-square analysis with Yates or Fisher's exact correction determined association of positive results with physical

presentation or patient history.

Results: 73.7% of positive results are attributed to nickel, palladium, and cobalt, in order of prevalence. There is an association between patients presenting with oozing (p=0.0227) and lesions/blistering (p=0.0011) and positive test results, but not with swelling, itch, or rash. Both patients with problematic (64%) and unproblematic (83%) health hardware have higher ACD rates, yet unproblematic hardware (p=0.0027) is more suggestive of a future metal allergy. 98.4% of allergens test positive on day 7. One patient (1.6% of positive results) tested positive on day 3 with resolution by day 7. 43.3% of patients did not react until after day 3.

Conclusion/Impact: Day 7 readings are essential in patch testing for metal-induced ACD because delayed reactions may not appear earlier, and day 3 readings are likely not necessary. A history of pre-existing hardware and whether the patient experienced lesions/blistering or oozing are of the highest importance.

MR1/MAIT Cell Axis Impacts Innate Immunity and Synaptic Proteins in 5XFAD Mice

Jalyn Warren, Season Johnson, Samantha Ackley, Reham Afifi, Rashmi Shrinivasan, Randy R. Brutkiewicz

Background: Amyloid beta (Aβ)-induced synaptic dysfunction and inflammation are features of Alzheimer's disease (AD). One contributor to inflammation is mucosal-associated invariant T (MAIT) cells, an innate T cell that recognizes antigens presented by the MR1 molecule. Previously, we found increased MR1 expression in microglia near plaques and the loss of MR1/MAIT cell axis slowed the progression of Aβ pathology. This study aimed to determine contributions of the MR1/MAIT cell axis to immunity and synaptic proteins in the 5XFAD AD model mouse.

Methods: We crossed 5XFAD mice with MR1-deficient mice (which lack MR1 and MAIT cells). At 2-, 4-, 6-, and 8-months of age, hippocampal and cortical brain tissue from wild-type, MR1KO, 5XFAD, and 5XFAD/MR1KO mice were analyzed by Western blot. Protein levels were analyzed with antibodies against GFAP (astrocytes), complement C3, and postsynaptic density protein (PSD)95. Additionally, Novel Object Recognition, Open Field, and Barnes Maze behavioral tests were performed in the 5XFAD mice to measure memory deficits.

Results: Region-specific results were obtained for the hippocampus and cortex. The expression levels of PSD95 and C3 were significantly upregulated in the hippocampus of 5XFAD/MR1KO compared to 5XFAD mice at 6-8 months of age; in the cortex, GFAP levels were also significantly increased in 5XFAD/MR1KO mice. Finally, compared to wildtype C57BL/6 mice, 5XFAD mice showed memory deficits.

Conclusions and Potential Impact: Approximately 6.7 million Americans are living with AD. This number is expected to double by 2050. Without any currently demonstrated therapy against AD, there is a need for therapeutic target(s) as part of novel treatment paradigms. Our results demonstrate the impact of the MR1/MAIT cell axis on postsynaptic proteins and consequent AD pathology. Thus, understanding the contribution of this axis could help reveal the role of innate immunity in AD and potentially serve as a future therapeutic target in AD patients.

Navigating End-of-Life Conversations with A Female Patient From the Democratic Republic of Congo

Gabrielle Li, Megan Eigsti, Davis Giffin, Myranda Grismore, Amy Johnson

Background: The Democratic Republic of Congo (DRC) has not incorporated palliative care into healthcare policy. When surveyed, 71% of DRC nurses felt uncomfortable discussing death with patients due to community expectations for healthcare providers to offer hopeful reports.

Case: A 33 year old French-speaking female rom the Republic of Congo living with metastatic cholangiocarcinoma presented with recurrent abdominal pain due to ESBL E. coli bacteremia and liver abscesses. Upon admission, the palliative care team initiated conversations regarding prognosis and goals of care, but the patient declined. She agreed to comfort measures, only to request additional intervention later. The patient's husband resisted end-of-life discussions, expressing, "all you want to talk about is death when she has kids and is still living." Despite using interpreters, the care team questioned whether the patient's prognosis and their recom-

mendations were clear. Ultimately, the chaplaincy team coordinated with a spiritual leader from the patient's community, who facilitated a decision to discharge to home hospice.

Discussion: Immigrant families making end-of-life decisions often face a barrier beyond language: cultural expectations. Such expectations are difficult for families to communicate and for providers to address, with the U.S. healthcare system offering few resources. Providers should more frequently engage immigrant community and spiritual leaders, who can help navigate difficult conversations and establish expectations and priorities to improve provider-patient relationships and patient satisfaction. Additionally, U.S. medical schools can implement a more concrete framework on navigating across cultural boundaries to the current curriculum.

Clinical Significance: Approximately 15% of individuals living in the U.S. identify as immigrants. Despite recent emphasis on the importance of culturally competent care, few resources are available for immigrant families and healthcare providers navigating end-of-life care. The incorporation of spiritual and cultural values into comprehensive end-of-life care is vital. In addition, an implementation of the fundamentals of communication amongst immigrant families is necessary to create competent and compassionate healthcare providers.

Neighborhood Disadvantage and Healthcare Utilization in Pediatric Sickle Cell Patients

Ashley Catanzarite, Jillian Bouck, Seethal Jacob

Background: Sickle cell disease (SCD) is a complex heritable blood disorder associated with higher acute healthcare utilization, further complicated by psychosocial and socioeconomic factors. Other studies have indicated a relationship between neighborhood disadvantage and increased healthcare utilization. We hypothesize that those with greater neighborhood disadvantage will have greater acute healthcare utilization.

Methods: Data was collected retrospectively from the electronic medical record between 9/30/2021 and 7/11/2023 for patients followed at Riley Hospital for Children's Pediatric SCD Clinic who completed a psychosocial needs assessment (PAT). Number of emergency department (ED) visits, hospitalizations, and missed clinic visits were collected from the time the PAT was completed up to 1 year after (or the end of the data collection period). Data regarding area deprivation index (ADI) and childhood opportunity index (COI) were collected utilizing patient home address. Descriptive statistics were performed on all data above, as well as t-tests and chi square tests for univariate analyses.

Results: 142 patients completed a PAT during the study period. 88% had a primary care provider documented and 73% had public insurance. The median state and national ADI (6, 76.5) and COI (2, 2) demonstrated greater neighborhood disadvantage and less childhood opportunity. There was no statistically significant difference between ADI or COI and number of ED encounters or hospitalizations. However, patients who missed 1 or more SCD visits had a higher median state ADI than those who did not miss a visit (7.5 vs 5, p=0.002). Median state COI was also lower in this group than those who did not miss a visit (1 vs 2, p=0.001).

Conclusion: Those with higher ADI and lower COI could benefit from more directed support to improve access to preventative care visits. Further analysis accounting for comorbidities (seizures, asthma, depression) could disambiguate a relationship between ADI or COI and acute care utilization.

Neutrophil-to-Lymphocyte Ratio (NLR) to Monitor Neuroinflammation Status During Long COVID

Luke Fisher, Benecia Goka, Jessica Pater, Fen-Lei Chang

Background/Objective: 480 million people have been infected with COVID-19 worldwide. Roughly 10-15% of these patients will develop Long COVID which causes an array of symptoms including fatigue and "brain fog". Currently, a reliable marker to monitor Long COVID has not been established. NLR (neutrophil/lymphocyte ratio) has been shown to be an economical, reliable, and easily obtainable blood biomarker to monitor systemic inflammation. Our study aimed to use NLR to monitor Long COVID patients across pre-COVID to 24 months after acute COVID.

Methods: A retrospective patient chart review of 831 patients from a tertiary community hospital Post-COVID Clinic was completed to assess the changes in NLR. Symptoms and demographic information were collected.

Results: Our studies showed that at the time of acute COVID, NLR was elevated to 5.22+/-0.50 from the baseline pre-COVID NLR of 2.67+/-0.14. 4 to 6 months after the acute phase of COVID, the NLR normalized to 2.61+/-0.20, which gradually re-elevated to 3.58+/-0.39 from 16-24 months after the acute COVID ($p < .01$), indicating a re-activation of systemic inflammation. At 16-24 months after the acute COVID, 66% of patients with elevated NLR were hospitalized during acute COVID, while 33% of patient with normal NLR were hospitalized (Chi Square=3.90; $p<0.05$).

Conclusion: Our findings support the potential connection between the sustained Long COVID symptoms with sustained elevation of NLR, a marker of systemic inflammation reactivation. Currently we are building a non-COVID control group with the expansion into a prospective study phase. If our findings can be validated with further studies, NLR may be a useful biomarker for future monitoring of disease progression and marker for treatment development.

Paramedic Use of Pre-Hospital Lung Ultrasound in Diagnosing Heart Failure

Oliver Hobson, Frances Russell, Mark Liao, George Chen

Background/Objective: Over 6 million patients with acute heart failure (AHF) and 8 million patients with chronic obstructive pulmonary disease (COPD) visit the emergency department annually. Both AHF and COPD exacerbations present with dyspnea. The current methods to differentiate the cause of acute onset of dyspnea are not reliable in the pre-hospital environment. Lung ultrasound (LUS) examinations have become popular for evaluating AHF exacerbations due to the ease of use, portability, and high sensitivity and specificity. Our study set out to determine the diagnostic accuracy of paramedic performed LUS for AHF in patients being transported by ambulance with acute dyspnea.

Methods: LUS devices were utilized by four emergency medical service (EMS) units throughout Wayne Township. The EMS units underwent several training sessions on how to use, interpret, and electronically submit LUS images. A modified 4-view LUS imaging protocol was used. Electronic data from EMS run reports, uploaded ultrasound images with paramedic interpretation, and electronic hospital charts were reviewed to determine prehospital diagnosis and final hospital diagnosis. This data was used to calculate sensitivity and specificity of diagnosing AHF with and without the use of LUS.

Results: Of the 382 dyspneic patients transported to the hospital by the Wayne Township Fire Department, 55 of them underwent lung ultrasonography during transport. Using the final hospital diagnosis as a reference, pre-hospital diagnoses informed by LUS were 76% sensitive and 97% specific for detecting CHF, while standard, non-LUS informed pre-hospital diagnoses had a sensitivity of 24% and specificity of 97%.

Conclusion/Implications: Our data suggest the use of the modified 4-window pulmonary ultrasound exam can help improve diagnostic sensitivity of CHF in the pre-hospital setting. The implications of recognizing CHF exacerbation earlier can decrease the time to treatment and improve both short- and long-term patient outcomes.

Percutaneous Liver Biopsy Adverse Events in Stable Fontan Patients

Brendon Glass, Sean Pfaff, Christopher Sinsabaugh

Background and Objective: In patients who have undergone a Fontan operation, altered cardiac circulation can lead to several organ pathologies, including Fontan-associated liver disease. Transjugular liver biopsies are the standard for assessing liver disease in these patients, however data for a percutaneous approach in these patients is limited. Percutaneous liver biopsies are the preferred method in the general population. The objective of this study was to compare the rate of adverse events for percutaneous liver biopsies in Fontan patients to the general pediatric population.

Methods: A retrospective chart review was conducted on percutaneous liver biopsy patients over a five-year period. For each patient, a 90-day period post-biopsy was investigated to look for any indications of adverse events (pain, hemorrhage) and related work-up (imaging, hospital admission), scoring the severity of these events based on SIR adverse event classification. Patients were stratified based on if they underwent a cardiac catheterization procedure immediately prior to biopsy or not.

Results: A total of 412 biopsies were reviewed, 367 without cardiac catheterization and 45 with catheter-

ization. Across the entire population, 38 adverse events were found, giving an overall adverse event rate of 9.2%. Comparing populations, non-catheterized patients were found to have an adverse event rate of 9.0%, with a minor rate of 7.2% and a major rate of 1.8%. The catheterized group had an adverse event rate of 11.1%, with a minor rate of 8.8% and a major rate of 2.3%. There were no lethal events. These rates align with reported literature.

Conclusion and Potential Impact: There was no significant difference in adverse event rates between Fontan patients and the general population after a percutaneous liver biopsy. This information can guide clinical decisions, as these biopsies are cheaper, less invasive, and do not expose patients to ionizing radiation.

Prenatal Predictors of Survival, Pulmonary Hypertension, and ECMO in Isolated CDH Undergoing Expectant Management, A Systematic Review and Meta-analysis

Meera A. Thiel, Alena N. Tofte, Asma Khalil, Hiba J. Mustafa

Background and Hypothesis: Congenital diaphragmatic hernia (CDH) is a severe developmental defect affecting 1-4 per 10,000 births, characterized by left/right-sided defect or mixed with herniation of abdominal contents into thorax with resultant lung hypoplasia and persistent pulmonary hypertension (PHTN). The study investigates prenatal predictors of survival to hospital discharge, PHTN, and the need for ECMO in fetuses with isolated CDH undergoing prenatal expectant management.

Project Methods: We performed a systematic literature review on prenatal diagnostic tests in fetuses with isolated CDH undergoing expectant management. Primary outcomes included survival-to-hospital discharge, persistent PHTN within 28 days, and ECMO need. Newcastle Ottawa Scale assessed the quality of studies. Meta-analysis was performed when two or more studies reported on the same test. Subgroup analysis performed according to CDH side.

Results: 161 full-text articles between 2000-2022 were assessed for eligibility; 48 met inclusion criteria. 45 reported on survival, 12 on ECMO need, 8 on PHTN; quality of studies was moderate. Studies included were retrospective (81%) or prospective (19%) regarding fetuses undergoing expectant management (77%), or mixed tracheal occlusion and expectant management (20%). Most studies included mixed (41%) or left-sided (47%) CDH. Survival predicted by TFLV, o/e-TFLV, o/e-TFLV <30%, LiTR, o/e-LHR, o/e-LHR <25%, percentage herniated liver, MSA, stomach position in mid-chest, and liver up. ECMO need predicted by o/e-TFLV, o/e-LHR, and PPLV. These results were confirmed through subgroup analysis of only left-sided lesions. PHTN was predicted by presence of intrathoracic liver (OR-1.96, 95%CI 1.14,3.37, I2-0%); this was not significant after left-sided subgroup analysis.

Conclusion and Potential Impact: In fetuses with CDH, FLV and presence/percentage of intrathoracic liver predict survival. FLV measurements predict ECMO need. Presence of intrathoracic liver may predict persistent PHTN; further studies are needed. Accurate prognostication of CDH severity would aid patient triage, resource mobilization, and identification of high-risk CDH infants in need of advanced treatment including ECMO or identification of candidates for fetal intervention procedures.

Prophylactic Posterior Targeted Muscle Reinnervation (TMR) Approach in Below Knee (BKA) Amputation Settings

Sri Charan Kanthala, Jeffrey Gross, Brian Christie

Background/Objective: Targeted muscle reinnervation (TMR) is a nerve reconstruction technique focused on improving phantom limb pain (PLP), residual limb pain (RLP), prosthesis function, and limiting neuroma formation. In below-knee-amputations (BKA), TMR performed "through-the-wound" is heavily documented. Alternatively, the "posterior approach" was developed to help increase visibility of peripheral nerves from the posterior fossa during the procedure. This study focuses on the surgical efficiency and patient outcomes of the posterior approach compared to the through-the-wound approach. We hypothesize the posterior approach will be comparable to or improve time-to-prosthesis fitting, OR time, and pain scores.

Methods: 157 patients underwent TMR at two hospitals in Indianapolis, IN, and were identified using CPT 64890. 18 patients underwent posterior approach TMR

post-BKA. Data on demographics, follow-up/rehabilitation visits, post-operative complications, prosthesis fitting, and total OR time were collected and analyzed. Additionally, 20 patients received TMR "through-the-wound," and total OR time, post-operative complications, and time-to-prosthesis fitting were tracked via EMR records.

Results: The average surgical time for posterior approach patients was 236.44 minutes (95% CI 258.34 – 214.55), while the through-the-wound approach took an average of 208.45 minutes (95% CI 241.58 – 175.32). However, this difference was deemed statistically insignificant, secondary to overlapping confidence intervals. Only three of the 18 posterior approach patients experienced post-operative complications (16.7%), while 10/20 (50%) of the through-the-wound patients experienced post-operative dehiscence and/or infection. Finally, the average time to prosthesis fitting from the end of surgery was 1.62 months and 6.39 months for posterior approach and through-the-wound patients, respectively.

Potential Impact: Posterior approach TMR had no significant impact on OR time, but time-to-prosthesis fitting significantly decreased. The use of the posterior approach correlated with reduced post-operative complications. Preliminarily, posterior approach TMR improves aspects of patient outcomes while not compromising surgical efficiency.

Retrospective Analysis of COVID-19 Impact on Social + Emotional Development in Children of Low-Income Communities from Head Start

Gabrielle S. Li, Satya P. Sanapati, Amy Han

Background: Geminus Head Start is a federal program that works with children under five years old from low-income communities to promote school readiness. Studies have shown that adverse childhood development can have a severe psychological and physiological impact on health outcomes into adulthood. However, there has been a lack of research on quantifying the extent of damage from the pandemic on our Head Start children, who mainly identify as Black/African American.

Methods: Geminus Head Start provided data for over 4650 students from 2019-2023. DECA, Devereux Early Childhood Assessment, is used by educators to evaluate children's social emotional competence for early intervention. In this study, we are investigating the DECA categories, including initiative, self-control, and attachment/relationships, and analyzing through ANOVA along with listening into the teacher focus groups.

Results: Race had an impact on self-regulation scores, with Black students scoring significantly lower than other races ($p<.001$). In particular, the results indicated that Black students in Geminus Head Start were affected in their self-regulation scores, so this group may have struggled more with handling frustration, showing patience, cooperating with others, and calming themselves down in comparison to other races.

Conclusion: The pandemic has created a time of isolation and instability for our children and their families. These children have not been able to access adequate conditions to develop emotional and social maturity. Lacking this development can lead to several negative health outcomes as it may impact mental health and the ability to create healthy supportive networks.

Role of Ultrasound in Operative Decision-Making for Necrotizing Enterocolitis

Ella Boardley, Sindhu Mannava, Rodica Muraru, Brian Gray

Background/Objective: Necrotizing enterocolitis (NEC) is a neonatal disease involving a spectrum of intestinal inflammation to necrosis, treated medically and surgically. Abdominal ultrasound (AUS) is a diagnostic modality used in the workup of NEC. The aim of this study is to identify the utility of AUS in clinical decision-making for surgical NEC patients. We hypothesize that, among patients with surgical NEC, AUS is more likely to be performed in close temporal proximity to the operation.

Methods: We performed a retrospective cohort study of infants less than six months old diagnosed with NEC at our institution from 2020 to 2022. We obtained data-points including results of abdominal x-ray (AXR) and AUS performed during the NEC episode, operations performed, intraoperative findings, and clinical outcomes. We performed statistical tests including Student's t-test, median test, and Fisher's exact test to assess differences between study groups.

Results: We identified 25 patients with medical NEC and 37 patients with surgical NEC. In total, we analyzed 68 episodes of NEC and 50 operations. There were no significant demographic differences between medical and surgical NEC groups in terms of age at diagnosis, sex, and race; however, the surgical NEC group had a lower median [IQR] gestational age (25 [3] vs. 37 [6], $p<0.001$) and more patients with respiratory comorbidities (83.8% vs. 48%, $p<0.01$). Surgical NEC patients had a significantly higher mean [SD] number of AUS performed per NEC period compared to medical NEC patients (0.77 [1.14] vs. 0.17 [0.39], $p<0.05$). Of the 50 operations performed for NEC, AUS was performed prior to surgery in 15 operations. AUS was obtained within six hours of operative time (OT) in 46.5% of operations and more than six hours from OT in 53.3% of operations. Median [IQR] hours from ultrasound to surgery was 7.3 [20.1]; this did not reach statistical significance. AXR was performed prior to surgery in 43 surgical procedures and of these, AXRs were performed within six hours of OT in 82.5% operations. AUS findings were mentioned in operative reports as an indication for surgery in 20% of all surgical procedures across all NEC episodes.

Conclusion/Implications: While there is variability in the timing of AUS in relation to operative intervention for NEC, most patients in our cohort who underwent AUS prior to surgery were more likely to have this performed more than six hours from OT. Despite this, ultrasound findings were not listed as a reason for operative intervention in the majority of surgical NEC cases with AUS data. While our results are limited by sample size, we identified a role for standardizing criteria for obtaining AUS in NEC patients. We plan to assess the use of an AUS protocol at our institution in a future study with the aim of optimizing AUS use in surgical decision-making for NEC.

Social Determinants of Health and 30-Day Readmissions in an Urban Community Hospital in Northwest Indiana

Eric Gonsiorowski, Michael Yallourakis, Jonathan Guerrero, Baraka Muvuka

Background/Objective: Hospital readmission within 30 days of discharge is a quality of care indicator with implications for patient and healthcare systems. This study examined social determinants of health on 30-day readmissions in a Northwest Indiana hospital. This is part of a community partnership between IUSM-NW and St. Mary Medical Center (SMMC).

Methods: This retrospective study analyzed a limited dataset generated by SMMC in EPIC™ from inpatient admissions between January 2021 to March 2023. Data analysis was descriptive, bivariate (Chi-Square; $p<0.05$), and multivariate (binary logistic regression; $p<0.05$) in SPSS 29.0. This study was exempted by the Indiana University Human Research Protection Program (IRB #14040).

Results: The sample consisted of 7445 patients, majority 65 years and above (56.5%), white (77.47%), and publicly insured (76.83%). 30-day readmissions represented 10.5% of admissions. The bivariate analysis revealed statistically significant associations between 30-day readmissions and age ($p<0.001$), language ($p=0.008$), insurance type ($p<0.001$), veteran status ($p=0.017$), and smoking ($p<0.001$). The multivariate analysis revealed age (OR=1.008; $p=0.004$), non-English speakers (OR=1.866; $p=0.009$), public insurance (OR=2.096; $p<0.001$), and former smoking (OR=1.243; $p=0.011$) remained significantly associated with 30-day readmission.

Conclusion/Implications: Various factors were associated with 30-day readmissions in a community hospital. Incorporating behavioral and social interventions into hospital readmission reduction programs may reinforce them. The next phase will conduct advanced analysis to uncover new relationships regarding SMMC's objectives.

Social Determinants of Health Associated with Inpatient Admissions for Congestive Heart Failure, Diabetes, Chronic Obstructive Pulmonary Disease, and Asthma

John Quentin Deckbar, Kelly DeMichael, Wael Gad, Baraka Muvuka, Jonathan Guerrero

Background/Objective: The CDC and American Lung Association estimate that congestive heart failure (CHF), diabetes, chronic obstructive pulmonary disorder (COPD), and asthma (COPD/asthma) cost Americans $30.7 billion, $327 billion, and $50 billion respectively each year. They account for most inpatient readmissions

at St. Mary Medical Center (SMMC), an urban hospital in Northwest Indiana. There is need for further research on the social, behavioral, and demographic determinants associated with these conditions. This study examined the social, behavioral, and demographic determinants associated with inpatient admission for CHF, diabetes, COPD/asthma in SMMC's service area.

Methods: This retrospective study was part of a multi-phased Community-Based Participatory Research partnership between SMMC and Indiana University School of Medicine Northwest. SMMC implemented a pilot screening and referral program to assess social determinants of health in their service area as part of their Hospital Readmission Reduction Program. This study included data from 10,953 inpatient admissions between January 2021 to March 2023, majority of whom were transferred from the emergency department. Data analysis consisted of univariate, bivariate (Chi-square), and multivariate (binary logistic regression) analysis in SPSS 29.0.

Results: Bivariate analysis revealed a statistically significant association between CHF and smoking, age, insurance type, and income. Diabetes was significantly associated with smoking, smokeless tobacco use, age group, race, income, and sex. COPD/asthma was significantly associated with smoking, age group, transportation needs, stress, insurance, ethnicity, and sex. Multivariate analysis found the following significant associations: age group with both CHF ($p<0.001$) and diabetes ($p<0.001$), former smoking with both CHF ($p = 0.007$) and COPD/asthma ($p = 0.049$), current smoking with COPD/asthma ($p = 0.016$), and sex with diabetes ($p <0.001$).

Conclusion/Implications: These findings indicate significant associations between multiple socio-behavioral factors and admission for CHF, diabetes, COPD/asthma. Multi-risk-factor interventions may address these interactions and contribute to reducing readmission.

Student Perceptions of Two Preclinical Medical School Exam Feedback Approaches

Elsie Gasaway, Valerie O'Loughlin

Background/Objective: In medical school, where learning an abundance of information in a short period of time is required, it is necessary that learners receive valuable feedback after summative assessments (i.e., unit exams). First-year medical students at Indiana University School of Medicine (IUSM) begin their education with a course titled Human Structure (HS), followed by Molecules to Cells and Tissues (MCT). Both courses provided different formats for exam feedback, resulting in anecdotal comments about preference and utility of feedback. This study uses qualitative research methods to examine IUSM-Bloomington students' perceptions of exam feedback formats with respect to their utility and applicability.

Methods: Five, second-year IUSM-Bloomington medical students participated in a focus group to discuss their utilization and perceived usefulness of HS and MCT exam feedback. A thematic analysis was used to interpret data from the focus group. This study was deemed exempt by the IU-IRB (19409).

Results: The thematic analysis revealed that students' discussions fell into three categories: logistics, utilization, and mentality. These categories were further broken into themes and subthemes, revealing 13 unique codes. Students spent a substantial amount of time discussing logistics of exam feedback. Barriers to utilization of exam feedback included a lack of information provided at the feedback sessions and a lack of time in the schedule available for feedback sessions. Students preferred MCT approach to exam feedback; however, they recognized HS course logistics may prevent similar adoption. Students had small suggestions on how to improve feedback in both courses.

Conclusion/Implications: The data suggest students would benefit from small changes in how first-year medical school courses at IUSM provide exam feedback. Improvements could include extending the time of exam review sessions, incorporating a discussion on commonly missed exam concepts, providing answer explanations for incorrect and correct answers, and transitioning statewide reviews to be campus led.

Symptom Network of Alzheimer's Disease

Dasanae Davis, Meichen Yu

Background/Objective: Alzheimer's Disease (AD) requires a multitude of cognitive and imaging tests for accurate diagnosis. Although amyloid-b and tau deposition are necessary for the diagnosis of AD, a patient must also

express clinical symptoms. Research exists categorizing clinical symptoms and their anatomical pathways, but interactions and associations of symptoms are not well understood. Understanding clinical symptoms can be useful for developing personalized treatment of AD. If certain symptoms are more implicated in the disease progression these can be targeted.

Methods: We created a novel symptom network across the AD spectrum using Montreal Cognitive Assessment (MoCA) scores from the Alzheimer's Disease Neuroimaging Initiative (ADNI) database replicating the progressive disease model. The spectrum ranges from CN (cognitive normal), SMC (subjective memory complaint), EMCI (early mild cognitive impairment), LMCI (late cognitive memory impairment) to AD. The symptom network was constructed by computing Pearson's correlations (network links) between MoCA sub-scores spanning seven cognitive domains (network nodes). Thus, the symptom network consists of seven nodes, representing correlated cognitive domains.

Results: Total MoCA scores and the seven domains were all shown to have differences amongst relevant diagnoses. We found differences in correlations among all the domains. The visuospatial/executive and attention domains showed the strongest group differences across the AD spectrum. In addition, the correlations between visuospatial/executive and orientation first increased from preclinical stage (i.e., CN and SMC) to prodromal stage (i.e., EMCI and LMCI), to AD dementia. Most notably, memory correlations with other six domains increased radically across the AD spectrum suggesting the dominating role of memory dysfunction during the disease progression.

Conclusion/Implications: This study implicates memory-related disease progression and its multiple notable interactions with other cognitive domains across the AD spectrum. Further, our findings suggest that the visuospatial/executive domain and memory domain might be promising candidates to target for treatments along the AD spectrum.

The Effects of Extracellular Matrix Allograft Administration on Knee Inflammation Following an Anterior Cruciate Ligament Injury in Mice

Caroline Bice, Peyton Estes, Ben Loflin, Roufael Hannah, Stephen Schlecht

Background and Hypothesis: A human placental-derived extracellular matrix (ECM) allograft has previously been developed and is indicated by the manufacturer for reducing tissue inflammation and accelerated repair. To evaluate the efficacy of this product for reducing post-anterior cruciate ligament (ACL) injury inflammation, we used a novel murine in vivo ACL injury model. This model has previously been shown to induce significant synovitis, infrapatellar fat pad (IFP) fibrosis, and articular cartilage (AC) degradation within 2 weeks following an ACL injury. We hypothesized that intra-articular injections of the allograft would correspond with a decrease in synovitis, fibrosis, and articular cartilage degradation.

Experimental Design: Ten-week-old C57BL/6J mice were randomly placed into 4 groups (n=10/group). For all mice, the right ACL was ruptured. One group served as sham controls, with a single intra-articular saline injection 24-hours following injury. The remaining three groups received 1, 2, and 6 allograft injections respectively beginning 24-hours after injury. Mice were euthanized 14 days after injury. Following euthanasia, the degree of IFP fibrosis, knee synovitis, and AC degradation were histopathologically evaluated.

Results: Thus far, 5 mice per group have been analyzed. Within this subset of mice, those that received 6 injections demonstrated a significantly higher synovitis score ($p < 0.01$) than the sham group. The 1-injection ($p < 0.01$), 2-injection ($p = 0.16$), and 6-injection ($p = 0.03$) groups each displayed greater IFP fibrosis, relative to sham. No significant differences were found in AC degeneration across groups.

Conclusion and Potential Impact: If the current results hold, following the analyses of the remaining mice, then this particular ortho-biologic may not be suitable for reducing the post-ACL injury inflammatory response in mice. However, there are several limitations to this pilot study that will first need to be accounted for to confirm

the lack of efficacy found.

The Impact of Early Interruption of Exclusive Breastfeeding on Growth and Development in Children Born to Mothers Living with HIV

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Background and Objective: Exclusive breastfeeding is recommended until six months of age in low-resource settings. Mixed evidence suggests that HIV-infected mothers may have early cessation of exclusive breastfeeding, which could be detrimental to infant growth and development. This study aims to examine the impact of early interruption of exclusive breastfeeding on the growth and development of children born to HIV-infected mothers in Kenya.

Methods: This study was an interim analysis of a prospective cohort of HIV-exposed uninfected (HEU) and HIV-unexposed uninfected (HUU) infants within the Academic Model Providing Access to Healthcare in Eldoret, Kenya. Data were collected on duration of exclusive breastfeeding (early interruption is defined as mixed feeding prior to six months of age), anthropometrics at six months of life (z-scores for head circumference-for-age (HCAZ)), height-for-age (HAZ), weight-for-age (WAZ), and weight-for-height (WHZ) and developmental screening items (measured 8 domains to indicate at-risk development). Descriptive summary statistics, Welch's two sample t-tests, and Fisher's Exact Tests were used for analysis.

Results: Overall, 229 HEU infants and 252 HUU infants were included. HEU infants had lower rates of early interruption of breastfeeding compared to HUU infants (24.1% versus 47.1% respectively, p-value < 0.001). HEU infants had lower mean WAZ, HAZ, and HCAZ compared to HUU infants in both the exclusive breastfeeding (EBF) and early interruption groups (EI). The EI group has lower WHZ and HCAZ compared to EBF, however no differences were found in other growth metrics. Overall, developmental scores did not differ between groups, except those in the EI group had higher rates of at-risk development in the behavior domain only compared to the EBF group (3.1% versus 0.4% missed, p-value = 0.027).

Conclusion and Potential Impact: Despite higher rates of exclusive breastfeeding, HEU infants have overall poorer growth outcomes at six months of age. Additional follow-up is needed to evaluate whether these patterns persist into early childhood.

The Impact of Endoluminal Functional Lumen Imaging Probe (EndoFLIP) findings on clinical decision making in pediatric patients

Ryan Pitman, Alexa Becker

Background/Objective: The endoluminal functional imaging probe (EndoFLIP) is a newer, minimally invasive technology that is utilized during endoscopy to analyze the dimensions, distensibility, and pressure within the esophagus. FLIP has been recognized as an important diagnostic tool in children. However, current data regarding the impact of FLIP assessment on clinical decision-making in children is limited. This study sought to analyze and evaluate this current gap in the literature with the hypothesis that FLIP assessments have a significant impact on clinical decision making in children with symptoms of upper GI dysfunction.

Methods: A retrospective cohort study was performed that extracted data from all pediatric patients who underwent a FLIP assessment at Riley Hospital for Children from July 2019-Janruary 2023. Relevant data extracted from each clinical record included demographic information, past and current medical history, and recorded measurements from each FLIP assessment. Statistical calculations utilized SPSS statistics version 25.

Results: This analysis included data from 40 pediatric patients and 44 FLIP assessments. Four of the 40 patients included in this study underwent FLIP assessment on two separate dates. Each event was analyzed independently. A change in therapy was suggested after 20 of the 44 FLIPs (45.5%). Changes in therapy included: a change in medication (12/44), a recommendation for a follow-up study (6/44), or a recommendation for surgery (4/44).

Conclusion/Implications: Endoluminal functional imaging probe is an effective tool in guiding therapy in children with known esophageal dysfunction.

The Potential Tripartite Connection: Alzheimer's Disease, Fracture Healing, and the Gut Microbiome

Reginald S. Parker, Will A. Varner, Murad K. Nazzal, Amy Creecy, Sonali J. Karnik, Rachel J. Blosser, Elizabeth Scott, Alexander C. Harris, Ashlyn J. Morris, Hannah S. Wang, Tyler J. Margetts, Marko Dragisic, Upasana Ganguly, Jill C. Fehrenbacher, Kathryn D. Fischer, Alexandru Movila, Adrian L. Oblak, Jessica Hathaway-Schrader, Melissa A. Kacena

Background: Alzheimer's disease (AD), fracture healing, and the gut microbiome are interconnected aspects of health that have gained significant research interest. Recent studies suggest gut dysbiosis may play a role in AD pathogenesis, potentially through the gut-brain axis, a bidirectional communication system. Moreover, the gut microbiome's role in bone health could link dysbiosis and fracture risk. Furthermore, research reports have revealed that the brain communicates with bone, termed the bone-brain axis. Despite these insights, the effect of the gut microbiome on fracture healing in AD remains largely unexplored.

Methods: To uncover these connections, our study uses the AD mouse model 5xFAD. We conducted osteotomies on these mice and analyzed fecal samples that were collected at different timepoints. Fecal samples are being examined via qPCR 16s RNA analysis and 16s rRNA genome sequencing to identify and quantify bacterial phyla. These findings will be linked to both AD progression, gauged through behavior and histological analyses, and fracture healing, quantified using X-ray, mRUST scoring, microCT, and histology.

Results: We hypothesize that the progression of AD could alter the gut microbiome, potentially affecting fracture healing. This might occur through inflammation pathways triggered by specific gut bacteria. We may identify specific gut bacteria that play critical roles in both fracture healing and AD. We anticipate finding a shift towards pro-inflammatory bacterial phyla in the context of AD progression and during the fracture healing process. Preliminary qPCR data shows differences in the bacterial phylae Bacteroidota and Actinomycetota one week post-surgery. We will soon analyze other time points to determine if these differences remain significant. Ongoing research will gather endpoint data from other analyses and correlate it to microbiome changes to identify potential connections. This study could eventually unlock new therapeutic strategies aimed at targeting the gut microbiome to improve bone health, fracture healing, and AD progression in patients.

The Quandary of Cellular Fractionation – Optimizing Ambion™ Paris System to Advance HPV16 Cancer Research

Emma Bisch, Caylin Billingsley, Rachel A. Katzenellenbogen

Background: Human Papillomavirus (HPV) is the causative agent in nearly all cervical cancer cases. It has been shown that the HPV type 16 E6 protein interacts directly with the host protein NFX1-123. Short-term studies have shown that NFX1-123 remains in the cytoplasm; however, it has not been investigated whether NFX1-123 actually translocates to the nucleus in the long term. We hypothesize that over time, NFX1-123 translocates to the nucleus of the cell in long term cultures with 16E6. This present study seeks to optimize the AmbionTM Paris system to allow for pure, proper separation of the cytoplasmic and nuclear cellular compartments.

Methods: Three biologically unique backgrounds of human foreskin keratinocytes (HFKs) were cultured in a monolayer tissue culture dish. Using the AmbionTM Paris system, proteins were isolated as whole cell extracts, nuclear, and cytoplasmic fractions. For one lysis method, only protease inhibitors were added to the lysis buffers of the AmbionTM Paris system. For another lysis method, 1% NP-40 and protease inhibitors were added to the lysis buffers of the Paris system. Proteins were quantified, then proper separation of the cellular compartments was confirmed by western blotting. Histone H3 and GAPDH were used to identify nuclear and cytoplasmic compartments, respectfully.

Results: Western blotting confirmed that adding 1% NP-40 to the lysis reagents of the AmbionTM Paris kit proved to be an optimal technique for separating the cellular compartments.

Conclusions and Potential Impact: Being able to efficiently separate the cytoplasmic and nuclear compartments will allow for accurate identification of NFX1-123 during long-term HPV16 infection. If NFX1-123 is

found to move into the nucleus under the influence of HPV 16E6, then this could indicate potential transcriptional regulatory functions of the NFX1-123 protein during HPV infection which is unique from its function in non-infected cells.

The Role of SHROOM3 in Congenital Heart Disease

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Background: Congenital heart defects (CHD) are the most common and most frequently fatal birth defects, but most etiology remains unknown. We identified a patient with CHD and implicated a gene called SHROOM3. SHROOM3 binds Dishevelled2 which is the central cytoplasmic component of both canonical and noncanonical Wnt/planar cell polarity (PCP) signaling pathways. PCP drives cell movement and is important to embryogenesis, and disruption causes CHD. We hypothesize CHD can result from SHROOM3-loss-of-function due to PCP disruption.

Methods: To interrogate SHROOM3's role in CHD and PCP, we utilized an established in vivo SHROOM3-loss-of-function model, Shroom3 gene trap mice (Shroom3gt). We also utilized a loss-of-function model for PCP membrane component VANGL2, (Vangl2+/-). We assayed genetic interaction between Shroom3 and Vangl2 during cardiac development by crossing singly heterozygous null mice to produce compound heterozygous embryos, harvested embryos, and performed histologic analysis for cardiac defects. We also utilized a human in vitro SHROOM3-loss-of-function model, a CRISPR-Cas9 edited SHROOM3 knockout HELA cell line. We assayed cell movement using a scratch assay.

Results: Compound heterozygous Shroom3+/gt;Vangl2+/- embryos had a threefold increase in heart defects compared to singly heterozygous Shroom3+/gt;Vangl2+/+ or Shroom3+/+;Vangl2+/- embryos (3 of 19 or 15.7%, versus 1 of 17 or 5.2%, and 1 of 19 or 4.8%, respectively), demonstrating a trend towards genetic interaction between SHROOM3 and VANGL2/PCP during cardiac development. The scratch assays demonstrated cell movement defects due to SHROOM3-loss-of-function consistent with increased cell movement.

Conclusions And Potential Impact: We demonstrate SHROOM3 interacts with Wnt/PCP during cardiac development. Further interrogation of SHROOM3's role in Wnt signaling will provide insight into the mechanisms by which a novel CHD candidate participates in cardiogenesis and will improve CHD diagnosis, management, and therapeutic development.

Therapeutic Effects of a Placental Tissue-Derived Allograft on Fracture Healing

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Background: As 5-10% of fractures will not heal without medical intervention, there is an ongoing need for effective treatments to promote fracture healing. CTM Biomedical produces human placental tissue-derived allografts that are used clinically and may assist in healing; however, no preclinical studies assessing these products have been performed. Our study investigating the impact of CTM products on the healing of a standard femoral fracture and a critical sized femoral defect (CSD) aims to fill this gap. We hypothesize that CTM product application will improve fracture healing and reduce pain-related behaviors.

Methods: Femoral fractures were induced in mice. CTM membrane, CTM paste, a combination of CTM membrane and paste, or saline was applied to each fracture. X-rays were taken twice weekly over 22 days, and blinded modified Radiological Union Scale for Tibia (mRUST) fracture scoring was performed. Complete blood analysis was conducted weekly. Following euthanasia 23 days post-surgery, μCT and histomorphometric analyses were conducted. CSDs have also been surgically induced in the femurs of 95 mice, with plans for similar fracture analyses.

Results: CTM product application did not significantly alter the levels of inflammatory cells, suggesting that the mice did not undergo immunological reactions. mRUST scoring indicated that CTM products may not alter fracture healing rates. However, combined application of CTM membrane and paste significantly increased the fracture callus's mineralized volume (by ~90%) and the percent of the callus that was bone. CTM membrane

and paste application also led to an increased threshold for hind paw withdrawal, suggesting that CTM products may decrease pain-related behaviors.

Conclusion And Potential Impact: We hypothesize that in our CSD model, mice treated with the combination of CTM membrane and paste will display improved fracture healing and decreased pain-related behaviors. If shown to be effective, CTM product use may decrease fracture nonunion risk and increase comfort.

Tobacco smoking and early onset cataracts

Albab Uddin, David G. Gross

Background: Cataracts are among the leading causes of blindness in the world. Smoking tobacco has been linked to cataract formation in old age. However, its linkage in causing an earlier onset is much more questionable. Assessing this linkage can help identify risk factors and help understand the causes and pathogenesis in development of cataracts over time. This can help direct modifiable risk factors in patients to prevent early deterioration in health, finance, physical capabilities, and overall comfort. It is hypothesized that history and intensity of smoking tobacco correlates with earlier onset cataracts.

Methods: Patient data of patients aged 40-65 were gathered from the last two years of cataract surgeries from Deen-Gross Eye Centers EMR (n=718). Age at date of surgery was used as observed value for determining earlier onset, and pre-operation charts were used to collect patient data on smoking status (light, someday, every day, heavy, former, never), age, gender, hypertension, diabetes, number of eyes operated on, family history (cataracts/glaucoma), and glaucoma. Statistical analysis was performed on the gathered data.

Results: Statistical analysis revealed no significant difference in the ages of cataract surgeries between smokers and non-smokers. Controlling for non-hypertensive and non-diabetic patients revealed a similar result. There was no significant difference in smoking status between ages 40-55 and ages 56-65 who underwent surgery. There was no significant difference in age of surgery among each of the individual types of smokers.

Conclusions and Potential Impact: No significant associations were found. This calls for further research to better understand the linkage between tobacco smoking and cataracts, as well as the pathogenesis of earlier onset cataracts. No modifications in directing patient care can be made yet.

Trends in Melanoma Patient Survival based on Tumor Depth and Anatomic Location

Bhavi Sarda, Justin Couetil, Kun Huang, Jie Zhang, Ahmed K Alomari

Background and Objective: Skin cancer is the most common cancer. Melanoma composes less than 4% of total cases but is the cause of most skin cancer deaths. In the United States, melanoma has the fifth highest rate of incidence of all cancers with an average 93.5% 5-year survival rate. However, when melanoma spreads either to regional lymph nodes or to distant organs, the prognosis drops significantly, therefore there is a critical need to identify patients at risk for tumor spread. The objective of this research project is to determine the correlation between tumor depth and anatomic location with metastasis outcomes.

Methods: We identified a cohort of 923 Stage 1 & 2 patients (those without lymph node metastases) from the Indiana University Simon Cancer Center Registry with an average follow up of 4 years (Standard deviation = 3.2). We retrieved the clinicopathologic descriptions of their melanomas using a database from the Indiana University Pathology department. Patients were stratified by tumor stage, location, and depth of invasion, and survival rates were analyzed Cox proportional hazard models and log-rank tests. Kaplan-Meier plots were generated with the survminer package.

Results: The results of the study indicate that there is no difference in metastasis for patients with similar levels of tumor invasion but different anatomic locations. Unexpectedly, multivariate cox regression showed that mitotic count was a stronger predictor of metastasis than tumor invasion.

Conclusion and Potential Impact: These results indicate that there is a need for bioinformatic tools to more accurately quantify semi-quantitative measures of tumor morphology. This would allow for rigorous research and higher precisions prognostic tools.

Trends in Thymic Epithelial Tumor Patients with Comorbid Autoimmune Disease

Aneesha Anand, Nikhitha Lavu, Kenneth A. Kesler, Patrick J. Loehrer

Background and Objective: Thymic epithelial tumors (TETs) are rare malignancies originating from the thymus in the anterior mediastinum. TETs include thymic carcinoma and thymoma. Approximately 30-40% of thymomas are associated with autoimmune paraneoplastic disorders, the most common being myasthenia gravis. A broad range of other paraneoplastic syndromes have also been reported. Currently, little is known about the most common demographic characteristics and tumor histology of thymoma patients with comorbid autoimmune disease. In this single institution retrospective chart review, we assessed the distribution of thymoma-associated paraneoplastic syndromes at the IU Simon Cancer Center (IUSCC) to identify trends in patient's demographic characteristics and tumor histology.

Methods: We created a database of IUSCC patients seen from 2000-2023 and identified 170 subjects with biopsy proven malignant TET and associated autoimmune disease. Data was exported to excel and R for analysis. Factors analyzed included: age at diagnosis, sex assigned at birth, body mass index (BMI), World Health Organization (WHO) classification, and Masaoka staging. Overall survival was also compared to matched controls without paraneoplastic syndrome.

Results: A total of 38 different paraneoplastic syndromes were identified in association with thymoma in IUSCC patients. The most prevalent was Myasthenia Gravis (110 patients), followed by Hypothyroidism (21 patients, 5 confirmed as Hashimoto's thyroiditis), Good Syndrome (19 patients), and Pure Red Cell Aplasia (15 patients). Significant findings included: 36.4% of patients with paraneoplastic comorbidity had >1 paraneoplastic syndrome, 51.9% presented with Stage IV disease, and 45.8% had WHO Type B2 tumor pathology, with Type B3 being second most common (29.01%). No significant demographic associations were identified. 10-year survival of TET patients with paraneoplastic syndromes was not significantly different from those without (p= 0.721).

Conclusion and Potential Impact: These results indicate potential associations between thymoma staging and grading and development of paraneoplastic disease. Further analysis with a larger data set is warranted. Serum and blood test analysis may also elucidate reasons behind the development of paraneoplastic disease in thymoma patients.

TRIM31: A Protein with an Oncogenic Role in Esophageal Adenocarcinoma

Jesse Mast, Sazzad Hassan, Annie Ritter, Akashdeep Singh, Urs von Holzen

Background: Esophageal adenocarcinoma (EAC) is a major cancer in the United States with increasing incidence. It is an aggressive cancer involving columnar-type cells different from the normal esophageal (NE) squamous cells. This metaplasia often involves an intermediary morphology called Barrett's esophagus (BE), which occurs from repeated acid exposure of the esophagus from gastroesophageal reflux disease (GERD). GERD leading to BE is a common pre-occurrence in EAC patients, but the mechanism remains obscure. To explore the mechanism and its components, we compared gene expression in BE and EAC cells with normal cells and discovered the overexpression of TRIM31 in the metaplastic cells. Although previous studies have shown oncogenic potential of TRIM31 in some cancers, its role in EAC is yet to be understood.

Methods: RNA sequencing and transcriptomic profiling were performed on human NE, BE, and EAC epithelial tissue samples. TRIM31 expression in NE cell line (Het-1A) and EAC cell lines (OE19, Flo-1, OE33, SK-GT-2, and OACM5.1C) were identified by Western blot. The Het-1A cell line, after exposure to acidic pH and bile acid, was assessed for variable TRIM31 expression. Cell viability analysis of NE and EAC cell lines after exposure to acidic pH and bile acids was observed by WST-1 assay.

Results: RNA sequencing, transcriptomic profiling, and western blot revealed overexpression of TRIM31 in BE and EAC epithelium. Exposure of Het-1A cells to bile acids in acidic pH changed the cell morphology with enhanced expression of TRIM31. WST-1 revealed that EAC cells were more resistant to acidic pH and bile acid exposure.

Conclusions and Potential Impact: Our data suggests that increased TRIM31 expression correlates with esoph-

ageal epithelium resistance when exposed to bile acids and acidic pH. Consequently, TRIM31 may be a key player in the metaplasia of GERD-induced EAC development and may be an innovative therapeutic target and marker for EAC.

Understanding Barriers Faced by Rural Adolescent and Young Adult Cancer Survivors

Joseph Sakel, Brittany Gass, Courtney Moore, Brandon Cockrum, Bridget Hawryluk, Lisa Parks, Kara Garcia, Tammy Sajdyk

Background: The current 5-year survival rate for adolescent and young adult (AYA) cancer diagnoses is 85.8%. However, AYA cancer survivors face many challenges including loss of insurance, infertility, sexual health concerns, physical disability, education barriers, housing instability, food insecurity, and decreased financial well-being. Survivors in rural areas may face additional challenges, such as lack of access to cancer centers, tailored resources, and networks of fellow AYA cancer survivors that may be available in large cities. The study goal was to better understand specific barriers to survivorship care for this rural population, using a comprehensive interactive workbook distributed to cancer survivors in southwest Indiana.

Methods: A prototype workbook was distributed to 42 AYA survivors in southwest Indiana. Follow-up interviews were conducted with 11 individuals. Interviews with the first wave of eligible participants (n=7) provided perspectives on the workbook, helped identify potential improvements, and offered further insight into their survivorship experiences. These eligible participants were also invited to participate in an online forum to facilitate group discussions on potential improvements to the workbook. Responses were evaluated through affinity mapping to identify common themes.

Results: AYA cancer was found to have a lasting impact on physical health, mental health, and relationships for many of the AYA survivors. Importantly, only 27% of participants who completed the workbook responded "yes" to having received a survivorship care plan, suggesting barriers in communication between survivors and healthcare providers. Regarding overall health, the three largest barriers identified by cancer survivors in rural southwest Indiana were insurance coverage, mental health services, and the availability of services needed.

Conclusions and Potential Impact: To strengthen survivorship care to rural survivors, our study suggests a need for better distribution and explanation of survivorship care plans, as well as increased access to stable insurance, medical services, and mental health services.

Understanding the Factors Preventing Latina Women from Seeking Domestic Violence Help Services

Karina Reynoso, Niki Messmore

Background: Latinos are one of the largest racial/ethnic minority groups, yet there is a scarcity of resources available to them in the United States. Moreover, many people in the Latino population have experienced domestic violence but are less likely to seek help due to factors like immigration status or cultural barriers. As community programs for domestic violence (DV) become available in the US, many are focused and structured to help and support the dominant, white population. In addition, from the select few resources available to Latino survivors, they are primarily utilized by females. Many of the domestic violence help services fail to address the masculinity factor that prevents males from seeking help, especially Latino males. Thus, females are predominantly the Latino survivors represented in research studies due to their overrepresentation in using help services. Regarding the limited current services available to victims of domestic violence, Latina women still face many challenges to initiate and commit to seeking these help services.

Methods: A literature search was conducted via Google Scholar and PubMed. A variety of peer reviewed articles and journal articles published within the last 10 years were utilized to identify possible barriers preventing Latina women from seeking domestic violence help services.

Results: There are a limited number of studies exploring the services provided for Latina victims of domestic violence. In analyzing these studies and systemic reviews, many have addressed several cultural barriers. The main factors discussed in the literature include immigration status, language services, and lack of knowledge and/or connections. Due to the financial and social dependence of women who immigrated to the US, some Latina women will not look for domestic violence help services because the only home she has in the US is with her perpetrator. The personal social support a Latina woman

has outside her partner can be a significant influence on her motivation to seek help services.

Conclusions & Future Implications: Due to many misconceptions that arise from other cultural perspectives, Latina women have additional fears that domestic violence services created for white women may not address. Thus, being able to appropriately educate and advocate for more domestic violence services that incorporate cultural factors may encourage more involvement from Latina women. One study mentioned that the referral card from their nurses was very helpful because they would not have known these services existed otherwise. In addition, it was found helpful to have bilingual services to build the trust and social connection with Latina women. Most of the studies had interventions and support groups that were held within community agencies and clinics. This helped create a safe environment where Latina women could connect with other women in similar situations as them. Although many of these interventions were done in person, future implications would be looking more into the impact of virtual support groups. In addition, with the limited amount of research on this topic, further research needs to be done to address these barriers to help improve the number of Latina women survivors receiving help, as well as extending it to address the needs of Latino male survivors.

Understanding the Homelessness Crisis and Responses in Bloomington, Indiana

Josie McQuillan, Niki Messmore

Introduction: The 2022 Indiana Point in Time count revealed that 5,449 Hoosiers were experiencing homelessness. 426 of these individuals were living in Region 10, which encompasses Bloomington's Monroe County and five surrounding counties. Bloomington faces a homelessness crisis marked by high rents, a scarcity of low-income housing, and the criminalization of homelessness in Indiana. Beacon, Inc., a Bloomington-based nonprofit, serves individuals experiencing extreme poverty and homelessness through programs like Friend's Place (an emergency shelter), Rapid Re-Housing, and Crawford Homes (permanent supportive housing). Friend's Place, the only year-round, nonreligious, emergency shelter for adults in the area, offers 40 safe and sober beds. The Rapid Re-Housing program helps people move into homes as quickly as possible and includes short-term financial assistance for security deposits, rent, utilities, moving expenses, application fees, etc. as well as supportive case management. Crawford Homes provides housing and supportive services for persons experiencing long-term homelessness due to a disability, providing 110 permanent homes for approximately 150 adults and children. This project aims to investigate homelessness and the factors that perpetuate homelessness in Bloomington, as well as responses to this issue considering these three distinct Beacon programs.

Methods: A mixed-methods research approach examining quantitative and qualitative data was conducted to analyze homelessness in Bloomington. A literature review was conducted via PubMed, JSTOR, and UpToDate for articles posted no earlier than 2018 discussing homelessness and programming to alleviate homelessness. Quantitative and de-identified data were analyzed from the 2022 nationwide Point in Time count and Housing Inventory Count and the Friend's Place, Rapid Re-Housing, and Crawford Homes programs in 2022. Interviews were conducted with three Beacon staff members to gain a better understanding of the quantitative data available and to identify specific barriers to housing in Bloomington.

Results & Discussion: The literature review and analysis of Beacon's data show that homelessness is a nuanced issue that must be addressed with different modalities, including emergency shelters, rapid re-housing programs, and permanent supportive housing programs. With these three programs, Beacon alone sheltered (or moved into housing) 88.75% of individuals experiencing homelessness in Region 10 of Indiana in 2022. In 2022, the Friend's Place program provided 11,761 bed nights. In the Rapid Re-Housing program, 52.9% of those served in 2022 were moved into housing. In the Crawford Homes program, 91.2% of those served in 2022 were moved into housing. Despite the benefit of these programs in Bloomington, there remains a high prevalence of individuals experiencing chronic homelessness, as defined by the Department of Housing and Urban Development; 27.0% of Friend's Place clients and 75.9% of Crawford Homes clients were chronically homeless in 2022. Qualitative data identified barriers contributing to this chronic and recurrent homelessness, which include high eviction rates, difficulty working with local landlords, and entanglements with the criminal justice system.

Conclusions & Implications: This work is part of an

ongoing initiative to better understand the challenges Bloomington residents face in securing and maintaining affordable housing, despite existing programming. This study underscores the urgency for evidence-based solutions, such as increased government-subsidized and affordable housing options to prevent homelessness, rather than relying on emergency shelters. This study also promotes the use of a mixed-methods research approach to gain a holistic understanding of homelessness in specific communities; narratives from individuals connected to homelessness in these communities can better inform the quantitative data on homelessness and related assistance programs.

User-Centered Design of an Insulin Leak Detection System for Adolescents with Type 1 Diabetes

Libby Bell, Bridget Hawryluk, Andrea Kiser, Lisa Parks, Kat Schomer, Tamara Hannon, James Rudolph, Kara Garcia

Background and Objective: The use of insulin pumps in the management of Type 1 Diabetes (T1D) has been shown to promote maintenance of glycemic control and improve quality of life. However, insulin delivery can be disrupted by technical issues including pump malfunction or leakage of insulin at the infusion site. While users are alerted to pump malfunctions, insulin leaks are typically only noticed by the distinctive odor of leaked insulin, wetness, and/or symptoms of hyperglycemia or diabetic ketoacidosis (DKA). The ability to quickly and automatically detect insulin leaks is an unmet clinical need; one that, if met, could minimize the incidence of diabetic complications. In this study, our primary objective was to gain feedback from pump users at high risk for insulin leaks, to inform the development of a future insulin leak detection system.

Methods: Study recruitment was aimed at adolescents and parents of children using insulin pumps. Our inclusion criteria required a diagnosis of T1D and use of an insulin pump. To collect patient experiences, we conducted an in-person co-design session utilizing Human Centered Design qualitative research approaches such as rapid brainstorming, idea refining techniques, and prototyping. Design researchers analyzed activities using group analysis, affinity diagramming, and framework activities.

Results: The session included 5 adolescents with T1D that use insulin pumps and 6 parents of children that use insulin pumps. The most common themes expressed related to leaks were hyperglycemia due to delayed detection and hesitations to replace insulin site components. Top recommendations from pump users were leak technology integration into current pump systems and immediate push notifications to caregivers.

Conclusions and Potential Impact: Recommendations and insights from current insulin pump users will guide development of technologies to mitigate insulin leaks, with the ultimate goal of reducing burden and improving health outcomes among patients with T1D.

Using Botulinum Toxin for the Treatment of Gastroparesis (GP) for the Selection of Patients with Higher Clinical Success, Improved Quality of Life (QOL), and Improved Social Functioning Post Gastric Peroral Endoscopic Myotomy (GPOEM)

Amr Kais, Mohammad Al-Haddad

Background/Objective: While G-POEM remains an effective and exciting treatment for GP patients, predictors of clinical success remain poorly characterized. Botox injection of the pylorus prior to committing to G-POEM can help differentiate those who might have a favorable clinical response to this procedure in patients with GP.

Methods: To evaluate the utility of Botox injection prior to G-POEM, 124 patients with clinically diagnosed GP who underwent a GPOEM were assessed in this retrospective cohort study. All G-POEM procedures were conducted at a single center and were completed between February 2018 and May 2023. Patients who had received intrapyloric Botox injection (n=79) had QoL and clinical success rates compared to patients who received other treatment options (n=45). Results were assessed at 1-, 3-, 6-, 12-, 24-, 36-, 48-months post G-POEM.

Results: When assessing symptom severity, the difference between the change in GCSI values for Botox patients and patients receiving other prior therapy was statistically significant at 6 months post-GPOEM; +1.27 for Botox patients vs +0.55 for other treatments (p-value of 0.03). At this 6- month checkpoint, 64% of the Botox

group achieved clinical success compared to 37.5% for the other treatment group. When comparing QoL, intrapyloric Botox injection has statistically significant improvements in SF-36 total score at 1, 3-, 6-, 12-, and 36-months post G-POEM, while patients receiving other treatments had no statistically significant improvements in their SF-36 total scores.

Conclusion/Impact: We hypothesize that clinical improvement on pre GPOEM Botox selects patients with a higher component of pyloric spasm who end up responding more favorably to G-POEM. Intrapyloric Botox injection is technically feasible in almost all patients with GP and does not require special expertise, training, or equipment; therefore, this should be strongly considered prior to referring a patient for G-POEM.

YebC Modulates Expression and Recombination of vlsE in Persistent Lyme Disease

Andrew Zoss, Sajith Raghunandanan, Raj Priya, X. Frank Yang

Background & Hypothesis: Lyme disease, caused by the bacterium Borrelia burgdorferi (Bb), is the most common vector-borne infectious disease in the United States. Although easily treated with antibiotics, undiagnosed cases may develop into persistent infections with complications including Lyme carditis, neuroborreliosis, & arthritis. VlsE antigenic variation is one of the major strategies employed by B. burgdorferi to evade and persist in a mammalian host, but the underlying mechanism is unknown. In the present study, we hypothesize that the Bb transcriptional regulator YebC modulates VlsE expression and antigenic variation, hence enabling the shift from acute to persistent infection.

Materials & Methods: C3H/HeN or C3H/SCID mice were infected with the B. burgdorferi strain 5A4NP1, yebC mutant, and yebC complement at a dose of 105 or 106 spirochetes. The mice were euthanized at days 7, 30, 60, and 90 post-infection. These tissue samples were subjected to RNA and DNA extraction.

Results: YebC regulates both vlsE expression and recombination in vitro and in vivo. The yebC mutant displayed loss of infectivity and reduced vlsE antigenic variation, however, it displayed unusual constant region recombination.

Conclusion & Impact: While the process of vlsE recombination was discovered more than two decades ago, the mechanism of regulation remained unclear. This study shows that vlsE recombination is regulated by the novel factor, YebC. This new factor may serve as a target to combat persistent Lyme disease in the future.

HRSA PRIME PROJECTS

In 2020, Indiana University School of Medicine was awarded a $12.1 million grant from the Health Resources and Services Administrations (HRSA) to create the Primary Care Reaffirmation for Indiana Medical Education (PRIME) program. The following projects are a representation of the school's multi-year initiative to investigate medical care for underserved communities, innovation in primary care, and the impact of racism on health equity.

Social Determinants of Health Associated with Inpatient Admissions for Congestive Heart Failure, Diabetes, Chronic Obstructive Pulmonary Disease, and Asthma

John Quentin Deckbar, Kelly DeMichael, Wael Gad, Baraka Muvuka, Jonathan Guerrero; IUSM-NW

Introduction: The CDC and American Lung Association estimate that congestive heart failure (CHF), diabetes, chronic obstructive pulmonary disorder (COPD), and asthma (COPD/asthma) cost Americans $30.7 billion, $327 billion, and $50 billion respectively each year. They account for most inpatient readmissions at St. Mary Medical Center (SMMC), an urban hospital in Northwest Indiana. There is need for further research on the social, behavioral, and demographic determinants associated with these conditions. This study examined the social, behavioral, and demographic determinants associated with inpatient admission for CHF, diabetes, COPD/asthma in SMMC's service area.

Methods: This retrospective study was part of a multiphased Community-Based Participatory Research partnership between SMMC and Indiana University School of Medicine Northwest. SMMC implemented a pilot screening and referral program to assess social determinants of health in their service area as part of their Hospital Readmission Reduction Program. This study included data from 10,953 inpatient admissions between January 2021 to March 2023, majority of whom were transferred from the emergency department. Data analysis consisted of univariate, bivariate (Chi-square), and multivariate (binary logistic regression) analysis in SPSS 29.0.

Results: Bivariate analysis revealed a statistically significant association between CHF and smoking, age, insurance type, and income. Diabetes was significantly associated with smoking, smokeless tobacco use, age group, race, income, and sex. COPD/asthma was significantly associated with smoking, age group, transportation needs, stress, insurance, ethnicity, and sex. Multivariate analysis found the following significant associations: age group with both CHF ($p<0.001$) and diabetes ($p<0.001$), former smoking with both CHF ($p = 0.007$) and COPD/asthma ($p = 0.049$), current smoking with COPD/asthma ($p = 0.016$), and sex with diabetes ($p <0.001$).

Conclusions: These findings indicate significant associations between multiple socio-behavioral factors and admission for CHF, diabetes, COPD/asthma. Multi-risk-factor interventions may address these interactions and contribute to reducing readmission.

Teaching Residents Interpretation Best Practices

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Jenifer Akinduro, MD – OB/GYN Resident, PGY2
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Jasmine Johnson, MD – OB/GYN Co-Director of Diversity, Equity, Inclusion and Justice
Anthony Shanks, MD, MEd – OB/GYN Vice Chair of Education

Purpose: To determine if a curriculum on cultural competency and interpretation best practices improves resident knowledge and performance when working with interpreters.

Background: Working with medical interpreters is vital for communication with Limited English Proficiency (LEP) patients, but formal training is lacking. Additionally, improving cultural competency – the ability to understand and interact effectively with people from different cultures – may be key to improving equity in healthcare. By combining education on cultural competency and best practices for working with medical interpreters, we aim to better equip residents to provide compassionate, equitable, and effective patient care.

Methods: A literature search was conducted to develop best practices and a lecture-based curriculum was then created in partnership with the Immigrant Welcome Center of Indianapolis, IN. The Immigrant Welcome Center is a local nonprofit committed to serving our diverse population of immigrants in Indianapolis. The sessions were "Navigating Cultural Bias," "Haitian Culture," and "Best Practices for Using Interpreter Services." These sessions were presented during weekly protected didactic time for faculty and residents.

Results: All forty OB/GYN residents participated in the didactic sessions and completed pre and post training surveys. There was a statistically significant increases in mean score in understanding interpretation best practices (39.2 to 46.8, $p < 0.01$). Additionally, there was a significant increase in understanding cultural competency (44.2 to 46.8, p 0.03).

Discussion: Resident understanding of cultural competency and interpretation best practices significantly increased. This demonstrated the importance of formal training and benefit of connection to community resources. Future study can focus on education of medical students transitioning to residency and impact to patient care.

Group Prenatal Care Models, Experiences, and Outcomes: An Integrative Review

Michelle LaTurner, Baraka Muvuka; IUSM-NW

Background: The United States (US) has the highest maternal and infant mortality rates among developed countries. Indiana has the third highest maternal mortality rate in the US. Group Prenatal Care (GPC) was piloted in the early 1990s to improve perinatal experiences and outcomes through enhanced social support and education. Further research is needed as GPC is increasingly implemented in diverse contexts. This study critically synthesized current evidence on GPC models, experiences, and perinatal outcomes in the US to inform a Community Based Participatory Research Partnership between Indiana University School of Medicine-Northwest and Community HealthNet.

Methods: This integrative review utilized PRISMA guidelines to conduct a systematic search in Embase, CINAHL, and PubMed. Two researchers screened articles for inclusion criteria and quality. Studies were included if they were empirical research or meta-analyses conducted in the US and published in English between January 2013 and June 2023. Data synthesis utilized a qualitative analytical approach that sorted findings thematically.

Results: We retained 98 articles, including 8 meta-analyses, 4 randomized trials, 3 cluster randomized trials, 3 quasi-experimental studies, 4 prospective cohort studies, 12 observational studies, 19 qualitative studies, and 46 retrospective cohort studies. There were several GPC models adapted to high-risk groups such as persons living with HIV, gestational diabetes, pre-existing or pregnancy-induced hypertension, and substance use disorders. GPC was associated with decreased preterm births among low income and minority women, with more significant reductions when attending 5 or more GPC sessions. GPC improved psychosocial outcomes including satisfaction with care, empowerment, and social connectedness. It was also associated with increased breastfeeding rates in adolescents and African Americans, and increased contraception use among adolescents.

Conclusions: Engaging in GPC may have benefits for high-risk pregnancies, adolescents, low-income, and minority populations. More studies are needed to evaluate GPC's impacts on perinatal experiences and outcomes among high-risk women.

Exploring methods of introducing PoCUS practice to rural physicians and evaluating barriers to uptake

Ellen Ireland, James Wilcox, Katheryn Smeltzer, Myanna Cook, Roarke Tollar

This study was designed to pilot best practices for introducing orthopedic/musculoskeletal aspects of point-of-care ultrasound to rural primary care practitioners. We recruited primary care practitioners from six clinics across Indiana with rural or split rural/urban patient populations to participate. Each location was provided with a kit (iPad, Butterfly probe, case, wipes, gel.) They watched a Canvas module with approx. 1 hour of videos, followed by an in person 2-hour training session on selected evaluations of common cardiovascular, respiratory, musculoskeletal and soft tissue disorders developed previously by Dr. Wilcox. Surveys were provided before and after training, and at 6+ months. Ongoing support was provided through offers of remote teleguidance, access to training videos, and a PoCUS themed Project ECHO.

Technology, access to support, and reimbursement/practice issues (e.g. space) proved to be minor concerns. Although interest from participant pool was strong, the major barrier proved to be time. The initial surveys suggested increased comfort with PoCUS among all participants (two had very little experience, two had limited past experience, and two had current OBGYN experience) but ongoing training engagement was difficult to

manage; they were very busy. An unexpected result of this study was observing the issue of rural practitioner understaffing in real time- during the course of this one-year project, two participants shifted from rural to urban practice, and two went on maternity leave. This study was small and qualitative, but it may suggest that one of the motivating factors for learning PoCUS is that it can be considered a skill advancement to improve the odds of getting desired work placement, and also that those practitioners in primary care who have ongoing OBGYN work are more comfortable with learning new applications for the technology.

Geographic Distribution and Associations Between Health Outcomes, Health Behaviors, Social Determinants of Health, and Demographics in an Urban Hospital

Antonio Presutti, Omkar Tamhankar, Emma Love, Sydnye Nosbusch, Jonathan Guerrero, Baraka Muvuka; IUSM-NW

Background: Social determinants of health (SDOH) account for over 50% of health outcomes. As healthcare institutions increasingly implement SDOH screenings, community-based health facilities are well positioned given their service to underserved populations. An urban community hospital in Northwest Indiana was the first acute care hospital to implement comprehensive SDOH screenings and referrals in Indiana using the Protocol for Responding to and Assessing Patients' Assets, Risks, and Experiences (PRAPARE). This study was part of an academic-health system partnership to examine the geographic distribution and relationships between SDOH and adverse health outcomes in urban medically underserved areas.

Methods: This descriptive study analyzed an EPIC™-generated limited dataset with SDOH, demographic, behavioral, and health outcomes data for adult inpatient visits in an urban hospital in Northwest Indiana from January 2021 to June 2022. Descriptive and bivariate analyses ($p<0.05$) were conducted in SPSS 28.0 while geographic analysis was conducted using ArcGIS Pro version 3.0 and Python 3. This study was exempted by Indiana University Human Research Protection Program (IRB # 14040).

Results: This study included 4370 admissions across 3038 patients from 184 zip codes. Participants were predominantly White (75.7%), older adults (65 ± 24), and publicly insured (76.3%). There were overlapping geographic clusters of adverse social, behavioral, and health outcomes. Circulatory (20%) and digestive (12.4%) conditions were top adverse health outcomes, with highest concentrations in 46307 zip code. Food insecurity, social isolation, and physical inactivity were the predominant social-behavioral concerns, overlapping in 46342 zip code. Tobacco use was significantly associated with most SDOH including insurance type ($p<.001$), housing risk ($p<.001$), financial risk ($p<.001$), unmet transportation ($p<.001$), and cumulative social risk ($p=.012$), with the highest prevalence in 46405 zip code.

Conclusions: Understanding relationships between adverse health outcomes, SDOH, and health behaviors while identifying high density areas can inform prioritization, co-development of targeted interventions, and community mobilization.

Virtual Point of Care Ultrasound (POCUS) Training Model for Rural and Global Education

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Background: In response to persistent disparities and critical healthcare delivery gaps in rural communities, we developed a Point of Care Ultrasound (POCUS) Extension for Community Health Outcomes (ECHO) program, hosted in partnership with Indiana University (IU) School of Medicine and IU Fairbanks School of Public Health. Rural healthcare clinicians connected with expert mentors in interactive sessions to democratize education, promote POCUS use in remote areas, support enhanced diagnostic accuracy, and ultimately reduce healthcare disparities. The project was initially designed for healthcare professionals in rural Indiana

yet expanded with participation from clinicians across the nation and the globe.

Methods: POCUS ECHO sessions were hosted using Zoom and supported by a "hub team" of subject matter experts (SMEs) who determined the target audience, set the recurring schedule, and co-designed the curriculum. Participants were recruited through professional associations, local marketing campaigns, and word of mouth. The program met twice a month for ninety minutes. Live sessions included evidence-based didactics presented by SMEs and de-identified patient cases presented by learners.

Results: From December 2022 to June 2023 thirteen sessions were hosted, attracting 117 participants. Learners included MDs (74), RNs (8), and students (8) from diverse geographical locations: spanning 28 Indiana counties, multiple states, and participants from Kenya and the United Kingdom. Post-surveys revealed high satisfaction; 98% of the respondents rated the session quality as excellent or good and 91% rated the sessions as meeting their expectations extremely or very well. These results highlight participants' value of the program and their view of the importance of POCUS in patient care.

Conclusions: The POCUS ECHO program successfully addressed rural healthcare education disparities, connecting clinicians locally and globally through interactive Zoom sessions. The initiative attracted participants worldwide, showcasing high satisfaction rates and emphasizing the program's impact on democratizing education, promoting POCUS use, and bridging healthcare delivery gaps.

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