



SPARK

A.T. Still University's scholarly activity magazine

“A spark of
fire will
start the
principles
of powder
into motion.”

– A.T. Still, DO

p.26

The strike zone

Dr. Bruce Young zeroes in on neuromuscular control in rattlesnake strikes.





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ATSU Mission

A.T. Still University of Health Sciences serves as a learning-centered university dedicated to preparing highly competent professionals through innovative academic programs with a commitment to continue its osteopathic heritage and focus on whole person healthcare, scholarship, community health, interprofessional education, diversity, and underserved populations.

ATSU schools and colleges

The University comprises Kirksville College of Osteopathic Medicine (ATSU-KCOM), College of Graduate Health Studies (ATSU-CGHS), Missouri School of Dentistry & Oral Health (ATSU-MOSDOH), Arizona School of Dentistry & Oral Health (ATSU-ASDOH), Arizona School of Health Sciences (ATSU-ASHS), and School of Osteopathic Medicine in Arizona (ATSU-SOMA).

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Introducing *Spark*, ATSU's strategic vision of scholarly activity

Welcome to ATSU's newest publication, *Spark*. This magazine is designed to celebrate and foster the University's continued commitment to scholarly activity contributing to healthcare education, knowledge, and society.


As a teaching and learning university that values scholarly activity supportive of our heritage, mission, and vision, ATSU is fortunate to have a 125-year foundation of actively participating faculty and students.

Scholarly activity at ATSU encompasses Boyer's definition allowing participation from all interested faculty and students. Forms of scholarly activity include scholarship of teaching and learning, engagement, discovery, application, and integration.

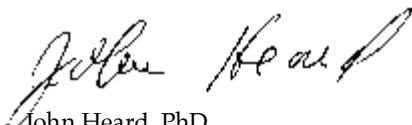
In *Spark's* inaugural issue, learn how ATSU's practice-based research networks are bringing together clinicians and researchers to improve patient health. Also, discover current investigations involving novel technology, online learning, battling harmful pathogens, and much more. From rattlesnakes to dental lasers, faculty members are pushing boundaries to improve learning outcomes and community health.

We hope you enjoy reading about our wonderful faculty and students who question and inspire scholarly activity leading to new knowledge. Please send us your comments or questions at research@atsu.edu.

Yours in service,



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Research, Grants, & Information Systems

SPARK

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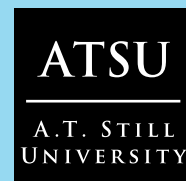
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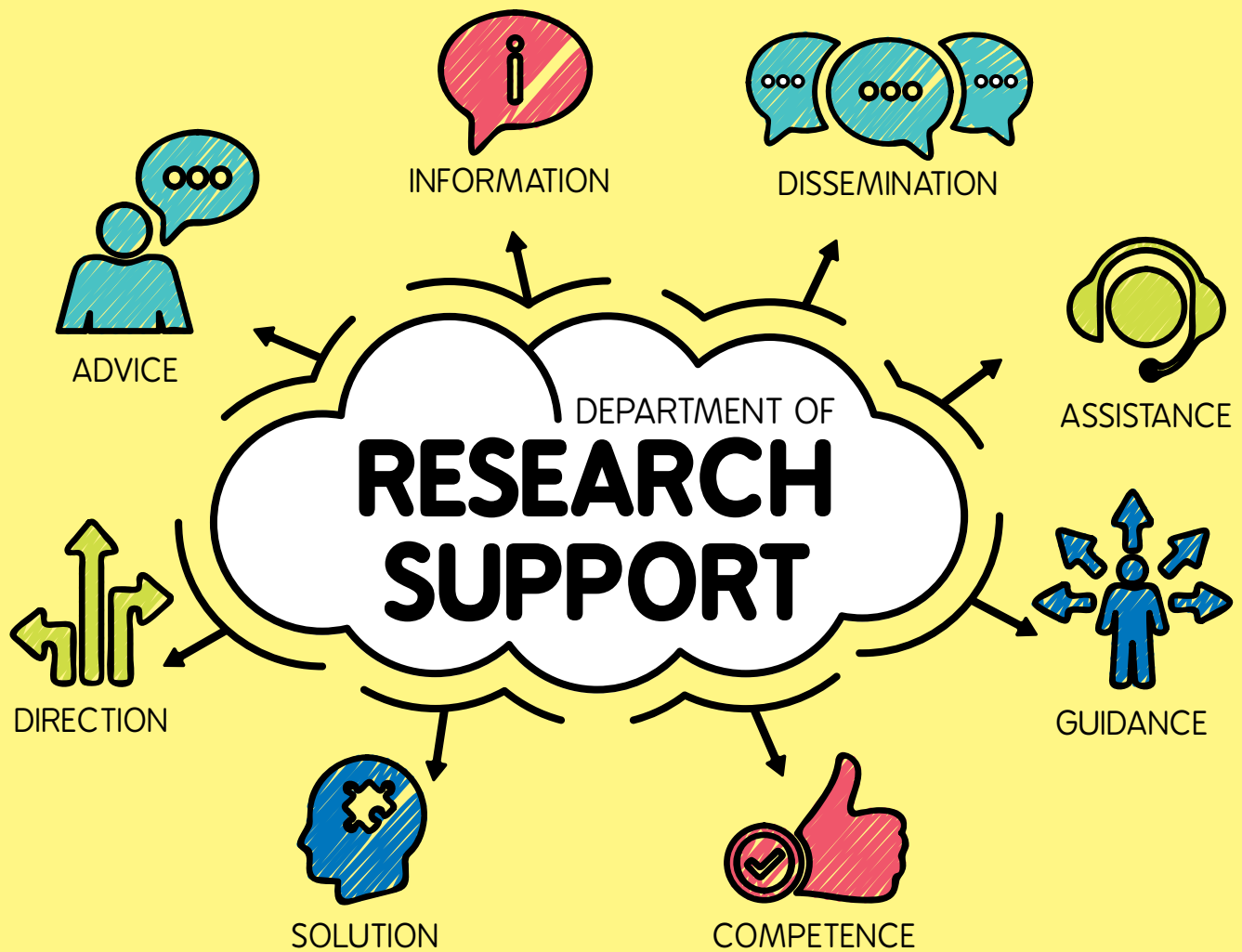
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The finger-stick test

Patient safety is the No. 1 priority for ATSU-ASDOH faculty members Seena Patel, DMD, MPH; Maureen Perry, DDS, MPA; Ann Spolarich, PhD, RDH, FSCDH; and Rebecca Schaffer, DDS. Together, they are studying a more effective way to assess a patient's bleeding risk before an invasive dental procedure. The project, which began in 2013, examines how a simple finger-stick test can ensure patient safety or determine the need for additional medical care.

What are you investigating?

The research project investigates the potential for a portable, self-monitoring finger-stick testing device to be used as a screening tool to assess the coagulation status of patients taking the blood thinner medication Coumadin (e.g., warfarin). In particular, we are evaluating the use of this device at chair side prior to a dental procedure.

A patient who is on the medication warfarin, or has a suspected bleeding disorder related to coagulopathy, will undergo a finger-stick test at the point of delivery of care, chair side, in the Advanced Care Center at ATSU-ASDOH to assess their international normalized ratio (INR). This value will indicate whether it is safe to proceed with the planned dental procedure. It will also be compared with the laboratory INR that the patient was required to have done 24 hours before the dental visit.

Why is your research important?

A patient taking a medication, or who has a medical condition that causes coagulopathy, is at risk for increased bleeding during and after an invasive dental procedure. A testing device that can be used at the point of care can provide an easy way to check a patient's INR and determine if it is safe to proceed with the planned treatment. Assessing the efficacy of this testing device may be beneficial for clinical practice because it is a convenient tool that promotes patient comfort and convenience more than traditional laboratory assessments. Results of this test can prevent the need to reschedule a procedure when the patient's status is unknown. Furthermore, it can make the patient aware of their current response to Coumadin therapy so they seek medical care sooner if their INR is outside the therapeutic range.

What do you hope to achieve?

Currently, INR self-monitoring is not approved or intended for use as a diagnostic device. Our study examines the accuracy, and therefore the validity and reliability, of this type of device compared with laboratory standards. If both types of tests show the same result, discussions may be opened about whether its use could be extended to clinical settings. We hope this study shows our dental and medical colleagues that using a finger-stick device to assess INR at the point of care is simple, accurate, and reliable and provides for a more predictable risk assessment of the patient's bleeding risk during and after an invasive dental procedure.

In addition, we hope this device will replace the 24-hour INR order that is required of patients before every invasive procedure.



Robotic rehab

For almost 20 years, James Lynskey, PhD, PT, associate professor and director of research, physical therapy, ATSU-ASHS, has been investigating recovery after neurologic injury. In a current study, funded by ATSU, he takes a closer look at a novel technology used in rehabilitation of individuals with neurologic diseases and disorders, specifically a robotic device called Foot Mentor™.

What are you investigating?

When using the Foot Mentor, which was originally developed by a local Arizona company, stroke survivors play video games controlled by their foot and ankle movements. The device is intended to be used in the home and engage the patient by turning rehabilitation into a game. Previous research showed that 12 weeks of training with this device in the home improved leg strength by 28.6 percent and walking ability by 20 percent in chronic stroke survivors. In the current follow-up study, I am collaborating with colleagues at the University of Illinois-Chicago and Arizona State University to determine if training with Foot Mentor promotes neuroplasticity. Using transcranial magnetic stimulation, we are assessing changes in connectivity between the brain's primary motor cortex and the ankle muscles after one session with the device and after the 12-week training program.

Why is your research important?

The current treatments that promote recovery of leg function and walking ability in stroke survivors are inadequate. Stroke survivors need continued care and rehabilitation, not just for a few months, but intermittently for the rest of their lives. The decreased reimbursement period and shortened time stroke survivors have in both inpatient and outpatient rehabilitation necessitate the implementation of alternative strategies of treatment, especially those based in the home. If we can demonstrate that using Foot Mentor in the home promotes recovery and plasticity, then



Dr. Lynskey studies novel technology used in rehabilitation of stroke survivors.

in-home rehabilitation models may become more common for improving lower extremity strength and walking ability in stroke survivors.

What is the next step?

For this area of research, larger scale studies are needed. Our current studies are fairly small, and a larger randomized controlled trial would be great to validate our findings. After that, more real-world implementations with stroke survivors as they are going through the rehabilitation process would be ideal.

Caries prevention

Jaana Gold, DDS, PhD, MPH, CPH, is an associate professor at ATSU-CGHS for the Master of Public Health – Dental Emphasis (MPH-D) program. During her 25 years of teaching, research, and practice in dentistry, she has focused her research on preventive dentistry, cariology, and dental public health. As a director of the Women, Infants, and Children (WIC) Oral Health Program in Gainesville, Florida, she recently completed a study titled “Oral Health Knowledge and Practices of WIC Staff at Florida WIC Program.”

What are you investigating?

I am an online faculty member for the MPH-D program, and in addition to guiding our residents’ and students’ research projects, I conduct research locally in Florida. As a director of the WIC Oral Health Program, which serves underserved pregnant women and young children who are clients of the local WIC program, I studied the knowledge and attitudes of WIC staff on oral health issues and dental care. Through my research, I found the WIC staff needs oral health training and education to provide oral health counseling for at-risk WIC populations. Specifically, the training should include oral health assessments and guidance on evidence-based prevention techniques, such as using fluoride toothpaste, tooth brushing, dietary counseling, and referrals to dentists.

Why is your research important?

Uninsured and low-income populations have greater oral disease burdens and oral health disparities. However, dental caries and many dental conditions are preventable. Early prevention and education is effective, and we should target vulnerable populations, such as pregnant women and families of young children. Because the oral health of pregnant women can affect the health of unborn children, it is important to educate pregnant women and prevent oral diseases early so the health of communities and underserved populations can be improved.

Dr. Gold promotes oral health awareness for underserved pregnant women and young children.

What do you hope to achieve?

I hope to promote awareness of the importance of oral health for underserved pregnant women and young children. As I expand my research, the next step is to research the effect of silver diamine fluoride on arresting dental caries in these populations. Silver diamine fluoride (38 percent SDF) is a desensitizing and cariostatic agent that has been gaining attention in the United States since it was approved by the Food and Drug Administration in 2014. SDF is an easy and low-cost application method with proven efficacy on active caries, resulting in an inexpensive nonsurgical treatment option for many Americans. Currently, most studies of SDF have been conducted overseas, and we have not established clinical evidence in the United States. Therefore, the investigation of SDF treatment has great potential to reduce oral disease burdens in our underserved populations.



Patent-approved research

Hamid Nurrohman, DDS, PhD, joined ATSU-MOSDOH as an assistant professor in January 2016 and is an assistant adjunct professor at the University of California San Francisco (UCSF) School of Dentistry. With his research background in cariology and operative dentistry, he is specifically interested in nano-controlled molecular interaction at adhesive interfaces for hard tissue reconstruction. His research interests have also branched into guided tissue remineralization as well as repair of caries-infected dentin and inherited dentin defects. In collaboration with Dr. Grayson W. Marshall from USCF School of Dentistry, Dr. Nurrohman most recently researched biomaterials that would provide better fillings for patients while restoring dentin within the teeth.

What did you investigate?

The project spanned seven years and was funded by the National Institutes of Health. As the primary investigator or co-investigator of these studies, our early publications addressed laboratory-based biomaterials research, which is essential to the genesis and development of improved biomaterials for dentistry. We also investigated how nano-controlled molecular interaction at the biomaterial-hard tissue interface can improve bond durability and resist caries attacks. Moreover, our recent publication described investigations into the remineralization and repair of dentin resulting from the progression of caries or inherited dentin defects.

What were your results?

As a result of our research, we invented a technology that provides the required ions and acidic polymers in dental fillings to fill cavities while repairing mineralization of the surrounding tooth. Additionally, the technology provides longer lifetimes for the fillings and robust light- or auto-cured dentin repair. In March 2016, Dr. Marshall and I documented our invention titled "Biomimetic and bioactive dental restorative for in situ remineralization." Recently, the patent was approved through the U.S. Patent and Trademark Office.



Dr. Nurrohman's patented technology will improve fillings for dental patients.

Why is this research important?

Optimization of a biomimetic mineralization approach may open new pathways toward an in situ strategy that can develop into clinically relevant biomedical applications for hard tissue repair and engineering. Even with our approved patent, more funding and evidence is needed in this area.

It's in the genes

Vineet Singh, PhD, professor of microbiology/immunology at ATSU-KCOM, has spent 20 years studying *Staphylococcus aureus*, specifically methicillin-resistant *Staphylococcus aureus* or MRSA, a highly destructive, antibiotic-resistant bacterium. In his pursuit to find an antibiotic to combat the damaging effects of this harmful pathogen, he received funding from the National Institutes of Health (NIH) to study the importance of many of the bacterium's genes that may be regulated by the presence of antibiotics.

What are you investigating?

My research began with studying how *S. aureus* responds when you add different antibiotics to it. I found that when antibiotics were added the bacterial cell produced large amounts of a few select proteins. So the question became, are these proteins somehow helping protect the bacterium from antibiotics? I identified some of these proteins, and one of them was a methionine sulfoxide reductase (Msr). Subsequently, I found that *S. aureus* makes four of these Msr proteins through four genes. One way to stop bacteria from making these proteins is by deleting the specific genes from the chromosome. After deleting the Msr encoding genes individually, I combined these deletions in the chromosomes, resulting in an *S. aureus* bacterium that was not producing any of these four Msr proteins. With funding from NIH and through collaboration with Dr. Jakob Moskovitz from the University of Kansas, I am studying the importance of these

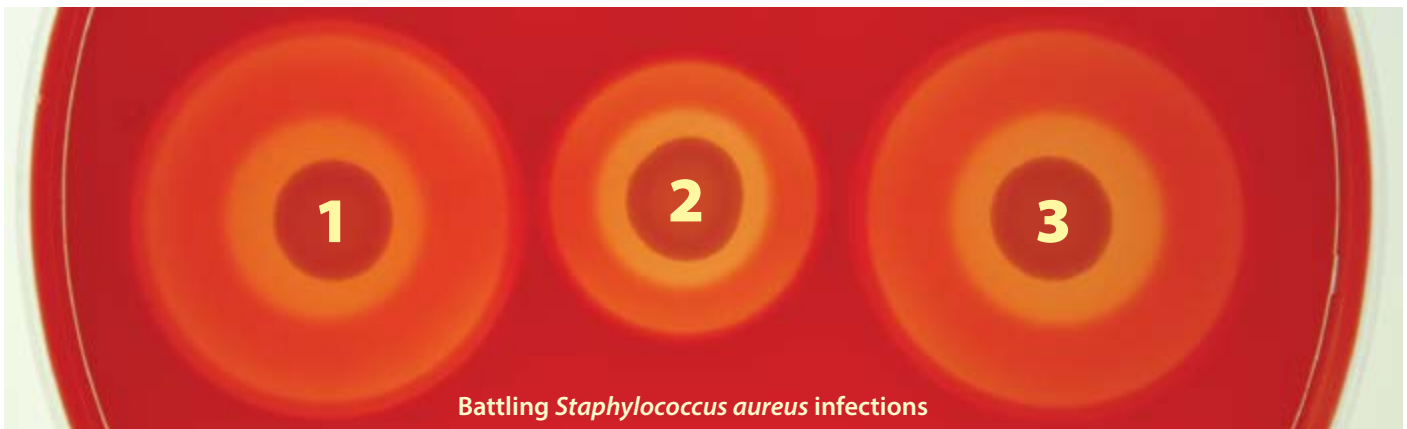
proteins and how they help this bacterium resist antibiotic stress.

Why is your research important?

This research is important because MRSA is everywhere. Approximately 50 percent of people in a community, particularly those who work in hospital settings, have the bacterium on their skin and in their nose. Nearly 90 percent of all skin infections are caused by this bacterium. Typically, this is not a problem because skin infections are easy to control. However, if MRSA gets into the blood circulation, it can consume bones, joints, and other tissues fairly rapidly. Infected individuals need an effective antibiotic to immediately stop the damage caused by this pathogen.

What do you hope to achieve?

I'm hoping I will be able to identify and target a few critical genes and find the means to completely control the expression of these genes. If these genes are not allowed to express and make proteins, the bacteria may not survive. Making these genes nonfunctional is my long-term goal. The next step would be to find a novel antibiotic that can shut down the expression of these genes during clinical infections and kill the bacteria once it's in the human body, ultimately providing a cure. Researchers have been trying to create a vaccine to prevent MRSA infections from occurring, but no one has been successful yet.



In the figure, the bacterium *S. aureus* is grown on a solidified medium mixed with sheep red blood cells (RBCs). Bacterial factors (toxins) are causing degradation of the RBCs, which is evidenced by the clearing of the red color in the plate. This is one of the many ways *S. aureus* can cause damage to the cells in human body tissues. The observation shown in the figure suggests that MsrA proteins are important for *S. aureus* to cause disease.

- 1) Degradation of RBCs is significant (observed by a larger circular zone of clearing) near growth of *S. aureus*, which produces all Msr proteins.
- 2) Degradation of RBCs is reduced by MsrA-deficient *S. aureus*.
- 3) MsrA1 protein is restored, again causing significant degradation of RBCs by *S. aureus*.

The bioinstrumentation team



Dr. Makin, Dr. Heath, and ATSU-SOMA students practice OMT techniques.

According to Inder Makin, MD, PhD, an associate professor at ATSU-SOMA and ATSU-ASDOH, collaborative and interdisciplinary teams are key for successful and effective medical research. As a medical professional and bio-engineering scientist, Dr. Makin's research background pairs nicely with that of Deborah Heath, DO, professor of osteopathic principles and practice and assistant dean for curriculum integration, and Chandhana Pedapati, MS, research associate with expertise in biosignal analysis. Since 2010, the group has studied changes in physiologic parameters from osteopathic manipulative treatment (OMT), and they offer research opportunities to engineering students from Arizona State University for specific technical tasks related to this research.

What are you investigating?

The research direction at ATSU-SOMA is to enhance the knowledge of functional and structural effects following OMT. The goal of this research is to demonstrate changes in physiologic status at the cardiac and peripheral blood circulatory levels following osteopathic procedures performed along the vertebral column. The idea that OMT positively influences the body's autonomic system, distant from the site of manipulation, through neural pathways along the spinal column was proposed by John Stedman Denslow, DO, '29, and Irvin Korr, PhD, several decades ago.

Through active collaboration, we are able to use precise instrumentation, photo plethysmography, and laser Doppler flowmetry to assess peripheral blood flow changes resulting from OMT. The changes in blood flow parameters can have multiple underlying mechanisms, including modulated local sympathetic vascular tone.

Our current studies have been conducted on clinically asymptomatic human participants, but future goals are to investigate the role of OMT on patients with compromised peripheral vascular status. Additional instrumentation techniques are being implemented to investigate the regional vasculature of the target region using spectral Doppler ultrasound and high-resolution ultrasound imaging. Several conference presentations have been made, and results from these studies will be published in early 2017.

Why is your research important?

For clinical practices and procedures to be established, the corresponding clinical evidence must be demonstrated. Therefore, research conducted at ATSU-SOMA that assesses quantitative physiological changes following OMT will augment the scientific literature related to OMT and potentially enhance adoption of OMT as one of the options in practice to treat somatic dysfunction.

What is the next step?

Ultimately, we hope to advance the scientific understanding of osteopathic medical principles by using sophisticated and appropriate instrumentation tools, such as continuously monitored cerebral blood flow measurements, measurement of segmental arterial velocities, as well as time and frequency post-analysis of acquired physiologic signals. The next step of this research would involve the use of ultrasound instrumentation to document spatially defined changes in blood flow and tissue morphology following OMT. Also, this research will be expanded to clinically symptomatic patients.

CONGRATULATIONS

to ATSU faculty, staff, and students engaged in scholarly activity during fiscal year 2015-16!

Number of publications

- 92 faculty publications
- 33 faculty and student/alumni publications
- 14 student publications

Number of presentations

- 117 faculty presentations
- 61 faculty and student/alumni presentations
- 19 student presentations

Number of grant awards received

- 33 external grant awards totaling \$2,628,294
- 14 internal grant awards totaling \$706,413

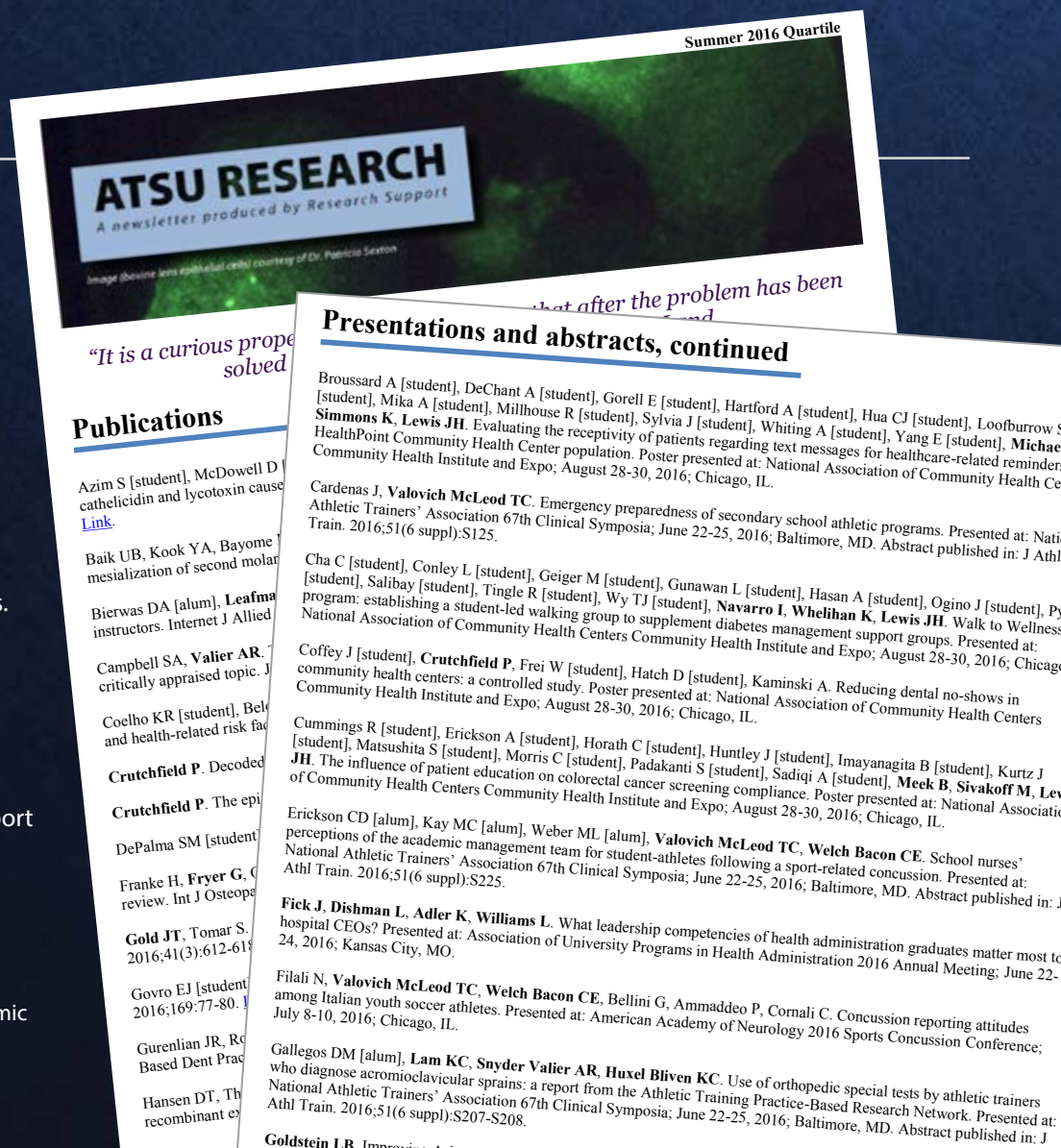
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Ketogenic diet effects



ATSU-ASDOH student Austin Shackelford investigates the ketogenic diet's effect on oral health at the Barrow Neurological Institute.

At the Barrow Neurological Institute, third-year dental student Austin Shackelford is investigating the ketogenic diet to determine if the molecules produced by the diet have an effect on inflammation in the oral cavity. With funding provided by the institute and ATSU, he hopes to produce clear and meaningful data that will expand his project and generate interest from other dental researchers in this specialized field.

What are you investigating?

I am researching the ketogenic diet, which is a high-fat, low-carbohydrate, and moderate-protein diet. This diet causes the body to produce ketones instead of carbohydrates to fuel its energy needs. Current evidence suggests this diet can reduce inflammation in certain areas of the body – especially the brain. Through my research, I would like to bridge the gap between neuroscience research and oral health research by determining if the ketogenic diet affects the mouth as much as it does the brain.

Specifically, I am performing in vitro cell culture experiments using human gingival fibroblasts. These cells make up a majority of the gum tissue. Once the cells have grown, I stimulate inflammation with the

bacterial byproduct lipopolysaccharide. Then, I give the cells ketone bodies and measure the inflammatory markers that the cells produce using immunohistochemistry imaging, gene expression techniques, and protein expression techniques.

Why is your research important?

Inflammation is at the center of periodontal disease. This disease affects many people, and while clinicians do all they can to stop the disease, it still progresses. This progression may be due to the body's inflammatory response to bacterial pathogens in the mouth. If my research can find a way to lessen that inflammatory response in a patient with periodontal disease, then dental professionals would have a useful tool for healing this disease.

What is the next step?

The next step in this research would be to validate the in vitro results in animal models. If that research progresses, then human trials could follow. After human trials, delivery of treatment would be the last step in the process.

Autism intervention

Occupational therapy (OT) students Hannah Maynard, Deborah Walker, Samantha Cao, Melinda Holder, Elena Stone, and Fonta Wenger have teamed up with ATSU-ASHS OT faculty research adviser Rachel Diamant, PhD, OTR/L, BCP, and community research partner Brynn Nealon, OTR/L, to create an autism-focused research group. Specifically, the group is investigating the relationships between sensory processing behaviors and visual-perceptual-motor (VPM) skills on school-related functions in school-aged children with a diagnosis of autism.

and sensory perceptual skills. As a result, children with ASD may be challenged by the performance of daily activities and school-related activities. Since sensory processing behaviors and VPM skills have the potential to influence performance and participation in school-related activities, an investigation of how these constructs are interrelated in children with ASD is warranted.

Successful study of the interrelationships between sensory processing behaviors and VPM skills could inform OT clinical practice and school-based OT practice. Therefore, results from our study may suggest how these behaviors and skills can be addressed during clinical intervention to increase functional abilities for school-related activities, such as handwriting, in school-aged children with ASD.

What results have you found?

During the first year of our study, 17 children and their parents participated. Inclusion criteria for this study were children who were enrolled in grades 1-4, had a diagnosis of ASD, were attending general education classes, and could speak and understand English. Participants were excluded if they had cognitive delays or a neuromuscular or physical limitation that inhibited the ability to hold a pencil and sit independently. The children participants completed standardized assessments that involved pencil and paper activities, and parents of the children were interviewed about their children's sensory-based behaviors. Preliminary analysis of the data suggests a statistically significant correlation between auditory sensory processing behaviors, VPM skills, and copying skills for handwriting.

What do you hope to achieve?

We hope to achieve a greater understanding of the relationships between sensory processing behaviors and VPM skills and how knowledge of these relationships can assist OTs who work with children with ASD on functional school-related skills. Published papers about the relationships between these behaviors and skills are limited; thus, this project may build a foundation for future research investigating this topic area.

Why is your research important?

A child's ability to integrate sensory processing behaviors and VPM skills is critical for skill development that supports participation in school-related activities. Children with autistic spectrum disorder (ASD) often have difficulties with social and communication skills, emotional self-regulation, motor skills, praxis,



Persistent bacteria

First-year medical student Ally Loveland is studying a phenomenon called persistence in *Staphylococcus aureus* bacteria. According to Loveland, persistence is increased bacterial cell survival that cannot be explained by the acquisition of genetic material. In other words, it is a perceived change in phenotype that occurs without an accompanying change in genotype, unlike what is often seen in resistant bacterial strains.

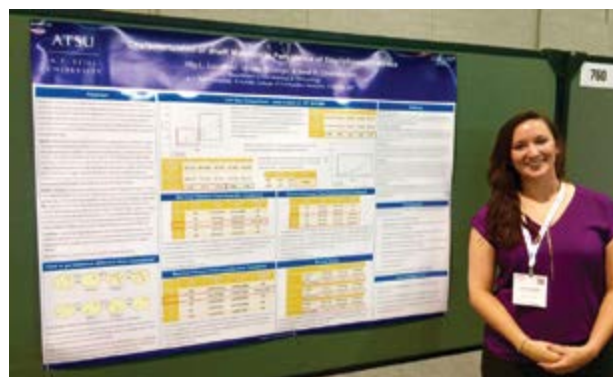
What are you investigating?

Through an internal research grant, I am working with Neal Chamberlain, PhD; Vineet Singh, PhD; and Timothy Geisbuhler, PhD. Although William Brechue, PhD, and William Sexton, PhD, are not directly involved in the research, they play important roles through grant writing and project support.

We focused our research efforts on characterizing the role of the *dnaK* gene as it pertains to the onset of persistence. We obtained a bacterial strain that was mutated in the region of the *dnaK* gene, which effectively knocks out production of this protein. We then treated this strain, and the unmutated parent strain, with antibiotic to determine the survival percentages at different stages of growth. By comparing these results, we can determine whether the *dnaK* gene plays a significant role in persistence at multiple growth phases or when different antibiotic classes are used for treatment.

Why is your research important?

This research really boils down to eradicating chronic bacterial infections. Many pathological bacterial species share this trait of increased survival, and in many cases, they have similar genetic attributes. If we can identify the important players in persistence, we can knock them out and reduce bacterial survival. Clinically, recalcitrant infections are often the product of persistence in bacterial species that cause difficulty for patients and doctors when it comes to treatment. Extensive antibiotic therapy to treat recalcitrant infections can lead to problems, but so can letting a bacterial population run rampant.



ATSU-KCOM student Ally Loveland presents a research poster at the American Society for Microbiology Microbe 2016 Conference in Boston, Massachusetts.

What is the next step?

In the short term, we hope to identify which genes have a major impact on persistence. In the long term, we hope to find areas of bacterial genomes that we can target to eliminate chronic infections. We found some effect with our mutant strain; our results suggested the *dnaK* gene played some role in persistence. However, the metabolic processes of cells are incredibly complex and often cannot be attributed to a single gene. For this research, additional antibiotic classes and different antibiotics within previously tested classes should be tested to determine if results vary within a class. Future research should focus on longer growth phases, different treatment lengths, and other genes that are similar to *dnaK*. A better understanding of persistence will help researchers develop more effective treatments for patients who have recurrent infections.

Uganda to Peru

Through ATSU's Global Health Honors Society, *Capacidad*, fourth-year ATSU-SOMA student Daniel Ebbs, MS, FP-C, society co-founder, is part of a team conducting international research through health worker training programs in the Peruvian Amazon and northern Uganda. The team focuses its research on three areas: community utilization of community health workers (CHWs) after pretraining and posttraining program implementation, retention of medical skills with innovative methodology, and osteopathic manipulative treatment (OMT) interest and utilization by CHWs. Currently, the

baseline, such as how often randomly surveyed community members utilize trained CHWs. Additionally, we are finding positive retention rates for medical skills based on the use of mHealth applications, which were developed for our training program. These education applications are used for training and provide health information for each community the CHWs represent.

Why is your research important?

This research is important because we are attempting to establish innovative, low-cost, and sustainable methods to help rural underserved communities develop their own medical training programs that also include research. CHW retention is critical for providing emergency skills and recognizing danger signs when, for example, an infant needs rapid transport to a hospital that requires more than a day's travel. By including OMT in this research, we support an area of interest and continued learning while providing sustainable medical treatment that also helps CHWs learn basic anatomy.

What do you hope to achieve?

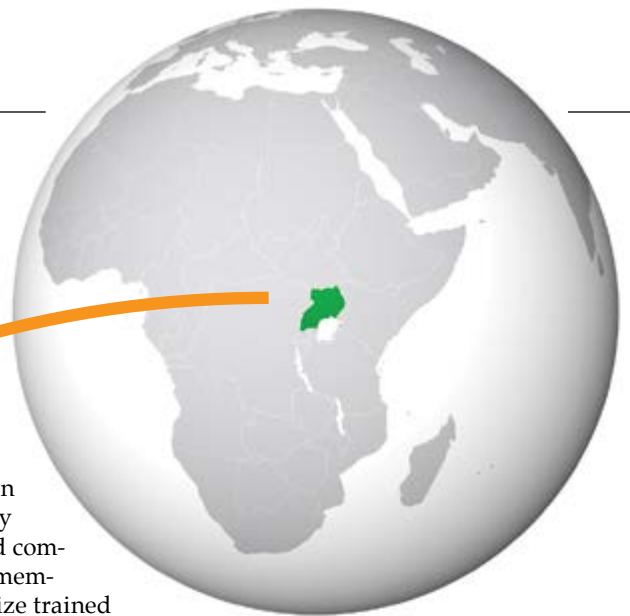
After five years, we intend that all programs will transition to completely community-run training programs with autonomous research efforts. We hope our programs will continue to flourish and represent more surrounding communities. We hope reassessments of vital skills and community knowledge of diseases, such as HIV, will change dramatically based on our interventions. We hope OMT becomes a valued part of each training program. Finally, we hope to have a large data set on mHealth to assess its use and retention.

The research team includes ATSU-SOMA's Deborah Heath, DO; Joy Lewis, DO, PhD, FACP; Jeffrey Morgan, DO, FACOI; Saikiran Earasi, OMS IV; Julian Hirschbaum, OMS IV; Stanton Jasicki, OMS IV; Jenni Adams, OMS III; Starr Matsushita, OMS III; and Amanda Mika, OMS III.

program's CHWs in Uganda reach more than 30,000 community members who have little to no access to healthcare. In Peru, CHWs reach more than 1,500 community members.

What is the goal of your project?

This research project is multifaceted. Our ultimate goal is to help CHWs develop their own research into best practices for training by transitioning them from a community participatory training and modified research model (using community participation to guide outside researchers) to community participatory research (equal research participation by community members and outside researchers). We have a five-year research goal to assess outcomes related to our



Early detection

Olawunmi Obisesan, DHEd, '16, is a recent ATSU-CGHS graduate who completed her dissertation on the prevalence and predictors of cervical cancer screening among African immigrants living in the United States. With research assistance from faculty members Donna Allen, PhD, and Meg Sheppard, PhD, Dr. Obisesan's study was accepted for presentation at the American Public Health Association's 2016 annual meeting in October.

What did you investigate?

Cervical cancer screening is less common in female immigrant populations compared with females born in the United States. The purpose of our research project was to examine the lifetime uptake of the Pap test in female African immigrants, a subset of the general black female population, and compare that uptake prevalence with other female populations. We also examined the influences of cervical cancer predictors, such as age, level of education, socioeconomic status, marital status, perceived health status, and healthcare provider's recommendation on the lifetime uptake of the Pap test.

What results did you find?

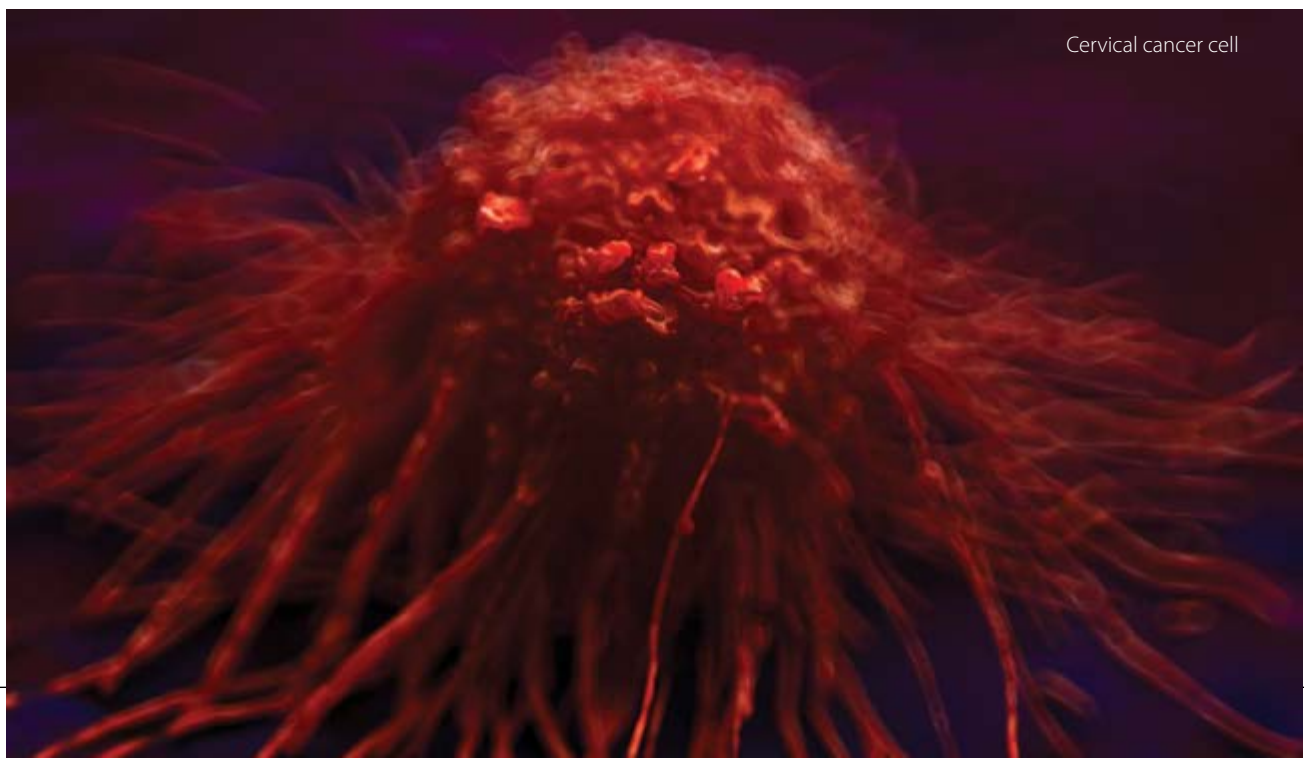
Our results indicated the prevalence of the lifetime uptake of the Pap test was lower in female African immigrants (87 percent) compared with females born in the United States, Europe, South America, and the

Middle East. The results also identified statistically significant associations between the lifetime uptake of the Pap test and specific predictors, namely, level of education and healthcare provider's recommendation.

What do you hope to achieve?

This research is important because early detection of cervical cancer in female African immigrants can reduce the incidence and mortality rates associated with cervical cancer and improve health equity in this population. At 87 percent participation, the uptake prevalence of the Pap test in this population is still six percent below the Healthy People 2020 target of 93 percent.

Healthcare providers are vital for the reduction of health disparities among immigrant populations in the United States. Through our research, we hope to increase awareness of the pivotal role of healthcare providers to improve cervical cancer screening behaviors in the female African immigrant population. We also hope to increase awareness of the need for innovative and culturally and linguistically appropriate health education materials that encourage them to be screened. Because education level was a predictor of cervical cancer screening in our study, the development of illustrated health education materials is needed.



Cervical cancer cell

Oral immunity

ATSU-MOSDOH's Josh Coffey spent a summer performing research at the National Institutes of Health-National Institute of Dental and Craniofacial Research in Bethesda, Maryland. He worked with several periodontists and became interested in how the microbiome shapes the immune system. For his research project, he investigated the species and quantities of bacteria present in the oral cavity of mice.

What did you investigate?

My project specifically involved classifying the oral microbiome of a particular strain of mice used in the laboratory. This research required delicate collection techniques and culturing and isolating bacteria, followed by purifying, amplifying, and sequencing the DNA.

Why is your research important?

Once the oral microbiome can be clearly defined and bacterial samples stored, then repopulation studies can be conducted. These studies would require using germ-free mice and introducing known mixtures of bacteria. This type of investigation allows for the study of antibiotic therapy and may result in determining the protective mechanisms of certain bacterial species.

What do you hope to achieve?

Bacteria play a fundamental role in establishing health. The more we learn about the interactions between bacteria and the host, the more we can utilize that relationship. This is where the research gets really interesting because certain bacterial interactions enhance immunity and resist colonization of bad oral bacteria, like gram-negative bacteria. Once bacterial interactions are more clearly understood, probiotic treatment for oral bugs is certainly on the table. Imagine if we could prophylactically eliminate, or greatly reduce, *Streptococcus mutans* in the mouth without any antibiotics.

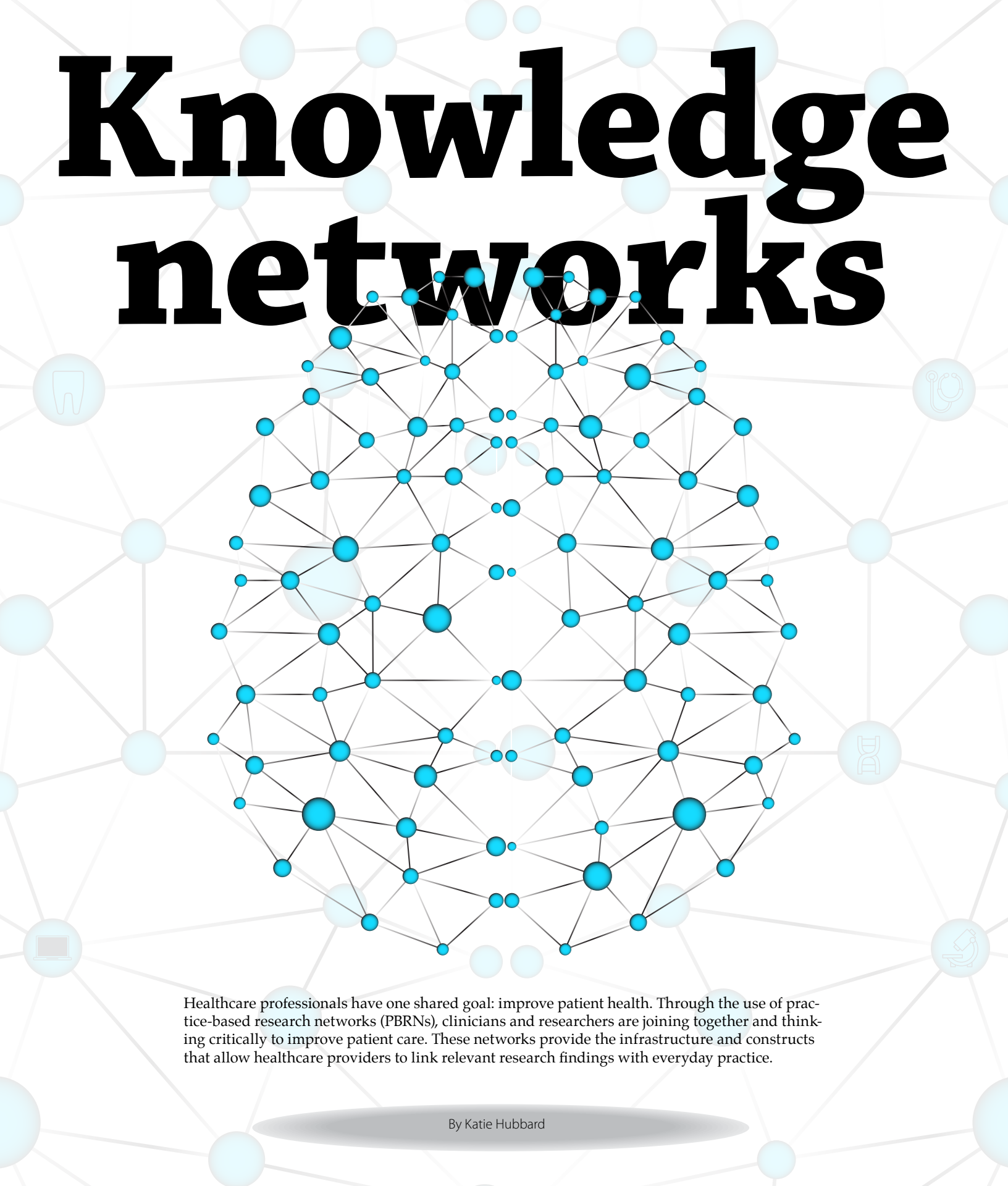


Third-year dental student Josh Coffey (third from left) investigates immune function in the oral cavity at the National Institute of Dental and Craniofacial Research.

WANT MORE RESEARCH?

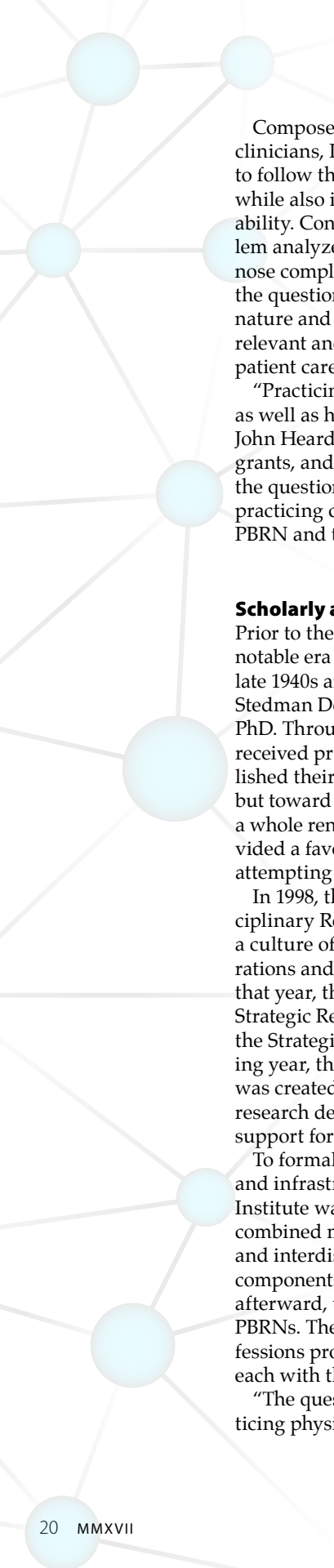
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Knowledge networks



Healthcare professionals have one shared goal: improve patient health. Through the use of practice-based research networks (PBRNs), clinicians and researchers are joining together and thinking critically to improve patient care. These networks provide the infrastructure and constructs that allow healthcare providers to link relevant research findings with everyday practice.

By Katie Hubbard



Composed of researchers and practicing clinicians, PBRNs help train clinician members to follow the scientific method of reasoning while also increasing their critical thinking ability. Consequently, they become better problem analyzers, improving their ability to diagnose complex patient conditions. Additionally, the questions they help answer are general in nature and carry a practical value that is relevant and immediately applicable to routine patient care.

“Practicing clinicians develop the questions as well as help discover the answers,” says John Heard, PhD, vice president for research, grants, and information systems at ATSU. “Both the questions and answers are relevant to the practicing clinician – those who are part of the PBRN and those who are not.”

Scholarly activity at ATSU

Prior to the late 1990s, the University’s most notable era of scientific research came in the late 1940s and 1950s with the work of John Stedman Denslow, DO, ‘29, and Irvin Korr, PhD. Throughout the years, some researchers received private and federal funding and published their findings in peer-reviewed journals, but toward the turn of the century, ATSU as a whole renewed its focus on research. This provided a favorable environment for researchers attempting to produce valid clinical outcomes.

In 1998, the University launched the Interdisciplinary Research Committee, which promoted a culture of research and facilitated key collaborations and internal research mentorships. Later that year, the Board of Trustees approved the Strategic Research Initiative, today termed as the Strategic Research Fund. During the following year, the Department of Research Support was created to provide expertise in clinical research design and data analysis as well as support for publications of research results.

To formalize the rejuvenated research culture and infrastructure, the A.T. Still Research Institute was established in 2001. The institute combined many of the University’s clinical and interdisciplinary research activities and components under one overarching entity. Soon afterward, the University began to focus on PBRNs. The University’s gamut of health professions programs required multiple networks, each with their own area of expertise.

“The questions that would be asked by a practicing physician may or may not be the same as

would be asked by a practicing physical therapist or athletic trainer,” says Dr. Heard. “Thus, each area has their own domain of interest and procedures, which require processes to analyze them that may be specific to their disciplines.”

The University’s PBRNs

AT-PBRN

ATSU’s first PBRN is the Athletic Training Practice-Based Research Network (AT-PBRN), developed in 2009. Striving to improve the quality of care and outcomes for patients treated by athletic trainers, AT-PBRN received recognition from the Agency for Healthcare Research and Quality (AHRQ) in 2010 and is the only athletic training PBRN recognized by AHRQ. It is headquartered within the Athletic Training program at ATSU-ASHS and includes more than 100 clinicians and 75 clinical practice sites across 23 states.

Compliant with the Health Information Portability and Accountability Act, the infrastructure of AT-PBRN includes a custom-made, practice-oriented electronic medical record (EMR) system. CORE-AT EMR provides clinicians access to an athletic training-specific EMR via laptops, tablets, and smartphones. The use of a custom-made EMR allows the regular patient documentation done by athletic trainers to be a means of data acquisition. The EMR includes complete patient records, from initial evaluation through discharge, and includes patient-reported outcome measures that link to a diagnosis to record the patient’s perspective on their injury, treatment, and recovery.

“As the only athletic training EMR to offer built-in, patient-reported outcome measures, the CORE-AT EMR can facilitate whole person, patient-centered care and support investigations aiming to identify effective treatment interventions,” says AT-PBRN Director Tamara Valovich McLeod, PhD, ATC, FNATA.

According to Dr. Valovich McLeod, investigations within the PBRN have generally focused on characterizing routine athletic training practice. For instance, through retrospective analyses of CORE-AT EMR data, AT-PBRN found the injured body part most commonly reported was the ankle. This information was based on 5,595 reported sport-related injuries, and ankle sprains accounted for the majority of the ankle injuries. Of the 4,510 athletic training services provided for ankle sprains, the most

common treatments were cryotherapy, taping, and therapeutic exercises or activities. In a more recent study that included 36,245 daily patient encounters, network researchers found the ankle was still the most commonly reported body part, and more importantly, that athletic trainers spend a fair amount of time working to prevent injuries.

AT-PBRN has also begun to focus on describing value characteristics of athletic training practice. Researchers estimated the cost of athletic training services related to lower and upper extremity injuries and described changes in patient-reported outcomes over time for a wide range of injuries, such as concussions, musculoskeletal injuries as a whole, knee sprains, and ankle sprains. In a recent study, researchers investigated changes in self-reported function during the first two weeks following an ankle sprain and found patients with ankle sprain injury generally reported significant and meaningful improvements in function during the first two weeks post-injury. However, most patients continued to experience self-reported deficits in general and sport function at two weeks post-injury. While these findings provide support for rapid improvement in self-reported function by patients under the care of an athletic trainer, according to Dr. Valovich McLeod, little is known about the effectiveness of specific treatments on long-term outcomes and recurrent injury risk.

Because most studies have been retrospective in nature, researchers within AT-PBRN are making efforts to conduct prospective studies. These studies will strive to identify outcomes of the care provided for injuries treated by athletic trainers, determine the comparative effectiveness of athletic training interventions, and conduct point-of-care clinical trials.

"To our knowledge, these efforts are the first to use an EMR to collect clinical data in support of point-of-care investigations in athletic training," Dr. Valovich McLeod says. "Ultimately, these types of efforts should help enhance clinical practice and improve the care provided to patients who suffer sport-related injury, which reflects the mission of AT-PBRN."

Director of AT-PBRN

Director:
Tamara Valovich McLeod,
PhD, ATC, FNATA

Title:
Professor and Director,
Athletic Training, ATSU-ASHS
Research Professor, ATSU-SOMA
John P. Wood, DO, Endowed Chair for
Sports Medicine
With ATSU since 2002

Research area:
Sport-related concussion



DO-Touch.NET

Created in 2010, DO-Touch.NET is the A.T. Still Research Institute's inaugural PBRN. It is also the first PBRN focusing on osteopathic manipulative medicine (OMM) and osteopathic manipulative treatment (OMT). With a mission to evaluate and advance the practice of OMM, its purpose is to create and sustain a network of clinicians engaged in the assessment of the clinical usefulness of OMM. DO-Touch.NET values and promotes the advancement of osteopathic medicine by supporting clinicians who integrate OMT into their patient care and whose practice promotes health and optimizes the inherent healing capacity of humans. Any practicing clinician who provides osteopathic manipulative services to their patients is eligible to be a member of DO-Touch.NET.

The network is comprised of more than 200 members from 30 states and 11 countries. Currently, about 65 of those members have contributed to its research studies. The Network Coordinating Center on the Kirksville, Missouri, campus serves as its headquarters, and in 2015, the PBRN established its first Regional



Director of DO-Touch.NET

Director:
Brian Degenhardt, DO

Title:
Director,
A.T. Still Research Institute
Associate Professor,
ATSU-KCOM
With ATSU since 1993

Research area:
Osteopathic manipulative medicine

Coordinating Center in Germany. In addition to the A.T. Still Research Institute's External Board of Scientific Counselors and ATSU's institutional support, the Network Coordinating Center is guided by its Executive Committee that consists of DO-Touch.NET members who review all proposed research studies, publications, and presentations to ensure research integrity and accurate representation of the network's activities.

"A Community Advisory Board of patients and other stakeholders advises the Executive Committee regarding the value and refinement of current and proposed research activities," says Brian Degenhardt, DO, director for DO-Touch.NET. "By involving members, patients, and other stakeholders, results from DO-Touch.NET research activities have increased applicability for practitioners of OMM and their patients."

According to Dr. Degenhardt, DO-Touch.NET has focused on research that addresses the need for evidence regarding the efficacy and safety of OMT. The PBRN's pilot study, "Establishment of the OMM Practice-based Research Network," resulted in preliminary data characterizing modern OMT practice and refinement of data

collection tools to evaluate patient-reported outcomes following OMT. A manuscript titled "Preliminary Findings on the Use of Osteopathic Manipulative Treatment: Outcomes During the Formation of the Practice-based Research Network, DO-Touch.NET" presented results of the pilot study and was published in the March 2014 issue of *The Journal of the American Osteopathic Association*. A follow-up study, known as the OMM Utilization Study, was funded by the American Osteopathic Association along with support from ATSU and expanded the scope of the pilot study in number of patients and research sites. It was designed to document how OMM is used in clinics and how patients respond to this form of treatment. Additionally, data on potential side effects from OMT was collected to guide future studies on the safety of OMT.

"In 2014, the American Academy of Osteopathy and the ATSU Strategic Research Fund provided funding to conduct the largest study of patient-reported adverse events from OMT to date," says Dr. Degenhardt. "The goal of this study is to collect data from more than 1,000 patients from 50 DO-Touch.NET members."

An independent, interdisciplinary event adjudication committee was established to help determine the likelihood that the adverse event is caused by OMT. To date, more than one-third of the data has been collected.

ATSU-SOMA PBRN

Building on the unique relationship between ATSU-SOMA and the National Association of Community Health Centers (NACHC), the ATSU-SOMA PBRN was established in 2011 following discussions with NACHC leadership. Focusing on the healthcare needs of America's underserved populations, the PBRN conducts clinically relevant research to develop and share sustainable programs to improve healthcare access and quality. It is housed within the A.T. Still Research Institute and includes 12 sites.

Since the network's main focus has been addressing health disparities and social determinants of health, much of the work has been integrated into the ATSU-SOMA curriculum. All OMS II students enroll in the Epidemiology and Biostatistics & Preventative Medicine courses to learn the fundamentals required for community-based participatory research.

According to ATSU-SOMA PBRN Director Joy Lewis, DO, PhD, FACP, students are taught to conduct needs assessments and to design and implement community projects addressing the social and economic determinants of health. Equipped with detailed instructions, tools, and support, students then work with the School's faculty members and regional directors of medical education at their assigned community health centers to develop, execute, and evaluate their research, service, and quality improvement projects.

"The goals and objectives of the PBRN are to promote and support student, resident, and practicing clinician community-oriented primary care projects," Dr. Lewis says. "Furthermore, PBRN members focus on improving knowledge related to the use of technology-enhanced active learning for medical education."

One example of a public health education collaborative that fosters student participatory research occurs at Waianae Coast Comprehensive Health Center on Oahu, Hawaii. At the center, which serves a population with high rates of diabetes, obesity, poverty, and homelessness, interdisciplinary teams of OMS II and nursing students deliver health and wellness education to elementary school children. Each lesson focuses on a different aspect of health

and includes an active component that enables the youth to act out what they learn via playful exercise. The children are encouraged to share these lessons with family and community members and report back what they were taught. Parents or guardians are then surveyed on what they learned from the lessons. At the end of the year, teams hold a ceremony that recognizes and rewards children for their efforts, and ATSU-SOMA students evaluate the impact of the educational project.

In addition to supporting community projects, ATSU-SOMA PBRN is part of an interdisciplinary team that provides concussion and traumatic brain injury education to University-affiliated community health centers. Funded by the ATSU Community Health Grant, the program titled "Traumatic Brain Injury Education: Enhancing Knowledge and Collaboration for Community-Based Youth Concussion Management" is implemented at participating community health centers that have at least one school-based health center. This design furthers the program's reach into the community through school personnel and community members.

Director of ATSU-SOMA PBRN

Director:
Joy Lewis, DO, PhD, FACP

Title:
Chair, Public Health,
ATSU-SOMA
With ATSU since 2011

Research area:
Community-oriented primary care



Network for Community Oral Health Research

ATSU's newest school, ATSU-MOSDOH, hosts the University's fourth PBRN: Network for Community Oral Health Research (NCOHR). Created in 2014 and housed within the A.T. Still Research Institute, NCOHR aims to improve the oral health of underserved populations through practice-based research and is the only PBRN in the country composed entirely of federally qualified health centers (FQHCs). The member FQHCs are also ATSU-MOSDOH affiliated sites where fourth-year dental students complete their clinical education. Currently, the four member FQHCs represent the Springfield, Sikeston, Kirksville, and St. Louis, Missouri, areas.

Although NCOHR is continuing to develop, it is conducting three studies. One study, now in the dissemination phase, looked at the adverse event rates of community health center patients. The project helped establish processes and procedures related to the internal conduct of the PBRN and how to create and maintain research relationships with FQHCs.

A second study, which is in the data collection phase, is a controlled experiment testing various interventions designed to reduce no-show rates among dental patients at commu-

nity health centers. Researchers established an intervention for scheduling procedures at the Northeast Missouri Health Council, which resulted in a 50 percent reduction in its no-show rate. In addition, the study determined the population most at risk for no-shows was Medicaid patients under age 18. This is an intriguing result, considering the state of Missouri pays for coverage of this group.

The third study, currently in the planning phase, will investigate the effectiveness of a targeted referral of patients who visit the emergency room for dental conditions to the local FQHC for treatment.

"The three studies were proposed by community dentists and are designed to solve the oral health needs of their local populations," says Parker Crutchfield, PhD, director for NCOHR. "All research activities are designed and carried out by ATSU-MOSDOH dental students under faculty supervision."

Knowledge is power

As PBRNs gained momentum in the past decade on a national level, so have PBRNs at ATSU. Although each of the University's PBRNs focuses on different areas of healthcare, each has shared values and promotes improved clinical practice. Each also advances the principles and practices of their respective fields by producing research that is applicable to clinicians and by translating the latest evidence into routine practice. With all the knowledge available through PBRNs, healthcare providers across the country and around the world are empowered to enhance their clinical decision-making skills and ultimately improve the care of their patients.

"Our PBRNs bring together practitioners from diverse settings to meet the needs of fellow clinicians and the needs of patients," says Dr. Heard. "As ATSU expands its program offerings, I would not be surprised to see a new PBRN emerge." ☞



Director of NCOHR

Director:
Parker Crutchfield, PhD

Title:
Research Director,
ATSU-MOSDOH
With ATSU since 2013

Research area:
Biomedical ethics



“ Social presence in online learning ”

By Laurie Trowbridge

Online learning has become a standard form of education in the last few decades. For full-time professionals, learning remotely provides a flexible alternative to expand knowledge because location limitations no longer exist. Establishing a learning community in a Learning Management System (LMS), rather than in a traditional classroom, is a challenge for faculty who must use email and the LMS discussion board as primary methods for communication.

Between 2010-12, Joan Leafman, PhD, and Kathleen Mathieson, PhD, CIP, associate professors at ATSU-CGHS, along with initial contributor Helen Ewing, DHSc, former health sciences chair and associate professor, explored faculty perceptions of communication tools in an LMS and the use of social media tools outside an LMS to increase social engagement in the learning community. In their research, Drs. Leafman and Mathieson applied the Community of Inquiry framework, which describes the factors that affect the online learning experience: teaching presence, cognitive presence, and social presence.

“We were interested in social presence, which includes emotional expression, open communication, and group cohesion – factors that are challenging to incorporate in an online learning environment,” said Dr. Mathieson.

Social presence aims to decrease transactional distance, that is, the cognitive space between faculty and students in online education. The lower the transactional distance the stronger the relationship between faculty and students, which leads to a better learning environment.

Drs. Leafman and Mathieson invited full- and part-time ATSU online faculty to participate in an

anonymous online survey. Of the 94 faculty members who completed the survey, most reported being satisfied with the level of interaction in the LMS. Those same faculty members, however, indicated interactions with students tended to be impersonal and the LMS did not allow for more casual, personal discussions. The reported limitations of communication tools in an LMS suggested that faculty should consider using alternative tools, such as social media, to improve social presence.

More than 90 percent of surveyed faculty members owned a social media account, with Facebook being the most common, and one-third indicated feeling comfortable using social media. Despite owning accounts, many did not use such tools outside the LMS to communicate with their students. Common factors that could contribute to avoiding social media in an online classroom include legal and ethical concerns and lack of familiarity with when to use social media and what type of content is appropriate to share.

While social media tools may create a stronger social presence between faculty and students, using social media to enhance online learning has no clear path. Drs. Leafman and Mathieson note that without guidelines faculty members are unsure how to proceed successfully, so they avoid using these dynamic tools in online learning. Both Drs. Leafman and Mathieson plan to expand their research by evaluating specific elements that affect social presence.

“Our interest in this area is fueled by our commitment to providing a high-quality online learning experience for our students,” Dr. Mathieson says. “Creating a sense of community and connectedness enhances their learning.” 📧

Striking distance

By Katie Hubbard



"Would you like to meet them?" says Bruce Young, PhD.

Making his way up six floors from the Anatomy department to the top of the Timken-Burnett Research Building, the ATSU-KCOM associate professor enters a secluded research laboratory. The laboratory's atmosphere is a balmy 85 degrees. Its open workspace and two small rooms are built to exact specifications with no gap larger than one-half inch. One interior room serves as a soundproof space for recording experiments. The second lodges a dozen western diamond-back rattlesnakes.

As he opens the door to the snake den, the rattles crescendo. He turns on the light and slowly slides out a plastic, opaque drawer from a tall storage rack. Skillfully maneuvering a long-handled hook, he snags a 3-foot snake.

"This is our colony of rattlesnakes," Dr. Young says. "Each snake is used in our controlled trials."

He cautiously handles the snake and describes the care involved in using these reptiles for his research. These snakes are part of a rotation, which ensures each one has several days' recovery between tests. He also makes sure to use appropriate experimentation materials, such as soft pads for snake strikes. His concern for their safety and well-being demonstrates his strong work ethic and enthusiasm for this research matter.

Make no missnake, Dr. Young is passionate about more than just herpetology. His area of interest is experimental biophysics to determine how morphological systems interact with physical forces. Specifically, he studies musculoskeletal systems and issues with gravity, torque, acceleration, and sensory systems. For this particular research project, he examines



Dr. Young has studied experimental biophysics for 25 years. With each project, he hopes to zero in on irregular neuromuscular integration.

neuromuscular control in rattlesnakes and the precision of their strikes.

"Snake strikes have been studied, but we still don't know the underlying mechanics," says Dr. Young. "How much control does the snake have? Is it just a lunge?"

In his early research, he studied puff adder strikes. Puff adders, which are found in Africa, are one of the largest venomous snakes in the world and are remarkably quick. He found that puff adders tense their muscles, using them as a spring to strike. That discovery prompted him to determine if the spring recoil model of neuromuscular control translated to rattlesnake strikes.

Despite his choice of research organism, the core of Dr. Young's study is neuromuscular integration, which is critical to human health. Disruption of normal

neuromuscular integration is associated with multiple debilitating human conditions and diseases. To help conduct his trials and analyze data, he gathered a research team consisting of two undergraduate interns and one graduate student from Truman State University as well as a first-year DO student from ATSU-KCOM.

"The finger-to-nose test is frequently used to assess neuromuscular control in humans," says Dr. Young. "That's essentially the test we performed, but we took it up several notches in complexity."

The team was particularly interested in patterns of muscle activation that are associated with snake strikes. To assess these patterns accurately, they standardized the variable factors within their controlled trials. Each snake was approximately the same length,

and all experiments were performed in a small glass cage, making each strike about 1 foot long.

A snake's strike is faster than the human eye can see, so the team had to use high-speed video to quantify body posture and strike accuracy. To discern patterns of muscle activation, Dr. Young had to perform electromyography (EMG). This required implanting microscopic wires – about half the size of human hair – into the snake's spinalis/semispinalis muscle complex.

Each test took approximately two and a half hours and included anesthetizing the snake, surgically implanting EMG wires, and recording the snake's movement. Keeping fragile wires in an active rattlesnake was a challenge for the team. Many times a snake flexed too aggressively and pulled out the wires, causing the test to stop. However, the wires were designed to slip out easily to prevent harm to the snake.

With all the experiments complete, the team compiled the data and video images and began analyzing the information. Their preliminary results indicated asymmetric muscle activation, meaning the snake monitors its body posture during a strike. It also means neural control of the activation is based on the curvature of its body.

“The snake begins a strike by holding part of his body off the ground, contracting its back muscles,” Dr. Young says. “The snake also has its body curved, with one side of the curve elongated and the other contracted. To launch a strike, the snake pulls one side more than the other.”

With the project nearly complete, Dr. Young plans to take this research to the next level, literally. He wants to repeat the same experiments with arboreal vipers, which are closely related to western diamondback rattlesnakes. The vipers strike prey in a similar fashion, but they add another layer of complexity because they strike while hanging from tree branches.

“Performing a strike in a tree top involves different risks,” says Dr. Young. “If a viper overshoots, it will fall out of the tree. If my rattlesnakes miss, they are already on the ground.”

Dr. Young is going the distance to study snake strikes. He supports ATSU-KCOM's commitment to research as he learns more about these different reptile species. Ultimately, he hopes to have a better understanding of neuromuscular control in snakes and shed some light on neuromuscular integration in humans. ■

A snake has hundreds of joints that add complexity to understanding neuromuscular control.



Laser focus

By Katie Hubbard

Laser-based treatments are the newest trend in emerging dental technology. Compared with traditional methods, lasers offer a minimally invasive approach to oral healthcare. They also offer the potential of portability and affordability for patients lacking access to care.

While lasers have become popular in dental settings, insufficient systematic clinical research has limited their role in most disease treatments. To learn more about lasers and their application in dental diseases, ATSU-ASDOH faculty members Inder Makin, MD, PhD, bioengineer; Marc Shlossman, DDS, MS, periodontist; and Robert Levine, DDS, laser clinical specialist, are focusing their research efforts on periodontal disease.

"According to scientific literature, periodontal disease affects up to 14 percent of the general population," says Dr. Makin. "It has significant public health implications such as associations with heart disease and pre-term pregnancies."

Chronic periodontal disease in particular is a problem that typically affects underserved, aging, and special needs populations. At the root of the disease are bacterial colonies resident in gum pockets. These bacteria become virulent under adverse health conditions, like smoking and tobacco use, or through systemic diseases, like diabetes. The harmful bacteria then destroy surrounding tissue, leading to gum tissue and bone loss, bleeding gums, and loosening and loss of teeth.

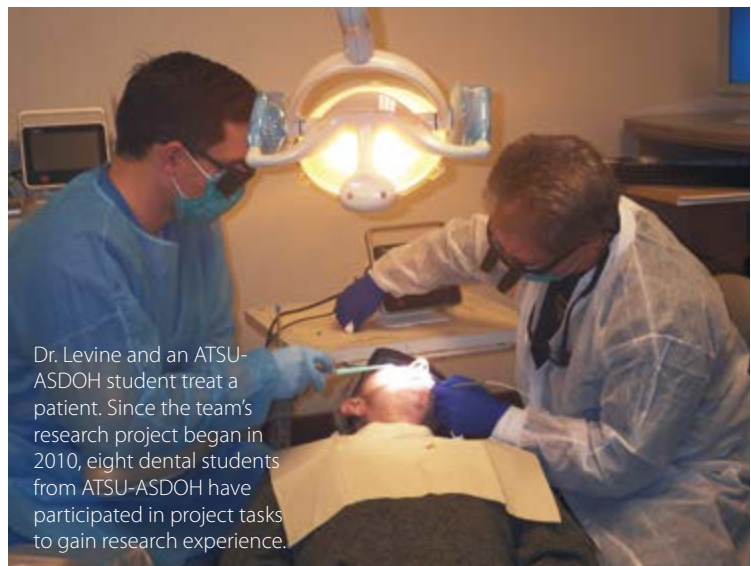
Currently, scaling and root planing (SRP) procedures are the most common treatments to remove plaque buildup and diseased tissue. However, SRP procedures are time consuming and require substantial skill by oral healthcare providers. Even after treatment, the disease can return. In addition, regular, long-term intake of systemic antibiotics may lead to drug resistance and cause some patients to become immune to treatment.

"Patients with this disease need effective, low-cost approaches that are widely accessible," says Dr. Makin. "In our project, we propose additional use of laser-based treatment of the periodontal pocket, which can reduce frequency of SRP procedures and also provide a response to antibiotic-resistant cases."

The research team developed a prospective controlled, randomized, and double-blind protocol for their 18-patient pilot study. They assessed clinical and microbial population improvement in patients undergoing SRP procedures compared with patients receiving diode laser treatments in addition to SRP procedures. As part of this research to understand the tissue effects and potential efficacious effects from laser treatment, they characterized the radiated energy from their laser system as well as its tip temperature.

"So far, we have refined the techniques of genomic analysis of critical periodontal bacteria," Dr. Makin says. "We have been successful in differentiating the bacterial profiles of gum pockets in individuals diagnosed with chronic gum disease from individuals having no periodontal disease."

Taking an interdisciplinary approach, they gained an understanding of the pathophysiology of chronic periodontal disease, clinical bioeffects and assessment approaches, and precise laser-soft tissue interactions. The team's motivation to advance scientific knowledge and enhance public health keeps a laser focus on addressing patient needs. With the pilot study to be completed by mid-2017, they hope their results will confirm laser-based treatments improve patient outcomes. ■



Dr. Levine and an ATSU-ASDOH student treat a patient. Since the team's research project began in 2010, eight dental students from ATSU-ASDOH have participated in project tasks to gain research experience.

ULTRASOUND:

ATSU-KCOM's ultrasonography program is making waves across the osteopathic profession. As a leader in ultrasound education, the College's robust curriculum affords students the opportunity to develop point-of-care ultrasound skills. In addition, ultrasound tools and resources provide students with experience in osteopathic research.

"We have 25 ultrasound machines, which allows us to have three to four students per machine so each student gets the best hands-on experience possible," says Tatyana Kondrashova, MD, PhD, associate professor, family medicine, preventive medicine, and community health. "During their initial exposure to ultrasound, students are anxious about working with the machines, but quickly become more confident and comfortable in identifying anatomical structures and pathology."

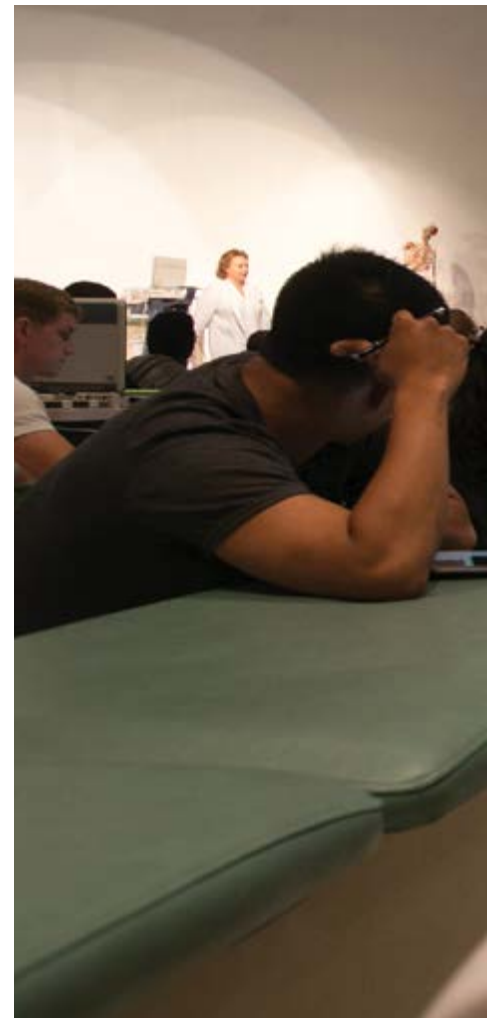
More and more hospitals are expecting physicians to use ultrasonography in emergency situations, such as FAST exams. Because ATSU-KCOM students have developed proficient ultrasound skills while in medical school, they are garnering the respect of attending physicians and residents when demonstrating their skills in a clinical setting.

"While on an 'audition rotation' at my first choice residency site, I was asked to perform OB ultrasound on several patients," says Brent Pickett, OMS IV, who is completing rotations at ATSU-KCOM's Provo, Utah, site. "I was able to find the vital structures and measure the fetal heart rate using M-mode. It earned me high praise from my preceptors."

"I've done about half a dozen FAST exams without assistance, which is about half a dozen



Above: Medical students Sierra Dickey, Megan Reidy, Daniel Brannen, and Adam Benchendorf practice ultrasound techniques.



Right: ATSU-KCOM's ultrasound curriculum earned a commendation from the American Osteopathic Association's Commission on Osteopathic College Accreditation.

Making waves in osteopathic research

By Virginia Halterman

more than almost every other auditioning medical student," says Richard Thomas, OMS IV. "They have little to no experience or comfort with ultrasound."

Integration of ultrasound into courses at ATSU-KCOM and ATSU-MOSDOH has allowed for educational research as well as interdisciplinary teamwork. Collaboration with anatomy, osteopathic manipulative medicine (OMM), and physiology instructors has resulted in the presentation of six posters at national and international conferences, two poster awards, and publications in *The Journal of the American Osteopathic Association*, *Medical Science Educator*, and *Clinical Anatomy*.

Clinical ultrasound research at ATSU includes several collaborative projects. ATSU-MOSDOH faculty and students are

studying the characteristics of the temporomandibular joint. Faculty from ATSU-KCOM's Physiology department and Truman State University are working on ultrasound evaluation of cardiac structure-function and aerobic capacity in college athletes. In addition, OMM faculty members are evaluating the effects of osteopathic manipulation on sacral dysfunction using ultrasound.

Ultrasonography has become an important tool for fulfilling ATSU's mission of preparing highly competent professionals. The ultrasound curriculum has opened new avenues for research and collaboration in educational and clinical studies. As these educational endeavors improve student learning, the University better prepares future healthcare professionals to improve patient care.





Drs. Tamara Roehling and Adrian Anast weigh in on plagiarism

By Katie Hubbard

A few years ago, a small group of ATSU-ASHS faculty came together to address academic integrity in the School's online courses. The ad hoc committee was led by Helen Ewing, DHSc, former chair, doctor of health sciences, and comprised faculty members including Tamara Roehling, PT, DPT, director, transitional doctor of physical therapy, and Kathleen Mathieson, PhD, CIP, associate professor, doctor of health sciences. After the committee was formed, Adrian Anast, PhD, director, University Writing Center at ATSU-CGHS, was asked to develop a remediation program for students who plagiarize parts of their assignments. Together, the group began tracking program participation and researching student and faculty perceptions of plagiarism on campus.

What is the most common form of plagiarism?

The most common form of plagiarism we see is poor paraphrasing. It's important to note that most plagiarism, for a first occurrence, is unintentional. Some students simply do not know the rules of scholarship. This is particularly the case in programs where the emphasis is on clinical experience – not writing papers.

What did you investigate?

Our research project assessed student and faculty perceptions of plagiarism. We used a cross-sectional survey design, and separate surveys were developed for students and faculty.

Why is this research important?

Policy, protocol, and practice should be based on facts. It's too easy to assume everyone is plagiarizing, no one is plagiarizing, or everyone else's students are plagiarizing. Therefore, basing practice on data from students is better than relying on assumption.

What results did you find?

1. We found no statistical difference between student and faculty self-rated knowledge about University plagiarism standards. Self-rated knowledge of University plagiarism standards was higher among online students and faculty compared with campus-based students and faculty.
2. While students perceived that plagiaristic behaviors were relatively common among their peers, few self-reported they had personally engaged in such behaviors. The most common perceived behavior among students was citing and referencing a full-text source when only the abstract was read. This was also the most common self-reported behavior among students. The next highest self-reported behaviors were submitting work prepared for a different course (self-plagiarism) and working with another student when not authorized by the instructor.
3. Compared with students, faculty perceived plagiaristic behaviors to be much more common. Seventy-five percent of faculty thought students cited and referenced a full-text source after only reading the abstract, and 70 percent thought students copied content and did not quote or cite correctly. Working closely with another student on assignments without instructor authorization was more common among campus-based students than online students.

What further steps have you taken?

In early 2016, we published a case study in *Assessment & Evaluation in Higher Education*, which outlined how our programs implemented best practices to detect and respond to plagiarism. When we implemented these best practices three years ago, the incidence of plagiarism decreased 50 percent overall. It decreased 75 percent among the student population for whom English is a second language.



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Did you know?

Many older adults lack a dental home and need assistance managing their oral health issues.

Tooth wisdom

By Katie Hubbard

Ann Spolarich, PhD, RDH, FSCDH, director of research at ATSU-ASDOH, has partnered with Oral Health America to conduct research for the national Tooth Wisdom Project. Her specific research project, "Tooth Wisdom for Pharmacists," is an inter-professional training program for community-based pharmacists.

According to Dr. Spolarich, many older adults do not regularly visit a dentist and need help finding resources to improve their access to oral healthcare. Pharmacists are well positioned to assist with this dilemma since they see this population more frequently than other healthcare providers do. Additionally, older adults often seek the advice of pharmacists about managing acute oral health problems, selecting appropriate products, and understanding their use.

"Hundreds of medications on the market cause adverse oral health effects," says Dr. Spolarich. "Pharmacists need assistance with knowing how to locate and recommend appropriate oral health interventions."

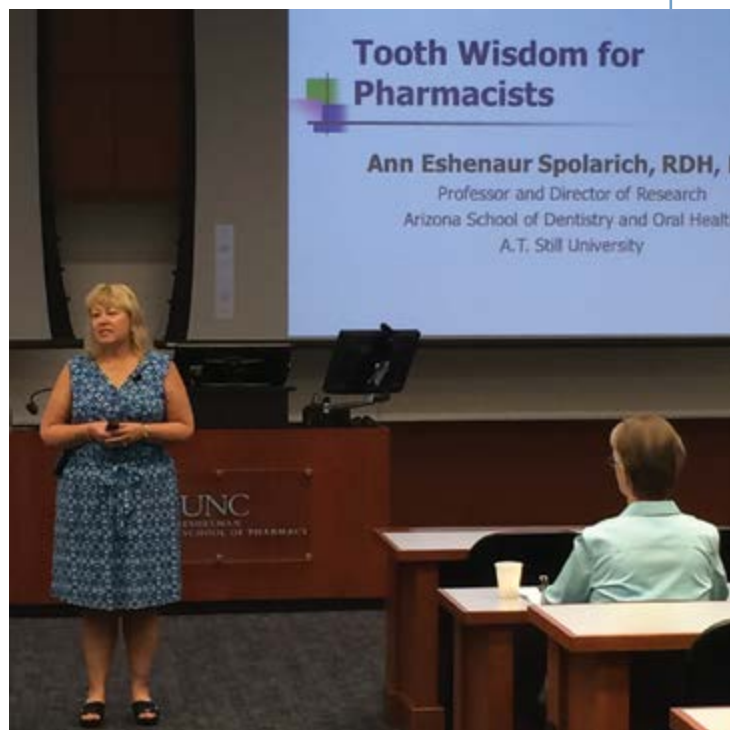
Pharmacists are moving toward the role of primary care providers, and the scope of their practice is changing accordingly. Pharmacists now give vaccines and offer health advice. Dr. Spolarich believes oral health education should be a natural extension of their practice.

Currently in her "Tooth Wisdom for Pharmacists" project, she is studying the types of oral health questions and concerns that older adults ask practicing pharmacists. She is also testing pharmacists' dental knowledge and level of comfort and preparedness with counseling on oral health issues, accessing reliable oral health information, and knowing how and where to refer for dental care.

"The training curriculum has been tested with pharmacists in Florida and North Carolina," says Dr. Spolarich, who has presented her findings nationally and internationally. "Results of the educational intervention have been remarkable."

Dr. Spolarich is thrilled by the interest and response from her pharmacist participants. She is planning to offer the training electronically to better reach pharmacists across North America. She is building relationships with pharmacy organizations and major industry partners to develop oral health educational materials for use at the pharmacy counter. In addition, she is developing a pharmacist resource toolkit that will be available on toothwisdom.org, the project website for Oral Health America. Once the toolkit is complete, she will assess its use and influence on pharmacists' practice behaviors.

"I am excited to be working with pharmacists in this interprofessional endeavor," Dr. Spolarich says. "This partnership will enable us to reach many older adults to help improve their overall health and quality of life."



Dr. Spolarich plans to pursue more initiatives with "Tooth Wisdom for Pharmacists," including developing a curriculum model for pharmacy schools.



A look back

In 1938, John Stedman Denslow, DO, '29, joined the faculty of the Kirksville College of Osteopathy and Surgery (KCOS), known today as A.T. Still University. Through his interest in research, support from President George M. Laughlin, DO, 1900, and \$5,000 from the College's general fund, Dr. Denslow established the first research program at KCOS. He focused his studies on the osteopathic lesion using electromyographical methods and opened the door for future investigators, such as Irvin M. Korr, PhD, and the Drs. Gutensohn, to contribute to scientific knowledge and validate osteopathic principles.

Dr. Denslow dedicated his career to research and the College, serving in various capacities from 1938-82. Museum of Osteopathic Medicine, Kirksville, Missouri [2010.02.876]