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# **Basic Sciences Abstracts**

# 1: Number of Active Social Media Users as a Predictor of HIPPA Infringements

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## Purpose

The number of annual HIPPA complaints across the nation has steadily risen since 2004 when HIPPA began releasing reports. Also around 2004, several social media platforms were released and gained widespread popularity. Social media platforms, for better or for worse, have allowed individuals to share more information across the world than at any previous time. Information that was previously viewed as unimportant, such as what individuals eat for each meal, is now commonly shared with the public. While both social media use and HIPPA infringements have increased in the past 20 years, any relation between the two has not been thoroughly explored. To investigate a possible relationship between the two, we looked at the number of users across various social media platforms and the number of HIPPA complaints filed annually.

## Methods

HIPPA has reported the number of annually filed complaints since 2004. Facebook and Twitter have reported the number of active users by year. Google trends were used to obtain the number of searches for “social media” or “twitter” since 2004. Pearson correlations were run against the various social media platforms and HIPPA complaints.

## Results

The tests show an extraordinarily strong correlation between social media use and HIPPA complaints filed. The Google Trends level of “social media” and the number of HIPPA complaints had an R2 value of 0.84 with a p-value of  $2.7 \times 10^{-5}$ . The number of active Facebook users since 2008 (no data was reported before 2008) was correlated with HIPPA complaints with an R2 value of 0.75 with a p-value of  $5.3 \times 10^{-3}$ , and Twitter users since 2010 was correlated with HIPPA complaints with an R2 value of 0.86 with a p-value of  $8.3 \times 10^{-3}$ .

## Conclusions

The level of correlation between HIPPA complaints and numbers of users across various social media platforms is higher than typically found by spurious correlation. To the best of our knowledge, HIPPA has not reported any information regarding the abuse of social media in relation to HIPPA violations, but the influence of social media likely has influenced, directly or indirectly, the unlawful sharing of protected health information.

## **2: Novel Methodology for the Investigation of Dmrt3a Interneurons in Larval Zebrafish**

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### **Purpose**

Understanding the neural circuits that underlie locomotion is key to understanding the causes of motor behaviors and disorders. This project explores the role of spinal interneurons, linked to the gene Dmrt3a, in larval zebrafish. Past studies suggest that these interneurons are linked to speed-shifting and locomotor coordination. We hypothesize that the activity of Dmrt3a neurons is necessary for coordinating locomotion at different speeds. Although there is evidence for this hypothesis in other models, the function of these neurons has never been tested in a moving animal which can be manipulated experimentally. Additionally, the use of highspeed footage tracked using machine-learning based software has not been described in previous zebra fish studies.

### **Methods**

A control group of 8 wildtype, 6 days post fertilization (dpf) zebrafish larvae was compared to an experimental group of 6 DMRT3a-HS:Gal4;Botox - GFP; nacre -/-, 6 dpf zebrafish larvae. Fish were screened manually using a fluorescent dissecting scope. Fish were head embedded in agar (2% low-melting point **agarose**) and a fishwater solution according to methodology described previously in Severi et al 2014. Videos were captured on a custom video rig. Fish were stimulated to swim using a projected OMR grating at one of 3 speeds (10mm/s, 20mm/s, 30mm/s) for 30 seconds for a total of 5250 frames per video. Each speed was run for 5-12 trials per fish rotating speeds to minimize desensitization of the stimulus. Raw video files were converted from .tiff to uncompressed .AVI files. Using the DeepLabCut software according to the published protocol, points along the bilateral pec fins and the tail were tracked. Output from DeepLabCut was then converted to .CSV in Python, cleaned and reformatted in R, and analyzed in MATLAB.

### **Results**

Final analysis of behavioral data has not yet been completed.

### **Conclusions**

Current work to this point has generated substantial usable data and supports use and credibility of the novel methodologies explored in this study. Eventual analysis of these data will reveal the phenotypical effect of Dmrt3a knockdown in developing zebra fish.

### **3: TrkB Activity Alters Voluntary Alcohol Consumption in Non-dependent Mice**

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#### **Purpose**

Alcohol addiction has staggering financial and health consequences. A commonly accepted theory of addiction is that it begins with alterations to neural dopamine (DA) transmission in the mesolimbic DA system, which is critical for reward and reinforcement circuitry. This system begins in the ventral tegmental area (VTA) in the midbrain and projects to areas of the cortex and limbic system. We have shown previously that GABA neurons located in the VTA are particularly sensitive to ethanol (EtOH) and become hyperexcitable during withdrawal from chronic EtOH exposure. It is thought that some of this change is mediated by brain-derived neurotrophic factor (BDNF), whose main receptor in the central nervous system is tyrosine receptor kinase B (TrkB). It has been shown previously that activating TrkB can cause a downregulation of the chloride-exporting potassium chloride cotransporter 2 (KCC2). Here we investigate this mechanism of adaptation in the context of chronic alcohol exposure and propose further investigation of KCC2 channels.

#### **Methods**

All animals were maintained in compliance with approved IACUC protocols. Male mice older than 28 days were housed communally. Animals were maintained on an inverted light cycle. All drug and EtOH injections were performed via intraperitoneal injection. BDNF was measured using ELISA. EtOH consumption was measured using a drinking in the dark (DID) model or similar two bottle choice paradigm. To produce dependence, mice were exposed to EtOH vapors using a chronic intermittent EtOH paradigm. Brains used in immunohistochemistry studies were preserved using cardiac perfusion of phosphate buffered saline and then 4% paraformaldehyde.

#### **Results**

We demonstrate that BDNF levels are elevated in the VTA during withdrawal from chronic EtOH exposure. We also observe that blocking TrkB activity decreases EtOH seeking behavior in non-dependent animals. Further, we investigate the expression patterns of KCC2 in connection with chronic EtOH administration.

#### **Conclusions**

There is much potential for KCC2 to be used as a drug target. Future work is needed to elucidate its potential as a novel target for AUD therapeutics. Further examination of the KCC2 channel using perforated patch clamp recordings is planned to better understand its role in the context of EtOH addiction.

#### **4: Effects of alcohol on the inflammatory response during *Toxoplasma gondii* infection**

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##### **Purpose**

*Toxoplasma gondii* (*T. gondii*) is an obligate intracellular parasite that undergoes multiple stages of development to infect and persist in a variety of hosts. Chronic *T. gondii* infection has shown to cause behavioral changes in rodents due to the presence of *T. gondii* cysts diffusely localized throughout the brain, including the ventral tegmental area (VTA). The mesolimbic dopamine (DA) system, originating in the VTA, is known to be involved in reward and addictive behaviors. For example, alcohol has previously shown an increase in DA release during acute intoxication and decrease in DA activity upon repeated exposure. Additionally, alcohol plays a role in enhancing microglial activation suggesting its influence on inflammatory responses. However, little is known about alcohol's modulation of specific inflammatory markers during *T. gondii* infection. Therefore, the goal of this project is to measure the immunological response to a *T. gondii* infection in the context of alcohol exposure and consumption.

##### **Methods**

Blood (200 – 500 µl) of healthy GAD67- GFP mice and *T. gondii* infected GAD67- GFP mice with and without alcohol will be analyzed. Ten *T. gondii* cysts will be administered to the infected group by oral gavage and the control will be sham infected with a vehicle buffer. Pro-inflammatory cytokines (IL-6, IL-12, IFN-γ, TNF-α) and anti-inflammatory cytokines (IL-10, IL-4, TGF-β) will be analyzed at 0, 4-, 6- and 12-weeks post-infection using multiplex ELISA.

##### **Results**

N/A

##### **Conclusions**

We hypothesize that *T. gondii* infected mice exposed to alcohol would show an increase in pro-inflammatory cytokines throughout the course of infection compared to controls. Measuring cytokine expression will provide foundational knowledge on the effects of alcohol during *T. gondii* infection; these data will elaborate on the mechanism of cyst formation in the brain and describe the effects of *T. gondii* infection on DA neurotransmission and the associated behavioral changes. Taken together, this study can provide an inflammatory profile linking the effects of alcohol abuse and the immune response during an active *T. gondii* infection.

## **5: CD5 Knockout Mice Exhibit Reduced Sensitivity to the Sedative Effects of Alcohol and Reduced Alcohol Seeking Behavior**

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### **Purpose**

Cluster of differentiation 5 (CD5) is expressed on the surface of T and a subset of B cells (B1 cells) and is a negative regulatory molecule that alters lymphocyte activation pathways. It has been found that CD5 expression is altered during chronic ethanol (EtOH) use. Given the apparent sensitivity of these cells to chronic EtOH consumption and the role of some lymphocytes in regulating the development of inhibitory GABA synapses, the impact of a CD5 genetic knockout (CD5KO) on measures related to EtOH reward and sedation was assessed.

### **Methods**

Male and female CD5 knockout (CD5KO) mice on a C57BL/6J background and their wild type counterparts were used. Locomotor activity was measured using an open field behavioral paradigm. To measure EtOH consumption, a 24-hr access two bottle choice drinking paradigm was used. The loss of righting reflex (LORR) was measured following a sedating IP injection of EtOH (4.0 g/kg). Onset and duration of LORR were measured.

### **Results**

A genetic knockout of the T cell marker CD5 blunted some of EtOH's effects, namely the reduction in locomotor activity and loss of the righting reflex. Wild type mice exhibited greater locomotor behavior prior to any EtOH exposure. CD5KO mice drink less EtOH in a 24-hr access two-bottle choice paradigm. This pattern was persistent throughout the entire 21-day testing period. There are multiple findings related to DA release and reuptake dynamics. In regards to EtOH effects on GABA neuron inhibition, there were no baseline differences in GABA neuron firing rate between CD5KO mice vs WT mice.

### **Conclusions**

In future work we will measure DA neuron activity to evaluate whether there is any direct impact on DA neuron firing rate in connections with a CD5 genetic knockout as well as how these respond to ethanol. Considering the tremendous need for new and improved treatments for AUD, future work will focus on elucidating this pathway further and determining whether there are targets in this pathway that could be used in the treatment of AUD.



## **6: Peripheral Mechanoreceptor Activation Modulates Mesolimbic GABA and Dopamine Neurons and Ameliorates Withdrawal Symptoms in Ethanol Dependent Rats**

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### **Purpose**

The therapeutic benefits to the supraspinal central nervous system (CNS) attributed to osteopathic manual manipulation (OMM) are poorly understood. However, there is a growing body of evidence that suggests mechanical stimulation (MStim), such as osteopathic manipulation, can modulate substrates of the supraspinal CNS. This study aimed to further investigate the effects of MStim, when applied to the cervical spine, on the activity of the neurons and neurotransmitters in the mesolimbic dopamine (DA) system, an area implicated in reward and motivation within the context of alcohol-use disorder.

### **Methods**

Electrophysiological, pharmacological, neurochemical, surgical, and behavioral techniques were utilized on male Wistar rats.

### **Results**

Low frequency (45-80 Hz) vibration depresses firing of ventral tegmental area (VTA) GABA neurons (52.8% baseline; 450 sec), increases VTA DA firing (248% baseline; 500 sec) and basal (178.43 % peak increase at 60 min), and evoked DA release in the nucleus accumbens (NAc; 135.03 % peak increase at 40 min). Peripheral MStim, administered concurrently with alcohol, alters alcohol-induced desensitization of VTA GABA neuron firing rate in response to a reinstatement dose of ethanol (2.5mg/kg;IP) from 117.5 % of baseline to 32.3 %. Dopamine release in the NAc at 20 min post-injection was changed from 95.4% of baseline to 144.4 % and at 80 min from 104.1% to 138.2%. We demonstrate that low frequency, but not higher frequency, peripheral MStim to the lower cervical spine depresses firing of ventral tegmental area (VTA) GABA neurons, increases VTA DA firing and basal, and evoked DA release in the nucleus accumbens. Furthermore, MStim-induced DA release was mediated, in part, by endogenous opioid and acetylcholine release in the NAc. Additionally, peripheral MStim provided protection against chronic ethanol withdrawal symptoms and dependence-induced insensitivity of VTA GABA neurons to ethanol reintroduction. Further, behavioral indices of withdrawal (rearing, open-field crosses, tail stiffness and gait) were substantively ameliorated with concurrent MStim treatment.

### **Conclusions**

These findings demonstrate robust effects of MStim on CNS substrates that are not typically associated with somatosensory circuits, suggesting the need to explore more broadly the extra-somatosensory effects of peripheral mechanoreceptor activation, as well as the specific role of mechanoreceptor-based therapies in the treatment of substance abuse.

## **7: Voluntary Aerobic Exercise Protects Against Chronic Ethanol-Induced Changes to Kappa-Opioid Receptors**

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### **Purpose**

Exercise has long been prescribed as adjunctive treatment for alcohol-use disorder (AUD) despite the underlying mechanisms remaining largely uncharacterized. Mu-opioid receptors (MORs), delta-opioid receptors (DORs) and kappa-opioid receptors (KORs) are the three types of opioid receptors expressed in the brain which are part of the mesolimbic dopamine system and have long been thought to drive alcohol withdrawal symptoms. They attenuate dopamine (DA) release in the nucleus accumbens (NAc) and are known to sensitize following chronic ethanol exposure. The objective of this study was to evaluate the effect of exercise in conjunction with chronic ethanol on opioid receptor expression and DA release in the NAc.

### **Methods**

To answer this question, we used fast scan-cyclic voltammetry (FSCV), immunohistochemistry (IHC) and a behavioral assay, specifically the drinking-in-the-dark (DID) paradigm, which measures self-administration of ethanol in mice.

### **Results**

Using FSCV, we found that a regiment of aerobic exercise was protective against ethanol-induced sensitization of KORs compared to non-exercised controls. Exercised mice displayed significantly lowered DA release upon exposure to KOR agonist u50488 using FSCV and reduced levels of KOR expression on DA neurons in the ventral tegmental area and NAc using IHC. Additionally, we found that aerobic exercise had no significant effect on DA release following superfusion of MOR agonist DAMGO; however aerobic exercise increased DA release following superfusion of DOR agonist DPDPE. Using IHC, we found that aerobic exercise was protective against ethanol-induced sensitization of DORs compared to non-exercised controls. Furthermore, in our DID model, aerobic exercise decreased seeking behavior compared to non-exercised controls.

### **Conclusions**

The findings in this study confirm that exercise is a good adjunctive treatment for AUD and helps to illuminate the underlying mechanisms behind the protective effects of exercise on ethanol-induced changes to KORs.

## **8: Sulforaphane Pre-treatment Improves Alveolar Macrophage Killing of Intracellular *Burkholderia thailandensis* E264 After Alcohol Exposure in vitro**

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### **Purpose**

Alcohol is associated with increased mortality and morbidity globally. *Burkholderia pseudomallei*, the causative agent of pneumonic melioidosis, can occur in healthy humans; however, binge alcohol intoxication ( $\geq 0.08\%$  BAC) is a major risk factor. We have previously shown that a single dose of alcohol comparable to binge alcohol intoxication increases *Burkholderia* infection by reducing alveolar macrophage function in vivo. The aim of this study was to investigate whether the phytonutrient sulforaphane (SFN) given as a pre-treatment could attenuate the dysfunctional effects of alcohol, by rescuing the phagocytic function of alveolar MH-S cells when infected with *Burkholderia* in vitro.

### **Methods**

*B. thailandensis* E264 is less virulent, opportunistic, and is genetically similar to *B. pseudomallei*. In the current study, *B. thailandensis* was used as a comparable BSL-1 surrogate to determine the therapeutic potential of sulforaphane (SFN) pre-treatment in the context of infection. The primary readout was intracellular phagocytic killing, while a secondary outcome was fold changes in Nrf2, an important cellular oxidant regulator. These were measured via CFU counts following live infection, and western blot, respectively.

### **Results**

Results indicate that MH-S cells pre-treated with SFN (5  $\mu$ M) and challenged with 0.2% (v/v) alcohol for 3 or 8 hours prior to live *B. thailandensis* infection, improved intracellular killing of *B. thailandensis* ~2-fold compared to MH-S cells treated with alcohol alone. Additionally, SFN pre-treatment of MH-S cells challenged with 0.2% (v/v) alcohol for 3 or 8 hours increased protein expression of Nrf2 ~ 3.5-fold compared to cells treated with alcohol alone. Moreover, MH-S cells pretreated with SFN and stimulated with LPS for 3 or 8 hours increased protein expression of Nrf2 ~12-fold compared to cells stimulated with LPS alone.

### **Conclusions**

These data demonstrate that SFN may be an effective pre-treatment option to prevent alcohol-mediated innate immune dysfunction. Consequently, cytoprotection could also be extended against other opportunistic pathogens when pre-treatment SFN is administered.

## **9: Evaluation of the Neurogenic and Dentinogenic Effect of Valproic Acid on Undifferentiated Mesenchymal Cells of Human Dental Pulp**

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### **Purpose**

The dental pulp is surrounded by dentin. Occasionally, during the removal of deep caries, a pulp exposure occurs, for which a pulp cap is required. This pulp cap aims to induce the formation of reparative tertiary dentin for the protection of the pulp. Tertiary dentin can be created in one of two ways: reactionary dentin produced by odontoblasts or reparative dentin produced by undifferentiated mesenchymal cells (stem cells) found in the center of the pulp. These mesenchymal cells migrate to the site of exposure, differentiating and synthesizing all proteins necessary for the process of dentinogenesis. Tissue engineering seeks to produce tissue that mimics the characteristics of a given target through tissue regeneration. In the case of pulp exposure, tertiary dentin can form through stem cells induced to an odontogenic lineage. The expression of the neuronal markers found in the odontoblasts when using direct pulp cap materials has not been reported in the literature. Valproic acid, a drug that inhibits deacetylases, has been shown to have the power to induce differentiation in various undifferentiated mesenchymal cells. The purpose is to evaluate the effect of valproic acid on the genetic expression for neuronal and odontogenic markers in pulp stem cells (in vitro). These findings can be applied to restorative dentistry during pulp exposures to favor the formation of dentin more like the primary and secondary dentin.

### **Methods**

**Isolation:** The stem cells will be isolated from the pulps of third molars by enzymatic digestion and cultured in a growth medium. The gene expression of pluripotential markers (SOX2, Nanog, OCT4, CD73, CD90) by qRT-PCR will be performed. **Evaluation of cell proliferation:** Different concentrations of Valproic Acid will be added to cell cultures and the cell proliferation will be evaluated through the method based on new DNA synthesis and flow cytometry at determined time intervals. Cytotoxicity will also be evaluated by an MTT assay. **Evaluation of cell differentiation:** Three different concentrations of valproic acid will be added to the cultures and we will evaluate the genetic expression for proteins of odontoblastic differentiation and neurogenic markers (DSP, Coll-I, Nestin, S100B, SOX 10, and Protein Zero) by qRT-PCR.

### **Results**

NA

### **Conclusions**

NA

## **10: Evaluation of Salivary Biomarkers for the Early Diagnosis of Periodontitis and Its Association with Hypertension**

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### **Purpose**

Oral health is interdependent with overall health – The diagnosis of periodontitis, a multifactorial, chronic inflammatory disease of the periodontium, has been strongly linked to the increased progression of hypertension. The current and most widely utilized diagnostic protocol for periodontitis involves the analysis of clinical parameters and radiographic examinations; however, these diagnostic protocols do not hold high sensitivity and accuracy to adequately diagnose the active form of the disease or prevent those at risk. Thus, the emergence of the use of salivary biomarkers as a prospective screening and diagnostic tool has increasingly been used to diagnose and determine the prognosis of periodontitis. This is due to the component of saliva as a reflection of the health status that intricately presents the upregulated or downregulated activity of specific microbial pathogens, and the various biomarkers involving DNA, RNA, and proteins. The purpose of this literature review is to evaluate the promising non-invasive use of salivary biomarkers for the diagnosis of periodontitis in the prevention and management of hypertension.

### **Methods**

A search of international and national scientific articles published between 2018 and 2021 in the PubMed Database has been gathered for assessment. The selection of the scientific articles is based on scientific soundness and has been gathered based on the scientific testing of identifying salivary biomarkers for the diagnosis of periodontitis and prevention of hypertension.

### **Results**

In Progress

### **Conclusions**

In Progress

# 11: A Quantitative Analysis of the Efficacy of Various Essential Oils Against the SARS Cov-2 Virus

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## Purpose

Humans have been turning to plants and plant extracts for medical purposes for the majority of recorded history. In recent years essential oils, derived from plants, have become increasingly popular and have been shown in several studies to exert positive antibacterial and antiviral effects. In the face of a worldwide pandemic with ever increasing shortages of medical supplies and disinfectants, we aim to understand the relationship between essential oil-based disinfectants and the SARS-CoV-2 virus. Specifically, do clove oil; a mixture of clove, lemon, cinnamon, eucalyptus, and rosemary oils; a mixture of citronella, lavender, lemongrass, myrtle, rosemary, and tea tree oils; and disinfectants containing these oils effectively inactivate SARS-Cov-2 when applied as a disinfectant? Additionally, do disinfectants based on these oils provide the same results? The potential of this research is large—If essential oil-based disinfectants are effective at neutralizing SARS-CoV-2, an enveloped virus, it is probable they would be effective at neutralizing other enveloped viruses as well. In a world of ever evolving pathogens, novel disinfectants will always be needed.

## Methods

To evaluate the effectiveness of these disinfectants a disc-based quantitative carrier test was performed. An inoculum of SARS CoV-2 was dried on the surface of a glass disc for approximately three hours before being exposed to a disinfectant. After a specified amount of time a neutralizer was placed on the virus inhibiting the disinfectant. The carriers were then vortexed and diluted to  $10^{-6}$ . The diluted virus was then allowed to incubate for one hour on a monolayer of Vero cells. After this time the cells were washed with PBS and allowed to incubate for three days with a layer of DMEM before being fixed with formaldehyde and stained for a plaque assay. Each disinfectant was neutralized at three different time points to show log reduction with each time point being plated three times to show consistency. The trials were run on every disinfectant three times. The control plaque assays run for each trial were the titer, a negative control, the neutralizer with virus, and the disinfectant with the neutralizer and the virus.

## Results

NA

## Conclusions

NA

## 12: The Role of CD5 in Periodontal Disease: Insights Into Chronic Inflammation

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### Purpose

Periodontal disease is a chronic inflammatory oral disease initiated by *P. gingivalis*, a gram-negative bacterium, within the periodontal pockets that surround teeth. CD4+ T helper cells (Th) play a key role in the oral adaptive immune response. However, hyperactive Th cells produce inflammatory cytokines that accelerate alveolar bone loss and soft tissue damage. CD5 is a coreceptor found on T cells that inhibits T cell activation and limits effector function. We seek to study the role of CD5 in periodontal disease pathogenesis. We hypothesize that CD5 knockout (CD5KO) T cells have increased activation and effector function compared to wildtype when exposed to *P. gingivalis* LPS and that CD5 is a potential drug target to reduce inflammation in periodontitis. Our initial data showed a faster activation of CD5KO T cells by measuring activation markers CD69 and CD25, thus suggesting the potential role of CD5 in periodontal disease. This research will provide greater insight into the inflammatory response in periodontitis.

### Methods

Oral mucosa epithelial cells and Gingiva epithelial cells from mice (C57BL/6 background) were exposed to Lipopolysaccharides (LPS) from *P. gingivalis* (LPS-PG) and LPS from *E. coli* (LPS-EC) for 24 hrs. Then, splenocytes from CD5 knockout (KO) and CD5 wild type (WT) mice (C57BL/6 background) were isolated and co-cultured with the supernatant from the oral epithelial cells. We initially measured differences in T cells activation by analyzing flow cytometry markers CD69 and CD25 (early and late activation markers). Following these results, we use an ELISpot assay to identify the presence of inflammatory and anti-inflammatory cytokines (IL-6, IL-2, IL-17a, IL-10 INF-gamma, and TGF-beta). Finally, we used an RT-qPCR to characterize differences in gene transcription of two additional molecules: CFS-a and RANKL.

### Results

Our initial data observed an increase in early and late T cell activation markers (CD69 and CD25) in CD5KO T cells co-cultured with gingival or oral mucosal epithelial cells stimulated with *P. gingivalis* LPS compared to WT T cells. Preliminary data suggested differences in protein expression and gene transcription of key inflammatory cytokines that contribute to inflammation and alveolar bone loss were also observed between CD5KO and WT T cells.

### Conclusions

Our preliminary results demonstrate that CD5 plays a prominent role in periodontal disease. This research will provide valuable insights for novel treatments for periodontitis, as well as novel insights into chronic inflammation.

### **13: Manual Manipulation Analogue Ameliorates Morphine-Induced VTA GABA Neuron Desensitization and Behavioral Measures of Withdrawal**

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#### **Purpose**

Previous research suggests that applied mechanical stimulation (Mstim), like osteopathic or chiropractic manual manipulation, modulates substrates which activate the mesolimbic dopaminergic (DA) pathway between the ventral tegmental area (VTA) and nucleus accumbens (NAc). While this treatment has been explored in rats with alcohol dependency, it has not previously been studied in a context of opioid withdrawal. We aim to determine whether MStim treats the effects of morphine withdrawal as manifested behaviorally and electrophysiologically.

#### **Methods**

Twenty-four male Wistar rats (n=12 with MStim treatment) received MStim (80 Hz; 15 min) applied via vibration plate 2 times per day for 2 weeks immediately following morphine administration (1mg/kg; IP). The effects of Mstim were evaluated using single-unit electrophysiological recordings of VTA GABA neurons in withdrawal, elevated plus maze and ultrasonic vocalizations (USV).

#### **Results**

Rats in withdrawal from morphine that underwent MStim treatment spent significantly more time ( $p < 0.05$ ) in open areas of the Elevated Plus maze as compared to naive rats. Treated rats also showed increased pain tolerance (decreased hyperalgesia,  $p < 0.05$ ) and generally exhibited higher USV call frequencies than naive rats ( $p < 0.05$ ). In naive rats, an acute dose of morphine causes an inhibition of VTA GABA neurons (8%baseline; 1mg/kg). Rats in withdrawal from morphine exhibit a tolerance to an acute reinstatement dose (91%baseline; 1mg/kg). These effects are mitigated with MStim treatment 1 hour before the reinstatement dose (34%baseline; 1mg/kg).

#### **Conclusions**

The behavioral assay and in-vivo electrophysiological measurements indicate a significant anxiolytic effect from MStim treatment on opioid withdrawal. Further research should be conducted exploring the physiological mechanisms by which MStim treatment operates and other applications of the treatment.



## **14: Genetic Knockdown of nmad-1 Demethylase in C. Elegans to Affect Longevity**

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### **Purpose**

As organisms age, the concentration of histone proteins decreases which exposes the formerly protected DNA to genetic instability, and alterations occur in epigenetic marks that control the chromatin state. A recent study identified 30 previously untested candidate genes in *C. elegans* (a model organism) that could affect longevity. Among those, a gene previously associated with DNA repair and cell reproduction, demethylase *nmad-1* stands out. While recent research has found that other demethylases in *C. elegans* impact aging, N6 methylation regulating genes, such as *nmad-1*, have not been experimentally linked to aging. Knocking down *nmad-1* expression using RNA interference (RNAi) is expected to increase *C. elegans* life span. *Nmad-1* has a close mammalian homolog ALKBH4, so research based on *C. elegans* demethylase could later be used in novel therapeutic approaches to ameliorate age-related health conditions in humans.

### **Methods**

To knock down *nmad-1*, we used RNAi feeding for *C. elegans*. After isolating an exon of the *nmad-1* gene through PCR, we ligated it into an L4440 vector. This vector was then transformed into ht115 *E. coli* with IPTG-inducible T7 polymerase activity. A positive control using an IPTG-inducible GFP marker and a negative control are also used. Using wt worms, we will pick 30 L4 worms onto a new plate and feed them with bacteria expressing dsRNA to inhibit *nmad-1* translation. We will transfer the worms every three days and count how many worms are alive each day.

### **Results**

NA

### **Conclusions**

NA

## **15: Investigation of Changes In Assembly and Function of the Peroxisomal Import Machinery in Human PEX10 Patient Fibroblasts**

Jake Graff<sup>1</sup> Esther Nuebel.<sup>1</sup>

### **Author Affiliations**

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### **Purpose**

Peroxisome disorders in the Zellweger spectrum of diseases are caused by mutations of the peroxin genes, of which Pex1 and Pex6 are the most common. Our purpose is to investigate the phenotype of a Pex10 mutation. Pex10 is part of the import machinery of peroxisomes. It is not known how the mutation of Pex10 interferes with the assembly and function of the import complex. Therefore, we will design peptide antibodies against different peroxins which will allow us to characterize peroxin complexes on peroxisomes and reveal if Pex10 mutations interrupt assembly or otherwise effect the import of peroxins.

### **Methods**

Initially, we will design peptide antibodies against different peroxins. and test the antibodies via Western Blot analysis in both denatured and native conditions. Finally we will utilize Blue native electrophoresis (BNE) followed by Western blotting to characterize the peroxisomal import machinery. We will isolate and confirm complexes via mass spectrometry.

### **Results**

N/A

### **Conclusions**

We expect to improve upon our understanding of how mutations interfere with the assembly of peroxisomal import machinery, particularly in Zellweger patients with milder symptoms.

## 16: Predicting Markers of Severe COVID-19 Through Transcriptomics Analysis

Jeffrey Clancy,<sup>1</sup> Brett Pickett.<sup>1</sup>

### Author Affiliations

<sup>1</sup>Brigham Young University, College of Life Sciences

### Purpose

Defining the human host factors associated with severe vs mild COVID-19 Cases in infected individuals has become of increasing interest. Mining the large number of public gene expression datasets together with the associated clinical metadata describing disease severity can offer important insights into early identification of those who are higher risk of developing severe disease.

### Methods

We consequently analyzed 356 public RNA-seq human transcriptomes from the Gene Expression Omnibus to identify genes that are most associated with severity in patients infected with SARS-CoV-2. We used an existing automated RNA-seq data processing workflow, to measure and quantify gene expression in these patients. This involved using Salmon to map the reads to the reference transcriptomes, using edgeR to calculate significant differential expression levels, and calculating gene ontology enrichment. In addition, we subjected the read mapping data to a Random Forest machine learning analysis to find associations between the expression of individual genes and increased disease severity

### Results

Ultimately, we produced a ranked list of several dozen genes that are consistently associated with a severe COVID-19 response.

### Conclusions

These results establish a groundwork foundation to improve the development of improved RNA and/or protein-based prognostics for severe COVID-19.

## **17: Meta-Analysis of Transcriptomic Datasets for the Investigation of Differential Expression in Hantavirus-Infected Human Tissue**

John Krapohl<sup>1</sup> Brett Pickett.<sup>1</sup>

### **Author Affiliations**

<sup>1</sup>Brigham Young University, College of Life Sciences

### **Purpose**

Orthohantavirus is a genus containing deadly zoonotic viruses that are passed from rodent to human through feces, urine, or bites. Currently, there are no known treatments for the disease, and it remains a threat around the globe. Hantaviruses target human endothelial tissue by binding to integrin beta-3, which is found in high quantities on most human endothelial cells. When a cell is infected, hantaviruses replicate without causing cytopathic effects or apoptosis in their host. Instead, host immune cells are recruited and attack the tissue, causing intercellular junctions to break down. This causes edema in the tissue and the symptoms of hantaviral diseases, including hemorrhagic fever and death. We hope to uncover genetic pathways that are associated with immune recruitment in hantavirus infection in the hopes of finding a target for potential treatments.

### **Methods**

While not extensive, there are many transcriptomic datasets of human infection with hantavirus available through public servers. By processing these datasets together using the data pipeline ARMOR, we can see patterns of infection that are only obvious in a meta-analysis. Most specifically, we can see how differential expression occurs by cell type and sample type (in vivo or in vitro) and see how the immune response is affected. In addition, by performing a pathway enrichment analysis of the differentially expressed genes, we can identify clusters of genes that have been perturbed, as well as targets for drug treatment.

### **Results**

Some emergent patterns can be seen that can be interpreted to be universal among all hantavirus species, as well as differential expression patterns unique to in vivo studies that are not present in vitro studies. These impacted pathways relate to the typical innate immune response to viral infection.

### **Conclusions**

While the pathways indicated in the study are interesting, the differential expression changes between cell and virus type, as well as any potential therapies, still need to be validated in vitro. This study may prove to be useful to those seeking to use existing medications to treat hantavirus infection, but the study needs further supplementation with additional studies as they become available.

## **18: Vitamin C Reduces IGF-1 and VEGF Signaling in Retinal Endothelial Cells**

Jonathon Reynolds<sup>1</sup>; Nasif Islam<sup>1</sup>; Varos Manukyan<sup>1</sup>; Alexander Sheppert<sup>1</sup>; Tyler Alger<sup>1</sup>; Gaofeng Wang<sup>1</sup>; David Sant.<sup>1</sup>

### **Author Affiliations**

<sup>1</sup>Noorda College of Osteopathic Medicine, College of Medicine

### **Purpose**

Glucose acts as a competitive inhibitor for vitamin C to cross the blood retinal barrier. Hyperglycemia reduces vitamin C levels in the eyes. Vitamin C acts as a cofactor for the Ten Eleven Translocation Oxidase (TET) enzymes, which are required for active DNA demethylation. Experiments were performed using primary, human retinal endothelial cells to elucidate the effects of vitamin C deficiency on the breakdown of the blood retinal barrier in diabetic retinopathy.

### **Methods**

Primary human retinal endothelial cells were treated either with or without 50 micromolar vitamin C and RNA was extracted. Whole transcriptome sequencing (RNA-seq) was used to determine transcription changes genome wide. Pathway analysis was performed using EnrichR, GOrilla, and Gene Set Enrichment Analysis (GSEA).

### **Results**

After treatment with vitamin C, 437 genes were found to have upregulated transcription and 308 genes were found to have downregulated transcription. Pathway analysis highlighted changes in several pathways that may elucidate changes that occur in retinal endothelial cells that may contribute to the pathogenesis of diabetic retinopathy, such as Insulin-like growth factor 1 (IGF-1) signaling, which was reduced after treatment with vitamin C. Although the contribution of IGF-1 to diabetic retinopathy has been largely attributed to stimulation of production of vascular endothelial growth factor A (VEGFA) in retinal pigment epithelial cells (RPE), knockout of IGF-1 receptors in retinal vascular endothelial cells was shown to reduce neovascularization in an oxygen-induced retinopathy mouse model. Additionally, VEGFA-VEGFR2 signaling pathways were reduced after treatment with vitamin C. New blood vessels from proliferative diabetic retinopathy have been found to regress after anti-VEGF treatments, and anti-VEGF is similar in efficiency to panretinal photocoagulation.

### **Conclusions**

These data suggest that local vitamin C deficiencies in the eyes of diabetics affect signaling in the retinal endothelial cells which may contribute to the breakdown of the blood-retinal barrier in diabetic retinopathy. Specifically, vitamin C reduces IGF-1 signaling and VEGF signaling in retinal endothelial cells.

## 19: Glutamine as an Acetyl-Lysine Mimic in Nucleosome Positioning Studies

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### Purpose

Nucleosome positioning, or the placement of nucleosomes along DNA, is known to be a significant factor in determining gene expression in eukaryotic cells. Further, post-translational modifications (or PTMs) help modulate gene expression by acting as an intermediate to other factors. The extent to which PTMs directly affect nucleosome positioning is poorly understood, however. Since gene expression is known to be affected by several coincident PTMs on each histone, the goal of this research is to evaluate the suitability of a Lys→Gln mutation as a substitute for histone lysine acetylation. If successful, this research can be used to support future combinatorial studies on PTMs and nucleosome positioning without the difficulty of combining several forms of PTMs simultaneously.

### Methods

Our procedure will have three main parts: (1) obtaining protein expression plasmids with the proper H3 lysine→glutamine and acetyl-lysine mutations, (2) transforming E. coli BL21 bacteria to express the Wild type H3 (H3WT) proteins and both the mutants, and (3) isolating each of the three desired proteins from the bacteria and performing the comparative nucleosome positioning test. We'll perform a Site-Directed Mutagenesis PCR mutation protocol on the H3WT plasmid to replace the codons for five target lysine residues with either amber stop codons (UAG) or glutamine codons (AUC). After transforming DH5α E. Coli to obtain enough copies of the newly mutated plasmids, we will transform E. Coli BL21, a protein-expressing strain, with both mutant plasmids as well as the H3WT. After testing proper protein production from our bacterial colonies, we will isolate the three desired variants of the H3 protein using column chromatography and prepare for the comparative positioning test. In each of our three trials, we will assemble histone protein complexes (each with the corresponding H3 variant) and put them in solution with naked DNA, allow nucleosomes to form, then perform MNase digestion, isolation of the nucleosome core, and high-throughput sequencing on each sample. This will provide us with the nucleosome positions for each sample, which will allow us to quantify the differences between samples and calculate the significance of those differences.

### Results

NA

### Conclusions

NA

## **20: Periodontitis and Increased Cognitive Decline in Alzheimer's Disease**

Nomikos Klonaris;<sup>1</sup> Claudia Freitas;<sup>2</sup> Josue Gonzalez.<sup>3</sup>

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<sup>3</sup>Brigham Young University, College of Life Sciences.

### **Purpose**

Periodontal disease (PD), a chronic inflammatory disease of the gums is characterized by periodontal pocket formation and bone resorption. Periodontitis has been also associated with the onset of Alzheimer's disease (AD), which is the leading cause of neurocognitive disorder. AD affects more than 6 million Americans of all ages according to the Alzheimer's disease association. As both of these diseases are characterized by inflammation, the purpose of this work is to evaluate current literature showing the association between PD and AD. More specifically, how periodontitis systemic inflammation may onset AD.

### **Methods**

First, we searched PubMed, MEDLINE, Scopus, Web of Science, and Google search evaluating the most recent peer-review literature on periodontitis, inflammation, and AD. Second, we propose a possible feedback loop inflammatory signal in PD affecting AD development. PD can onset AD development through increasing Beta Amyloid concentrations, increasing kinase activity involved in the hyperphosphorylation of the tau protein, and lower concentrations of Brain-Derived Neurotrophic Factor, a neuroprotective protein against neurodegeneration.

### **Results**

In progress. However, the main goal of our work is to recollect the most significant reported work linking PD and AD which will serve as a foundation of future studies investigating new avenues of treatment in periodontitis patients with a high risk to develop AD.

### **Conclusions**

In progress

## 21: Blocking CTLA-4 for T Cell Activation

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### Author Affiliations

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### Purpose

Compared to antibodies, small compounds have the advantage of targeting intracellular CTLA-4, which comprises about ninety percent of total CTLA-4. Therefore, targeting CTLA-4 with small compounds may be an effective strategy to directly bind both surface and intracellular CTLA-4, whereas antibodies can only target CTLA-4 displayed on cellular membrane. The purpose of this study was to investigate if small compounds can directly bind CTLA-4 and promote T cell activation. We also wanted to elucidate the mechanism of action of these compounds.

### Methods

To test the small compound strategy, 10 million compounds were screened for primary hits targeting CTLA-4 by Atomwise Incorporation using deep learning. We inoculated MC38 colorectal cancer cells in mice that were treated with a small compound (lead compound) and extracted the tumors. We isolated the tumor-infiltrating lymphocytes (TILs) and measured IFN- $\gamma$  levels released by the TILs. We co-cultured extracted TILs from compound treatment or the vehicle control (PBS) with MC38 cells with ipilimumab as a positive control. We ran flow cytometry on Tregs from the mouse tumors. We also did lysotracker staining on 293T cells to visualize endocytosis of CTLA-4 and localization to lysosomes. Also, we did a western blot for CTLA-4 from Jurkat cell lysate after incubation with either the lead compound or ipilimumab.

### Results

The results showed that ipilimumab-treated TILs from compound-treated mice release increased levels of IFN- $\gamma$  when co-cultured with MC38 cells compared to the only ipilimumab-treated TILs derived from PBS mice (control). Flow cytometry revealed that CD4 was downregulated in Tregs from mouse tumors that were treated with CTLA-4 blocking compound. The Jurkat western blot showed decreased levels of CTLA-4 when cells were treated with ipilimumab compared to the small compound treatment.

### Conclusions

The results showed that ipilimumab-treated TILs from compound-treated mice release increased levels of IFN- $\gamma$  when co-cultured with MC38 cells compared to the only ipilimumab-treated TILs derived from PBS mice (control). Flow cytometry revealed that CD4 was downregulated in Tregs from mouse tumors that were treated with CTLA-4 blocking compound. The Jurkat western blot showed decreased levels of CTLA-4 when cells were treated with ipilimumab compared to the small compound treatment.



## **22: Interactions of Potential Addiction Pharmacotherapies and Substances of Abuse with the KCC2 Channel**

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### **Author Affiliations**

<sup>1</sup>Noorda College of Osteopathic, Biomedical Sciences

### **Purpose**

As addiction has become more prevalent in the United States, with Utah being one of the leading states in opioid addiction, better treatments for substance use disorders (SUDs) are needed. For example, improved means of decreasing the symptoms of withdrawal from chronic alcohol exposure could be invaluable. The potassium chloride cotransporter 2 (KCC2) has previously been shown to be implicated in SUDs related to alcohol, nicotine, and cocaine. Activating KCC2 has been shown to normalize stress-induced alcohol consumption in rats. Furthermore, we hypothesize that the downregulation of KCC2 mediates some of the symptoms of alcohol withdrawal. In spite of the clinical potential of this protein, there is no direct agonist of KCC2, and there are problems with the indirect agonists that exist. The present work focuses on the modeling of KCC2 to identify potential direct binding sites as well as modeling of other proteins to identify improved indirect agonists. The development of a direct agonist for KCC2 could lead to improved addiction treatment with few side effects.

### **Methods**

Utilizing Autodoc in Linux and a previously established crystal structure, the KCC2 channel will be modeled. Substances of abuse such as alcohol and potential pharmacotherapies will also be modeled in Autodoc. Using software such as GROMACS, these substances will be auditioned against the protein to reveal potential interactions. By analyzing where the molecules accumulate, interact and bind we will identify potential pharmacological binding sites. Agents that exhibit high affinity for the protein can then be assayed for physiological activation or deactivation of the protein in a future study.

### **Results**

NA

### **Conclusions**

NA

## **23: RNA Broccoli Aptamer to Track Transcription Rates In Vitro**

Sarah Hodson;<sup>1</sup> David Bates;<sup>1</sup> Steven Johnson.<sup>1</sup>

### **Author Affiliations**

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### **Purpose**

Regulation of gene expression is essential to understanding cellular structure and function. We seek to study the effects of histone post-translational modifications (PTM's) on transcription rate using an engineered DNA sequence containing *C. elegans* promoter elements and nucleosome positioning DNA sequences followed by an RNA aptamer sequence that will fluoresce upon full transcription. DNA in eukaryotic nuclei is organized into nucleosomes, each composed of an eight-histone protein core wrapped ~1.7 times by approximately 147 base pairs of DNA. PTM's to histone tails are known to regulate nucleosome structure and by extension gene expression; however, the residual effect of PTM's on transcription rate is poorly understood.

### **Methods**

Our approach will allow us to detect the transcription rate of reconstituted chromatin in vitro, comparing histones with PTM's to those without. Using the Broccoli aptamer, a derivative of the well-known Spinach aptamer, will allow for detection of transcription rates in common qPCR instruments. These methods can further be used to discern if multiple PTM's on a single histone are synergistic or nullify each other, as well as measuring the role of histone variants on transcription rate, ultimately allowing for more precise manipulation of transcriptional output.

### **Results**

NA

### **Conclusions**

NA

## **24: Meta-analysis of Two RNAseq Datasets to Determine Diagnostic Biomarkers and Drug target Candidates for Periodontitis**

Carlos Moreno<sup>1</sup>; K. Scott Weber<sup>1</sup>; Brett E. Pickett<sup>1</sup>; Elizabeth Bybee<sup>1</sup>; Claudia M. Tellez Freitas.<sup>2</sup>

### **Author Affiliations**

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### **Purpose**

Periodontitis is a chronic inflammatory oral disease that affects approximately 47% of adults aged 30 or older in the United States. It is a more severe form of gingivitis that is characterized by recession of gums, alveolar bone loss, destruction of periodontal ligaments, and tooth decay in addition to swollen and bleeding gums. Periodontitis is caused by microbial dysbiosis within the periodontal pockets surrounding teeth, typically a result of improper oral hygiene. Interactions between pathogenic bacteria (primarily including gram-negative *Porphyromonas gingivalis*, *Tannerella forsythia* and *Treponema denticola* and the host immune system creates an inflammatory environment which leads to the observed pathology. If left untreated, the continued destruction of periodontal ligaments and alveolar bone may result in reduced tooth support and eventually tooth loss. Although prevention of this disease is possible through proper oral hygiene practices, such as brushing and flossing teeth daily, periodontal disease is still considered to be an important public health problem in the United States. In this study we sought to identify drugs which may be repurposed to treat inflammation in periodontitis.

### **Methods**

A meta-analysis was performed with two RNAseq data sets retrieved from NCBI Gene Omnibus. RNAseq analysis, signaling pathway impact analysis, protein-protein interaction analysis, and drug target analysis were performed as part of this study to determine the mechanistic drivers of inflammation in periodontitis.

### **Results**

We identified 78 differentially expressed genes in periodontitis gingival samples. 10 signaling pathways were identified as significantly impacted in periodontitis. Protein-protein interaction analysis identified 10 hub genes, and the top 20 drugs from our drug target analysis are provided.

### **Conclusions**

Herein, we provide insight into the mechanistic drivers of inflammation in gingival tissues during periodontitis and drugs that may be repurposed into treating periodontitis.

## 25: Identification of Inhibitors of GSK-3 Beta from Natural Products

Vincent Anella,<sup>1</sup> Tyler Rose.<sup>1</sup>

### Author Affiliations

<sup>1</sup>Roseman University, College of Pharmacy

### Purpose

Currently, there are only a small number of drugs available to treat Alzheimer's disease. However, these drugs do not cure, reverse, or stop the disease from progressing. They all work by a similar mechanism of action by inhibiting acetylcholinesterase to boost the amount of acetylcholine in the system. This only moderately helps maintain the function of the neurons but does not stop neuronal death. In theory, inhibition of the enzyme GSK-3 will stop the neurotoxic tangles that are causing the cholinergic neuron death. This should help to slow or even stop the progression of the disease. The project will help identify herbal compounds that could possibly be used in the prevention or treatment of Alzheimer's disease

### Methods

An x-ray crystal structure of human GSK3 protein will be downloaded from the RCSB Protein Data Bank ([https:// www.rcsb.org/](https://www.rcsb.org/)) and used in a computer-based screen of chemical structures derived from plant sources. Herbs will be identified that contain compounds that bind the GSK3 active site in the computer model. Identified herbs will be purchased and extracted in hot solvents of various polarities, including water, alcohol, ethyl acetate, and/or heptane. Extract solutions will be filtered to remove particulate matter. Extracts will be tested for their ability to inhibit human, recombinant GSK3 enzyme purchased from BPS Bioscience. GSK3 kinase activity will be monitored using Kinase-Glo<sup>®</sup> reagent from Promega. This reagent works by producing luminescence in response to the amount of ATP in the assay solution. Less ATP produces less luminescence and more ATP produces more luminescence. Any inhibition should result in little to no ATP use by the enzyme, resulting in higher luminescence in the assay. Control inhibitors SB216763 and lithium chloride will also be purchased and used in the assay.

### Results

Results show that inhibition is primarily done by flavonoid molecules. Molecules such as Quercetin Hydrate, Eriodictyol, Naringenin, and S-Pinocembrin all inhibited GSK-3B at rates of 82.7%, 55.7%, 32.5%, and 48.8%. It is thought that the alcohol groups at the 3 and 7 position increase the amount of inhibition of each molecule greatly.

### Conclusions

Natural products do contain molecules that can possibly inhibit GSK-3B which leads to Alzheimer's disease. Flavonoids identified that express inhibition are found in honey, lemons, damiana, fingerroot, propolis, yerba santa, and rose hips. Further testing would need to be done to determine if in vitro results carried over too in vivo.

## **26: Activating VTA GABA Neurons Through Chemogenetic Stimulation of Connexin-36-targeted DREADDS**

Hyrum Wright;<sup>1</sup> Andrew Payne;<sup>1</sup> Stephanie Pistorius;<sup>1</sup> Stephanie Williams;<sup>1</sup> Scott Steffensen.<sup>2</sup>

### **Author Affiliations**

<sup>1</sup>The Noorda College of Osteopathic Medicine, College of Medicine; <sup>2</sup>Brigham Young University, Department of Psychology and Center for Neuroscience

### **Purpose**

The mesolimbic dopamine (DA) system, which is implicated in regulating reward and addiction, consists of DA neurons in the ventral tegmental area (VTA) that innervate the nucleus accumbens (NAc). It is believed that VTA DA neurons are inhibited by local gamma-aminobutyric acid (GABA) interneurons that express connexin-36 (Cx36) gap junctions (GJs). The aim of this study is to further investigate the role of VTA GABA neurons expressing Cx36 GJs in regulating DA neuron activity and release and mediating ethanol effects on VTA GABA neurons. To this end, we customized a Designer Receptor Exclusively Activated by Designer Drugs (DREADDs) viral vector to target VTA GABA neurons expressing Cx36 GJs in order to chemogenetically modulate their activity.

### **Methods**

For fluorescence studies, mice were briefly anesthetized with isoflurane and injected with an adeno-associated virus (AAV) into the VTA. Following a 21-day incubation, brains were sliced and recorded using microscopy. The calcium-sensitive fluorophore GCaMP6 was used as an indirect indicator of neuronal activation. Chemogenetic activation of Cx36-expressing VTA neurons was achieved in mice and rats using an AAV encoded to produce Designer Receptors Exclusively Activated by Designer Drugs (DREADDs) in Cx36-positive neurons. These receptors were activated using clozapine N oxide (CNO). Patch-clamp electrophysiology and single unit electrophysiology were also used to directly measure the firing patterns of individual neurons.

### **Results**

When perfused with CNO, VTA GABA neurons increased in firing rate, measured both in ex vivo and in vivo preparations. VTA DA neurons showed less of an effect when activated by CNO. Preliminary fluorescence studies in the VTA have shown that CNO increases both the number of neurons that are transiently active as well as calcium transients in neurons that are already transiently active.

### **Conclusions**

While much work remains to be done, initial results suggest that VTA GABA neurons express Cx36 and that Cx36 activation increases the activity of that neuronal population. Future work will investigate the impact of EtOH on Cx36 activity using GCaMP6 calcium fluorescence imaging.

# **Clinical Abstracts**

## **27: Appropriate Use of Bone Protective Agents in Hormone-Sensitive Prostate Cancer**

Danielle Gundrum;<sup>1</sup> David Gill;<sup>2</sup> Allison Snoke;<sup>2</sup> Kelsey Brown.<sup>2</sup>

### **Author Affiliations**

<sup>1</sup>Roseman University, College of Pharmacy; <sup>2</sup>Intermountain Healthcare, Intermountain Medical Oncology

### **Purpose**

Bone protective agents (BPAs) have an established role in the treatment of metastatic castration resistant prostate cancer (mCRPC). Zoledronic acid and denosumab have been shown to have similarly improve progression free survival (PFS), overall survival (OS), and rates of skeletal related adverse events (SREs) in men with prostate cancer (Fizazi 2011). However, this benefit is limited to men with mCRPC as both the CALGB 9020/Alliance and STAMPEDE trials report no benefit in SREs or OS in men with metastatic hormone sensitive prostate cancer (mHSPC). Men with mHSPC and concomitant osteopenia or osteoporosis can receive BPA at a reduced dosing interval, zoledronic acid 5 mg every 12 months or denosumab 60 mg every 6 months. During COVID-19, infusion capacity has been limited to reduce viral transmission and because of the emergence of monoclonal antibodies. The Oncology Pharmacy and Therapeutics (P&T) committee sought to identify the rate of inappropriate BPA use in mHSPC and quantify its effects in terms of unnecessary infusion visits and added cost.

### **Methods**

At our large, community-based institution, pharmacists reviewed the treatment indication for every patient receiving zoledronic acid or denosumab over a 1-year period. For men with mHSPC and osteopenia/osteoporosis, zoledronic acid 5 mg every 12 months or denosumab 60 mg every 6 months was considered appropriate. Zoledronic acid 4 mg every 12 weeks was considered appropriate in men with mCRPC or hypercalcemia. Medication costs were calculated using institutional data. Infusion visits were calculated based on the drug administration schedule.

### **Results**

From September 2020 to September 2021, there were 5 patients receiving zoledronic acid 4 mg every 12 weeks and 18 patients receiving denosumab 120 mg every 4 weeks for mHSPC. Of the patients receiving zoledronic acid, 4 met indication for treatment at 5 mg every 12-month dosing and 1 did not need a BPA. Regarding denosumab, 8 patients could be transitioned to annual zoledronic acid and 10 did not meet an indication for BPA. In total, there is an estimated reduction from 254 to 12 infusion visits associated with an estimated cost savings of over \$165,000.

### **Conclusions**

Twenty-three men at our single healthcare institution are receiving off-guideline BPAs. Implementation of pharmacist oversight is associated with a reduction of 242 infusion visits and a significant cost savings.

## **28: Comparing the Efficacy of Sodium Fluoride and Silver Diamine Fluoride in Arresting Caries through Statistical Analysis.**

Elana Ferris<sup>1</sup>

### **Author Affiliations**

<sup>1</sup>Roseman University, College of Graduate Studies

### **Purpose**

Dental caries is a common disease in children; therefore, it is important to determine effective treatment approaches that are manageable for pediatric patients.

### **Methods**

Two individual randomized controlled trials were studied and statistically analyzed. The total number of recruited patients was 746 with a mean age of 3.7 years. In the first randomized controlled trial (RCT), researchers focused on carious lesions of upper anterior primary teeth only. This study compared three treatments: placebo (water), 5% NaF, and 38% SDF. While the other RCT included both posterior and anterior primary teeth. 30% SDF and 5% NaF were used in this study. Both RTCs operated under blinding protocols. Each utilized the DMFS protocol when recording outcomes by tactile examination. Lesions were classified as either active caries or arrested caries. Variability such as frequency of brushing, use of fluoride toothpaste, and demographic background was accounted for in the statistical analysis.

### **Results**

The second RCT reported the caries arrest rate of Group 1 (annual SDF application) to be significantly higher than Group 2 (3 weekly SDF applications) and Group 3 (3 weekly NaF applications) ( $p < 0.001$ ). The first RCT found that SDF was statistically significant over NaF and water in its caries arrest rate (ANOVA,  $p < 0.001$ ). Prior excavation of soft carious tissue did not induce a significant difference in the caries arrest rate (CI 95%). A follow-up study at 30 months found similar results in that SDF groups arrest caries at a higher rate than all other groups (NaF and water) (ANCOVA,  $p < 0.001$ ). A secondary statistical analysis found that SDF application had a shorter arrest time than NaF. In addition, prior soft carious tissue removal with the application of SDF or NaF also resulted in a shorter arrest time than with no prior excavation.

### **Conclusions**

SDF is more effective than NaF in arresting dentine caries and, therefore, has many implications for the treatment of pediatric patients in dentistry. Additional clinical research must be conducted to further verify these findings.



## 29: Nutrition Evaluations in Patients with Zellweger Spectrum Disorder

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### Author Affiliations

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### Purpose

The objective of this study was to analyze macro and micronutrient intake in patients with Zellweger Spectrum Disorder (ZSD), as reported by their family or caregivers. ZSD is a rare, metabolic disease characterized by defects in the PEX genes, resulting in impairment of peroxisome biogenesis, acute physical and mental disabilities, and progressive deterioration in health. Previous studies have suggested a potential role of nutrition in ZSD, but to date, there have been no nutritional assessments conducted in this population.

### Methods

Dietary intake of patients diagnosed with ZSD was collected from family or caregivers 3 times over a 7 month period, in addition to information on age, sex, height, weight, physical activity level, and feeding modality (oral feeding or tube feeding) for the patient. During each timepoint, dietary intake was collected from each participant using 2 approaches: 24-hour dietary recall and 3-day food record. Nutrient analyses were generated from dietary intake using NDSR software (2021 edition, Minneapolis, MN). Each participant reported data for three-time points for each method: six data entries total. Nutrient intake across data collection methods were compared using Pearson's correlation coefficient. Nutrient intake across feeding modalities were compared using an independent samples t-test. Significance was assigned at  $p < 0.05$ .

### Results

This study consisted of eleven family caregivers (parents), each representing one patient with ZSD ( $n=11$ ). The dietary recall data and food record data were highly correlated ( $r^2 = 0.983$ ,  $p < 0.0001$ ), indicating that both methods result in highly interpretable data. The data allows to distinguish between oral versus tube fed patients and allows us to make nutrition recommendations.

### Conclusions

This study serves to support the claim that nutrition evaluations can be performed in the rare disease community without the need to exclude tube fed patients. Additionally, this study shows that it is possible to characterize the differences between tube fed and orally fed patients. This data enables us to make nutrition recommendations in the Peroxisomal Biogenesis Disorder Community for the first time.

### **30: Evaluation of Rituximab Infusion Rates at an Outpatient Infusion Clinic**

Kimberly Wilson,<sup>1</sup> Alvin Tran.<sup>1</sup>

#### **Author Affiliations**

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#### **Purpose**

Rituximab is a monoclonal antibody that targets the CD20 antigen present on the surface of B-lymphocytes and activates complement-dependent cytotoxicity. Rituximab products have a high rate of infusion-related reactions and typically require longer infusion times. We evaluated rituximab infusions administered at an Intermountain Healthcare outpatient clinic to determine if any doses could have been administered over 90 minutes per manufacturer recommendations. An overall goal of rapid infusion rate would be to reduce clinic chair time.

#### **Methods**

This was a retrospective chart review that evaluated all rituximab doses administered at an Intermountain Health Care outpatient clinic for follicular lymphoma or diffuse large B-cell lymphoma during April 2021. Data collection included indication, infusion rate duration, concomitant steroid administration (yes or no), elevated absolute leucocyte count (yes or no), documentation of previous infusion reaction (yes or no), documentation of major cardiovascular disease (yes or no), whether rituximab dose qualified for rapid infusion rate (yes or no). No patient identifiers were collected. Information was de-identified and stored on a password-protected file. The project was a process improvement project in nature and institutional review board approval was not deemed necessary.

#### **Results**

The sample included 35 rituximab doses administered during April of 2021. Twenty-three of the 35 (66%) doses administered at the standard infusion rate met the criteria for the rapid (90-minute) infusion rate. All 4 rituximab doses (100%) administered at the rapid infusion rate did not result in infusion reactions. Additionally, two rituximab doses were infused at the rapid infusion rate but did not meet rapid infusion criteria due to lack of steroid co-administration or documentation of major cardiovascular disease.

#### **Conclusions**

Physicians should be encouraged to prescribe 90-minute rituximab infusions if the criteria for rapid infusion are met. With standard infusion rates lasting 3-4 hours, 90-minute infusion rates will provide time-saving benefits for patients, healthcare workers, and healthcare facilities alike. Although not assessed in this project, future investigations could evaluate the potential cost-savings of shorter infusion times.

### **31: Effectiveness of the Matrix Model in Treating Substance Use Disorders as a Function of the Substances Abused**

Odette Homsj<sup>1</sup>; Seema Arshed<sup>1</sup>; Andrew Payne.<sup>1</sup>

#### **Author Affiliations**

<sup>1</sup>Noorda College of Osteopathic Medicine, Biomedical Sciences

#### **Purpose**

Drug overdoses are the number one cause of injury-related deaths in the United States. Additionally, substance use disorders (SUDs) are notoriously difficult to treat, making them a problem of critical importance. In spite of the difficulty in treating SUDs, advances have been made. Previous research has shown that the Matrix Model can improve treatment outcomes in patients who abuse stimulants and other drugs of abuse. However, additional work is needed to determine the optimal combination of treatment modalities within the Matrix Model. The objective of this prospective study is to analyze the effectiveness of the Matrix Model on patients with SUDs as a function of the substance(s) abused. We hypothesize that the Matrix Model will prove equally effective for patients who abuse different substances. This study will bring awareness to health organizations and clinicians caring for individuals with SUDs about developing better strategies in prevention and management of SUDs.

#### **Methods**

Data will be collected from various addiction facilities, including some that implement a form of the Matrix Model. The effectiveness of these treatments will then be analyzed as a function of the substance(s) abused, the specific treatment modalities implemented, socioeconomic status, and a number of other variables. We will also compare the differences in treatment outcomes between facilities who use the Matrix Model and those who don't, specifically as a function of these same variables to determine if the Matrix Model is more effective in treating patients who abuse specific substances.

#### **Results**

NA

#### **Conclusions**

NA

## **32: Evaluation of Hepatitis B Screening for Patients Receiving Systemic Anticancer Therapy**

Paul To;<sup>1</sup> Melanie Wilber;<sup>1</sup> Danielle Gundrum;<sup>1</sup> Kelsey Brown;<sup>1</sup> Allison Snoke;<sup>1</sup> Alexandra Eberlin.<sup>1</sup>

### **Author Affiliations**

1Roseman University, College of Pharmacy

### **Purpose**

In July 2020, the American Society of Clinical Oncology (ASCO) expanded their recommendation for hepatitis B screening to screen all patients receiving systemic anticancer treatment excluding hormonal monotherapy. Previously, only patients receiving anti-CD20 monoclonal antibodies, stem-cell transplantation, or those who had a high risk of hepatitis b virus (HBV) reactivation was recommended for screening. This project was designed to determine whether our hepatitis B screening practices at Intermountain Medical Center (IMC) follow current guidelines. Hepatitis B screening can help to prevent HBV reactivation which can lead to complicated events such as increased hepatotoxicity, liver failure, and death in oncology patients who treated with chemotherapy

### **Methods**

The institutional board review approved this retrospective chart review looking from June 1, 2021, to June 30, 2021. Only patients who were receiving systemic anticancer regimens at IMC and had started their first treatment after July 2020 were eligible to be included in this project. Patients who were receiving hormonal therapy, localized treatments and had started their treatment before July 2020 were excluded from this project. Data collection included indication, regimen, provider, first treatment date, 3 lab results (HBsAg, anti-HBc, anti-Sag), prophylaxis for chronic HBV and medications if prescribed, and whether HBV guideline was followed or not. After collecting all the information, data was de-identified and will not include any patient specific information to mitigate the risk associated with confidentiality

### **Results**

A total of 176 chemotherapy treatments were recorded. Twenty-five patients out of 176 were screened for hepatitis B before starting their first chemotherapy treatments and 3 patients out of 176 were screened after starting their first chemotherapy treatments. Patient with hepatocellular adenocarcinoma, follicular lymphoma, Hodgkin's lymphoma, and non-Hodgkin lymphoma (Rituxan-containing regimen) were the most frequently screened for hepatitis B before starting chemotherapy

### **Conclusions**

Only 14.2% of the patients who received systemic anticancer treatment at IMC were screened for hepatitis B before starting on their first treatment. Providing education to oncology physicians about hepatitis B reactivation or implementing hepatitis B screening into patient's treatment plan would be a future consideration for the IMC infusion clinic. A new protocol would be necessary for the IMC infusion clinic to screen all patients to avoid any complications which can lead to increased liver failure and mortality.

### **33: Successfully Reducing Severe Asthma Exacerbations and Improving Asthma Control in a Pragmatic Study of African American/Black (AA/B) and Hispanic/Latinx (H/L) Adults with Moderate-Severe Asthma (PREPARE)**

Alex Colon;<sup>1</sup> Eliot Israel;<sup>2</sup> Juan Carlos Cardet;<sup>3</sup> Jennifer Carroll;<sup>4</sup> Wilson Pase;<sup>4</sup> Anne Fuhlbrigge;<sup>4</sup> Lilin She;<sup>5</sup> Nancy Maher;<sup>2</sup> Barbara Yawn;<sup>6</sup> Paulina Arias;<sup>2</sup> Jacqueline Rodriguez.<sup>2</sup>

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#### **Purpose**

Efforts to reduce the disproportionate asthma morbidity in AA/B and H/L patients have been mostly unsuccessful. In a pragmatic, randomized study, we tested a Patient-Activated Reliever-Triggered Inhaled Corticosteroid (ICS) Strategy (PARTICS) in 1201 AA/B and H/L patients with moderate-to-severe asthma.

#### **Methods**

PREPARE compared the addition of PARTICS [concomitant use of study-provided ICS (beclomethasone dipropionate 80 mcg) with reliever] to usual care (UC) (PARTICS+UC) with UC in 603 AA/B and 598 H/L adults (18–75 yo) who had an Asthma Control Test (ACT) <20 or an exacerbation in the past year (NCT02995733). UC continued at physician discretion. The primary endpoint was verified severe asthma exacerbations. Patients had one instructional visit followed by 15 monthly questionnaires

#### **Results**

PARTICS+UC reduced severe asthma exacerbations by 15.4% ( $p=0.048$ ) which corresponded to a reduction of 13 exacerbations/100 patient-years. PARTICS+UC improved the ACT by 3.37 vs. 2.53 points from baseline ( $p<0.0001$ ). ACT improved by 3 points from baseline during 11.8% more study months for patients assigned to PARTICS+UC versus UC ( $p=0.006$ ). Asthma Symptom Utility Index (ASUI) scores improved by 0.12 versus 0.08 points ( $p<0.0001$ ). Annualized rate of days missed of work/school/usual activities was reduced by 3.33 days/year ( $p=0.013$ ). The total additional ICS use in PARTICS+UC was 1.3 refills/year.

#### **Conclusions**

Patient-centered, one-time instruction in PARTICS, resulting in minimal additional ICS use, substantially reduces asthma exacerbations and improves asthma control and quality of life in AA/B and H/L adults with poorly controlled asthma.

### **34: Appearance of Reactive Hypoglycemia in Otherwise Healthy Patients with Treatment-Resistant Migraine**

Wyatt Magoffin,<sup>1</sup> Caleb McKee;<sup>1</sup> Aparna Naik;<sup>1</sup> Lena DiPrizito;<sup>1</sup> Paulo Kelly;<sup>1</sup> David Sant;<sup>1</sup> John Kriak;<sup>1</sup> Kyle Bills.<sup>1</sup>

#### **Author Affiliations**

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#### **Purpose**

Migraine is the most common neurological disorder in the world. It is a multisystemic, multicausal condition characterized by increased neuronal activity in various brain regions including the hypothalamus and trigeminal nerve complex. Reactive hypoglycemia has not been previously characterized as a diagnostically or therapeutically relevant ancillary to chronic migraine. Previous reports have indicated an association between migraine and reduced insulin sensitivity leading to increased average blood glucose levels. Among the possible explanations, are the connections between the ventromedial nucleus of the hypothalamus, migraines, and glucose regulation. This case series presents four chronic migraine patients with co-occurring reactive hypoglycemia

#### **Methods**

We extensively evaluated four patients with severe, chronic migraine patient poorly responsive to traditional medication therapy. Each of the patients received a complete blood count with differential, hemoglobin A1C (with estimate average glucose), oral glucose tolerance test (GTT), comprehensive metabolic panel, calculated glomerular filtration rate, a flexion extension cervical spine X-ray series head tilted backwards, forwards, and upright. Patients also received a psychological performance summary evaluating types of memory as well as mental processing, reasoning, planning and attention.

#### **Results**

Four otherwise healthy patients with chronic migraine were included in the analysis. Although some unrelated laboratory abnormalities were seen in individual patients, the only abnormal result consistent in all four patient's was reactive hypoglycemia following the fasting administration of 100 grams of glucose (GTT). The average glucose blood levels were as follows: post fasting baseline (82 mg/dL +/- 12 mg/dL), 1-hour post glucose ingestion (110 mg/dL +/- 14 mg/dL), 2-hour post glucose ingestion (80.25 mg/dL +/- 14 mg/dL), and 3-hour post glucose ingestion (53 mg/dL +/- 6 mg/dL). The flagged reference glucose range was 65-139 mg/dL.

#### **Conclusions**

The mechanistic pathophysiological causes of altered glucose regulation in migraine are poorly understood. There could be various aspects of the glucose profile that should be taken into consideration by the clinician until greater understanding of the extent to which this issue contributes to migraine is further elucidated.

# Others Abstracts

## **35: Potential Cost Savings with Implementation of Systemwide Rasburicase Protocol**

Parker Gundersen;<sup>1</sup> Adalyn Lee;<sup>1</sup> Danielle Gundrum;<sup>1</sup> Allison Stoke;<sup>1</sup> Kelsey Brown.<sup>2</sup>

### **Author Affiliations**

<sup>1</sup>Roseman University, College of Pharmacy, <sup>2</sup>Intermountain Healthcare

### **Purpose**

Tumor Lysis Syndrome is a condition that takes place when apoptosis in cancer cells occurs within a short time period. This condition can lead to organ dysfunction and even death. Rasburicase is used to treat high uric acid levels in patients that are experiencing tumor lysis syndrome and is expensive. Dosing and frequency of rasburicase varies across health care institutions. This project evaluated if adherence to a systemwide rasburicase protocol could help reduce drug waste and reduce costs across a healthcare system.

### **Methods**

We conducted a retrospective data analysis reviewing rasburicase doses administered across Intermountain Healthcare over the course of one year. A report was generated that collected all rasburicase doses administered between July 1, 2020 to June 30, 2021 and related uric acid lab draw times and respective results. Analysis of this data report included rasburicase dose administered, rasburicase dose recommended per protocol based upon uric acid level, and if uric acid lab draws were drawn at appropriate intervals. No patient identifiers were collected. The protocol that was utilized to evaluate the data set recommended 3mg of rasburicase for patients experiencing hyperuricemia, which was defined as uric acid above 8mg/dL, or 6mg of rasburicase as an initial dose if baseline uric acid was > 14mg/dL. The recommended time for lab draw was 6 hours after rasburicase administration, followed by repeat doses if uric acid levels were higher than 8mg/dL. The rasburicase dose difference in milligrams was reported out, and the average wholesale price was applied to determine cost difference. Additionally, the number of inappropriate lab draws was totaled. Data was stored on a de-identified document in a password protected file. This project was process improvement in nature therefore the institutional review board approval was not deemed necessary.

### **Results**

A total of ninety-nine rasburicase doses were evaluated. Seventy-five doses (75.6% of doses) were administered off protocol, resulting in 210 mg of additional rasburicase dispensed. This equated to an additional \$160,947 of extra hospital drug-related costs. A total of ninety-nine uric acid lab results were reviewed after the initial rasburicase dose. Of those, thirty-five (35%) were drawn inappropriately, or too soon.

### **Conclusions**

The results determined that in one year, the healthcare system could have saved an average of \$160,947. Additionally, uric acid lab monitoring could be standardized. Future direction includes physician education and implementation of a system-wide rasburicase protocol and evaluation of cost savings related to rasburicase dosing and lab monitoring.



### **36: Hospitalized Patients Use of Inhalers: Assessment of Wasted Doses**

Samaya Cristina;<sup>1</sup> Savannah Flores.<sup>2</sup>

#### **Author Affiliations**

<sup>1</sup>Intermountain Healthcare, College of Pharmacy

#### **Purpose**

The purpose was to investigate the amount of waste from returned metered-dose inhalers (MDI) and dry-powder inhalers (DPI) that accumulated at Utah Valley Intermountain Hospital (UVH) during a five-month period to evaluate the monthly and yearly wastage costs.

#### **Methods**

This is a retrospective chart review that estimated hospital costs from MDI and DPI wasted doses. Data was collected from a secure hospital database by study investigators. Approximately 200 inhalers were included in this study. These inhalers were collected from February 2021 to July 2021. Inhalers were marked as wasted if they were used or opened, and not used. All the included inhalers were returned to the inpatient pharmacy. Data collected from each inhaler included the patient's financial identification number (FIN), national drug code (NDC), drug name, counter number, and order directions. Additional data that was collected included patient characteristics, reasons for stay, and home medications. Data from returned inhalers was excluded if the patient was a vulnerable subject, which includes pregnant and pediatric patients. Cost of wasted doses were estimated from the patient's medication administration record (MAR) for order price and order cost.

#### **Results**

A total of 146 inhalers were included in the cost analysis. The number of inhaled doses estimated to be dispensed was 20,670. The number of doses estimated to be inhaled was 371. The number of doses estimated to have been wasted was 20,299. The total estimated cost for UVH was \$3,140.97 monthly, \$15,704.84 during the five-month period, and \$37,961.62 yearly.

#### **Conclusions**

In conclusion, the cost of wasted doses from inhalers were about 55 times (approximately 20,299 doses wasted compared to 371 doses used) the number of doses administered to patients; estimated to be over \$3,000 per month in wasted inhaler cost. We suggest that UVH consider resolving this issue of wasted inhaler products, by including a unit dose institutional nebulizer to the protocol as a first line medication choice. Further cost analysis studies would have to be conducted to consider the suggested adjustment to the protocol.

### **37: Utilization Of Medi-Cal Dental Benefits**

Beatrice Bautista,<sup>1</sup> Jungweon Park;<sup>1</sup> Amir Mohajeri;<sup>1</sup> Jody Chiang;<sup>1</sup> Frank Licari;<sup>1</sup> Man Hung.<sup>1</sup>

#### **Author Affiliations**

<sup>1</sup>Roseman University, College of Dental Medicine

#### **Purpose**

Historically, access to dental services has been limited with the increasing costs of dental care and dental insurance. Yet, dental services have become more accessible for people with low-incomes through the aid of Medi-Cal reform and expansion. This study evaluated the disparity among various ethnic and age groups of those who utilized their Medi-Cal dental benefits from 2013 to 2019.

#### **Methods**

Data were collected by the California Department of Health Care Services. Analyses consisted of descriptive statistics and ANOVA to estimate the differences between demographic variables and dental services measures. All analyses used IBM SPSS Statistics V28 software, with a significance set at  $p < 0.05$ .

#### **Results**

There was an increase in the utilization of Medi-Cal dental benefits each year from 10,795,430 cases in 2013 to 24,335,097 in 2019. The majority of those who utilized the Medi-Cal dental benefits were aged 6-9 years old (20.08%) and were Hispanic (61.44%). Significant differences were also observed among members in age, race, and years with respect to usage of Medi-Cal dental benefits for most dental services ( $p < 0.05$ ). The age group 6-9, within Asians, and during the 2019 calendar year exhibited the highest prevalence of usage of Medi-Cal dental benefits for all dental services.

#### **Conclusions**

Overall, there was a prevalence of usage of Medi-Cal dental benefits among participants in the age group 6-9, within Asians, and during the 2019 calendar year. The reinstatement of Medi-Cal dental benefits in 2014 may have played a major role in the increase of utilization. This study can help us understand the disparity seen between Denti-Cal and private dental insurances. Hopefully, this study can urge public health reformers to allocate federal spending to encourage and execute efficient government subsidy programs to benefit those who are in need.

# **Public Health Abstracts**

### **38: Media Marketing of E-Cigarettes: Calling Dental Education in Action**

Ben Raymond;<sup>1</sup> Jungweon Park;<sup>1</sup> Chase Hardy;<sup>1</sup> Andrew Spencer;<sup>1</sup> Clarissa Goh;<sup>1</sup> Martin Lipsky;<sup>1</sup> Joseph Cheever;<sup>1</sup> Ryan Moffat;<sup>1</sup> Frank Licari;<sup>1</sup> Man Hung.<sup>1</sup>

#### **Author Affiliations**

<sup>1</sup>Roseman University, College of Dental Medicine

#### **Purpose**

By implementing many marketing tactics to increase product popularity, the manufacturers of e-cigarettes are likely promoting harm to our youth. Here, we study how adolescents perceive harm of e-cigarette use and five types of advertising exposures: social media, radio, billboard, newspaper, and television.

#### **Methods**

The Population Assessment of Tobacco and Health study provides data on participants' knowledge of tobacco use, health outcomes, attitudes, and behaviors. Linear regression analysis was used to investigate the relationship between harm perception and recalled viewing of the five media within the past 30 days. A secondary analysis explored protective effects of anti-tobacco media and environmental factors such as family approval.

#### **Results**

The study sample was 12,570 (weighted N = 23,993,149) youth aged 12 to 17 years old. Exposure to newspaper, radio, billboard, and social media advertising all correlated with reduced harm perception, with only the associations involving newspaper and social media exposure being statistically significant ( $p < 0.05$ ). Including such factors as environmental support, there is a statistically significant association between increased harm perception and exposure to radio, billboard, and television advertisements ( $p < 0.05$ ). Adjusting for covariates, it also reduced the association for all media.

#### **Conclusions**

Advertising profoundly affects adolescents' perception of harm from e-cigarette usage, especially through social media and newspaper advertising. Among other factors, anti-tobacco marketing results in bolstered awareness of e-cigarettes' adverse effects. Policy makers should implement increased levels of anti-tobacco marketing while promoting holistic, dental education to reduce e-cigarette use among adolescents.

### **39: Current Trends in the SARS-CoV-2 Pandemic During the Emergence of the Omicron Variant**

Benjamin Mennell;<sup>1</sup> Man Hung;<sup>2</sup> Amir Mohajeri;<sup>2</sup> Helen Azabache;<sup>3</sup> Ryan Moffat.<sup>2</sup>

#### **Author Affiliations**

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#### **Purpose**

The SARS-CoV-2 virus has caused hospitalizations to increase throughout the world. The purpose of this study was to analyze hospitalization data in the United States from December 15th, 2021 to February 15th, 2022, and explore trends during this period.

#### **Methods**

Using data collected by the U.S. Department of Health & Human Services this study examined hospitalization rates from December 15th, 2021 to February 15th, 2022. We used correlation tests to explore the relationship between the variables. Descriptive statistics of all hospital data were calculated. SPSS Version 28 software was used to analyze the data (p-value < 0.05).

#### **Results**

We anticipate seeing hospitalizations increase from pre-COVID-19 numbers. Because we have tracked data beginning at about the same time as the rise of the Omicron variant in the United States, we anticipate hospitalization rates remaining high due to Omicron's higher transmissibility, even though it causes generally milder symptoms than other variants.

#### **Conclusions**

Implications of this study include current trends in the COVID-19 pandemic and how the Omicron variant emergence in the U.S. has affected hospitalizations. Comparing data from the different variants also showed us a difference in hospitalization rates vs. infections rates. The Omicron variant caused fewer hospitalizations when compared to the Delta variant, although the infection rate was higher. Results of this study can inform hospital administrators and public health policymakers on how to modify the use of existing hospital and human resources as the continually evolving pandemic taxes hospital capacity. Future studies need to be conducted to determine the long-term data and how the COVID-19 pandemic continues to change rapidly.

## **40: Identifying Bias in Healthcare and Creating Intervention Strategies At Colleges of Medicine and other Healthcare Professions**

Cameron Chalmers;<sup>1</sup> Emmanuel Oyalabu;<sup>1</sup> Maria E. Vazquez-Amaral.<sup>1</sup>

### **Author Affiliations**

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### **Purpose**

Events over the last several years, have indicated that the medical education community is not immune to issues of bias and that it may play an important part in the mitigation of the continued issues of bias in the delivery of healthcare in the United States. However, more research needs to be done regarding quantifying that bias at all levels of medical education in order to create mitigating strategies for students, faculty and staff at colleges of medicine and other healthcare professions.

### **Methods**

The first aim will be to create a substantial database of multiple points of demographic information regarding respondents to surveys about bias who are involved in medical education. The second aim is to analyze responses to survey questions about experience of bias as well as commonly held beliefs. The third aim is to analyze the data in relation to demographics to create treatment strategies tailored to specific demographics within the healthcare community.

### **Results**

Work in Progress

### **Conclusions**

Work in Progress

## **41: Succinic Semialdehyde Dehydrogenase Deficiency (SSADHD): Qualitative Needs Assessment for Patients With a Rare Neurologic Disorder**

Cassandra Bovee;<sup>1</sup> Esther Nuebel;<sup>1,2</sup> Mousumi Bose.<sup>3</sup>

### **Author Affiliations**

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<sup>3</sup>Montclair State University, Nutrition and Food Studies

### **Purpose**

This project is an FDA-guided qualitative needs assessment from the caregiver community of patients with Succinic Semialdehyde Dehydrogenase Deficiency (SSADHD). SSADHD is a disorder that is associated with a wide variety of neurological defects, secondary to defects in GABA metabolism. By understanding the needs of affected patients through their family caregivers, this project will serve as the first step in patient-focused therapeutic development and evaluation for SSADHD.

### **Methods**

The qualitative data will be collected through a variety of methods, including caregiver focus groups and patient interviews. The results will be summarized and analyzed using inductive content analysis techniques. Common themes will be identified, using words and phrases that caregivers used to describe their observations and experiences. For content validity, multiple techniques including peer debriefing and member checking will be used to ensure that themes are generated rigorously.

### **Results**

Trial ongoing.

### **Conclusions**

While the focus groups are ongoing, the results of the qualitative needs assessment will be reviewed and summarized to determine the development for future clinical trials to treat SSADHD and improve the quality of life for patients and their families.

## **42: Student Perceptions of COVID-19s Effect on Dental Education**

David Stewart<sup>1</sup>; Nicole Hablitzel<sup>1</sup>; Sharon Su<sup>1</sup>; Jungweon V Park<sup>1</sup>; Chase Hardy<sup>1</sup>; Diarmid Hall<sup>1</sup>; Martin Lipsky<sup>1</sup>; Frank Liacari<sup>1</sup>; Man Hung.<sup>1</sup>

### **Author Affiliations**

<sup>1</sup>Roseman University, College of Dental Medicine

### **Purpose**

This study evaluated the impact of COVID-19 on dental students' mental health and perceptions about the SARS-CoV2 vaccine.

### **Methods**

An anonymous online survey was administered to professional dental students at an accredited dental school in Southwestern United States. It focused on students' health, experiences, and perceptions related to COVID-19. The survey consisted of questions ranging from demographics, mental health, institutional responses, and vaccinations. Descriptive statistics were utilized to examine the impacts.

### **Results**

There was a total of 95 respondents with an average age of 27.7 years old (SD= 3.9), of which 48.9% were male. 46.3% of respondents were first-year dental students (D1) while 4.2% were second-year residents (R2). In light of COVID-19, more than half of the students were concerned about their emotional health (56.8%), with 82.1% feeling stressed, 60.6% feeling depressed, and 52.1% feeling lonely. Nearly 80% of students found it difficult to find motivation to study. At the time of this study, 81.9% of respondents had received a SARS-CoV2 vaccine and 75.5% believed the vaccine is effective in protecting individuals. Additionally, 55.3% believed that the school should require students and faculty to receive the vaccine.

### **Conclusions**

The COVID-19 pandemic has negatively impacted the emotional health of dental students. Our findings indicate that students experienced more stress, depression, and loneliness due to the pandemic. Students were also less motivated, highlighting the need for mental health support by institutions. While most students were vaccinated and believed the vaccine was effective, not as many believed schools should require vaccinations for students, faculty, or staff.



## **43: Using a Reconciliatory Model to Change Attitudes Towards COVID-19**

Gabriella Hubble;<sup>1</sup> Mark Rockwood;<sup>1</sup> Jordan Willis;<sup>1</sup> Jamie Jensen.<sup>1</sup>

### **Author Affiliations**

<sup>1</sup>Brigham Young University, College of Life Sciences

### **Purpose**

This research was designed to see if we were able to change university students' attitudes about COVID-19 in regard to precautionary behaviors such as mask-wearing, social distancing, and vaccinations using a reconciliatory model. The reconciliatory model has had success in evolution research and we wanted to assess its success here. Additionally, we wanted to test if students' perception of the respectfulness and relatability of the presenter influenced a change in attitude.

### **Methods**

We created six different videos from various individuals for our reconciliatory model. These videos included scientific research from various professionals as well as individuals' personal experiences. Participants were introductory biology students here at our university. After watching the videos, they filled out a survey about if/how the video changed their mind, and if/how the presenter in the video was respectful or relatable. We then thematically coded the results.

### **Results**

Of all our videos, video 4 (describing how the mRNA vaccine works) and video 5 (a nurse's experience in overcrowded hospitals) influenced the highest percentage of students. 48.04% and 42.20% changed their minds, from videos 4 and 5, respectively. 97.77% of students found video 4 respectful, with "demeanor" and "just stating facts" being the two highest coded categories. Additionally, 88.89% of students found the video relatable, with the top coded categories being "shared experience/ideology", "easy to understand" and "personality". When it comes to video 5, 93.33% found the video respectful, with "demeanor" and "simply shared their experience" as the top categories. 77.78% found it relatable, "personality" and "shared experience/ideology" being the most coded.

### **Conclusions**

The purpose of this research was to analyze if university students' minds would be changed in regards to attitudes towards the COVID-19 vaccine and other precautionary behaviors based on information provided through informative videos in a reconciliatory model. The results concluded that overall, respectability was shown to be more effective in changing the minds of students than relatability. When presenting new vaccines in the future, these findings will be advantageous in presenting correct and credible scientific information in the most effective and convincing way.

#### **44: Uses of Orthodontia, Braces or Retainers Across Demographic Groups**

Golnoush Zakeri<sup>1</sup> Sharon Su,<sup>1</sup> Amir Mohajeri,<sup>1</sup> Ashley Hinkle,<sup>1</sup> Jungweon Park,<sup>1</sup> Man Hung,<sup>1</sup> Tanisha Khurana.<sup>1</sup>

##### **Author Affiliations**

<sup>1</sup>Roseman University, College of Dental Medicine

##### **Purpose**

Population-based studies have focused on patients' rendering orthodontic treatment due to their malocclusion and medical needs. However, there is a scarcity of data from national sources on the prevalence of orthodontic visits and associated patient characteristics. This study looked at the demographic profile including age, sex, race, income and marital status of orthodontic patients to evaluate for any demographic differences in orthodontic visits and services used in the United States

##### **Methods**

This study used data collected from the 2019 Medical Expenditure Panel Survey (MEPS). Demographics and socio-economic characteristics, employment, access to care, satisfactory level of health care and health status data were extracted from the participant responses to the MEPS Household Component (HC). Independent samples t-test and chi-square test were utilized as appropriate to evaluate demographic differences of the respondents who had indicated whether they used or did not use orthodontia, braces, or retainers.

##### **Results**

The sample size was 28,270; of which, 3,033 respondents indicated usage of orthodontia, braces or retainers with 61.1% females, 60.8% Whites, 19.9% Hispanics, 11.6% African American, and 50.3% less than 16 years old and 36.7% never married. There was a significant difference in age between those who used orthodontia (mean = 19.12 years; SD = 11.70 years) and those who did not use (mean = 40.86 years; SD = 23.84 years) ( $p < 0.05$ ). The distributions of sex, race, income and marital status between those used and did not use orthodontia were also significantly different (All p-values < 0.05).

##### **Conclusions**

Malocclusion, esthetics and regain of functionality are significant factors in the orthodontic field that can improve quality of life. Our findings indicate orthodontics, braces, and retainer usage was higher in females, younger patients, and Whites, highlighting the possible demographic disparities in orthodontics use.

## **45: Efficacy of Vaccine and Naturally-Acquired Antibodies to SARS-CoV-2**

Jaden Mindy<sup>1</sup>, Bivash Arnold<sup>1</sup>, Cook Neupane<sup>1</sup>, Rex Ripplinger<sup>1</sup>

### **Author Affiliations**

<sup>1</sup>Noorda College of Osteopathic Medicine, College of Medicine

### **Purpose**

The purpose of this study is to (1) assess the efficacy of naturally-acquired antibodies in the prevention of reinfection with the SARS-CoV-2 virus, and (2) the rate of breakthrough infections following vaccination with one of the newly-developed vaccines. Much emphasis has been placed nationwide on the campaign to vaccinate the population with the new mRNA vaccine, ostensibly to achieve herd immunity. However, not nearly as much interest has been displayed by the medical community in general – and policymakers specifically – in the value of naturally-acquired antibodies. We hypothesize that the efficacy of naturally-acquired immunity compares favorably with the immunity acquired following vaccination. Therefore, to further assess the efficacy of natural immunity and vaccine-induced immunity we propose to collect data by survey inquiring after information regarding prior COVID infection, vaccination status, and basic demographics. Following analysis, should our data be consistent with other studies showing a significantly reduced risk of reinfection and/or subsequent serious illness, we would propose that those individuals who have survived a COVID infection should be considered as fully immune.

### **Methods**

Information about vaccination status, vaccination dates, as well as infection dates will be gathered in survey format. The surveys will be conducted in public settings in multiple counties in Utah, both virtually and in-person. The questions asked will gather information about infection and vaccination, as well as about potential confounding factors such as age, ethnicity, and sex. The survey hopes to gain more than 150-200 participants and questions will be validated to assess coherency. After acquisition, data will be analyzed using logistic regression to account for covariates. Odds ratios of infection rates will be calculated by using individuals that had no previous infection or COVID-19 vaccination as baseline. A second logistic regression analysis will compare vaccinated individuals to individuals with natural immunity by using vaccinated individuals as baseline. Infections during the delta-dominant period (June through November 2021) will be analyzed separately from infections that occurred during the Omicron-dominant period (December 2021 through present).

### **Results**

Pending

### **Conclusions**

Pending

## **46: Monitoring Water Fluoride in America's Community Water Systems**

Jody Chiang;<sup>1</sup> Jungweon Park;<sup>1</sup> Amir Mohajeri;<sup>1</sup> Beatrice Bautista;<sup>1</sup> Frank Licari;<sup>1</sup> Man Hung.<sup>1</sup>

### **Author Affiliations**

<sup>1</sup>Roseman University, College of Dental Medicine

### **Purpose**

Fluoridated public water systems is a key public health intervention to prevent dental caries in the United States. To improve the health outcomes of individuals in the nation, accurate monitoring of fluoridated water level should be assessed

### **Methods**

This study evaluated data collected by the Centers for Disease Control and Prevention from 2006 to 2018 in the United States Examination of the trends in the number of individuals having CWS was conducted, in addition to the number of CWS existed in the nation. Further, the percentage of individuals receiving CWS fluoridated water in each of the 50 states was calculated and ranked.

### **Results**

While the total number of Americans on CWS has increased from 26 million in 2006 to 28 million in 2018, the total number of CWS in the United States has steadily decreased from 53,429 in 2006 to 52,211 in 2018. The number of CWS adjusting for fluoride level has also decreased from 6,368 in 2006 to 5,735 in 2018 ( $p < 0.05$ ), with the number of CWS having optimal fluoride levels has lowered from 6,705 to 6,340 during the same period ( $p < 0.05$ ). The percent of the population on CWS receiving fluoridated water has fluctuated throughout the years from 69% in 2006 to 73% in 2018 ( $P < 0.05$ ). Among the 50 states, Kentucky has the highest percent of individuals receiving CWS fluoridated water, followed by Minnesota and Illinois.

### **Conclusions**

From 2006 to 2018, less CWS adjusts for fluoride levels and less CWS ensures there is optimal fluoride level in the drinking water. Due to risk of high levels of fluoride concentration on possible negative health outcomes, policy makers should consider monitoring fluoridated CWS in each state. This study provides empirical evidence for public health policy makers to take action in reducing the U.S. population's dental caries without increasing adverse health outcomes.

## **47: Impact Of COVID19 on Stress, Self Esteem and Lifestyle Behavior Among Dental Students – A Cross-Sectional Study**

Landon Ledingham;<sup>1</sup> Tapasya Gurumurthy;<sup>1</sup> Teresa Vu;<sup>1</sup> Joshua Finch;<sup>1</sup> Amir Mohajeri;<sup>1</sup> Kamran Awan;<sup>1</sup> Claudia M. Tellez Freitas;<sup>1</sup> Reeya Shrestha.<sup>1</sup>

### **Author Affiliations**

<sup>1</sup>Roseman University, College of Dental Medicine

### **Purpose**

The purpose of this study was to analyze the perceived psychological impact of the COVID19 pandemic among dental students. The students' perceived changes were assessed in self esteem, stress and lifestyle behavior changes based on the impact of the pandemic.

### **Methods**

A self-designed, anonymous online questionnaire was administered to the University dental students. A series of themed questions regarding stress/anxiety, self-esteem and lifestyle behaviors were presented, a total of 18 questions, with six questions in each section. Participants in the survey were asked whether they strongly agreed, agreed, disagreed, or strongly disagreed to each question, so the survey was entirely of a self-reporting nature and completely subjective. Chi-square test was used for comparison of psychological factors towards socio-demographic variables. Correlations between stress and self-esteem as well as lifestyle behavior was also reported. The study was approved by the institutional review board.

### **Results**

There were statistically significant differences between students in ages and years of study with regards to stress and lifestyle behavior changes. A total of 313 students with the mean age of 28.15 (SD:4.21) participated in the study. Regarding marital status, statistically significant differences were observed for stress and self-esteem. Also, we found race differences between students in lifestyle behavior changes. Positive correlations were observed with self-esteem and lifestyle behavior changes, as students with higher levels of stress showed significant self-esteem problems and lifestyle behavior changes.

### **Conclusions**

Further studies are needed to assess the long-lasting impacts of COVID-19 pandemic on university healthcare students. Our results showed that the COVID-19 pandemic imposes significant psychological impact on dental students.

## **48: Roseman University of Health Science College of Dental Medicine Electronic Cigarette Awareness**

Ryan Kinney,<sup>1</sup> Nushrah Elahi,<sup>1</sup> Elizabeth Uoo,<sup>1</sup> Claudia M. Tellez Freitas,<sup>2</sup> Kamran Awan.<sup>2</sup>

### **Author Affiliations**

<sup>1</sup>Roseman University, College of Graduate Studies; <sup>2</sup>Roseman University, College of Dental Medicine

### **Purpose**

The use of electronic cigarettes (e-cigarettes) has increased in adults in the United States, and recent studies have shown that more than two million adolescents are using e-cigarettes with more frequency. While ongoing studies are helping to better understand the potential benefits and risks of e-cigarettes, the intention of this questionnaire was to investigate the perception of e-cigarettes among dental future healthcare professionals. The purpose of this study was to qualitatively measure how health professional students perceived e-cigarettes and to analyze their knowledge regarding their use

### **Methods**

Participants in our study were dental students at Roseman University of Health Sciences College of Dental Medicine. The questionnaire included three demographic questions and 16 questions to measure the participants' awareness of e-cigarettes. All information was collected by a self-complied questionnaire. Once consent was received, a link to the online survey was sent to the student body.

### **Results**

In progress

### **Conclusions**

In progress

## **49: Social Impact of COVID-19 on University Healthcare Students Nationally and Internationally**

Sukhkarn Gahunia;<sup>1</sup>

### **Author Affiliations**

<sup>1</sup>Roseman University, College of Graduate Studies

### **Purpose**

The pandemic caused by the novel coronavirus (COVID-19) generated uncertainty and fear among the general population. Students all over the United States needed to shift their way of learning, while facing emotional and stressful feelings all consequences associated with the virus. The purpose of this study is to examine the impact COVID-19 pandemic had on dental students.

### **Methods**

A scholarly literature review was conducted on the following databases; Kerala Dental Journal, PLOS One, Enviro Dental Journal, Thieme, BDJ, Elsevier, ResearchSquare. Also taken into consideration for this review were articles from PubMed, Google Scholar, Cochrane and Web of Science databases. The search strategy used was a combination of terms such as “COVID-19 and stress”, “COVID-19 effects on students mental health”, “COVID-19 effect on healthcare”, and “COVID-19 and Dental Students”. Studies selected had a published date ranging between January 1, 2020, through February 2022. Only English language articles were considered for this research. Most studies designed questionnaires to collect data from dental students at different National and International Universities. The questionnaires contain different questions that assessed the levels of stress, self-esteem, and lifestyle behavior changes among current dental students. The sample size varied for each research but did not exceed more than 400 participants. The sample population were current dental students ranging between D1 students to D4 students.

### **Results**

In progress.

### **Conclusions**

In progress.

## **50: Reduced Access to Dental Care During COVID-19**

Val Joseph Cheever,<sup>1</sup> Amir Mohajeri.<sup>1</sup>

### **Author Affiliations**

<sup>1</sup>Roseman University, College of Dental Medicine

### **Purpose**

To assess to what degree COVID-19 had affected access to routine dental care.

### **Methods**

The data evaluated were from The Research and Development Survey (RAND) from May-June of 2021. The total sample size was 5,458. (3rd Survey) The survey tool looks at variables such as age, gender, race/ethnicity, and educational levels.

### **Results**

The survey results show that COVID-19 reduced access to the subject's dental care, or they chose to postpone dental care for any reason. Variables included age, education, and race/ethnicity. Graphs show trends that are unique and could merit further assessment.

### **Conclusions**

COVID-19 has affected access to dental care for several reasons such as healthcare workers affected, fear of becoming COVID-19 positive in a healthcare environment, or the decision to put their health needs off until COVID-19 passes or deferring care.



## **51: Access To Dental Care During the Pandemic: A National Examination**

Val Joseph Cheever<sup>1</sup> Sharon Su;<sup>1</sup> Jungweon Park;<sup>1</sup> Chase Hardy;<sup>1</sup> Amir Mohajeri;<sup>1</sup> Frank W. Licari;<sup>1</sup> Man Hung.<sup>1</sup>

### **Author Affiliations**

<sup>1</sup>Roseman University, College of Medicine

### **Purpose**

COVID-19 has affected access to dental care for several reasons such as healthcare worker affected, fear of becoming COVID-19 positive in a healthcare environment or the decision to put their health needs off until COVID-19 passes or deferring care. There is no question that COVID-19 has affected access to routine and urgent dental care, but how much it has affected the access remains less understood. The contribution of socio-demographic characteristics to reduced dental care was also less understood. This research examined how much various demographic groups have reduced access to dental care due to the COVID-19 pandemic and how much due to other reasons in the United States.

### **Methods**

The data used in this study came from the National Center for Health Statistics (NCHS) and were collected from May 17, 2021 and June 30, 2021. The main outcome variable of this study was the percentage of adults in the United States who were unable to receive dental care. Descriptive statistics were performed to describe the sample. Independent samples t-test and chi square test were conducted as appropriate to compare the different among demographic groups.

### **Results**

There was a total of 5,458 participants in the survey administered by the NCHS. The younger age group (18-44 years old) was affected more than the older age group (65+ years old) in terms of access to dental care, 7.5% versus 4.6%, respectively. For gender, females (6.8%) had larger percentage drop in access to care than males (5.6%) ( $p < 0.05$ ). Those with lower educational level (4.9%) had more reduced access to dental care than those with some college (7.5%) and those with bachelor's degree or above (6.7%). Non-Hispanic White (5.9%) had less reduced access than Hispanic (6.7%).

### **Conclusions**

The current study provides evidence that there were disparities in the access to dental care among various demographic groups. Those groups that COVID-19 affected their dental care, or they chose to postpone for any reason showed unique trends. Age, education and race/ethnicity graphs show trends that that are unique and could use further assessment.

# **Scholarship of Teaching and Learning Abstracts**

## **52: A Standardized Approach to Blood Pressure Training in First-Year Medical Students**

Andrew Romney;<sup>1</sup> Chelsea Romney;<sup>2</sup> Lynsey Drew.<sup>1</sup>

### **Author Affiliations**

<sup>1</sup>Noorda College of Osteopathic Medicine, Doctor of Osteopathic Medicine; <sup>2</sup>Brigham Young University, College of Family, Home, and Social Sciences

### **Purpose**

Accurate blood pressure measurement is an important clinical skill for physicians to assess an important marker of patient's health. Despite this, training in blood pressure assessment is not standardized across medical schools. The current study seeks to assess the effectiveness of the American Medical Association (AMA) blood pressure module in providing training and longitudinal mastery of blood pressure assessment in first-year medical students.

### **Methods**

The AMA blood pressure module uses the latest evidence-based techniques for blood pressure measurement. Medical students at Noorda COM will complete this training module at the beginning of first year, be assessed immediately afterward, and again at the end of the first year. At the first assessment, students completed a 10-item online AMA blood pressure module pre-test. Then, they completed the AMA blood pressure module. This was followed by an identical 10-item AMA blood pressure module post-test to assess mastery of the module. The same assessment will be completed at the end of the first year in order to assess longitudinal mastery in addition to module effectiveness.

### **Results**

Data have been collected at one of the two-time points (N=44). Scores on the online 10-item assessment were significantly different between the pre-test (M=4.59, SD=1.87) and post-test scores (M=7.55, SD=1.91), ( $t(43)=68.48$ ,  $p<.001$ ) indicating that the modules significantly improved students' understanding of blood pressure measurement. An additional timepoint will be assessed for longitudinal assessment at the end of the first year.

### **Conclusions**

The current study provides evidence that the AMA blood pressure module is an effective training tool for blood pressure assessment in first-year medical students. Future analyses will test if these results are significant longitudinally. Based on these findings, we recommend the standardized use of the AMA module as a blood pressure training tool for medical schools.

### **53: Popular Culture Devolves Students' Understanding of Evolution**

Chandler Messer,<sup>1</sup> Danny Ferguson,<sup>1</sup> Sarah Palmer,<sup>1</sup> Juliana Lindberg,<sup>1</sup> Porter Fife,<sup>1</sup> Connor McDonald,<sup>1</sup> Jordan Willis,<sup>1</sup> Jessica Abele,<sup>1</sup> Josh Oliver.<sup>1</sup>

#### **Author Affiliations**

<sup>1</sup>Brigham Young University, College of Life Sciences

#### **Purpose**

The theory of evolution is the central theme in biology classes, and many students enter biology classes with misconceptions about evolution. Studies have shown these misconceptions may come from teachers, textbooks, and cultural beliefs. However, with the ease and access of content available at our fingertips, individuals are bombarded with information from a wide variety of sources: movies, TV series, social media, the internet, etc., and the information is not always accurate. The theory of evolution has been portrayed in movies such as Jurassic Park, kids' shows like Pokémon, video games, and even popular scientific documentaries. Popular culture is shaping where individuals obtain knowledge about evolution. The objective of this study was to determine the effects of popular culture and social media on BYU and UVU students' conception of evolution. We hypothesized that evolutionary theory, as described by popular culture, does not portray evolution accurately, and may lead students to have misconceptions about evolution.

#### **Methods**

To determine the effects of popular culture misconceptions on evolution acceptance, we administered three surveys in introductory biology courses at BYU and UVU at the beginning and end of the semester. The first survey asked students about their exposure to evolution portrayed in popular culture and measured on a six-point Likert scale how much they agreed with their reference. Students were able to share as many evolution references as they wanted. We also measure students' evolution acceptance and evolution misconceptions, using the Inventory on Students Evolution Acceptance (ISEA) and Biological Evolution Literacy survey (BEL Survey) Surveys were used to compare evolution acceptance and evolution misconception scores over the course of the semester. Using their popular culture evolution references, we were able to create codes using emergent themes about misconceptions found in popular culture.

#### **Results**

Our preliminary results showed that evolution is not always accurately portrayed in popular culture.

#### **Conclusions**

N/A

## **54: Early Patient Care and Biomedical Science Integration Increases Student Competence and Confidence**

Edgar Tilley;<sup>1</sup> Rachel Novak;<sup>1</sup> Bethany Blinsky;<sup>1</sup> Burke Soffe;<sup>1</sup> Clark Dana;<sup>1</sup> Elizabeth Bailey;<sup>2</sup> Spencer Judd;<sup>1</sup> Ashley Hinkle;<sup>1</sup> Duane Winden;<sup>1</sup> Aaron Ferguson;<sup>1</sup> Frank Licari;<sup>1</sup> Jamie Jensen.<sup>2</sup>

### **Author Affiliations**

<sup>1</sup>Roseman University, College of Dental Medicine; <sup>2</sup>Brigham Young University, College of Life Sciences

### **Purpose**

In response to the new Integrated National Board Dental Examination, predoctoral dental education programs are striving to find best practices and methods to integrate the biomedical and clinical sciences. Our study investigates early experiential learning as a method of curricular integration by allowing students to begin their clinical experience in the first year of the program, as well as distributing biomedical classes throughout the predoctoral dental school curriculum.

### **Methods**

This study utilizes a quasi-experimental design with two different treatments, Standard Curriculum Treatment, n=43 and Integrated Curriculum Treatment, n=44. This project was IRB-approved for use of human subjects. Each participant gave written consent prior to the beginning of research. Aggregate data sets, including demographic information, undergraduate grade point averages, and DAT scores were collected. These were then referenced alongside clinical competency results that each student had completed since entering dental school. Participants then completed a multiple choice and free response survey to ascertain their perceptions of competency and attitudes toward evolving curriculums.

### **Results**

We found that, on average, it took 608 hours less for the participants in an integrated curriculum treatment to reach clinical competence in comparison to peers who did not experience the same methods of integration in their program. These data were collected through daily faculty evaluations of students' progression as well as participants' own self-assessment. Our results indicate that those in the Integrated Curriculum Treatment also had an increased sense of confidence in their ability to apply the biomedical sciences to patient care.

### **Conclusions**

The findings of our study demonstrate that by providing opportunities for patient care at the beginning of the first year, as well as integrating the biomedical sciences throughout the curriculum, students were able to reach clinical competence half a year earlier than their peers. Our data shows that early experiential learning may be a viable option not only for integration, but for sequencing the curriculum to best support students' progression towards clinical competency.

## **55: Interprofessional (IPE) Activities and Interactions - A Comparison of Didactic Curriculum and Rotation Experiences**

Emily Christiansen;<sup>1</sup> Kristheana Rico;<sup>1</sup> Angela Chu;<sup>1</sup> Michelle Hon;<sup>1</sup> Erin Johanson;<sup>1</sup> Susan Nguyen.<sup>1</sup>

### **Author Affiliations**

<sup>1</sup>Roseman University, College of Pharmacy

### **Purpose**

IPE is a required component for the accreditation of all health professional programs. While national organizations, Interprofessional Educational Collaborative (IPEC) and ACPE provide competencies and standards for IPE, there is a lack of IPE curriculum quality assurance. No validated assessment tools exist to evaluate the quality of IPE curriculum being delivered in didactic and experiential settings. At Roseman University College of Pharmacy (RUCOP), second-year students participate in 4 IPE activities per year in collaboration with other professional program (nursing and dental) and other local health professional programs (DO, PA, PT/OT, etc.) across two campuses. Students also participate in IPE activities during their third year while on their 6-week APPE rotations. As an initial step in evaluating the quality of the IPE curriculum, new IPE questions were integrated into APPE final evaluations to assess 1) the type of student IPE experiences while on rotations and 2) the medium for participating in IPE. Subsequently both IPE directors assessed each didactic IPE day for 1) type of IPE experience, and 2) medium for practicing IPE.

### **Methods**

RUCOP's Experiential Team integrated new IPE questions into the Class of 2022 evaluations for three consecutive APPE blocks. Each survey consisted of a total of 13 IPE-related question items that asked students if they participated in a variety of interprofessional activities with other members of the healthcare team and the type of interaction (in-person, phone, electronic, or telehealth). A total of 303 surveys were completed over 18 weeks. RUCOP's IPE Directors evaluated their didactic 2020-2021 curriculum. Using the IPE activity types specified in the APPE evaluation, the Directors classified how many of those IPE didactic days (0-4) incorporated IPE experiential-related activities and if each didactic IPE day incorporated in-person, phone, or telehealth communications. Descriptive data analysis will be used for the reporting of this data.

### **Results**

Pending

### **Conclusions**

Pending

## **56: Participation in Curriculum/Cultural Ambassador Group to Enhance Student Belongingness**

Jacob Tuft;<sup>1</sup> Rachel Novak;<sup>1</sup> Roberto Lara;<sup>1</sup> Brooke Wilder-Corrigan;<sup>1</sup> Jacob Schvaneveldt.<sup>1</sup>

### **Author Affiliations**

<sup>1</sup>Roseman University, College of Dental Medicine

### **Purpose**

COVID-19 negatively impacted students' abilities to participate in live, in-person events; students were unable to interact with peers or build relationships critical to success and well-being. Quarantine, social distancing and video conferencing did not create this problem however, it simply amplified the fact that dental students seemingly lack camaraderie and a sense of belongingness. The Curriculum and Cultural Ambassador group was created to allow students to bond over shared goals in the hopes of improving their experiences within dental school. This group gives students the ability to “Be the Change” on campus and enact real-time change to foster a sense of belongingness. This study will provide data regarding the effectiveness of the Ambassador group to increase sense of belongingness and interest in education.

### **Methods**

First, second, third and fourth year students involved in the Curriculum and Cultural Ambassadors group (n=40) will attend a monthly in-person meeting to discuss topics related to the university's curriculum and culture. Students have taken a pre survey and will take a post survey, including questions regarding their demographic information, sense of belongingness at the university, social anxiety, introversion, and their desire to become a future educator.

### **Results**

Data will be analyzed after the second survey is given. Multiple linear regressions will be used to determine which factors predict increases in student knowledge, sense of belongingness, and desire to become a future educator. Independent sample t-tests, paired sample t-tests, and Mann-Whitney u-tests will be used to compare survey results. Open ended questions will be coded for emergent themes.

### **Conclusions**

Conclusions will be ready in February of 2022. This study will provide meaningful data that can be utilized at all dental schools to better understand sense of belonging and how to improve it.

## **57: Verbalized Studying and Elaborative Interrogation in the Virtual Classroom**

Jordon Ockey;<sup>1</sup> Rachel Novak;<sup>2</sup> Elizabeth Bailey;<sup>1</sup> Bethany Blinsky;<sup>2</sup> Burke Soffe;<sup>2</sup> David Patterson;<sup>2</sup> Jamie Jensen.<sup>1</sup>

### **Author Affiliations**

<sup>1</sup>Brigham Young University, College of Life Sciences; <sup>2</sup>Roseman University, College of Dental Medicine

### **Purpose**

Due to public health measures enacted in response to the Covid-19 pandemic, educators and students alike have been suddenly thrust into the realm of emergency online learning. To better understand how active and collaborative learning methods can apply to students studying in isolation, we compared the effects of two teach-and-question (TQ) assignments: one that utilizes the active learning method of reciprocal peer tutoring and a solo version that required individual verbalized studying and elaborative interrogation.

### **Methods**

We used a quasi-experimental design, with student participants enrolled in 11 sections of an online introductory human anatomy course, n=167. The first treatment group completed regular TQ study assignments virtually with a peer, and the second treatment group completed the same assignment independently. The students completed 23 TQ assignments total. All assignments were audio-recorded and uploaded to the learning management system for credit.

### **Results**

We found no differences in exam scores between treatments, even for students with high social anxiety; however, student attitudes about the social versus individual assignment did differ for specific types of students. Students who reported experiencing high social anxiety preferred completing the active learning exercise by themselves, and students with low scientific reasoning ability preferred the partnered assignment.

### **Conclusions**

This research has potential implications for online classrooms. For instance, our results indicate that students who study independently, or in isolation, may have similar learning outcomes as those who study with a peer as long as they study actively. Because we found no negative impact on examination results, it also could be that virtually partnered or independent teach-and-question assignments could be helpful for instructors teaching large online classes, to ensure all students are getting individualized feedback and attention.



## **58: The Implementation of Telehealth Scenarios and COVID-19 Training to Prepare Nurses for the Future of Healthcare**

Shamar Lejardi<sup>1</sup>

### **Author Affiliations**

<sup>1</sup>Roseman University, College of Nursing

### **Purpose**

The purpose of creating telehealth scenarios, and the implementation of COVID-19 training, was to prepare undergraduate nursing students for the future of healthcare and the delivery of care using telehealth. Students were provided the opportunity to engage in 1. Assessing a client using telehealth communication techniques, 2. Developing and utilizing communication strategies, 3. Practicing the use of correct nasal swabbing for the collection of COVID-19 screenings, and 4. Assessing lung sounds utilizing a COVID-19 lung simulator

### **Methods**

Students in groups of 4-8 completed four stations that included the following scenarios: **1.** Interviewing a client via telehealth, **2.** Assessing signs and symptoms of a client via telehealth, **3.** Implementing a COVID-19 algorithm via telehealth, **4.** Educating the client regarding the signs and symptoms of COVID-19 and associated CDC guidelines. Additionally, each group of students was exposed to a high-fidelity simulation of a COVID-19 high-risk hospital admission. By the completion of high-fidelity simulation, students were able to: **A.** Recognize and assess a client with signs and symptoms of COVID-19, **B.** Practice interdisciplinary team safety, **C.** Apply appropriate PPE standards and equipment, and **D.** Communicate with the interdisciplinary team using SBAR.

### **Results**

Survey results for the telehealth scenarios (N=71) indicated that post scenarios, the majority of nursing students were: Comfortable to very comfortable: using telehealth technology, assessing clients using telehealth communication techniques, and using strategies to overcome client barriers to participate and respond during telehealth encounters.

Survey results for the training related to the use of the COVID-19 simulators (N=46) indicated post scenarios/training, the majority of nursing students were: Comfortable to very comfortable: performing nasal swabbing for the collection of COVID-19 screenings, and the assessing of lung sounds of a COVID-19 client.

### **Conclusions**

Nursing education needs to embrace the use of technology in the preparation of students for the current and future delivery of healthcare. By the utilization of telehealth scenarios, and COVID-19 simulators, nursing students were afforded “real life” application of knowledge and skills in a controlled practice environment. In order to continue to meet the challenges of preparing holistic healthcare providers, innovative learning strategies and technological modalities will need to be embraced by the profession of nursing. (\*Data/surveys are still being collected from students and will be included in the final poster presentation.)

## **59: Developing a Learning Tool for Roseman Pharmacy Students- The Continual Evolution of Roseman Basics**

Taylor Taylor;<sup>1</sup> Nicole Ventrello;<sup>1</sup> Mahdeed Raja;<sup>1</sup> Shannon Kinard;<sup>1</sup> Catherine Oswald;<sup>1</sup> Christopher So.<sup>1</sup>

### **Author Affiliations**

<sup>1</sup>Roseman University, College of Pharmacy

### **Purpose**

In July of 2021, Roseman College of Pharmacy (COP) launched a self-paced online course titled Roseman Basics (RB). This course was designed to introduce incoming students to various concepts prior to matriculating into pharmacy school, as well as provide resources once a student is enrolled. The primary purpose of this poster is to describe this Roseman Basics Course. Secondary points include identifying what other pharmacy schools have done as well as ways to improve the current course will be shared.

### **Methods**

Members of the COP Curriculum Committee provided information regarding the evolution of the RB to the authors of this poster. The authors will perform general search query using search engines, such as Google Scholar and PubMed, using various keywords and phrases. Furthermore, published literature searches will be done seeking interesting strategies for the continued development of such a platform. Collected literature will be reviewed and compared to the RB course to identify potential ways to improve the course.

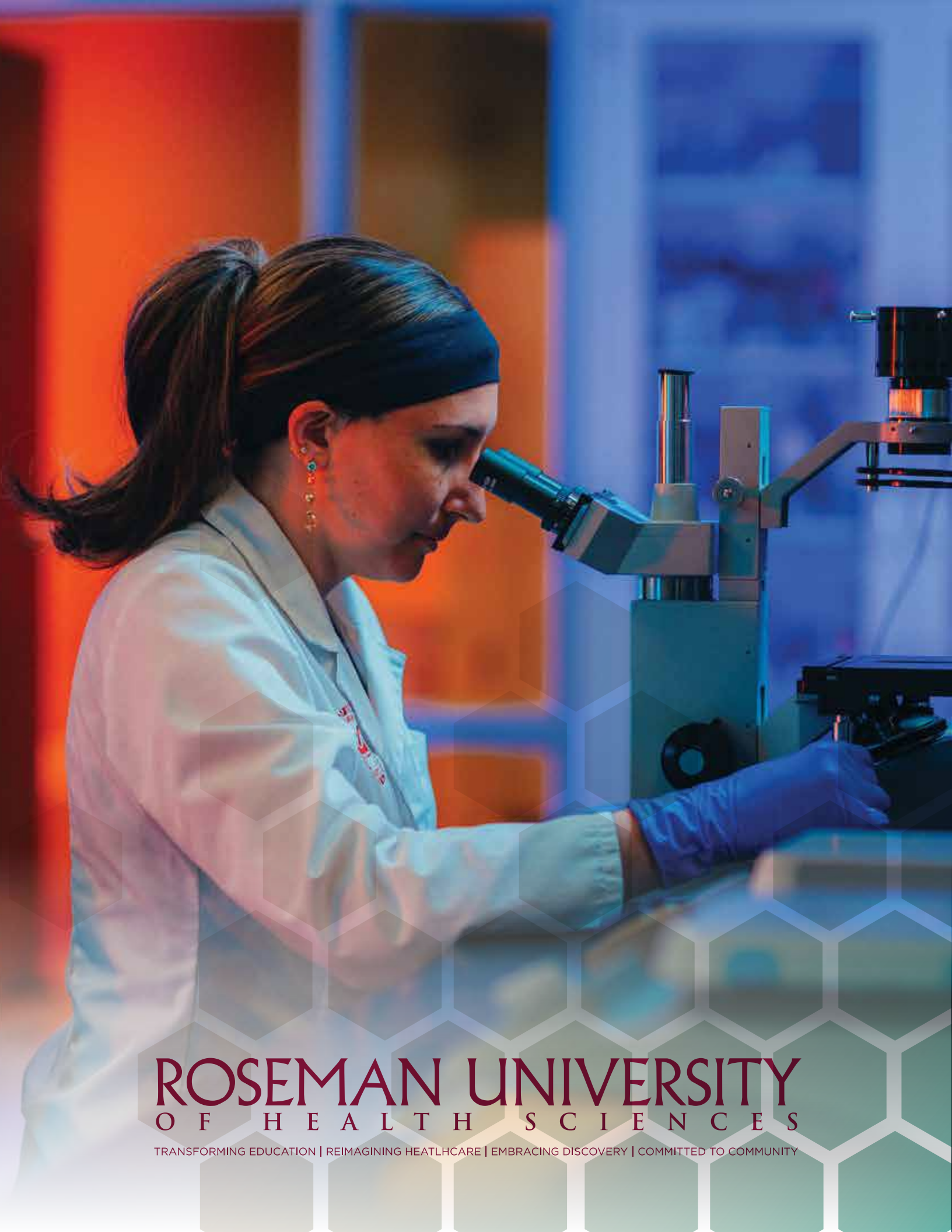
### **Results**

This research is ongoing and not yet finished.

### **Conclusions**

The conclusion is a work in progress and will include findings from the methods sections. All research will be concluded and reported upon by the Roseman research symposium.





# ROSEMAN UNIVERSITY OF HEALTH SCIENCES

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