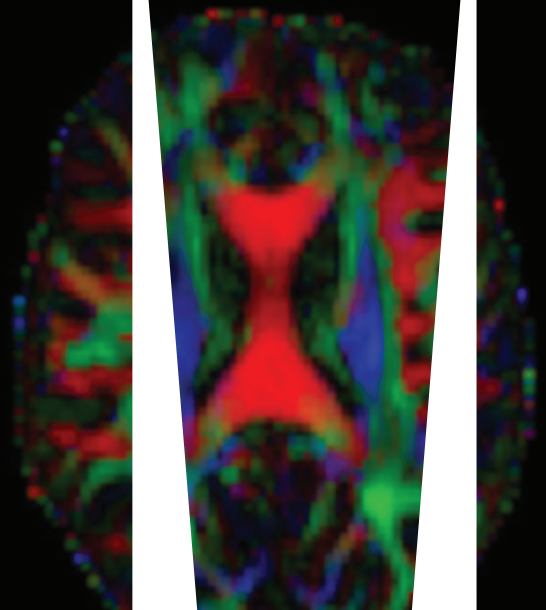
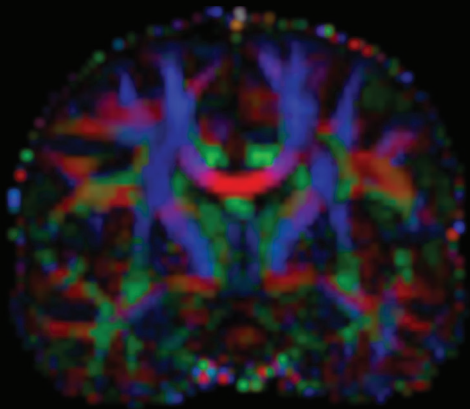
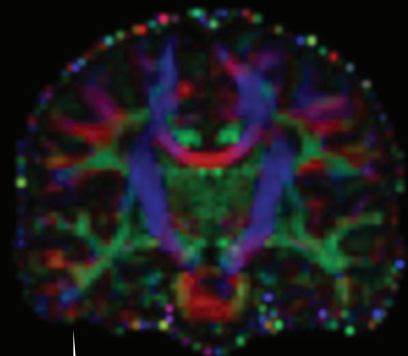
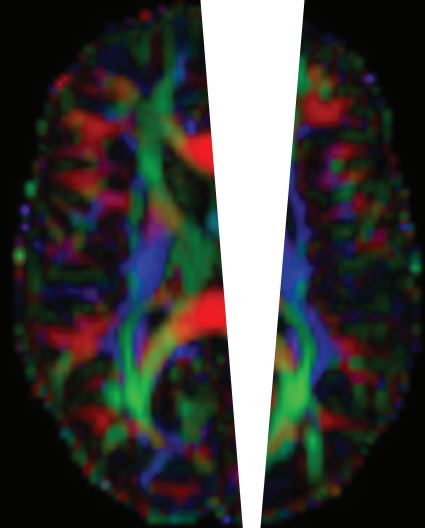




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**MRSS ANNUAL  
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YEARBOOK 2023**



**GROUP  
OF EIGHT  
AUSTRALIA**

## **FRONT COVER**

### **Joshua Lee – The Tracts That Matter**

Image description: Mimicking the harmony of a well-coordinated orchestra or the beauty of a breathtaking fireworks spectacle is the synchronised firing of neurons within the brain. Electrical firing occurs along white matter tracts, which are far from static. Through neuroplasticity, the brain can change its firing and wiring, meaning that these tracts can be strengthened through repetition and learning and weakened through non-use, such as after an amputation. Diffusion Tensor Imaging (DTI) is a powerful MRI imaging technique that visualises the white matter tracts in the brain. Like with a water pipe, water diffuses more easily along tracts than across them. Thus, by measuring the preferential diffusion of water in the brain, the lay of the underlying white matter tracts and their structural integrity can be estimated. Red: Right-Left, Green: Rostral-Caudal, Blue: Dorsal-Ventral.

# Message from the BMedSc(Hons) Convenor and Course Management Committee

Dear BMedSc(Hons) students, congratulations on completing your BMedSc(Hons) degree! Well done, it is a very significant achievement and I hope that you all feel extremely proud of what you have achieved.

The School BMedSc(Hons) Coordinators, the Course Management Committee and I, would like to thank you for choosing to enrol in BMedSc(Hons). We hope that the year has challenged you and given you an appreciation of; how new knowledge is created, how research can be translated into clinical practice and an appreciation of how much more there still is to learn. We also hope that you will have much more confidence in your ability to read and critically evaluate new research findings, and to develop into a practitioner of evidence-based medicine.

We would also like to sincerely express our thanks to your supervisors and to other members of their research teams who have devoted their time to support your learning during the year. We would also like to thank the examiners who volunteered their time to assess Literature Reviews, Theses, Departmental Oral Seminars, and the Faculty Presentations. A particular thank you to Brenna Dempsey and to each of the School BMedSc(Hons) academic and support staff who do a huge amount of behind-the-scenes work during the year to ensure that the course runs smoothly. The Course would not be possible without them. We would also like to thank your BMedSc(Hons) Student Representatives for giving us feedback and supporting your interests during the year and to the MRSS committee for help organising the BMedSc(Hons) conference. It was so lovely to see you all present in person at the conference, to hear what you have all been up to this year and to see such a hive of activity around each other's posters! I am sure that everyone agrees that the conference was a terrific success and a really wonderful way to celebrate the end of your BMedSc(Hons) year.

The BMedSc(Hons) Course Management Committee and I, wish you all the very best for your future and we hope to see and hear about your future research endeavours.

**A/Professor Megan Wallace, Director of Medical Student Research,  
Faculty of Medicine, Nursing and Health Sciences**

# Faizah Alam

## Creatine Replacement Therapy In Steatotic Patients

Supervisor Names and Institute Affiliations:

Professor Stuart Roberts (main supervisor), Professor William Kemp (co-supervisor), Professor Ammar Majeed (co-supervisor)



Hi! My name is Faizah, and I had the privilege of undertaking my honours year with the Hepatology department at the Alfred Hospital. My honours thesis, which is a phase I clinical trial was something I picked as I am very passionate about gastroenterology, and in particular, the Upper GI tract.

I was attracted to my project as it allowed me to work with patients in a clinical environment, and to learn about NAFLD disease processes and management from patients' themselves.

It has been a challenging but demonstrative year, from learning how ethics applications work, to being able to be involved with a clinical trial from conception to finish. There have been hiccups along the way, but with the amazing support from supervisors, friends and family, I have learnt more about what medical research entails and am keen to continue pursuing it in the future.

Feel free to contact me via:  
[fala0007@student.monash.edu](mailto:fala0007@student.monash.edu),  
or find me on Facebook for any further questions!

### ABSTRACT

#### Background

Non-Alcoholic Fatty Liver Diseases (NAFLD) describes an array of conditions from simple liver fat build-up to more severe liver damage (fibrosis). Despite a growing global disease burden, there are currently no effective pharmacological or surgical treatment options approved for NAFLD with only lifestyle management available.

Creatine monohydrate is the most widely used sporting supplement due to its capacity to increase muscle mass and functional performance. Subsequently, creatine has undergone therapeutic trials to assess its impact in disease progression. In animal model trials, creatine has established benefit for NAFLD management by decreased hepatic steatosis, inflammation, and oxidative stress. It also has considerable impacts on cardiovascular and metabolic disease, increasing exercise capacity which further decreases morbidity and mortality in NAFLD patients.

#### Method

This is a single-arm, proof of concept, phase 1B trial involving 10 participants recruited from the Fatty Liver Disease clinic at the Alfred Hospital. Eligible participants will undergo safety assessments in a prior four-week screening period and a baseline visit. Subsequently, they will receive 12-weeks of oral creatine supplementation in a dose of 5gm/day. During these 12-weeks, patients will visit the fatty liver clinic five times to assess disease progression and wellbeing. Following the treatment period, all participants will be followed up for four-weeks before statistical analysis is completed using Stata.

#### Results

The study is currently in the recruitment phase. Four patients have been recruited and undergone the full screening process. Four additional patients have been recruited and are yet to begin formalised screening. Our study cohort has reported relatively similar characteristics to larger cohort and cross-sectional studies already performed. The mean age of participants was 58.75 years, with 75% being female. All patients have an elevated Body Mass Index, waist circumference, visceral adipose tissue and fat mass index as also seen in other NAFLD studies. As patient Magnetic Resonance Imaging results were not available, the Controlled Attenuated Parameter (CAP) values were used to estimate patient hepatic steatosis. The mean CAP score was 303.5 dB/m with range 226-362 dB/m. The mean CAP score represents over a 67% fatty change in the liver, indicating significant steatosis. Our cohort however does not have any patients diagnosed with Type 2 Diabetes Mellitus, which has been proven to have one of the biggest associations with NAFLD.

#### Conclusions

Given the largely similar characteristics of our recruited cohort and larger epidemiology studies, it may lend greater validity to results and allow for generalisation to the wider NAFLD patient population.

This thesis also underscores the difficulties faced when obtaining ethics and governance approval for a greater than low risk clinical trial. This process lasted over 5 months and involved difficulties with submission of an initial ethics application, attainment of resource centre declarations and research collaboration agreements. These delays highlight the need for more streamlined ethics and governance processes in hospitals and calls for face-to-face and more direct communications between researchers and an institution's ethics committee and review panel.

# Emma Aldous

## The Association Between Mammographic Breast Density and Cardiovascular Disease

Supervisor Names and Institute Affiliations:

A/Prof Nitesh Nerlekar<sup>1</sup>, A/Prof Adam Brown<sup>1</sup>

<sup>1</sup>Victorian Heart Institute & Monash Heart, Victorian Heart Hospital



I chose to undertake a BMedSc(Hons) in 2023, after completing 4th year in 2022, to explore my interests in both cardiology and research in general. Throughout this year I have gained invaluable experience in a wide range of skills, including critical thinking, problem solving and scientific writing. My project provided me with an insight into the current gender disparities in cardiovascular health, as well as expanding my understanding of emerging technologies in cardiac imaging.

I am extremely grateful for the unwavering support provided by my supervisors and for their patience in helping me to develop both this project and my research skills. Undertaking an Honours year at the Victorian Heart Hospital was extremely enjoyable, with plenty of opportunity for being involved in both clinical and research education. Overall, BMedSc(Hons) is an incredibly rewarding year that has provided me with insights into the field of medical research and without a doubt inspired me to continue pursuing research into the future.

I am more than happy to be contacted by any future students at [eald0002@student.monash.edu](mailto:eald0002@student.monash.edu)

### ABSTRACT

#### Background

Cardiovascular disease (CVD), including coronary artery disease (CAD), is the global leading cause of death in women, however current cardiovascular risk stratification tools underestimate risk in women. Visceral fat deposits, including epicardial adipose tissue (EAT), secrete pro-inflammatory cytokines which mediate development of CAD. Mammographic findings associate with CAD, through breast arterial calcification (BAC). Breast adipose tissue, measured through breast density on mammography (low breast density indicates high adiposity) has shown to potentially act as a pro-inflammatory adipose tissue deposit. Therefore, mammography may represent a novel risk stratification tool for CVD in women.

#### Aims:

This study aimed to evaluate the association of breast density, as well as breast density and BAC combined, with the presence of CAD. It also aimed to evaluate the association of breast density with epicardial adipose tissue volume (EATv).

#### Method

This is a single-centre, retrospective, cross-sectional study, with a subsequent prospective arm, including women who had undergone both clinically indicated coronary computed tomography angiogram (CCTA) and mammography at Monash Health. EATv was quantified using semi-automated software, presence of CAD was determined based on radiologist reports, and breast density and BAC were visually assessed on mammography, with breast density categorised based on a validated categorisation system. Patient demographics and cardiovascular risk factors were retrieved from medical records. A subgroup of prospectively recruited patients underwent follow-up CCTA (median 6.2 years post-baseline CCTA). Chi-square, t-test, Mann-Whitney U test and one-way ANOVA were used to assess significance between group differences, where appropriate. Multivariable logistic regression modelling was used to assess association between variables when adjusting for confounders. Paired t-test assessed change in variables over time in the follow-up cohort.

#### Results

Among 153 participants included in the retrospective cohort (mean age  $62 \pm 10$ ), 103 (67.3%) had low breast density. Low breast density was associated with CAD, independent of modifiable (OR: 2.66 [1.21-5.94],  $p=0.015$ ) and non-modifiable (OR: 2.46 [1.06-5.75],  $p=0.036$ ) cardiovascular risk factors. Furthermore, low breast density combined with presence of BAC, showed a strong association with CAD, independent of modifiable (OR: 6.90 [1.84-34.34],  $p=0.008$ ) and non-modifiable (OR: 4.69 [1.17-24.18],  $p=0.040$ ) cardiovascular risk factors. Low breast density participants had higher mean EATv than high breast density participants ( $106.6 \pm 43.0$  vs  $81.0 \pm 31.6$  ml,  $p<0.001$ ), however this association was confounded by factors that influence breast density ( $p=0.134$ ). In the follow-up cohort ( $n=21$ ), mean EATv increased significantly between baseline and follow-up CCTA ( $90.3 \pm 39.5$  vs  $107.3 \pm 42.2$  ml,  $p<0.0001$ ). In a subgroup of the follow-up cohort who also had a follow-up mammogram ( $n=14$ ), those who had a decrease in breast density over time ( $n=5$ ) had a higher increase in EATv than those who had no change in breast density ( $n=9$ ) (+24% vs +19.9% increase in EATv).

#### Conclusions

Low breast density, both alone and in combination with BAC, is independently associated with CAD. Breast density is not independently associated with EATv. Association between low breast density and CAD may reflect both cardiometabolic health and unique pro-inflammatory adipose tissue activity. Consequently, mammographic breast density shows potential to act as a risk stratification tool for CAD in women.

# Jemima Allen

## Consent-GPT: Would it be ethical to delegate seeking consent for surgery to large language models (LLMs)

Supervisor Names and Institute Affiliations:

Professor Dominic Wilkinson (University of Oxford)

Dr Brian Earp (University of Oxford)

Dr Julian Koplin (Monash University)



I undertook my BMedSc(Hon) in Bioethics at the Uehiro Centre, Oxford University follow Year 4C. After two years of clinical placement, I was keen to delve deeper into the ethical aspects of medicine I had seen on the wards, as well as develop my skills in research and academic writing. I chose my topic because I feel that having an in-depth knowledge of AI technology, like large language models, and how it could shape clinical practice will be an important asset in my future medical career.

I am so grateful for the incredible opportunities I have had this year being at Oxford. I enjoyed making new friends from all over the world, and being a part of Exeter College and the Oxford University Lightweight Rowing Club. I loved integrating into life as a student at Oxford, from candlelit dinners in centuries-old dining halls, to stimulating discussions with some of the brightest minds in bioethics and other fields.

Although not without its own challenges, this year has taught me invaluable skills in bioethics and research, which has been equally rewarding and fascinating to learn.

Please feel free to reach out if you are interested to learn more about the program: [jemimaallen2@gmail.com](mailto:jemimaallen2@gmail.com)

### ABSTRACT

#### Background

Informed consent prior to a medical procedure or operation is fundamental to safe and ethical clinical practice. Commonly, a significant part of the consent-seeking process is delegated to members of the clinical team not performing the operation. However, despite its clear importance, the consent process is often done poorly. Consent delegates frequently lack sufficient time and clinical knowledge to adequately promote patient autonomy and informed decision-making. Various strategies have been proposed to address this.

One possible solution is to delegate parts of the consent-seeking process to conversational artificial intelligence (AI), otherwise known as large language models (LLMs). This technology would provide tailored responses to patients' questions, allow ease-of-access to relevant information and record conversations for formal documentation of informed consent. Such technology, whilst still in its early stages, could offer considerable benefits in medicine. In the case of delegated surgical consent, not only could LLMs improve patients' access to the relevant information for decision-making, but their use could also allow clinicians to focus their time on more complex tasks and spend longer with patients that need it.

#### Aim/ Method

The aim of this thesis is to assess whether, and under what conditions, it would be ethical to delegate surgical consent-seeking to LLMs.

My thesis is split into two parts: an ethical and empirical analysis. In the ethical analysis, I discuss whether consent delegation to LLMs would be ethically and clinically valid. Next, in the empirical analysis, I evaluate the results of an online survey I conducted assessing public perceptions regarding the validity of consent delegation, particularly to LLMs.

#### Results

Firstly, for my ethical analysis, I use a thought experiment (Consent-GPT), imagining that this technology were to be developed, and discuss its potential to promote patient autonomy and wellbeing by providing clear, jargon-free information to facilitate informed decision-making. However, concerns may arise regarding its lack of genuine empathy and the risk of anthropomorphising it, which could lead patients to place misguided trust in these systems. I also address several practical objections to their use in the consent process.

The results from the pilot study, which recruited 300 UK adults, indicate that the majority of participants regarded consent delegation as valid, both to a junior doctor (95.6%) and LLM (80.6%). A key finding in this study was that people's beliefs about the validity of consent delegated to LLMs were related to their level of trust in the accuracy of these systems. Participants also indicated that if a junior doctor known to them was not available, they may consider an LLM personalised with their medical data as equally acceptable to a junior doctor when providing consent.

#### Conclusions

Drawing on both these ethical and empirical analyses, I conclude by proposing that, under the right conditions and subject to thorough validation of medical accuracy, delegating surgical consent-seeking to LLMs would be ethically acceptable. Indeed, if empirical studies confirm that LLMs are accurate, consent delegation to these systems may not simply be ethically permissible, but it may become an ethical imperative for healthcare providers.

# Tanay Bapna

## Motion-tracking in the Operating Room (MoTOR)

Supervisor Names and Institute Affiliations

Supervisor: A/Professor Ramesh Nataraja<sup>1,2</sup>

Co-Supervisor: Dr. Maurizio Pacilli<sup>1,2</sup>

<sup>1</sup>Department of Paediatric Surgery & Surgical Simulation, Monash Children's Hospital, Melbourne Australia.

<sup>2</sup>Departments of Paediatrics & Surgery, School of Clinical Sciences, Faculty of Medicine, Nursing and Health Sciences Monash University, Melbourne Australia.



Hi! I'm Tanay. I chose to do my BMedSc after Year 4C. I chose my specific project because of an interest in surgery and medical technology as a field. My project was the perfect combination of my two interests. I learned so many untaught skills in my honours this year like submitting ethics applications, creating poster presentations, oral presentations, learning basic biostatistics and more. The two main highlights of this year included the abundant professional opportunities I was given and a chance to pursue non-medical hobbies like golf with more flexible working hours. A tip that most future students would've heard countless times is selecting a supervisor intentionally and speaking with previous students. It's also important to know your own expectations for the honours year before speaking with potential supervisors and selecting a project that suits your expectations.

I'm happy to be contacted on [tbap0001@student.monash.edu](mailto:tbap0001@student.monash.edu)

## ABSTRACT

### Background

The current surgical training landscape involves competency-based assessments. These assessments involve a senior surgeon observing a trainee complete an operation while rating their performance on domains such as tissue handling, manual dexterity and more. While this method of assessment is valid and provides feedback to trainees, it is prone to bias. There has been increasing evidence for the use of objective methods of assessment in surgery. Eye and hand tracking have been used in surgical assessment to objectively differentiate between varying surgical skill levels. Specific metrics evidenced to classify skill include dwell time, fixation frequency, path length, speed of movement, and total time. A previous study conducted by our research group used the Microsoft HoloLens 2 to differentiate novice and expert skill on individual simple surgical tasks.

### Aims

We aimed to use the HoloLens 2 to objectively differentiate between novice and expert performance on a simulated paediatric open inguinal hernia model. We also aimed to validate the surgical model developed.

### Methods

An open paediatric inguinal hernia model was developed under the guidance of a paediatric surgeon and was piloted with a group of experts. Participants completed the simulated procedure while wearing the HoloLens 2™, an augmented reality headset with hand-tracking capabilities. The outcomes measured included mean path length (cm), total path length (cm), velocity of movement (cm/s) and total time (seconds).

We recruited medical students and senior paediatric surgical registrars, fellows, and consultants as our novice and expert group, respectively. We intended to recruit a total sample size of 40 participants with 30 novices and 10 experts. Participants completed a pre and post task questionnaire with experts also responding to model validation questions.

### Results

We have currently recruited 24 participants, 60% of our target sample size. However, participant recruitment is ongoing, and the following results are from an interim analysis. The expert group had a mean path length of 71.8 cm (SD 15.1cm) compared to 112.5 cm (SD 13.9cm) in the novice group,  $p < 0.0001$ . The expert group also had a significantly reduced mean total path length, 287.0 cm (SD 60.35cm) versus 450.1 cm (SD 55.7cm) in the novice group,  $p < 0.0001$ . The mean velocity of movement was 0.14 cm/s (SD 0.02 cm/s) in the novice group and 0.17 cm/s (SD 0.07 cm/s) in the expert group,  $p = 0.13$ . Novices tended to take significantly longer 836 seconds (SD 70.0s) to complete the task compared to 458.1 seconds (SD 65.8s) time for experts,  $p < 0.0001$ . The inguinal hernia model had median scores greater than 7.0/10.0 for content validity domains. The model also established construct validity as novice and expert performance was differentiated using hand-tracking metrics and total number of errors made on the procedure,  $p < 0.05$ . Our surgical simulator had a high degree of functional task alignment.

### Conclusion

Overall, we displayed the ability of the HoloLens 2™ and hand-tracking metrics to objectively differentiate between novice and expert performance. The inguinal hernia model demonstrated favourable scores for content and construct validity, and acceptable functional task alignment.

# Imogen Bowden

## Perfusion as an Imaging Biomarker in Progressive Supranuclear Palsy

Supervisor Names and Institute Affiliations

Dr Lucy Vivash – Research Fellow Department of Neuroscience, Monash University

Prof. Terry O'Brien – Program Director Alfred Brain, Deputy Director of Research and Head of Neuroscience Clinical Trials Unit at The Alfred



As an undergraduate medical student, I was ready for a change in my university experience and a change is certainly what I got. The honours year has been a whirlwind of learning and challenges, successes and failures, highs and lows. I have learnt more than I thought possible over the course of the year, from understanding basic research principles, to radiology, to coding. Often, I found myself caught in the spiral of my brain contemplating brains in order to contemplate brains better. The honours experience has been a different experience all together and one I am incredibly grateful for.

### ABSTRACT

#### Background

Progressive Supranuclear Palsy (PSP) is a pernicious neurodegenerative disease driven by hyperphosphorylated tau accumulation. Diagnosis of PSP is challenging as early stages of disease mimic other neurodegenerative presentation including Parkinson's Disease. Presently, diagnosis of PSP is made based on clinical presentation due to a lack of sensitive and specific biomarkers in this condition. Tau-PET has shown promise as a diagnostic tool in PSP due to its ability to accurately portray patterns of tau burden. Several studies have explored early phase tau-PET as a surrogate of neurodegeneration to further optimise tau-PET imaging as a one-stop-shop in the diagnosis and investigation of PSP. Therefore, this study investigated the correlation of early phase tau-PET and Arterial Spin Labelling (ASL) measures of cerebral blood flow (CBF) and explored the relationship of these findings to clinical measures of PSP.

#### Method

The imaging modalities of 18F-PI2620 tau-PET, pulsed ASL, and MRI were used for this study. ASL preprocessing involved the use of the BASIL toolbox in FSL to construct the perfusion weighted image and transform into the MNI standard space. Imaging preprocessing of PET scans also involved transforming each scan into MNI standard space to allow comparison between the ASL and PET modalities. Restriction of early phase PET was performed in 24 iterations for each PET scan to produce timeframes ranging from 1.0 to 5.0 minutes. Eight regions of interest (caudate, putamen, thalamus, frontal lobe, insula, occipital lobe, parietal lobe, and temporal lobe) were extracted from both modalities using binarized masks of each region. Three reference regions (pons, cerebellum, cerebellum (excluding dentate nucleus)) were created and used to normalise results to assess which optimised correlation.

#### Results

A total of 15 paired ASL and PET scans were used, representing 12 participants (three with 52 week follow up scans) with a clinical PSP diagnosis. The best correlation seen between ASL and PET was with the 1.0-3.5 minute restriction (frontal lobe [ $r^2=0.4383$ ,  $p=0.0072$ ]). This early phase tau-PET 1.0-3.5 minute restriction was therefore used for subsequent analysis. The use of the cerebellum (excluding DN) as a reference region for value normalisation showed the strongest correlation between PET and ASL. In comparison to the pons, 5/8 ROIs showed improved correlation and statistical significance including in the frontal lobe (cerebellum (excluding DN) [ $r^2=0.3359$ ,  $p=0.0235$ ] vs pons [ $r^2=0.2241$ ,  $p=0.0747$ ]). Using the cerebellum (excluding DN) as a reference region, the caudate, frontal lobe, and temporal lobe were shown to hypoperfused; however, this was only significant in both PET and ASL for the caudate (PET [median=0.6879,  $p<0.0001$ ] and ASL [median=0.8209,  $p=0.0020$ ]). Positive correlations between ASL imaging findings and the EQ-5D-5L self-rated health score were also discovered (caudate [ $r^2=0.4986$ ,  $p=0.0103$ ], putamen [ $r^2=0.4284$ ,  $p=0.0209$ ] and frontal lobe [ $r^2=0.4495$ ,  $p=0.0170$ ]).

#### Conclusions

The strongest correlations were found between ASL and 1.0-3.5 minute early-phase 18F-PI-2620 tau-PET normalised by the cerebellum (excluding DN). Whilst this early phase PET protocol has weak correlations to perfusion, further investigation is needed to quantify perfusion changes and evaluate the relationship between perfusion and metabolism changes in PSP.

# Meghna Burmi

## Precisely Mapping Choroidal Tumour Margins

Supervisor Names and Institute Affiliations

A/Prof Anthony Hall — Department of Surgery, Central Clinical School

A/Prof Peter van Wijngaarden — Deputy Director, CERA and Principal Investigator, CERA Ophthalmic Neuroscience Unit

Dr Roderick O'Day — Principal Investigator, CERA Ocular Oncology Unit



Hi, I'm Meghna, an undergraduate student, and I completed my BMedSc(Hons) after Year 4C! I loved doing my project this year at the Centre for Eye Research Australia, in ocular oncology. CERA is a leading organisation in ophthalmic research in the heart of Melbourne, and a great place to learn all about medical research as a beginner and student. My project intrigued me as it involved ophthalmology, imaging, oncology, and artificial intelligence, and new technology that could be the future of eye care – exciting! I had minimal research experience before Honours but learnt so much throughout the year and now have a newfound passion for medical research. I would recommend the year to anyone who wants to try their hand at research or experience something different from clinical medicine.

I would be very happy to be contacted for any advice or further information (email: [mbur0009@student.monash.edu](mailto:mbur0009@student.monash.edu)).

## ABSTRACT

### Background

Choroidal melanoma is rare, life-threatening, and difficult to distinguish from its benign and common counterpart, choroidal naevus. Their differentiation and management is dependent on imaging of horizontal tumour margins. Colour fundus photography (CFP), ultrawide field scanning laser ophthalmoscopy (UWFSLO), and optical coherence tomography (OCT) may be used. Multimodal imaging is preferred, however often restricted to CFP and/or UWFSLO. An experimental modality, hyperspectral imaging (HSI), detects spectral reflectance of the fundus and with training, artificial intelligence can identify reflectance patterns. Literature has not assessed variation in horizontal margin detection across conventional modalities, or the potential for HSI as a comparable modality.

### Aims and Hypotheses

**Aim 1:** to compare the tumour margin annotations of two ocular oncologists (image graders) on CFP and UWFSLO images against the gold-standard multimodal approach (CFP, UWFSLO, IR-OCT en face, and EDI-OCT B-scans).

**Null Hypothesis:** the graders' annotations will be similar and will closely approximate the gold-standard.

**Aim 2:** to compare CFP and UWFSLO annotations individually against the multimodal method.

**Null Hypothesis:** that margin delineations using CFP and UWFSLO will be similar to the multimodal method.

**Aim 3:** to compare a deep learning model trained for HSI analysis for tumour margin delineation against the multimodal approach.

**Null Hypothesis:** that HSI will provide inaccurate tumour margins when compared with the gold-standard.

### Methods

Adult participants with a choroidal naevus or melanoma were imaged on CFP, UWFSLO, EDI-OCT and HSI. Tumour characteristics data was collected from these images and recent medical records.

Images from all modalities were stitched together and annotation (tumour margin mapping) was completed by two ocular oncologists. CFP and UWFSLO were independently annotated. Through clinician collaboration, a ground-truth annotation was generated using conventional modalities conjunctively.

A deep learning AI model was constructed and trained to detect unique spectral reflectance patterns (spectral signature) using 64% of participant data. The model was tested on the remaining 36% to assess its recognition of the spectral signature on this new dataset. This generated a 'probability map' image denoting likely tumour tissue, which was manually annotated by a data scientist.

Dice coefficients, a measure of overlap, was calculated for each two-image set for various comparisons.

### Results

Graders varied in accuracy and precision on CFP ( $p$ -value  $<0.01$ ) and in precision on UWFSLO ( $p < 0.01$ ). UWFSLO was more precise than CFP for Grader 1 ( $p < 0.01$ ) and more precise and accurate for Grader 2 ( $p < 0.01$ ). Lower pigmentation compromised accuracy and precision on both CFP ( $p < 0.01$ ) and UWFSLO ( $p < 0.01$ ). HSI annotations showed a trend towards precision and accuracy, however, were statistically insignificant.

### Conclusions

There is significant variation in tumour margin delineation between experts and across conventional modalities, particularly with lower-pigmented lesions. While not statistically significant, there are promising preliminary findings to support the presence of a spectral signature in choroidal tumours that can aid in more precise margin delineation but should be further researched. These findings suggest a potential for the use of HSI in ocular oncology.

# Stephanie Cameron

## Taking Patients Seriously: Overcoming Epistemic Injustice in the Domain of Difficult-to-Diagnose Conditions

Supervisor Names and Institute Affiliations

Professor Justin Oakley (Monash University)

Dr. Katrien Devolder (University of Oxford)

Dr. Bridget Williams (University of Oxford)



I undertook a BMedSc(Hons) in bioethics after my fourth year of medicine. I was excited to take a year to explore a different side of medicine and I have always been interested in studying philosophy, so the Bioethics Program was a perfect way to do both. Living in Oxford was an incredible experience. There were many great opportunities to meet new people, play sport, get involved with college events, and attend interesting philosophy and ethics lectures. I particularly loved playing football with the Oxford team, rowing, and doing a few surf trips. I am grateful for the opportunity to undertake challenging research in a supportive environment, and for the opportunity to learn so much about new areas of medicine and bioethics!

I highly recommend the program to anyone thinking about applying. I am happy to chat or answer any questions about the program at: [stephcameron9@gmail.com](mailto:stephcameron9@gmail.com)

### ABSTRACT

#### Background

There is a growing body of literature examining healthcare interactions in which doctors implicitly or explicitly express dismissal of patient symptoms. The phenomenon, “invalidation of patient symptoms”, appears to frequently arise in the context of chronic difficult-to-diagnose conditions (DDCs). DDCs include conditions such as long COVID, myalgic encephalomyelitis/chronic fatigue syndrome, fibromyalgia, and endometriosis. Such communication appears to be often unintentional and to reflect more insidious patterns of injustice pertaining to knowledge and communicative practices. Miranda Fricker’s influential theory of epistemic injustice provides a powerful tool for uncovering these patterns.

Epistemic injustice is a wrong done to someone in their capacity as a knower. Fricker explores the concept of epistemic injustice through a virtue-theoretic lens, conceptualising the two key forms of epistemic injustice – testimonial and hermeneutical injustice – as vices. She proposes the corrective virtues of testimonial and hermeneutical justice. Remedies for epistemic injustice have hardly been explored in the domain of DDCs.

#### Body

In my thesis, I aim to apply a virtue-theoretic lens to investigate remedies for epistemic injustice in the domain of DDCs. I use theoretical argumentation and draw on existing empirical research. I limit my discussion to general practice contexts because general practitioners (GPs) are often at the coalface of interactions concerning DDCs. First, I review five interrelated conditions of epistemic injustice and find that invalidating the symptoms of a patient with a DDC could theoretically meet the criteria for all five of those conditions. I argue that people with DDCs are especially vulnerable to epistemic injustice, in part, because uncertainty about a patient’s condition can lead to uncertainty about the patient themselves.

Subsequently, I explore the philosophy of general practice and develop a concept of an epistemically just healthcare encounter in the context of DDCs. Using the tools of analytical philosophy, I expound accounts of key virtues that could facilitate GPs cultivating an epistemically just healthcare encounter. I focus on the virtues of testimonial justice, hermeneutical justice, and epistemic humility. Drawing on empirical research investigating cognitive biases, I argue that the Fundamental Attribution Error and the Dunning-Kruger Effect could undermine GPs’ attempts to hit the targets of these virtues (i.e., justice and truth). Finally, I examine empirical research on “virtue-conducive environments” – that is, real-world strategies in medical education that could help to address key biases and cultivate key virtues. Among various suggestions, I propose (1) clearly addressing and prioritising DDCs in medical teaching and (2) embedding cognitive debiasing strategies such as “perspective-taking” throughout medical curricula.

#### Conclusions

People with DDCs are vulnerable to epistemic injustice which can cause clinical, epistemic, and morally significant harms. To promote epistemic justice, GPs ought to cultivate the virtues of testimonial justice, hermeneutical justice, and epistemic humility. Medical educators can pave the way for students to cultivate relevant virtues, for example, by clearly addressing DDCs in medical teaching and by embedding cognitive debiasing strategies throughout medical curricula. An array of further structural and cultural changes may be needed to address epistemic injustice in the domain of DDCs which warrant further exploration.

# Kristine Carlos

## Understanding the experiences of Gestational Diabetes Prevention in Chinese Women

### Supervisor Names and Institute Affiliations

Dr Siew Lim, Eastern Health Clinical School (Health Systems and Equity team)

Dr Rajshree Thapa, Eastern Health Clinical School (Health Systems and Equity team)

Associate Professor Jacqueline Boyle, Eastern Health Clinical School (Health Systems and Equity team)



I chose to take part in the honours year because I wanted to see what research was like but also have some time to invest in new and old interests. Not only did I get to learn a whole lot about my field of study, but I was also able to pick up new sports like volleyball and strength training as well as reinvest in old hobbies through Medrevue.

Getting to learn more about the intersectionality of experiences relating to women's health and immigrant health has been eye opening. It given me invaluable insight into the struggles CALD women face when engaging with a foreign health system and I'd like to believe this will help make me a better clinician. It's also made me even more curious on how else we can improve health service experiences for other CALD groups and would love an opportunity to continue this line of work in the future.

I would like to thank the Eastern Health Clinical School, Dr Pavel Sluka, Dr Siew Lim, Dr Rajshree Thapa and Associate Professor Jacqueline Boyle for all their help and support.

If you have questions about doing a Bmedsc(Hons), do not hesitate to email me at [kcar0005@student.monash.edu](mailto:kcar0005@student.monash.edu)

## ABSTRACT

### Background

Culturally and linguistically diverse (CALD) groups such as the Chinese population in Australia are disproportionately affected by gestational diabetes (GDM). The literature also suggests CALD groups face additional barriers when attempting to engage in lifestyle modification to improve their general health and wellbeing. Emerging evidence suggests lifestyle modifications in the preconception and interconception periods can prevent GDM, which has more than tripled in incidence over the past 20 years. However, engagement with lifestyle modifications is suboptimal. The Chinese population are the 2nd most permanent migrant group in Australia and yet there are no studies investigating Chinese women's experiences of engaging with GDM preventative care. Understanding their experiences and unmet needs in relation to engaging with preventative health services and lifestyle modifications is paramount to creating a culturally safe health care system that is easier to engage with. This study explores these experiences and unmet needs through the Social Ecological Model (SEM) framework.

### Method

Photovoice and semi-structured interviews were conducted with 8 women of Chinese ethnicity and migrant backgrounds. Participants were recruited through public advertising and purposive sampling. Interviews explored the phenomenon captured in the photos. Each photo received further questioning to elicit responses that answer the interview schedule. The interview schedule sought to understand how internal and external factors of the SEM influenced one's likelihood to engage with preventative care for GDM. Qualitative data was thematically analysed through an iterative open coding process.

### Results

13 major themes were identified across the five SEM levels. Individual themes included perceived risk for GDM, fixation on the thinness ideal over healthy habits formation and conception chances as major motivators or barriers to lifestyle modification. The thinness ideal was then reinforced interpersonally and institutionally by friends, family, and healthcare workers. Other interpersonal themes included the lack of social support, peer pressure to conform to other's preferences and the untapped potential of social support groups to encourage lifestyle modifications. Preconception and GDM health education appeared to be inadequate and non-comprehensive, sometimes leaving the impression that GDM is not serious. Access to the services were often difficult for participants and engagement was difficult due to the unfamiliarity participants had with their receiving countries channels of information dissemination. Participants also found it difficult to reconcile cultural food and postpartum traditions with the health advice relating to GDM provided in Australia. Finally, priorities were shifted away from proactive health service engagement and healthy diets secondary to the Medicare rebate freeze and cost of living crisis.

### Conclusions

Chinese immigrants face unique experiences that limit preconception and interconception lifestyle modification engagement for GDM prevention. Our study reinforces the need for development of GDM prevention guidelines and resources that are culturally accommodating and have the capacity to enable a balance of Chinese traditions with Australian healthcare practices. It also indicates a need to further investigate the pervasiveness of the influence of body image and collectivism on one's choice to engage with GDM prevention strategies. Purposive advertising of reliable resources (ie. Government pages) to information channels utilised by different CALD groups should be strongly considered.

# Sofia Carter

## Causative organisms and antibiotic susceptibility and use in urinary tract infections among adults with a vagina attending the Melbourne Sexual Health Centre over five years.

Supervisor Names and Institute Affiliations

Professor Catriona Bradshaw<sup>1,2,3</sup>, Dr Erica Plummer<sup>1,2</sup>, Dr Lenka Vodstrcil<sup>1,2,3</sup>

<sup>1</sup>Central Clinical School, Monash University;

<sup>2</sup>Melbourne Sexual Health Centre, Alfred Health;

<sup>3</sup>Melbourne School of Population and Global Health, The University of Melbourne



This year, I undertook a BMedSc(Hons) project that assessed how to improve antibiotic stewardship when treating urinary tract infections. Infectious diseases is an area that I am drawn to because it is one of the few specialties where patients are often cured, rather than just managed. It is also an area of medicine that has significant overlap with some of my other interests, including global health and public health. My undergraduate degree in biomedical science instilled in me my initial respect and enthusiasm for research, and this year has solidified my desire to pursue a career as a clinician researcher. I've always enjoyed puzzles, and my project this year has been a continuous process of checking to see if pieces fit, turning them on their head when they don't, and finding solutions until a picture ultimately comes together. I am more than happy to be contacted by students who have any questions about my experience.

### ABSTRACT

#### Background

Urinary tract infections (UTIs) are one of the most common infections. UTIs disproportionately affect females; 40-50% of adult females experience a UTI in their lifetime, and young, sexually active females have the highest incidence of uncomplicated UTIs. UTI diagnostic criteria are heterogeneous and management often involves empirical antibiotic use. This can contribute to antibiotic misuse in an era when addressing antimicrobial resistance is a global priority. We aimed to assess the causative organisms, prevalence of antimicrobial resistance and empirical prescribing practices to improve antibiotic use for UTIs.

#### Method

We conducted a retrospective audit in nonpregnant adults with a vagina aged 18-51 years old who received a UTI diagnosis at Melbourne Sexual Health Centre (MSHC) between 2/1/2018-24/1/2023. We calculated the proportion of participants with specific midstream urine dipstick, microscopy, culture, and antibiotic susceptibility results with 95% confidence intervals (CI). We compared empirical antibiotic prescriptions with the antibiotic resistance profiles of isolated organisms, and assessed adherence to first-line Australian Therapeutic guideline recommendations for acute uncomplicated lower UTIs in females (i.e. trimethoprim, nitrofurantoin and cefalexin). We assessed the performance characteristics of leucocyte esterase and nitrites on urine dipstick, and significant levels of bacteria (defined as  $\geq 1$  bacteria/10 small grids) and polymorphonuclear cells (defined as  $\geq 10 \times 10^6$  polymorphonuclear cells/L) on microscopy for diagnosing a UTI.

#### Results

Our study included 1694 acute UTI episodes in 1582 patients. On urine dipstick, 1419 (83.8%, 95%CI: 82.2-85.7) episodes had positive leucocyte esterase and 240 (14.2%, 95%CI: 12.5-15.9) had positive nitrites. On microscopy, significant numbers of polymorphonuclear cells and bacteria were present in 1459 (86.1%, 95%CI: 84.4-87.7) and 1631 samples (96.3%, 95%CI: 95.3-97.1), respectively. Urine culture was performed in 1517 episodes, with 69 (4.5%, 95%CI: 3.5-5.6) demonstrating no growth, 527 (34.7%, 95%CI: 32.3-37.1) reported as "Probable Contamination" and 921 (60.7%, 95%CI: 58.2-63.2) classified by the laboratory as a "Probable UTI" or "Possible UTI". The most common isolates were *Escherichia coli* (n=609/921; 66.1%, 95%CI: 62.9-69.1) and *Staphylococcus saprophyticus* (n=171/921; 18.6%, 95%CI: 16.5-21.7). Of the first-line recommendations, *E. coli* isolates had highest resistance to trimethoprim (n=194/606; 32.0%, 95%CI: 28.3-35.9). Nitrofurantoin susceptibility rates were high for all isolates (>97%), except *Klebsiella pneumoniae* (n=7/40; 17.5%, 95%CI: 7.3-32.8). Empirical antibiotics were prescribed for 1547 (91.3%, 95%CI: 89.8-92.6) episodes, with trimethoprim prescribed 842 (54.4%, 95%CI: 51.9-56.9) and cefalexin 586 (37.9%, 95%CI: 35.5-40.4) times. Most prescriptions (n=1465/1547; 94.7%, 95%CI: 93.5-95.8) adhered to first-line recommendations. For patients prescribed an empirical antibiotic, 17.5% (n=128/730; 95%CI: 14.8-20.5) of isolates were resistant to the prescribed antibiotic. Based on antimicrobial resistance profiles, a quarter (n=85/329; 25.8%, 95%CI: 21.2-30.9) of patients prescribed empirical trimethoprim could have required an alternative antibiotic. Overall, urine dipstick and microscopy findings demonstrated poor performance for the diagnosis of a UTI.

#### Conclusions

At MSHC, *E. coli* was responsible for two-thirds of diagnosed UTIs and a third of *E. coli* isolates demonstrated trimethoprim resistance. Empirical antibiotics were frequently prescribed, and trimethoprim accounted for >50% of prescriptions. Trimethoprim was not indicated in one in four cases where it was prescribed, highlighting the need for changes to antibiotic recommendations.

# Johnson Chen

## Dietary Fibre as an Adjunct Therapy for Reducing Kidney Injury in Diabetes and Hypertension

Supervisor Names and Institute Affiliations

A/Prof Melinda Coughlan, Prof Mark Cooper, Dr Arpeeta Sharma

Glycation, Nutrition & Metabolism Laboratory, Department of Diabetes, Central Clinical School



Hi, my name is Johnson and I decided to undertake a BMedSc(Hons) year after completing year 4C.

I was drawn to doing an honours year because it offered a different and intriguing challenge. I wanted to spend a year immersing myself into a project to gain more exposure about what research entails, as well as to develop skills that would help me in the future as a clinician-scientist.

I chose this project because endocrinology and nephrology are areas that interest me, and diabetes and hypertension are extremely common medical conditions that affect so many people. I was also interested in learning more about lifestyle managements, and this project enabled me to further delve into this.

I really enjoyed my honours year, and also managed to learn a lot and expand my skills greatly. I am happy to be contacted at [jche0225@student.monash.edu](mailto:jche0225@student.monash.edu).

### ABSTRACT

#### Background

Chronic Kidney Disease (CKD) is a prevalent condition causing significant mortality and morbidity. Despite numerous intervention principles, two of the leading causes – diabetes and hypertension – still result in significant progression to CKD. Therefore, it is crucial to investigate therapies that could slow or stop the progression to CKD. There are no interventions that target the gut-kidney axis, which is emerging as a critical pathway in the pathophysiology of CKD. Dietary fibre holds promise as a safe therapy to modulate renal health through the gut-kidney axis. Further investigation into its efficacy in diabetes and hypertension, and characterisation of its mechanisms of action are warranted into this potential adjunct therapy for CKD.

#### Aims

To elucidate the effects of a high fibre diet on kidney injury in a rat model of diabetes and hypertension, and further characterise the mechanisms underpinning the effects of a high fibre diet in DKD and hypertension.

Methods: Animal models were used to study the effects of high fibre on kidney disease. STZ type 1 diabetic rats, Ren-2 hypertensive rats, and control Sprague Dawley rats were randomised into receiving a control diet (4.7% fibre) or a high fibre diet (35% fibre consisting of 20% cellulose and 20% guar gum) for eight weeks. Endpoint glucose, kidney, and body weights were measured. Plasma, kidney, urine, and fecal pellet were collected for analysis of renal function, renal structure, and gene expression.

#### Results

High fibre did not appear to affect renal function, measured using UACR and Cystatin C, after eight weeks in diabetic and hypertensive rats. High fibre was linked with improvements in early signs of DKD – renal hypertrophy, and 8-Isoprostane (a marker of oxidative stress) – in the diabetic rats. There was no increased fibrosis and glomerulosclerosis in the diabetic rats suggesting the study length was not long enough for structural DKD changes to develop. Structural changes of hypertensive nephropathy were seen in the hypertensive rats, however high fibre did not attenuate these. Gene expression associated with fibrosis and inflammation was mostly unchanged in diabetic and hypertensive rats. There was a significantly decreased rise in HbA1c in high fibre diabetic rats compared to diabetic rats on a normal diet. Diabetes was linked to higher LPS concentrations, a marker of intestinal permeability.

#### Conclusions

Diabetic rats on the high fibre diet had less renal hypertrophy, lower HbA1c, and lower oxidative stress. These effects on early markers of DKD are promising and the results warrant further investigations with longer term interventions. This study supports the gut-kidney axis as a pathway in the development of DKD, and more investigations into this mechanism and how high fibre modulates renal health are warranted. High fibre was not observed to affect functional or structural parameters of kidney disease in hypertensive rats.

# James Crispin

## Women's Preferences for Caesarean or Vaginal Birth with a Perspective of Future Fertility: A Discrete Choice Experiment

Supervisor Names and Institute Affiliations

A/Prof Daniel Rolnik (Department of Obstetrics and Gynaecology, Monash Health)

Prof Ben Mol (Department of Obstetrics and Gynaecology, Monash Health)



With a newfound interest in obstetrics, I commenced my BMedSc(Hons) after completing year 4C. I was keen to explore the world of research, and how I might contribute to it. I was open to exploring most projects and eager to learn new things. Most of all, I was keen to help make a difference in patient care in whatever small way I could. Unexpectedly, my interests aligned in the form of a preference study, which had the potential to help guide consent procedures, and let me delve into the fascinating science and mathematics behind discrete choice experiments. It's been a challenging year, but through those challenges I have found greater independence, self-direction, self-motivation, and problem-solving skills. I've also had the incredible privilege of being supervised by and learning from two of the most intelligent, passionate, and caring people I have ever met.

If you have any questions, feel free to reach out: [JCri0002@student.monash.edu](mailto:JCri0002@student.monash.edu)

### ABSTRACT

#### Background

In lieu of research on how pregnant women weigh their medical risks, clinical practice guidelines are based on subjective expert valuations of obstetric risks. Women in low-risk pregnancies are not routinely offered a caesarean birth because the expert consensus is that the risks outweigh the benefits, and patients are not routinely informed of a possible risk to their future fertility with a caesarean delivery because it is unclear if it would change their birth decisions. This study investigated how nulliparous women in low-risk pregnancies preference their medical risks between a planned vaginal and elective caesarean birth, including this possible reduction in their fertility.

#### Aim

To determine how nulliparous women in a low-risk pregnancy preference the risks of vaginal and caesarean birth, including possible risks to their future fertility, when making mode of delivery decisions.

**Methods:** In this discrete choice experiment, low-risk nulliparous pregnant women were asked to choose between hypothetical birth scenarios in eight choice sets. These scenarios differed by six attributes: pain, health of the baby after delivery, health of the mother after delivery, risk of placenta accreta or uterine rupture in the next pregnancy, risk of extra (unplanned) intervention and probability of having another baby in the future. Two alternatives were created for each of these attributes, representing a planned vaginal and elective caesarean birth in a low-risk pregnancy. These alternatives were mixed between hypothetical birth scenarios and data on participants choices between scenarios was analysed using a conditional logistic regression model to produce conditional Odds Ratios (OR) for each attribute, representing their relative importance in participant's birth decisions.

#### Results

Two-hundred and eleven responses meeting the inclusion criteria were obtained, including 34 pilot interviews. Participants weighed the included risks evenly between favouring a planned caesarean or vaginal birth and showed a statistically significant preference for the risks to the health of the mother (conditional OR 1.29, 95% CI 1.17 to 1.42) and the lower risk of unplanned intervention with a caesarean birth (conditional OR 1.37, 95% CI 1.24 to 1.51). The risk to future fertility was the second most influential attribute in participants' decisions, favouring a vaginal birth (conditional OR 0.75, 95% CI 0.68 to 0.83). Risks to the health of the baby after delivery had no statistically significant effect on patients' choices between birth scenarios (conditional OR 1.01, 95% CI 0.92 to 1.12).

#### Conclusion

Risks to the health of the neonate may be weighed equally between a planned caesarean and vaginal birth by low-risk pregnant women, but the possible reduction in future fertility with caesarean birth may be sufficient to sway their decisions in favour of a vaginal delivery. Some low-risk pregnant women may weigh their medical risks in favour an elective caesarean birth, although more research is needed to confirm this finding.

# Kevindu De Silva

## Cochrane's COVID-19 Living Systematic Reviews

Supervisor Names and Institute Affiliations

Supervisor: Tari Turner

Co-supervisor: Steve McDonald

Institute: Cochrane Australia



I intermitted between my fourth and fifth year of Medicine to do my BMedSc(Hons) year. I chose my project because I was interested in learning about the medical research landscape. I wanted to identify medical research stakeholders and understand what limits the utility of medical research. Living evidence is an innovative field that has the potential to address the redundancy and lack of currency that plagues most research fields. I wanted to contribute in some form to increasing the usefulness of the research that students and other academics conduct. Beyond understanding the principles of rigorous mixed-methods research, I have gained exposure to the world of public health and worked with a team of incredible people. My advice for future students is to carefully consider your Honours supervisor – I found this year rewarding because I had two amazing supervisors who were supportive of my goals and were readily available to answer questions.

## ABSTRACT

### Background

Cochrane conceptualised living systematic reviews in 2014 to address the redundancy and lack of currency of many standard systematic reviews. Although some living reviews existed before 2020, the number of living reviews surged during the COVID-19 pandemic. However, there is limited research on COVID-19 living reviews, particularly qualitative studies. It is unclear if living reviews are being maintained as intended or what the main issues authors face when conducting and publishing their living reviews.

### Method

This study comprised three sub-studies. The first sub-study was an analysis of the characteristics of Cochrane's COVID-19 living reviews. The second assessed whether the subset of intervention and prevention living reviews included all relevant, available randomised trials (using a list of COVID-19 randomised trials maintained by the National Clinical Evidence Taskforce). The final sub-study was a qualitative study involving semi-structured interviews with Cochrane's COVID-19 living review authors to identify the barriers and enablers to conducting, reporting and publishing living reviews.

### Results

Cochrane published 25 COVID-19 living systematic reviews. Half of these reviews were not updated and only four were updated more than once. On average, reviews took over a year to be updated and after 1 October 2021, this appears to mostly have been due to editorial delays. Publication speed was also reduced by teams losing external funding, waning commitment to keep reviews in living mode, and the burden of screening results. Although LSR searches were out of date, many authors felt that their conclusions were still current. We interviewed six Cochrane LSR authors. Identifying Cochrane reviews as living was challenging because authors commonly acknowledged the living approach outside of the title and abstract and the Cochrane Library does not have a visual cue for LSRs. An inability to communicate the status of the living review through the Cochrane Library platform was a frequent frustration for many authors. Although many authors felt their review's conclusions were current, only one living review communicated its update status and made accessible new evidence after the LSR was published.

### Conclusions

Our findings are consistent with previous living review research conducted both pre- and mid-pandemic. Cochrane's platform and publication model significantly limited the currency and transparency of their living reviews. If Cochrane is to prioritise living reviews, then it needs a separate streamlined editorial process and platform that makes living reviews instantly recognisable. Much like the reviews themselves, living review platforms need to be dynamic. This would allow authors to communicate the results of their ongoing searches and provide interim updates on the status of their living reviews. Future research in this field should involve speaking to editors and users to identify other issues with the living approach. A comparison of all living review-supporting journals could also help identify an ideal platform and publication model.

# Andrew Duan

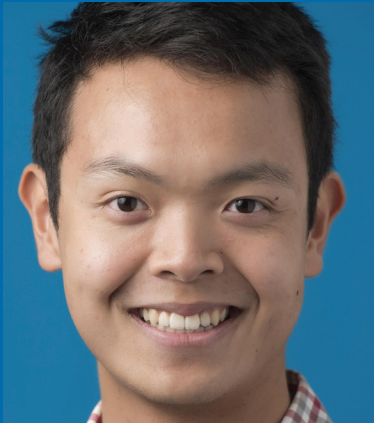
## Identifying the incidence, risk factors and discriminators for Sudden Unexpected Death in Epilepsy (SUDEP) among young Australians who die suddenly

### Supervisor Names and Institute Affiliations

Dr Shobi Sivathamboo: Department of Neuroscience, CCS

Prof Terence O'Brien: Department of Neuroscience, CCS & Alfred Brain, Alfred Health

A/Prof Piero Perucca: Department of Medicine (Austin Health), University of Melbourne & Bladin-Berkovic Comprehensive Epilepsy Programme, Austin Health



After the academic busyness of fourth year, I decided to try my hand at something different – medical research. I'd also wanted to gain more exposure in the field of Neurology and hence the two coalesced into a decision to do a BMedSc(Hons). And it's definitely been worthwhile! Doing my BMedSc(Hons) at the Department of Neuroscience at CCS has allowed me to immerse myself in their world-class epilepsy research & clinical programmes whilst being exposed to the rigours and ups and downs of medical research. And yes – I would recommend the Department for anyone considering a neuroscience honours project! My supervisors have been wonderfully supportive and there is a collegial atmosphere that runs across the medical, biomedical and science honours students. It's been a privilege to work with Australia's leading SUDEP experts and I have definitely grown as a professional and a clinician scientist over the past year. One thing that I've learnt is there is no such thing as an 'easy' research project. Though behind every cloud lies a silver lining. I'm more than happy to be contacted via email at [Andrew.duan.2016@gmail.com](mailto:Andrew.duan.2016@gmail.com) regarding any questions on epilepsy research or the honours year in general.

## ABSTRACT

### Background

Sudden unexpected death in epilepsy (SUDEP) is the most common cause of deaths directly due to epilepsy. Despite increased global awareness and research into SUDEP, the burden of SUDEP among young Australians remains unclear. Furthermore, the identification of SUDEP cases is complicated by overlapping definitions and a lack of validated biomarkers. The resulting diagnostic inaccuracies impede public health efforts to reduce SUDEP incidence. Thus, there is a need to better understand the incidence and risk factors of SUDEP to develop targeted risk reduction strategies.

### Aims

Our, the Sudden Arrests and Deaths in Epilepsy (SADIE) study, had three separate aims. Firstly, we examined the incidence of SUDEP in individuals aged 1-50 years in Victoria, Australia. Secondly, we assessed the proportion of these SUDEP cases reported in routine death investigations. Thirdly, we identified risk factors and possible discriminating features for SUDEP in the Victorian population.

### Methods

We reviewed cases with a history of epilepsy or seizures (n=100) between April 1, 2019, and April 1, 2021, in a novel sudden cardiac arrest registry, the Victorian EndUCD registry (n=1319). A panel of epilepsy experts adjudicated the epilepsy cases to identify the SUDEP cases. These adjudicated SUDEP cases were used to calculate incidence rates. Cases of sudden cardiac death (SCD) that were confirmed via autopsy and cardiologist review served as a comparator group (n=635). An adjusted logistic regression analysis between SUDEP cases and SCD cases was performed to identify risk factors that discriminate between the two conditions.

### Results

We identified 63 Definite, Probable and Fatal Near SUDEP cases (median age 35.5, IQR 24-43), of which 29% were female. The SUDEP incidence in Victoria among individuals aged 1-50 years was 1.22 per 1000 person-years of observation. Only 48% (30/63) of the SUDEP cases were recognised in routine death investigations. Among the SUDEP cases, 22% (14/63) had been seizure free for at least 12 months and 48% (30/63) had undetectable antiseizure medication levels. The odds of cardiac fibrosis (aOR 2.48, 95% CI 1.06 – 5.80, p=0.036), cardiac hypertrophy (aOR 6.49, 95% CI 2.41 – 17.42, p<0.001), previous stroke (aOR 14.09, 95% CI 2.32 – 85.40, p=0.004), and death before ambulance arrival (aOR 2.77, 95% CI 1.08 – 7.11, p=0.035) were higher in SUDEP than SCD cases. The odds of older age (aOR 0.95, 95% CI 0.92 – 0.98, p<0.001), survival to hospital discharge (aOR 0.03, 95% CI 0.00 – 0.54, p=0.018), cardiomegaly (aOR 0.39, 95% CI 0.18 – 0.87, p=0.021), and coronary artery atheroma (aOR 0.32, 95% CI 0.14 – 0.75, p=0.009) were lower in SUDEP than SCD cases.

### Discussion and Conclusions

Our findings suggest that SUDEP is a common cause of sudden death in young Australians and it is often unrecognised in routine death investigations. We identified multiple risk factors and discriminators that provide further insights into the differences between SUDEP and SCD. Our research highlights that improving seizure control and compliance with antiseizure medication therapy would likely play an important role in decreasing the incidence of SUDEP.

# Lachlan Evenden

## Interferon epsilon and mucosal immunity

### Supervisor Names and Institute Affiliations

Dr Ed Giles

Dr Eva Chan

Dr Eveline De Geus

Hudson Institute of Medical Research and Department of Paediatrics



During my 4<sup>th</sup> year of medicine, I decided to look into doing a BMedSc (Hons). I initially wasn't sure what project I would be interested in however found myself being drawn to a few gastroenterology projects, especially those to do with mucosal immunity. I ended up choosing a project which studied a new cytokine known as Interferon Epsilon. This was a lab-based project, which was a completely new area for me. I quickly found I really enjoyed the hands-on challenge of working in a lab and the great environment of people who also worked there. I spent a lot of my time learning to culture cells which was a completely unique skill. I would highly recommend a lab-based project to anyone considering a BMedSc as they offer an entirely new perspective towards medicine. I am happy to be contacted by future students.

## ABSTRACT

### Background

The intestinal mucosa must maintain a delicate balance of tolerance and defence. It is simultaneously responsible for absorbing our nutritional needs and supporting the commensal gut bacteria whilst protecting against invading pathogens. The ability for the intestinal mucosa to achieve this selective tolerance is complex and yet to be fully understood, however the breakdown of these mechanisms results in clear disease phenotypes. Inflammatory bowel disease is widely accepted to be due to a loss of tolerance of the commensal organisms residing in the gut. Two key pathological features are the breakdown of the epithelial barrier, allowing translocation of the microbiome, and immune dysregulation.

Interferon epsilon (IFN- $\epsilon$ ) is a novel type 1 interferon that has been implicated in mucosal immunology. Type 1 interferons (T1IFNs) are a diverse group of cytokines with anti-viral, anti-proliferative and anti-tumour effects, typically in response to a pathogenic stimulus. IFN- $\epsilon$  is unique due to its constitutive expression in the mucosal epithelium. Mice studies of the intestinal mucosa revealed IFN- $\epsilon$  is protective against a DSS model of colitis, with IFN- $\epsilon$  knockout mice suffering from far worse breakdown of the epithelial barrier and immune cell expansion. This has led to the hypothesis that IFN- $\epsilon$  plays an important role in maintaining the epithelial gut barrier and modulating the immune response.

### Aim

To investigate the role of IFN- $\epsilon$  in human colonic models.

### Methods

IFN- $\epsilon$  was studied with the use of an in-house generated neutralizing antibody (known as HE2), which prevented IFN- $\epsilon$  binding with its cell surface receptor. An effective neutralizing concentration of HE2 was determined by titrating Caco2 cells with HE2 and measuring interferon stimulated gene (ISG) expression. Colonic organoids were then utilized to investigate the impact of IFN- $\epsilon$  on key epithelial gap junction genes and ISGs. As a different antibody (ME2) was mistakenly used for a number of these experiments, Hek-Blue<sup>TM</sup> T1IFN reporter cells were utilized to test the neutralizing ability of HE2 and ME2. Finally, gene expression of ISGs, gap junction genes and key cytokines were investigated in colonic biopsies treated with HE2.

### Results

No effective neutralization dose of HE2 was observed in the Caco2 cells. The Hek-Blue T1IFN reporter assay showed a neutralization effect of HE2 at a concentration of 10  $\mu$ g/mL however no neutralization effect was observed with ME2. This made it difficult to draw conclusions from the organoid experiments as they were done with ME2, however, a down regulation effect on the housekeeper gene (18S) was observed ( $p=0.0499$ ). No significant changes were observed in the colonic biopsies treated with HE2.

### Conclusions

No significant effect of neutralizing constitutive IFN- $\epsilon$  expression suggests that alternative methods need to be used to study IFN- $\epsilon$ . There are two key alternatives, to trial the addition (as opposed to neutralization) of IFN- $\epsilon$  on models of human colonic tissue, or investigate IFN- $\epsilon$  in the context of epithelial damage, which is where the protective effect of IFN- $\epsilon$  was revealed in the murine DSS colitis model.

# Carrie Fei

## RNA sequencing of lens epithelial cells in secondary cataracts

Supervisor Names and Institute Affiliations

A/Prof Anthony Hall (Central Clinical School)

A/Prof Lyndell Lim (Centre for Eye Research Australia)



I chose to do a BMedSc(Hons) in the field of Ophthalmology to learn research skills and explore the specialty. The basic skills of writing a literature review and thesis were valuable skills I learnt this year, and I was also able to gain a thorough insight into the medical and surgical sides of Ophthalmology with the nature of my project. (email: [cfei0002@student.monash.edu](mailto:cfei0002@student.monash.edu))

### ABSTRACT

#### Background

Cataract, the opacification of the human lens, is the leading cause of blindness worldwide. Unoperated cataract accounts for moderate to severe visual impairment in at least 94 million people aged 50 years or over. Despite this significance, cataract pathogenesis is not well understood. Steroid-induced, uveitic and post-vitrectomy cataracts are three types of secondary cataracts that typically affect younger individuals compared to the most common age-related cataracts (ARCs), and patients with these types of secondary cataract are likely encounter more complications during and after surgery. RNA sequencing uses gene expression technology to identify the transcriptome of cells or tissues of an organism. The lens epithelial cells (LECs), which is found as a monolayer of cells posterior to the anterior capsule, is the progenitor of almost the entire lens structure, making it the best candidate for RNA sequencing.

#### Method

Participants were recruited from the Royal Victorian Eye and Ear Hospital, Alfred Health and Eye Surgery Associated between March and July of 2023. Target enrolment was 15-20 samples for each of the four groups: ARCs (controls), steroid-induced cataracts, uveitic cataracts and post-vitrectomy cataracts. Human lens' anterior capsule samples were collected during routine cataract surgery and preserved in RNeasy<sup>®</sup> reagent in Eppendorf Tubes<sup>®</sup>. Samples were stored at -80°C at the Australian Centre for Blood Disease (ACBD) in Alfred Hospital. RNA extraction, library preparation and library quantification were completed at the Australian Genome Research Facility (AGRF) in Adelaide and Melbourne using the RNeasy<sup>®</sup> Mini Kit, the Illumina Stranded Total RNA Prep kit, and the NEBNext<sup>®</sup> Library Quant Kit. This project is ongoing and sequencing will use the NovaSeq X protocol. Methods for gene expression analysis cannot be selected until sequencing results are released.

#### Results

97 samples were sent for RNA extraction; 36 controls, 23 steroid cataracts, 25 uveitic cataracts, and 13 post vitrectomy cataracts. 96 samples came back with high quality (RIN $\geq$ 8 or DV200  $\geq$  80%) and low volume (mean volume 175 ng). 1 sample was degraded and excluded from the study. Libraries were successfully generated for all 96 samples.

#### Conclusions:

RNA sequencing in cataracts is a novel field, and the methodology is not well defined. This project is the first large-scale gene expression study on these three types of secondary cataracts. I was able to collect most of the target specimens and was able to extract high quality RNA from all but one sample. Inevitably, all extracted RNA samples were of low volume, which may introduce bias during sequencing and analysis.

# Sarthak Gandhi

## The Emerging Utility of Ketamine in the Management of Severe Mental Health Conditions in Children and Adolescents

Supervisor Names and Institute Affiliations: Prof Simon Craig<sup>1,2</sup>, A/Prof Michael Gordon<sup>3,4</sup>

<sup>1</sup>Department of Paediatrics, School of Clinical Sciences, Monash University

<sup>2</sup>Paediatric Emergency Department, Monash Medical Centre, Monash Health

<sup>3</sup>Monash Health, Melbourne, Victoria, Australia

<sup>4</sup>School of Clinical Sciences, Monash University



I've found my BMedSc(Hons) year such a unique and rewarding experience! I enjoyed some time away from clinical placement, and the opportunity to engage with a research project right from conception to presentation of findings. It offered many valuable insights and certainly strengthened my understanding of what research is all about (things you may not otherwise realise in a short-term project), and all the challenges and complexities that come with conducting a study. Moreover, it's been a year that has allowed me to reflect on the critical importance of research and methodologies, and their invaluable role in guiding clinical practice. As such, I am very much looking forward to continuing my active involvement in clinical research and ensuring my career is holistic and diverse. I'd like to say a huge thank you to my supervisors, Simon and Michael for their support, it has been so incredibly appreciated and made my whole experience that much more fulfilling!

### ABSTRACT

#### Background

The management of severe and 'difficult-to-treat' mental health presentations in young people, such as acute behavioural disturbance (ABD), treatment-resistant depression and suicidal ideation presents significant challenges with limited empirical guidance.

Ketamine, long recognised for its anaesthetic and analgesic properties, has recently gained significant attention for its robust (yet short-lived) anti-depressant and anti-suicidal effects in adults. As such, it has been identified as an agent with the potential to become a novel and efficacious treatment option. However, investigation into its utility for children and adolescents with acute severe mental health concerns remains relatively unexplored.

#### Method

Employing a mixed-methodology approach, we conducted a retrospective chart review (with case-control and observational cohort components) and an anonymous online survey of psychiatrists.

The retrospective chart review, conducted at Monash Health (Victoria, Australia), encompassed a three-year study period (2020-22) and identified cases, aged 7 to 18 years, where parenteral ketamine was administered for ABD or severe mental illness. In addition, cases where other parenteral agents (olanzapine, droperidol, or a benzodiazepine) were administered for ABD were also included, enabling a case-control analysis (ketamine cases vs non-ketamine controls). Clinical data from medical records was used to describe the use of ketamine in the management of ABD and severe mental illness, and compare ketamine with other parenteral medications used for ABD.

The online, voluntary, and anonymous survey, distributed by the Royal Australian and New Zealand College of Psychiatrists, gathered insights from psychiatrists across Australia and Aotearoa New Zealand. The survey aimed to describe current ketamine use, obtain an understanding of any challenges/barriers to its use, and to seek recommendations for future research directions.

#### Results

The chart review revealed that ketamine use for ABD in paediatric emergency department settings is rare, with only ten episodes (involving 7 unique patients) identified over the 3-year study period. These patients often had a history of neurodevelopmental diagnoses and frequently required physical/mechanical or chemical restraint during transport to hospital, with police presence. In the ED, there was variability in ketamine administration practices (including timing of administration, and use of other agents prior to ketamine administration), reflecting the absence of consistent, evidence-based clinical guidelines. No patients receiving ketamine in the management of a severe mental illness were identified.

Survey results from 24 psychiatrists indicated infrequent ketamine use for severe mental illness. However, when utilised, favourable outcomes were reported, particularly among adult patients with major depressive disorder. Concerns about ketamine also emerged, such as the stigma associated with its history as a drug of abuse. Research priorities include studies comparing ketamine to other treatments, and long-term trials evaluating safety and efficacy in the paediatric cohort.

#### Conclusions

The study contributes to emerging investigation into ketamine use in paediatric mental health. Our findings reflect its rare administration, suggesting that a larger sample size over multiple hospital networks is required to obtain sufficient data. For clinical trials with the paediatric population to commence, this preliminary data is a critical first step to contextualise current use, and inform key research questions, outcome measures and feasibility of clinical trials with children and adolescents.

# Jade Guitera

## General Practitioner experiences of negotiating paediatric mental health care access

Supervisor Names and Institute Affiliations:

Pr. Grant Russell and Dr. Riki Lane, Department of General Practice, School of Public Health and Preventive Medicine, Monash university



I have a strong interest in public health and particularly access to healthcare. With the support of the Department of GP and my supervisor Grant Russell, I developed my own research question centred around my interests. I had a longstanding interest in paediatrics and was curious about the role of GPs at the nexus of care for these patients that struggle to access mental health care. I have loved conducting qualitative research and have learnt a lot about the mental health system in Australia. This year has also allowed me to pursue my other interests such as travel, musical theatre and volunteering in the Australian Medical Student Association.

### ABSTRACT

#### Background

Mental illness has a prevalence of 14% in Australians aged 4-17-years and is a leading cause of mortality and morbidity for this age group. Despite a multitude of services dedicated to mental health, only 56% of these children and adolescents access help and only 35% report that their needs are being met by them. As the most consulted health professional for this issue in youth, General Practitioners (GPs) can play an essential role in enabling access for this patient population, however very little research has been done into what their experience providing that care and guidance looks like.

#### Aim/objective

To understand GPs' experience in negotiating access to mental health care for children and adolescents.

#### Methodology

This qualitative study used a phenomenological design. We conducted semi-structured interviews with Melbourne-based GPs recruited using purposive sampling. The audio-recorded interviews were transcribed and coded using the software NVivo14™. Analysis used a reflexive thematic approach informed by Braun and Clarke.

#### Findings

Twelve Melbourne-based GPs were interviewed for an average of 35 minutes from May to July 2023. Three themes emerged from analysis. The first is of GPs fighting for children to address their mental health, the second of GPs being essential providers of mental health care and the third of GPs guiding children through the mental health system maze. These also include subthemes mainly around the tangible actions that GPs take in their negotiation, the barriers they face along the way as well as their working environment. While describing their experience, participants also mentioned solutions that they were hopeful would alleviate some of the challenges they were facing.

#### Implications

Our study has shed light on the crucial but under-supported role of GPs within the paediatric mental health care system in Melbourne. The interviews highlighted challenges in their work that must be addressed through policy and funding, particularly around support of their work in this space and lowering barriers of referral to psychological services. They also suggest opportunities to better the system and experience of their patients, such as increased collaboration with schools and psychologists or psychiatrists, that must be further researched and implemented in policy and practice.

# Joshua Hamilton

## Statin Intolerance: A Study of the Involvement of the Inflammatory System in Statin Absent Individuals.

Supervisor Names and Institute Affiliations

Professor Stephen Nicholls and Dr Kristen Bubb

Victorian Heart Institute, Monash University (School of Clinical Sciences)



The concept of a full year of research was far from what I thought I would complete during my medicine degree. During my 4th year, I attended the information nights and seminars with no intentions of undertaking an honours year. I was won over by the lovely people of the Victorian Heart Institute and I am forever grateful for that decision.

By undertaking a clinical project with lab work, I was able to upkeep my clinical knowledge with patient recruitment and witness the other side of medicine in the laboratory. Throughout this year I learnt invaluable skills, both in individual research and in working with collaborative research teams. The year did not come without its ups and downs, but this felt part of the journey and built up my resilience.

All would not have been possible without the wonderful support of my supervisors, Prof Stephen Nicholls, and Dr Kristen Bubb. Nor, without the assistance of the wonderful staff within the VHI. I have met researchers and doctors from as the far reaches of the world, making lifelong friendships and research connections.

### ABSTRACT

#### Background

Cardiovascular disease is the leading cause of death in Australia. Dyslipidaemia drives this process with excess LDL-Cholesterol whilst chronic inflammation drives plaque vulnerability and major adverse cardiovascular events. Established treatment with Statins is available, with large uptake. Statins actively lower LDL-C levels and pleiotropically act to reduce chronic inflammation. But subpopulations are left behind, particularly those with statin intolerance. A condition characterised by the inability to tolerate  $\geq 2$  statins due to myalgia symptoms. Understanding the complex interplay between high-risk individuals that have absence of statin therapy, including those with statin intolerance, and activity of chronic inflammation can provide new methods to risk stratify and new pathways of therapy for cardiovascular disease.

#### Method

The aims of this project were to identify the differences chronic inflammation, in statin therapy compared with statin absent or intolerant individuals, that are classified as high-risk. A further aim was to examine the impact of chronic inflammation on atherosclerotic disease progression.

Two individual studies took place in parallel:

- 1) A cross sectional study involving 24 participants of statin intolerance or control statin therapy. Patient characteristic data, biochemistry tests including inflammatory markers and laboratory analysis to measure interleukin levels were assessed and directly compared across groups.
- 2) A post-hoc analysis of six clinical trials measuring atheroma burden with intravascular (IVUS) imaging. 3023 participants were grouped into concomitant statin therapy or statin absence. Annualised changes in biochemistry, atheroma percentage and volume were compared between groups. Multivariable analysis was applied to elicit changes associated with chronic inflammation.

#### Results

Statin intolerance study included 24 individuals; data collection is ongoing. No significant association between statin intolerance and pro-inflammatory marker hsCRP was observed (controls 2.5mg/L (0.6, 8.0) vs statin intolerant 2.09mg/L (1.1, 3.1),  $P=0.853$ ). IL-1 $\beta$  (8.06 $\pm$ 23.35pg/ml vs 15.92 $\pm$ 39.57pg/ml,  $P=0.569$ ) and IL-6 (4.31 $\pm$ 9.18pg/ml vs 68.47 $\pm$ 182.9pg/ml,  $P=0.259$ ) displayed no statistical significance but trended higher amongst statin intolerant individuals. Regression analysis displayed a positive trend between interleukins ( $R^2 = 0.752$ ).

IVUS analysis included 3023 participants, 2790 on statin therapy and 233 absent of statin therapy. Significant associations between statin absence and LDL-C levels (2.16 $\pm$ 0.74mmol/L vs 2.76 $\pm$ 0.94mmol/L,  $P < 0.001$ ) as well as hsCRP measurements (1.8mg/L (0.9, 3.9) vs 3.2mg/L (1.3, 6.1),  $P < 0.001$ ) were observed at annualised follow-up. Percentage atheroma volume (PAV) increased less amongst those on statins (+0.1 $\pm$ 1.9% vs +0.8 $\pm$ 1.9%,  $P < 0.001$ ). Total atheroma volume (TAV) decreased with statin therapy and increased with statin absence. (-1.8mm $^3$  vs +2.5mm $^3$ ,  $P < 0.001$ ). Mixed multivariable analysis exacerbated differences in change across groups when isolating hsCRP impacts (-0.48 $\pm$ 0.14%,  $P < 0.001$  and -6.05 $\pm$ 1.36mm $^3$ ,  $P < 0.001$ ).

#### Conclusions

The absence of statin therapy in high-risk individuals displays an upward trend in pro-inflammatory markers associated with increased chronic inflammation. There was no association between statin intolerance and hsCRP, although limited in analysis due low sensitivity in cardiovascular disease with a small sample size. Absence of statin therapy associated with a greater increase in PAV and TAV which was exacerbated through isolating pro-inflammatory impacts. Future directives include assessments of inflammation within risk stratification and anti-inflammatory agents in cardiovascular outcome reduction.

# Ally Hui

## Long term observation of endometriosis with transvaginal ultrasound surveillance (LOETUS)

Supervisor Names and Institute Affiliations: Professor Ben Mol, Dr Nyasha Gwata, Department of Obstetrics and Gynaecology, School of Clinical Sciences, Monash Health



It was my aim to get some exposure to clinical research during my years in medical school and the Honours degree was the perfect opportunity to do so, while being supported in a structured environment. I had the privilege of undertaking my BMedSc(Hons) year with the Department of Obstetrics and Gynaecology at the School of Clinical Sciences. I chose a project in endometriosis, as the prospect of contributing to the literature for a debilitating disease affecting 11% of those assigned female at birth was very worthwhile to me.

I have gained invaluable skills including time management and effective communication, having carried out two observational studies from study design to data collection and analysis. Overall, this year has been a very rewarding experience and I thank my supervisors and my peers for supporting me throughout!

For those considering a BMedSc(Hons) year, my advice would be to know what you want to get out of the year and seek out a supervisor and project that aligns with those goals. I'm happy to be contacted by anyone considering a BMedSc(Hons) project at: [ahui0004@student.monash.edu](mailto:ahui0004@student.monash.edu).

### ABSTRACT

#### Background

The natural progression of endometriosis remains unclear, with consensus limited by the scarcity and heterogeneity of available studies. Furthermore, there is no robust evidence to help clinicians decide between medical and surgical treatments. The COVID-19 pandemic provided a unique opportunity to study disease prognosis and the effects of non-surgical management in a cohort of women who could not receive surgery for an extended period of time.

#### Aims

To investigate the progression of endometriosis lesions in sequential TVUS surveillance of patients undergoing conservative management.

Secondary research aims were to quantify the COVID-19 pandemic impact on the quality of life and quality of care for women with endometriosis in Melbourne, Australia and to compare non-surgical and surgical management of endometriosis in relieving pain.

#### Method

A retrospective single cohort study was conducted investigating endometriosis patients who had 2 transvaginal ultrasound scans taken at least 6 months apart and did not receive surgery during the follow up period. The number and size of endometriosis lesions in each scan was recorded and compared over time.

A cross-sectional online questionnaire was conducted quantifying the impact of the pandemic on endometriosis care, quality of life measured over three time points reflective of the pre-, during, and post-pandemic periods, and treatment response. The survey was distributed to two cohorts; one who had received surgical treatment in 2018-2019 and one who did not receive surgery in 2020-2022.

#### Results

Retrospective study: One hundred and twenty-two patients fulfilled the inclusion criteria. The median follow up time was 490.5 days (255.4 - 725.6). At second scan, 22% (95% CI: 15-30%) of the cohort experienced an increase in the number of endometriosis nodules compared to at first scan, with 51% (95% CI: 42-60%) remaining static while 27% (95% CI: 19-35%) experienced a decrease. While there was no statistically significant difference in the volumes of uterosacral ligament, retrocervical and bowel endometriosis, endometrioma volumes were significantly lower at second scan (Mdn = 3243.7  $\mu$ L, IQR = 602.4 - 16868.5) as compared to the first scan (Mdn = 7411.6  $\mu$ L, IQR = 2045.2 - 28950.8),  $p < 0.001$ .

#### Cross-sectional study

There was a total of 60 respondents with 30 participants in each cohort. Overall, 56.7% of participants had a cancelled, postponed, or rescheduled clinic appointment, while 33.3% were impacted for endometriosis surgery and 8.3% for fertility treatment. There were no statistically significant differences in EQ-5D quality of life scores during or after the pandemic as compared to before and during for all domains except for psychological health which saw an improvement during (52.11) to after (44.88) the pandemic ( $p = 0.03$ ) for the non-surgical cohort. Finally, both surgery and non-surgical treatment decreased VAS pain scores significantly by -3,  $p < 0.001$ . There was no significant difference between the two treatments ( $p = 0.901$ ).

#### Conclusions

Individuals with severe deep endometriosis are unlikely to see significant disease progression over time. Both surgical and non-surgical management of endometriosis are effective in treating pain and our findings suggest they may have similar effectiveness, although more research is needed to confirm this.

# Luis Anthony Jayanata

## Improving Bone Health in Multiple Sclerosis

Supervisor Names and Institute Affiliations

Peter R Ebeling<sup>1</sup>, Lisa Grech<sup>1</sup>, Ayse Zengin<sup>1\*</sup>

<sup>1</sup>School of Clinical Sciences at Monash Health, Monash University, Clayton Victoria.



I am a 4<sup>th</sup> year medical student from the University of Indonesia! I chose this project because I was interested in ageing originally, and I didn't know much about osteoporosis but I'm really happy that I learned a lot about it throughout this year, and how people with MS can be affected by it. I also looked for a non-lab based research as I'm not adept or particularly interested in lab research. I've improved my interviewing and qualitative research skills since I have never done this type of work before, I also like talking and learning from people, especially experts in their field, so this was a perfect opportunity to learn from medical professionals with decades of experience. My advice would be to know what approach of research you like (field work, secondary data analysis, qualitative research, lab research .etc) and find a topic that you have at least some interest in and can be proud of once you are finished ☺. Feel free to contact me if you have further questions!

### ABSTRACT

#### Background

People with multiple sclerosis (MS) have a higher prevalence of osteoporosis (27% vs 12.6%) and onset occurs at a younger age (41.5yrs±7.9) when compared to the general population (>50 years). MS-related osteoporosis and poor bone health are under-recognised and managed in people with MS, and if not managed well, it may reduce independence and impair quality of life.

#### Aim

This study aimed to assess the healthcare professionals who are part of the multidisciplinary care team for people with MS about their knowledge, current practices, barriers and enablers to bone health management in MS.

#### Methods

Participants were 30 healthcare professionals, including: neurologists (4), endocrinologists (8), MS nurses (9), general practitioners (5), and physiotherapists (4), recruited through network contacts. Participants were interviewed using a semi-structured script (mean: 26min, range: 17.8 – 33.1min). Interviews were undertaken and recorded using Zoom. Transcription was performed using Otter.ai and reviewed for accuracy by the interviewing researcher (LAJ). Transcripts were coded in NVivo Plus (v12) using framework analysis.

#### Results

Most participants with experience in managing people with MS acknowledged the higher risk of osteoporosis compared with the general population. Apart from the endocrinologists and nurses, many participants reported limited bone health knowledge in people with MS which hindered proper bone health management. MS-related priorities overshadowed bone health concerns. Many endocrinologists and half of the general practitioners found bone health management practices in MS insufficient, and some endocrinologists were uncertain of best practice for people with MS. Improved clinician and patient educational materials were recommended.

#### Conclusion

There is a clear need for greater proactive management of bone health in people with MS. This would be supported by guidelines for managing bone health in MS and development of educational resources for people with MS and healthcare professionals.

# Haini Jiang

## Latitudinal differences in melanoma characteristics and risk factors among Australian melanoma risk groups

Supervisor Names and Institute Affiliations

A/Prof Victoria Mar<sup>1,2</sup>, Dr Maithili Sashindranath<sup>2</sup>, Dr Åsa Ingvar<sup>2,3</sup>

<sup>1</sup>Victorian Melanoma Service, Alfred Hospital, Australia

<sup>2</sup>School of Public Health and Preventive Medicine, Monash University, Melbourne, Australia

<sup>3</sup>Department of Dermatology, Skåne University Hospital, Lund University, Sweden



Hi! I'm Haini and I did my BMedSc (Honours) year at the School of Public Health and Preventive Medicine (SPHPM) after fourth year. After COVID, I wanted to take a break from clinical medicine and explore the world of research, which I hadn't been able to do previously. I was very lucky to meet my main supervisor, A/Prof Victoria Mar, who had some incredibly interesting melanoma research projects and was a perfect match for my growing passion for all things dermatology.

I highly encourage anyone who has a field that they are passionate about or interested in gaining a better understanding of how research works to apply for an Honours year! This year at SPHPM has been so rewarding and I feel incredibly supported as I move forward with my research journey. Feel free to get in contact if you have any questions!

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### ABSTRACT

#### Background

Australians are disproportionately affected by melanoma when compared against the global incidence. Melanoma risk is generally assessed by algorithms that take into account a combination of phenotypic characteristics (e.g. naevus count, hair colour), personal history of skin cancer and sun exposure risk factors. States have different levels of average UV exposure and intensity as they are at different latitudes. Since melanoma incidence has an inverse relationship with latitude, does latitude directly correlate with melanoma risk or is it a combination of latitude, behaviour, phenotype, and genetics that contribute to melanoma risk and development? Few studies have objectively defined the relationship between melanoma risk factors and latitude, although the lack of objective and standardised data collections makes this difficult.

#### Aim

Our aim was to compare the phenotypic characteristics, risk factors and behavioural characteristics of people in low, high, and very high melanoma risk groups from different latitudes across Australia.

#### Method

This was a cross-sectional study, comparing risk factors and behavioural risk factors across Victoria (38°S) and Queensland (27°S), using the Victorian Australian Centre of Excellence in Melanoma Imaging & Diagnosis (ACEMID) and Queensland Mind Your Moles (MYM) and Health Outcomes Programs (HOPs) data. 935 participants were included in the analysis, with 46% from Victoria, 54% from Queensland. Participants completed a questionnaire collecting clinical and demographic information, were imaged with the VECTRA WB360 (Canfield Scientific, USA) for total naevus count and were risk stratified using the Melanoma Institute Australia Risk Stratification Tool. We performed Pearson chi-square, Mann-Whitney U, and Jonckheere-Terpstra tests to identify statistically significant trends across states within melanoma risk groups.

#### Results

A significant difference in several melanoma risk factors and behavioural characteristics was found between those living at different latitudes across all melanoma risk groups. A lighter skin type was more common in Queensland and there were higher median naevus counts observed in Victoria. Those in Queensland were more likely to engage in sun protective behaviours than those in Victoria. A personal and family history of skin cancer was linked to increased melanoma risk, with high risk individuals more likely to engage in annual skin checks.

#### Conclusions

Melanoma risk factors are likely to vary across populations living in different latitudes and this would need to be considered to improve melanoma risk and surveillance. We identified that there is a significantly different distribution in certain phenotypic characteristics, risk factors and sun protective behaviours across latitudes. This means that an individual identified as being at very high risk of melanoma in Victoria will likely have different characteristics to an individual identified as very high risk in Queensland.

# Christopher Kanellis

## Infection and Immune Function Monitoring in Multiple Myeloma Patients on Novel Immunotherapies

Supervisor Names and Institute Affiliations

Professor Orla Morrissey, Infectious Diseases, Alfred Health, Central Clinical School, Monash University

Dr. Anna Hearps, Burnet Institute



Hi! My name is Chris and I completed my BMedSc(Hons) at the Alfred after my fourth year of medical school. I chose to do a BMedSc(Hons) because I wanted to try something a bit different after year 4C. Through my medical school studies I have developed interests in haematology and infectious diseases and so this project was very interesting to me. My project largely involved practical wet-lab research and was very different from any clinical medicine I had undertaken before. The year was very rewarding and I learned a huge amount about the research process. I would like to extend a huge thank you to my supervisors Professor Orla Morrissey and Dr. Anna Hearps as well as Mr. Tanveer Ahmed and the ARAFlow Core team that were instrumental in the laboratory components of my project.

I'm excited about returning to clinical medicine for final year next year. I'm happy to be contacted by future students at: [ckan0001@student.monash.edu](mailto:ckan0001@student.monash.edu)

### ABSTRACT

#### Background

Multiple myeloma (MM) is a haematological malignancy of plasma cells. Due to immunosuppression from both the disease and treatment MM patients suffer high rates of infection-related morbidity and mortality. Infection risk varies considerably between individual MM patients at the same stage of disease and treatment. Vaccination and antimicrobial prophylaxis are used clinically to prevent infection in MM. However, due to a lack of MM-specific research, the best schedule (timing) for vaccination and ideal timing and duration of prophylaxis for individual patients is still unknown.

The aim of this project was to characterise changes in immune function and subsequent infection risk across MM treatment with some of the novel immunomodulatory therapies, and to correlate biomarkers of immune function with clinical infection data.

#### Method

Clinical data, and previously collected peripheral blood mononuclear cell (PBMC) and serum samples from 26 Alfred Health MM patients were used in this project. Patients were from the IMPROVE Registry (n=16) or the Australasian Leukemia Lymphoma Group MM17 Trial (n=10). PBMC and serum were collected at timepoints across treatment (baseline or trial entry, during chemotherapy, and pre- and post-autologous haematopoietic stem cell transplant [auto-HSCT]). Patient samples were compared to cryopreserved PBMC and serum samples previously collected from ten healthy volunteers (HV). Samples were tested using several immunological assays including immunophenotyping, and immunoglobulin isotyping. Antigen-specific immune cell function was evaluated using an in vitro lymphocyte proliferation assay and cell culture supernatant cytokine profiling

#### Result

Significant deficits in anti-bacterial and anti-viral immunity were seen in both cohorts. Anti-fungal responses were less impaired, and in some cases were comparable to HV. IgG3 levels were decreased at baseline in both cohorts. CD4 T-cell cytokine function was significantly impaired at various timepoints for key anti-bacterial and anti-viral cytokines in both cohorts. Significantly lower IL-6, IL-22, IL-25, IL-10, and IL-33 were detected in response to LPS, and significantly lower TNF- $\alpha$ , sCD40L and IFN- $\gamma$  were detected in response to Influenza. Regulatory T-cell counts in the IMPROVE cohort were significantly increased at baseline, 4- and 8-months compared to HV. CD8-counts were significantly lower in patients treated with bortezomib during the study period compared to those who were not ( $p=0.0390$ ). A trend towards lower B-cell counts being associated with more infections was detected ( $p=0.0509$ ).

#### Conclusion

Our findings provide important information about the mechanisms of immunocompromise in MM in the era of novel immune therapies. They support the concept that immune function and infection risk in MM is highly variable between patients and that an individualised approach to infection prevention is needed. Several immune biomarkers have been identified in this study that could act as indicators of immune function in MM patients including CD4 and Treg counts, cells ratios (CD4/CD8 and Th1/Th2), cytokines (TNF- $\alpha$ , IFN- $\gamma$ , sCD40L, IL-10, IL-17A, IL-17F, IL-22, IL-23, IL-25, IL-31, and IL-33), and immunoglobulin isotypes (IgG3 and IgG4). Large prospective studies are required to determine the full potential of these markers in guiding clinician's decisions around infection prevention, prophylaxis and vaccination with the ultimate goal of reducing infection burden and improving outcomes in MM patients.

# Nabil Hasnaa Khoirunnisa

## Characterisation of Depressive Symptoms in People with MS

Supervisor Names and Institute Affiliations

Lisa Grech and Ayse Zengin

School of Clinical Sciences, Department of Medicine



Following my fourth year of medicine in Indonesia, I pursued an Honours year at Monash University. Though back in my home country, I've also done research, I have chosen a different department in Australia. My research on depression in multiple sclerosis integrated neurology and psychiatry—both of which are personally intriguing to me.

Not only did I follow doctors at clinical interviews, but also recruited respondents on my own at Monash Campus and had discussions with other respected researchers in my project.

Occasionally during my research project, the roads got rocky, however, there has never been a time that I did not obtain anything. It was learning all around the clock be it problem-solving, effective communication or time management.

### ABSTRACT

#### Background

Depression in multiple sclerosis (MS) is two to three times more prevalent than the general population, yet often goes undetected and undertreated. Differences in depression presentation between people with and without MS may contribute to this. Studies comparing depression symptoms between both cohorts exist, but outcomes vary.

#### Method

Participants were administered a survey with validated mood scales including the PHQ-9 depression questionnaire, DASS-21 for anxiety and stress evaluation, PROMIS anger short form, BITE irritability test, and DERS-16 emotional regulation difficulties scales. Recruitment was conducted through social media, a hospital MS clinic, and a university campus (control) with valid survey responses included: MS with  $n=237$ , mean age =  $46.5 \pm 12.4$  and controls with  $n=248$ , age  $M=28.9 \pm 12.4$ ; respectively). An age-gender-matched sample (mean age:  $40.1 \pm 12.3$  in MS and  $40.0 \pm 12.4$  in controls) was used for analysis,  $n=95$  for both groups with logistic regression to characterize similarities and differences in mood across levels of depression severity.

#### Results

Compared to the sample in controls, people with MS reporting moderate-severe depression had lower stress (OR= 0.493, 95%CI [0.493, 0.991  $p=0.045$ ]). Differences in anxiety, anger, irritability and emotional regulation difficulties were not statistically significant between depression in people with MS and controls.

#### Conclusions

Our study found depression in MS is comparable to depression in controls. This adds further to the difficulty in detecting depression in MS. Thus, stressing the importance of addressing depression assessments, in MS neurological visits. However, also means that clinicians can be confident in using similar diagnostic methods as the general population, and criteria from the Diagnostic and Statistical Manual of Mental Disorders (DSM) and the International Classification of Diseases (ICD).

# Joshua Lee

## Brain-machine Interfaces – Prosthetic Limbs – Luke Skywalker

### Supervisor Names and Institute Affiliations

Dr Ben Sinclair – Department of Neuroscience, Central Clinical School, Monash University

Dr Brendan Major – Department of Neuroscience, Central Clinical School, Monash University



Hey, my name is Josh, and I had the joy of completing my BMedSc(Hons) with the Department of Neuroscience at Central Clinical School. I was initially attracted to my project by the title, but it was only after meeting my supervisors, Dr. Ben Sinclair and Dr. Brendan Major, that I was sold on joining the team.

For those considering honours, know that this year will not be easy. There will be times that you will feel like punching a wall, but it will teach you resilience, perseverance and how to work well under pressure. In the end, you will gain the ability to ask better questions and think critically, two crucial skills in a world increasingly dominated by AI.

If I had some advice, I'd say start meeting your supervisors early. At the end of the day, your honours experience won't be determined by how epic your project is but rather by the people you work with on a daily basis. Think of this process like dating; a meeting is not a commitment but to get a vibe check; be respectful but don't be afraid to turn supervisors down if you're not compatible.

Feel free to reach out at [jlee0134@student.monash.edu](mailto:jlee0134@student.monash.edu)

## ABSTRACT

### Background

Amputations are devastating events for patients, and following amputations, patients often experience chronic pain localised to the stump (Residual limb pain) or in the place of the previously intact limb (Phantom limb pain). One of the novel developments in this space has been the introduction of Targeted Muscle Reinnervation (TMR) to reduce pain and improve the use of a myoelectric prosthesis, should patients elect to use them. Numerous studies document the effectiveness of TMR in reducing or preventing pain, as well as improving the function of a patient's prosthetic, but few have documented the effect of this procedure on brain changes.

### Aim

The primary objective of this investigation was to compare brain differences among a group of TMR participants, namely differences in cortical thickness of the primary motor area (M1) and primary somatosensory area (S1) and the white matter integrity of the corticospinal tract. This was to determine if there were any differences between performing TMR at the time of amputation (acute) or at least eight months later (delayed). The secondary objective was to compare the brain differences between these amputees who had undergone TMR with a group of controls.

### Method

This case-case study compared three acute TMR participants with seven delayed TMR participants and then compared all 10 TMR participants with healthy controls. All scan sequences were performed with 3.0 Tesla MRI machines and then analysed with various neuroimaging software. For cortical thickness, the Freesurfer program was chosen, while FSL was the software of choice for analysing white matter integrity. Statistics were run with SPSS.

### Results

Results showed that between acute and delayed TMR participants, there were no differences in the raw values or asymmetries of the cortical thickness in M1 and S1, and no difference in Diffusion Tensor Imaging (DTI) metrics (FA, AD, RD, MD) of the corticospinal tract. Due to the systematic differences between TMR participants and controls, we compared their brain asymmetries by comparing the interhemispheric difference instead of raw values in cortical thickness and DTI metrics. There were no differences in the asymmetries of cortical thickness of M1 and S1 nor FA and AD of the corticospinal tract, but there were significant symmetry differences in RD ( $p=0.002$ ) and MD ( $p=0.021$ ). In addition, the asymmetries of RD and MD indicated that the controlling side, the hemisphere contralateral to the side of amputation, was not preferentially affected by amputation, which was not what we expected.

### Conclusions

Overall, it was found that doing TMR acutely, as compared to delaying it had no positive brain benefits in terms of attenuating cortical thinning or reducing white matter tract integrity. However, the lack of differences in the asymmetry of cortical thickness between TMR participants and controls contrasted with the asymmetry difference observed in RD and MD may be indicative that TMR is effective in attenuating cortical thinning but is not as efficacious in preventing white matter degradation.

Care must, however, be taken when interpreting these results and further studies with larger sample sizes should be conducted to fortify these findings.

# Sandra Li

## Comparison of Subgaleal and Subdural Drain in Minicraniotomy for Chronic Subdural Haematoma

Supervisor Names and Institute Affiliations Associate Professor Leon Lai, Monash Health

Mr. Jeremy Kam, Monash Health



Hi! I'm Sandra and I completed BMedSc(Hons) after fourth year at the Department of Neurosurgery, Monash Medical Centre. The year has been an incredibly rewarding experience. Having the whole year to focus on my research project allowed me to learn the ins and outs of designing and conducting a research project. With the support of my amazing supervisors, I was able to navigate through obstacles and challenges. If you're interested in undertaking a BMedSc(Hons) year, I'd recommend you to contact multiple supervisors to find a project that you like. I'm also happy to be contacted directly if you have specific queries about the Honours experience with the Department of Neurosurgery.

### ABSTRACT

#### Background

Chronic subdural haematoma (cSDH) is a very common neurosurgical condition. However, there is no gold standard surgical treatment protocol or guideline. Traditional methods of using the subdural drain have been associated with risks of key complications. Therefore, the subgaleal drain is emerging as a promising alternative. Despite this, the literature has no studies comparing subdural and subgaleal drains in cSDH patients treated with minicraniotomy.

#### Aim

Our aim was to firstly assess the efficacy and complication profile of the subgaleal drain in cSDH patients treated with minicraniotomy, and secondly to determine whether subgaleal drains will result in better clinical outcomes in the same group of patients.

#### Methods

We conducted a retrospective clinical audit and cohort study of all cSDH patients treated with minicraniotomy and postoperative drain by the Neurosurgery department at Monash Health from 2019 to mid-2023. Cases were stratified according to drain location; subdural or subgaleal. Baseline demographic data collected included age, sex, use of anticoagulant or antiplatelet medications, preoperative Glasgow Coma Scale (GCS), premorbid Modified Rankin Score (mRS), focal neurological deficits, Nakaguchi score and whether patients were from home premorbid. Our primary outcome was change in functional status (as measured by mRS) at 3-month follow-up. Secondary outcomes included mortality, functional status at discharge (mRS), discharge to home, recurrence, recurrence requiring reoperation, surgical complications, and medical complications. Fisher's exact test and Mann-Whitney U test were performed to compare and analyse baseline demographics and outcome variables. Multivariate binary logistic regression analyses were performed to determine the strength of variables to predict mRS change at 3-month follow-up and rate of discharge to home. All statistical analyses were conducted using the SPSS Statistics software.

#### Results

A total of 137 patients were included in this study, 103 in the subdural drain group and 34 in the subgaleal drain group. The subgaleal drain group had a statistically significant better functional outcome at 3-month follow-up and at discharge. The subgaleal drain group also had significantly higher chances of discharge to home (79.4% vs. 55.3%) and shorter length of stay (LOS) ( $7.14 \pm 5$  vs.  $9.97 \pm 9$ ). Rate of recurrence was similar. Rate of recurrence requiring reoperation, medical complications and surgical complications were borderline better in the subgaleal drain group, but differences were not statistically significant. Multivariate analysis identified subgaleal drain, worse premorbid mRS and better preoperative GCS to be significant independent predictors of mRS improvement at 3-month follow-up. The subdural drain, worse premorbid mRS and reduced preoperative GCS were found to be significant independent predictors of discharge to destinations other than home.

#### Conclusion

Overall, our study demonstrated that subgaleal drains resulted in better functional outcomes than subdural drains. Its efficacy and complication profile may be better than or is at least non-inferior to the subdural drain. These findings support future higher quality prospective studies and randomised trials to assess for confounders and to further validate our results. Research into mechanisms behind how the subgaleal drain may improve clinical outcomes will also be helpful in determining surgical treatment standards.

# Alex Lin

## Chest x-rays for non-traumatic chest pain in the emergency department

Supervisor Names and Institute Affiliations:

Prof Biswadev Mitra, Emergency Research Unit, School of Public Health and Preventive Medicine (Monash University), 533 St Kilda Road

A/Prof Dinesh Varma, The Alfred Hospital Radiology Department, and Department of Surgery, Monash University, Melbourne



I'm Alex, and having completed Year 4C I felt I needed a bit of a break from clinical before continuing on the journey, and an honours year seemed like the perfect opportunity to explore what else medicine has to offer. Research is incredibly important and definitely worth a try to see if you might take a liking to it. Reasons why I chose my specific project were that it aligned with my current interests, had many things I could get out of, and had transferrable skills that I could learn about.

Some of the pitfalls I fell into was relaxing too much and then having stress levels peak through the roof near deadlines. Another thing I learned relatively late was that clear and constant communication with your supervisor can really go a long way into helping you navigate your project, as well as giving you that support and peace of mind? that you're on the right track and are able to make it all the way. Supervisors can make or break your honours year, and you should really try to choose the right one for you. Otherwise, school coordinators are also a good point of contact if you're a bit stuck and have no one else to turn to!

Contact: [alin0019@student.monash.edu](mailto:alin0019@student.monash.edu)

## ABSTRACT

### Background

Chest pain remains one of the most common presenting complaints to the emergency department (ED). The routine use of a chest X-ray (CXR) as first line investigation for chest

pain has been documented by previous literature, but brings with it economic burden, and increases time spent by patients in the ED, potentially causing overcrowding. A systematic review was conducted to investigate the utility of CXR for patients with non-traumatic chest pain (NTCP) presenting to the ED, that appeared to validate the use of CXRs as a first-line investigation for chest pain. However, heterogeneity in the literature, variable sample sizes and variation in definitions of key clinical variables across studies limits confidence in conclusions. A further retrospective cohort study was conducted.

### Aim

The aim of the study was to quantify the proportion of CXRs for non-traumatic chest pain in the ED that are abnormal and assess clinical significance of abnormalities. In addition, we aimed to explore variables associated with abnormal and clinically significant CXRs.

### Methods

A retrospective cohort study was conducted at the Alfred Hospital using an explicit chart review. We included all patients who presented to the ED with NTCP and were investigated with a CXR between 01 January 2022 and 31 December 2022. We excluded all patients who were under 18 years old, patients with traumatic aetiology of chest pain, patients without chest pain, and patients without medical history documented. Data were extracted from electronic medical records for clinical variables and radiology report findings. All data were summarised using counts (proportions) and differences assessed using the chi-square test. We assessed the association of clinical variables with abnormal and clinically significant CXRs using univariable and multivariable logistic regression models. A p-value of less than 0.05 was defined as statistically significant.

### Results:

There were 3419 eligible patient encounters included for analysis. Of these, 745 (21.8%; 95%CI: 20.4-23.2) CXRs had an abnormality detected. There were 218 (6.4%; 95%CI: 6.06-7.87) CXRs deemed to have clinically significant abnormalities. Older age, the presence of diminished lung sounds, added sounds and abnormal oxygen saturations were found to be independently associated with clinically significant abnormalities on CXRs.

### Conclusions

The results were consistent with the findings of the systematic review and suggest CXRs are important as a first-line investigation for NTCP due to their high yield of abnormalities. Given their relative inexpensiveness, accessibility, and low risk of harm to the patient, until a suitable clinical decision rule can be developed, CXRs should be recommended as routine investigations for NTCP.

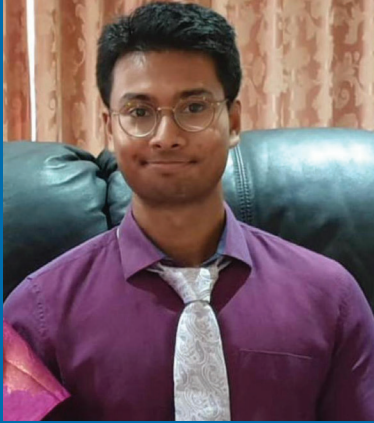
# Ashwin Madhavan

## Immunogenicity of adalimumab in non-infectious uveitis

### Supervisor Names and Institute Affiliations

Associate Professor Anthony Hall, Department of Surgery, Central Clinical School, Monash University

Associate Professor Lyndell Lim, Centre for Eye Research Australia, The Royal Victorian Eye and Ear Hospital



I'm Ashwin and in 2023, I had the privilege of studying the Immunogenicity of adalimumab in non-infectious uveitis, supervised by Associate Professor Anthony Hall and Associate Professor Lyndell Lim.

This year has been very enjoyable, and I have learnt a lot. As with all years of med school, there are certainly ups and downs, and intense times particularly around lit review and thesis submission.

I particularly enjoy studying uveitis, as it affects many young people. To be receiving adalimumab, most of my study patients had rare and aggressive forms of ocular inflammation. They were extremely grateful to have their vision and quality of life improved by their ophthalmologists.

I think the biggest advice I've learned, is that you are responsible for everything in your project. Don't rely on others to keep it moving, you need to drive the project from start to finish. Take the opportunity to sink your teeth deep into the project, and you will find it much more enjoyable and rewarding. This is particularly true if there is a fun and technically demanding procedural aspect to your project, such as venepuncture in mine.

Very happy to be contacted and chat!  
All the best.

## ABSTRACT

### Background

Adalimumab is a fully human monoclonal antibody that targets Tumour Necrosis Factor Alpha. It is used widely to treat autoimmune conditions, including non-infectious uveitis. Although adalimumab is effective in treating non-infectious uveitis, some patients develop anti-drug antibodies (ADA) against adalimumab. These antibodies can reduce serum drug levels and thus cause treatment failure. It is not yet known how commonly these antibodies occur in patients with non-infectious uveitis, the factors associated with their formation, and their impact on a patient's uveitis and vision.

### Method

We recruited 70 patients receiving adalimumab for non-infectious uveitis across the Royal Victorian Eye and Ear Hospital, and Eye Surgery Associates. All patients had a blood sample tested for serum trough adalimumab level, and anti-drug antibodies against adalimumab. Clinical data was retrospectively collected via chart review. Statistical analysis was performed using Stata v18.0 (Stata/SE v18.0, STATA Corp, Texas, USA).

### Results

Of the 70 patients tested, 5 (7.1%) had ADA. Patients with ADA had lower serum adalimumab levels compared with those that did not (median 0.0 µg/mL (Interquartile Range (IQR) 0.0, 0.0) vs 5.6 µg/mL (IQR 2.8, 8.2),  $p=0.003$ ), higher C-reactive protein (CRP) (median 7.4 (IQR 5.5, 7.9) vs 2.0 (IQR 0.0, 5.8),  $p=0.033$ ) were less likely to have bilateral uveitis (60.0% vs 95.4%,  $p=0.038$ ), and scored lower on a validated patient-reported measure of overall health (median 5.0 out of 10 (IQR 5, 6) vs 8.0 out of 10 (IQR 6, 8),  $p=0.027$ ). We found no association with sex, duration of therapy, use of concomitant conventional immunosuppression, presence of systemic inflammatory disease, or recent breaks from adalimumab therapy. We found no statistically significant impact of ADA on uveitis activity, visual acuity or side effects to adalimumab.

### Conclusions

Through routine cross-sectional testing, we found an ADA prevalence of 7.1%. ADA was associated with reduced serum adalimumab levels, higher CRP, unilateral uveitis, and worse patient-reported overall health. Further conclusions regarding factors associated with ADA formation, and the impact of ADA, are limited by the low number of patients with ADA present, warranting future research with larger samples.

# Sarah Marian

## Milrinone infusion for cerebral vasospasm in patients with aneurysmal subarachnoid haemorrhage (M-CASH): A pilot randomised controlled trial.

### Supervisor Names and Institute Affiliations:

Prof. Yahya Shehabi, School of Clinical Sciences, Monash University — Monash Health, Director of Research — Intensive Care — Monash Health,  
Dr. Adrian Pakavakis, Consultant Intensive Care Physician — Monash Health, Clinical Dean — School of Clinical Sciences — Monash University



After completing Year 4D, I chose to undertake the BMedSc Honours year in 2023. I chose my project due to an interest in critical care, and because I was interested in undertaking a clinical-based project. My learning this year was broad. I learned all about the process of conducting a clinical trial; from designing a protocol, gaining ethical approval, building a study database, and eventually to screening and enrolling patients. I gained hands-on experience as part of a research team and learned a lot about ICU as a speciality. Thank you to my supervisors and the team in the ICU! I am happy to be contacted by future students.

## ABSTRACT

### Background

Cerebral vasospasm is a common complication of aneurysmal subarachnoid haemorrhage (aSAH), which is associated with significant morbidity and long-term mortality. Current treatment options for cerebral vasospasm are limited. Intravenous (IV) milrinone infusion is an emerging medical therapy for refractory cerebral vasospasm in patients with aSAH. In small, retrospective studies, IV milrinone infusion appears to be a promising treatment with a relatively low incidence of adverse events. However, the addition of IV milrinone to current vasospasm treatment has not been explored in randomised controlled trials (RCT). A pilot study to determine a feasible study design, including an appropriate IV milrinone protocol, would support the development of larger randomised controlled trials of this intervention in the future.

### Method

M-CASH is a single-centre pilot RCT examining the use of IV milrinone in adult patients with medically refractory aSAH-associated cerebral vasospasm. A total cohort of 40 patients will be recruited. Twenty patients will be randomised to the intervention group to receive IV milrinone and standard care. The remaining 20 patients will receive standard care only. The total duration of the trial for each participant is 7 days. The joint primary outcomes of the study are the dose and duration of IV milrinone infusion and the resolution of vasospasm on CT or DSA. A number of secondary outcomes are explored, including the incidence of adverse events and the vasopressor requirement.

### Results

The M-CASH study is ongoing, with insufficient data for a formal interim analysis at the time of writing. 15 patients with ruptured aSAH were screened for inclusion in the study during the first 4 months of active recruitment. 12 patients were ineligible. 3 patients were eligible and enrolled. All enrolled patients completed the 7-day follow-up period. However, 1 patient did not receive follow-up CT or DSA imaging within the 7-day trial period.

### Conclusions

M-CASH is an ongoing pilot RCT investigating IV milrinone as an adjunct to current standard care of cerebral vasospasm. At the time of writing, key feasibility barriers for the M-CASH study include recruitment, and measurement of the primary outcome due to lack of follow-up imaging.

# Lucas Neumaier

## Identifying the change in patterns of orthopaedic trauma during the Victorian COVID-19 lockdowns

Supervisor Names and Institute Affiliations

Professor Belinda Gabbe - School of Public Health and Preventive Medicine, Monash University

Adjunct Associate Professor Susan Liew - Department of Orthopaedics, Alfred Health

DrJoanna Dipnall - School of Public Health and Preventive Medicine, Monash University



In 2023 I had the pleasure of working alongside fantastic mentors, both academic researchers at the School of Public Health and Preventive Medicine, and surgeons at The Alfred Hospital. But what made this year so valuable for me was not simply the nuanced focus on orthopaedics, it was the personal connections I formed and the flexibility a BMedSc(Hons) provided. The year allowed me to explore new hobbies, pursue passions, and work multiple jobs to a far greater extent than any of my previous years in medical school.

If you are considering undertaking an honours year, remember that the supervisors and project type you choose will have a far greater influence on your year than the specific research question you set out to answer. Consider qualitative vs quantitative, retrospective vs prospective, and in-person vs remote. Feel free to reach out to me on social media if you have any questions about my project, registry based studies in general, or completing a BMedSc(Hons).

### ABSTRACT

#### Background

Previous observational cohort studies conducted in Australia and internationally have suggested that restrictions due to the COVID-19 pandemic may have influenced the demographics, characteristics, and outcomes of patients with traumatic orthopaedic injuries. However, these investigations have yielded heterogeneous results. Due to differences in study populations and the specific nuances of the lockdown measures employed, their findings may not reflect the Victorian experience. This study aimed to assess the demographics, injury cause, location of injury, care, and in-hospital outcomes of both metropolitan and regional patients with traumatic orthopaedic injuries during the Victorian COVID-19 lockdowns.

#### Method

A registry-based cohort study was conducted using data from the Victorian Orthopaedic Trauma Outcomes Registry (VOTOR) for patients with a date of injury from January 2017 to June 2022. Demographics, injury cause, location of injury, injury severity, patient outcomes and specific orthopaedic diagnoses were analysed before, during, between, and after the COVID-19 lockdowns in Victoria. The analysis spanned five time periods in metropolitan Melbourne and three periods in regional Victoria. An interrupted time series analysis was performed using Poisson and ordinary least squares regression, with Newey-West standard errors to account for autocorrelation.

#### Results

Overall, the initial lockdown in Victoria reduced weekly orthopaedic trauma admissions; weekly metropolitan admissions declined from an average of 88 (95%CI 85, 90) the week prior to the lockdown to 67 (95%CI 59, 75) the first week of lockdown and regional admissions declined from 37 (95%CI 35, 39) to 29 (95%CI 23, 35).

An increase in metropolitan orthopaedic trauma admissions occurred during the first weeks of Intermission (time between lockdowns) and Post-COVID periods by 18 (95%CI 11, 24) and 13 (9%CI 3, 23) weekly admissions respectively, compared to what would be expected based on pre-pandemic levels. This was not evident in the regional cohort. During periods of lockdown, patients were older (61 versus 58 years old) and more likely to be injured at home (38% versus 28%). A greater proportion of admissions during the first and second metropolitan lockdown were the result of low falls; fewer due to road traffic collisions. The proportion of sports or leisure related injuries increased by 6% (95CI 4%, 8%) at the start of the metropolitan Intermission period relative to pre-pandemic levels. While severity was unchanged, patients stayed longer in the hospital during the Intermission (9.0 days) and Post-COVID (9.9 days) periods compared to the Pre-COVID (8.3 days) period.

#### Conclusions

The findings highlight the impact of COVID-19 lockdowns on the epidemiology of hospitalised orthopaedic trauma in Victoria, Australia. Differences between lockdown periods, and between metropolitan and regional areas, were identified. Understanding these changes is needed to enhance preparedness for future public health challenges, develop targeted injury prevention strategies and quantify the ever-changing casemix of orthopaedic injuries. Further research should examine particular demographic groups, such as elderly patients, and investigate the inclusion of seasonality in the statistical process to guide targeted preventative strategies.

# Natasha Newman

## Quality of life in patients post thyroidectomy for benign and malignant diseases

Supervisor Names and Institute Affiliations

Primary Supervisor: Associate Professor James Lee<sup>1,2,3</sup>

Co-Supervisor: Professor Jeremy Millar<sup>1,3</sup>

<sup>1</sup>Australian and New Zealand Thyroid Cancer Registry

<sup>2</sup>Monash University Endocrine Surgical Unit

<sup>3</sup>Central Clinical School, Monash University



Hi! I'm Tash, and I completed my honours on quality of life in patients undergoing thyroid surgery. I chose to complete this degree as I was drawn to the concept of a surgical career from my first years of clinical placement, but wanted to find out more about the field and gain some research skills before progressing further with the medical degree. My project involved recruitment, collection and analysis of patient reported outcomes data, an area that I have learnt a lot more about since the start of the year.

I was supported along the honours journey by my amazing supervisors, who gave a lot of their time and effort to the project. Getting to spend time with the endocrine surgery team was also a highlight of the year. Though difficult, the process pushed me to develop a host of new skills in scientific research, communication and collaboration. I can already see how invaluable these tools will be in the years ahead.

For those considering completing an honours, my advice would be to know your goals. By understanding what you want to get from the degree, you will be best placed to find a project and team that suits your needs. Dedicate yourself to making the most of the opportunities available, and you will undoubtedly have a valuable experience! Please feel free to contact me at [nnew0004@student.monash.edu](mailto:nnew0004@student.monash.edu) if you have any questions.

## ABSTRACT

### Background

Thyroidectomy patients experience quality of life (QOL) issues that are disproportionate to the medical severity of their conditions. The frequency of these problems is suspected to depend on the extent of surgery. QOL has been increasingly examined in thyroid cancer patients, but limited studies have been conducted comparing surgery for both malignant and benign thyroid disease. Hemithyroidectomy (HT) is becoming a more common procedure for thyroid cancer as adjuvant methods improve and subsequent studies show the safety of the procedure in low-risk cancers. Therefore, it is important to examine the impact of thyroid function after surgery on patients undergoing HT and compare these outcomes to total thyroidectomy (TT), especially for low-risk malignancy. As thyroid surgery interferes with the balance of the hypothalamic pituitary thyroid axis, it is likely that QOL disturbances could also be related to changes in the hormonal system.

This prospective observational study measured the QOL issues experienced by a cohort of Australian thyroidectomy patients and aimed to investigate the effect of surgery extent and cancer diagnosis on postoperative QOL. A preliminary analysis of the correlation between QOL and changes in thyroid stimulating hormone (TSH) was also conducted.

### Method

The study was conducted in a prospective cohort of adult thyroidectomy patients from the Australian and New Zealand Thyroid Cancer Registry (ANZTCR) and the Monash University Endocrine Unit (MUESU) who underwent surgery at 22 participating institutions and completed patient reported outcome measures (PROMs) between 2nd June 2021 and 31st August 2023. An online survey containing the European Organisation for Research and Treatment of Cancer (EORTC) C30 & THY34 PROM was emailed to patients at three, six and twelve-month timepoints, providing a validated measure of thyroid related QOL. A combination of univariable and multivariable statistical analyses were conducted to examine the effect of surgery extent, malignancy status and changes in TSH on QOL after thyroidectomy.

### Results

At least one PROM was completed by 537 patients who met the inclusion criteria. Females made up 74.9% percent of the sample and the mean age was 54 years. 246 HT and 291 TT patients were included, 95.3% with a malignant diagnosis of thyroid cancer. Temporary or permanent postoperative complications were experienced by 9.5% of patients. Short term QOL outcomes were superior for HT but this difference was undetectable at twelve-month follow up. Fear and insomnia scores were increased in malignant patients after adjusting for covariates. Analysis of QOL by TSH change showed six symptoms with potential correlations but was limited by the small sample size and presence of confounders.

### Conclusions

These findings reflect the international evidence available on QOL after thyroidectomy, particularly in relation to the transient increase in issues experienced by TT recipients. Our analysis of TSH change was unable to support QOL conclusions but demonstrates a viable method to achieve this goal. Future directions of this research involve collecting matched preoperative PROMs and TSH data from a wider multi-institutional cohort of benign and malignant thyroidectomy patients.

# Shani Nguyen

## External Validation of a Machine Learning Model for Predicting Medication Response in Epilepsy

### Supervisor Names and Institute Affiliations

Dr Zhibin Chen, PhD, MBIostat, Bsc(Hons)

Research Fellow, Central Clinical School, Monash University

Professor Patrick Kwan, MB, BChir, PhD, FRCP, FRACP, FAHMS

Professor of Neurology, Monash University Co-director, Monash Institute of Medical Engineering



To summarise my BMedSc(Hons) in one sentence: a phenomenal year looking at cutting-edge technology/machine learning and its use in predicting medication response for epilepsy patients, with the incredible guidance of supervisors.

I undertook my BMedSc(Hons) at the Central Clinical School Department of Neuroscience after completing 4C. I chose to complete an honours year because I was keenly interested in internal medicine and wanted to learn more about medical research. The BMedSc(Hons) provided me the opportunity to learn about biostatistics, academic writing, data collection and extraction. Especially, I was able to apply these skills to a very cool project using machine learning – the machine learning model I focused on for my project is the same type used for ChatGPT. I am very grateful for my supervisors in supporting me and providing me this neurology research opportunity.

Also, I was fortunate to still have clinical exposure during the BMedSc(Hons). I attended weekly epilepsy clinics, neurology grand rounds and video-EEG monitoring meetings. I highly recommend the BMedSc(Hons) year to learn more about research and feel free to contact me at [sngu0022@student.monash.edu](mailto:sngu0022@student.monash.edu).

## ABSTRACT

### Background

Epilepsy affects 50 million people worldwide, yet the trial-and-error approach to select antiseizure medications (ASMs) has remained unchanged over decades. Approximately half of all patients will have an intolerable or ineffective first ASM regimen. This results in months-to-years of successive regimen trials before a suitable one is found. Machine learning has been shown to be a reliable clinical decision-support tool in medicine and can outperform clinicians in diagnostic imaging and prognostication. Despite the relatively novel use of machine learning to select the best ASM for epilepsy patients, its ability to handle multimodal data and detect new patterns between clinical variables makes it a promising adjunct to clinicians' decision-making.

### Aim

To externally validate a machine learning model in predicting success for first ASM regimen on a retrospective Melbourne cohort using commonly collected clinical variables and ASM information

### Method

Patients who attended the Alfred First Seizure clinic between January 1st 2018 to December 31st 2020 had their medical records screened for use in external validation of a transformer model developed by Hakeem et al. The complete-case analysis approach was taken, so patients with missing input features were excluded. Sixteen clinical features and first ASM information were used in this geographical external validation. The outcome predicted was the individual patient's probability of one-year seizure freedom on their first ASM regimen. A probability of greater than 0.5 was classified as a successful first ASM regimen.

The performance of the model was measured in terms of area under the receiver operating characteristic curve (AUC), sensitivity, specificity, weighted balance accuracy, precision, and F1-score. 95% confidence intervals (CI) were determined for all metrics via 5-fold cross-validation. Values above 0.5 were considered better than chance performance. Sub-group analyses were performed for patients with focal epilepsy and those with generalised or unclassified epilepsy.

### Results

Of the 201 patients who attended the clinic during the study period, 91 were eligible for inclusion (64.8% males, median age of 38.7 years). The performance of the model on this cohort was: AUC 0.63 (95% CI, 0.61-0.65), sensitivity 0.62 (95% CI, 0.61-0.63), specificity 0.54 (95% CI, 0.52-0.56), weighted balance accuracy 0.58 (95% CI, 0.57-0.59), precision 0.57 (95% CI, 0.55-0.59), and F1-score 0.60 (95% CI, 0.58-0.62). On sub-group analysis, the model showed the highest performance on 54 patients with focal epilepsy with an AUC of 0.67 (95% CI, 0.64-0.70). In comparison, the model had an AUC of 0.59 (95% CI, 0.58-0.60) for the 37 patients with generalised or unclassified epilepsy.

### Conclusions

This cohort study showed that the model, based on clinical information alone, can generalise its predictions of the probability of success for first ASM monotherapy. The model demonstrated modest performance on an external validation cohort that is geographically different to the development cohort. Adding different data types, such as genetics and unstructured investigation reports may improve the machine learning model's performance in the future.

# Isobel Nicholls

## The association between child externalising behaviour and maternal postpartum depression: Exploring the roles of social support and sex of the child

### Supervisor Names and Institute Affiliations

Prof Megan Galbally, Department of Psychiatry, Monash University

Dr Stuart Watson, Health Futures Institute, Murdoch University

Dr Kelsey Perrykkad, Department of Psychiatry, Monash University

Dr Karen Wynter, Department of Psychiatry, Monash University



I completed a BMedSc(Hons) after finishing year 4C. When I first considered doing an Honours year, it felt daunting to take a break from clinical medicine and dedicate a whole year to research. One year on, I am so glad I decided to go down this path. I am very grateful for all the learning experiences and opportunities I have received. Starting the Honours year with limited research experience, there were certainly various hurdles and learning curves I came across, and I am incredibly grateful to my supervisors for guiding me through these challenges. After taking interest in all the year 4C rotations, it was difficult to choose a topic that felt like it encapsulated all my interests – I felt very lucky to come across a project that involved psychiatry, as well as women's and children's health. Finding a project I felt passionate about, with such an amazing supervisory team, has made this year all the more worthwhile. If you are interested in a change of pace from clinical medicine, while gaining research experience and skills that will be valuable for years to come, definitely consider doing a BMedSc(Hons) year. I'm happy to be contacted at: [inic0001@student.monash.edu](mailto:inic0001@student.monash.edu).

## ABSTRACT

### Background

Postpartum depression is a prevalent mental health condition that affects mothers in what can be an incredibly challenging and vulnerable period, in the first months of welcoming a new baby. There are known consequences not just for the mother, but also for the baby and the family. Externalising, or disruptive, behaviours in children are thought to have a diverse range of aetiological factors, including maternal depression. These behaviours, including aggression, defiance, and hyperactivity, can be challenging for children and families to experience, and can put strain on familial relationships and social interactions. Understanding the connection between maternal postpartum depression and later child externalising behaviour in more detail, as well as exploring the role of possible moderators, such as child sex and maternal social support, could provide focussed avenues for improving the outcomes of children whose mothers may be experiencing postpartum depression. The aims of this project were to examine the relationship between maternal postpartum depression in the first 6 months post birth and later child externalising behaviour at 3-4 years old, and assess for any moderating role of child sex, or maternal perceived social support at 6 months post birth, on the relationship between maternal postpartum depression and later child externalising behaviour.

### Method

Data from 377 mother-child pairs from the Mercy Pregnancy and Emotional Wellbeing Study, an Australian pregnancy selected cohort study, were included across a range of measures. The Structured Clinical Interview for DSM Disorders, a diagnostic measure, was used to assess maternal postpartum depression, and the Child Behaviour Checklist was used to assess child externalising behaviour. Two social support measures were used to characterise maternal perceived social support in the postpartum – the first looking at support from family, friends and a significant other; and the second assessing task and emotional support. Data were analysed using multiple regression analysis, with moderation techniques.

### Results

There was no significant association between maternal postpartum depression and later child externalising behaviours ( $B = -.717$ ,  $p = .554$ ). There was also no statistically significant moderation effect for child sex on this relationship ( $\Delta R^2 = <.001$ ,  $p = .715$ ), or either measure of social support ( $\Delta R^2 = .002$ ,  $p = .462$ ;  $\Delta R^2 = .003$ ,  $p = .319$ ). Social support had an independent significant association with child externalising behaviour ( $B = -1.379$ ,  $p = .011$ ;  $B = -.119$ ,  $p = .036$ ).

### Conclusions:

When measured with a diagnostic instrument, postpartum depression had no association with later child externalising behaviour at 3-4 years of age, conflicting past research. There was also no moderating role of child sex and social support; however, social support did independently explain a statistically significant amount of variance in child externalising behaviour regardless of maternal depression status. This may indicate the importance of ensuring all mothers are adequately supported, particularly in the postpartum period.

# Lucinda Pezzimenti

## A novel genetic cause of differences in sex development

Supervisor Names and Institute Affiliations

Professor Vincent Harley, Centre for Endocrinology and Metabolism, Hudson Institute of Medical Research.



I chose to complete an honours year after year 4C as I wanted to explore medicine outside of clinical practice. I performed by research at the Hudson Institute in the Centre for Endocrinology and Metabolism. I chose my project as I was interested in endocrinology, in particular sex development and intersex conditions. This year was a steep learning curve, as my project involved lab-based studies, particularly cell work, which I had no previous experience in. I was surrounded by many skilled researchers, who were able to teach me all the skills required to complete this research. I am incredibly thankful for the valuable experience I have gained, both in lab skills and scientific writing, and would recommend an honours year to anyone curious about research. I am more than happy to be contacted by any future students considering a BMedSc(Hons), particularly those considering a project with the Hudson Institute.

Email: [lpez0001@student.monash.edu](mailto:lpez0001@student.monash.edu)

## ABSTRACT

### Background

Differences in sex development (DSDs) are a group of congenital conditions characterised by atypical development of chromosomal, gonadal, hormonal, or anatomical sex. Only around half of 46,XY patients with DSD receive a genetic diagnosis, which impacts their quality of care. DSD associated genes and causative variants can be discovered by whole-exome sequencing of patients with DSDs. In this study, I explored the potential pathogenicity of the p.Val84Met variant in a novel gene not previously associated with DSD, MAP3K7. The affected patient had syndromic 46,XY DSD, with small testes and atypical genitalia. MAP3K7 variants have previously been associated with two clinical syndromes, frontometaphyseal dysplasia 2 (FMD2) and cardio-spondylocarpofacial syndrome (CSCF). These syndromes have skeletal phenotypes which have been associated with variants in MAP3K7, but the connection to DSD has not been previously described.

### Aim

To evaluate the pathogenicity of the p.Val84Met variant in the MAP3K7 gene of a patient with syndromic DSD to assess its effects on sex development.

### Method

I performed a systematic review to assess how commonly DSD occurs in patients with MAP3K7 variants. I transfected mutant and wild-type MAP3K7 expression plasmids into HEK293T cells to perform a Western blot and luciferase assay. Using a Western blot, the protein stability of p.Val84Met MAP3K7 was compared with wild-type MAP3K7, as well as mutated proteins described as either loss-of-function or gain-of-function in previous studies. Cells with mutant and wild-type MAP3K7 expression plasmids were co-transfected with a TCF luciferase reporter plasmid to measure  $\beta$ -catenin activity, an important factor in ovarian development, via a luciferase assay.

### Results

A systematic review found that DSD features are common in male patients with MAP3K7 variants (8/12), suggesting that variants in this gene interfere with male sex development. Our patient's variant was compared with two published MAP3K7 variants associated with DSD symptoms. p.Val50del is a loss-of-function variant causing CSCF and small testes, and p.Tyr113Asp is a gain-of-function variant causing FMD2. Assessment of protein stability showed that protein with the p.Val84Met variant had similar protein levels to the gain-of-function variant p.Tyr113Asp. This suggests that this variant's functional effects may be because of increased protein function, rather than a loss of function. The levels of  $\beta$ -catenin activity were higher in cells transfected with p.Val84Met MAP3K7 compared to wild-type, suggesting that this mutation may activate the ovarian pathway and lead to DSD in 46,XY patients.

### Conclusions

Based on the results of this study, I present a theory that MAP3K7 may act similarly to other members of the MAP3K family with known involvements in sex development, MAP3K1 and MAP3K4. I suspect that gain-of-function MAP3K7 variants increase activation of the ovarian development pathway via  $\beta$ -catenin, while loss-of-function variants downregulate testis development by reducing SRY expression via p38 signalling. This explains the DSD phenotype of three patients with MAP3K7 variants.

# Zoe Poulos

## Determining the optimal cord-clamping approach to minimise oxidative lung injury in extremely preterm neonates

Supervisor Names and Institute Affiliations: Professor Graeme Polglase and Dr Calum Roberts, The Ritchie Centre, Hudson Institute of Medical Research



I undertook a BMedSc(Hons) after Year 4C to take a break from placement and to gain a deeper understanding of medical research. I chose my project as I had an interest in neonatology and was excited by the challenge of trying something completely new to me. Although the idea of participating in animal research and lab work was slightly overwhelming, I was surrounded by skilled researchers to help me every step of the way.

This year was a challenging but rewarding experience, and I have developed skills both in and out of the lab. I recommend students who are interested in lab-based projects to chat with past students to gain an understanding of the workload and commitment involved. I'm happy to be contacted to answer any questions about Honours at The Ritchie Centre at [zpou0001@student.monash.edu](mailto:zpou0001@student.monash.edu).

### ABSTRACT

#### Background

Extremely preterm neonates require respiratory support at birth due to immature lung development. Nearly half of these neonates will develop chronic lung disease, with rates of disease unchanged for decades. Increased oxygen exposure and subsequent oxidative stress is a key mechanism in preterm chronic lung disease development. Resuscitation guidelines recommend starting resuscitation with low oxygen concentrations to avoid this consequence. However, higher oxygen concentrations are associated with faster achievement of oxygen saturations following birth. Further complicating this issue is the emergence of physiological-based cord clamping (PBCC) in neonatal resuscitation. PBCC is defined as delaying umbilical cord clamping until lung aeration, either through breathing or by providing resuscitation prior to umbilical cord clamping. While current guidelines recommend immediate cord clamping (ICC) prior to resuscitation, PBCC offers a smoother physiological transition at birth. However, its effects on oxidative lung injury following high-oxygen resuscitation remain unknown.

#### Aim

To investigate whether physiological-based cord clamping is associated with more or less oxidative stress compared to immediate cord clamping, in preterm lamb lungs ventilated with 100% oxygen for 10 minutes after birth.

#### Hypothesis

Physiological-based cord clamping will result in decreased oxidative stress in preterm lamb lungs ventilated with 100% oxygen for 10 minutes after birth, as compared to immediate cord clamping.

#### Methods

Preterm lambs at 125 days  $\pm$  1 day gestation (term ~148 days) underwent instrumentation with flow probes and catheters to measure blood flows, pressures and to collect blood gases. Pulse oximetry measured peripheral oxygen saturations. Lambs were randomly allocated to undergo PBCC (n = 8), ICC (n = 7) or unventilated controls (no instrumentation, n = 8). Both cord clamping groups received 10 minutes of resuscitation with 100% oxygen, with a further 50 minutes of resuscitation where oxygen was titrated to target oxygen saturations following clinical guidelines. ICC lambs underwent cord clamping 30 seconds prior to resuscitation and PBCC lambs underwent cord clamping following 10 minutes of resuscitation. After resuscitation, a post-mortem was conducted with the lungs collected for histological and molecular analysis of oxidative stress, inflammation and lung morphology.

#### Results

We observed an increased alveolar-arterial oxygen gradient in PBCC lambs compared to ICC lambs during the first 10 minutes of resuscitation. PBCC lambs also had lower pulmonary blood flows than ICC lambs over the same time. PBCC lambs had increased mRNA expression of inflammatory cytokines IL-1B, IL-6 and IL-10 compared to ICC lambs and unventilated controls. PBCC and ICC lambs had increased expression of antioxidant enzyme SOD2 compared to unventilated controls. No differences were found in oxidative stress or lung morphology between experimental groups.

#### Conclusion

PBCC results in poorer oxygenation and increased inflammation in preterm lambs compared to ICC, following hyperoxia exposure. Although our understanding of oxidative stress outcomes remains limited, these preliminary findings suggest that PBCC may enhance inflammatory lung injury in preterm lambs resuscitated with 100% oxygen.

# Arsheeya Rattan

## Oxytocin vs Placebo or No Intervention for the Prevention of Post-Partum Haemorrhage: An Individual Participant Data Meta Analysis

Supervisor Names and Institute Affiliations

Dr. Carole-Anne Whigham<sup>1</sup>, Dr. Madeline Flanagan<sup>1</sup>, Professor Andrew Weeks<sup>2</sup>, Professor Ben Mol<sup>1</sup>

<sup>1</sup>Department of Obstetrics & Gynaecology, Monash Health

<sup>2</sup>Department of Obstetrics & Gynaecology, Liverpool Womens' Hospital



I decided to do my BmedSc(Hons) in 2023 because I have always wanted to be a clinician researcher, and felt like this was the perfect opportunity to explore that. I chose a project in Obstetrics, because of all my clinical rotations, I really gravitated towards it.

I spent nearly 5 months overseas in Liverpool, United Kingdom as my project was also in collaboration with the University of Liverpool and the Liverpool Womens' Hospital. I was so fortunate to have such an incredible opportunity to explore medicine in the UK, whilst also travelling and spending time in Europe too! This year has been one of growth, resilience and opportunity and I am so glad that I undertook this degree.

### ABSTRACT

#### Background

Postpartum haemorrhage (PPH) is an obstetric emergency impacting up to 10% of all deliveries globally, and is the leading cause of maternal mortality. Active management of the third stage of labour is utilised to prevent PPH and severe PPH by administering a uterotonic after delivery of the fetus' shoulder. Uterotonics help contract the uterus to prevent uterine atony, the predominant cause of PPH. Several uterotonic options are available, of which oxytocin is the most commonly used in practice and is recommended by the world health organisation.

#### Aims

This individual participant data meta-analysis (IPDMA) aimed to compare the effectiveness, safety and rate of adverse effects of oxytocin in comparison to placebo or no intervention for the prevention of PPH.

#### Methods

We identified randomised controlled trials (RCT) from previous Cochrane reviews and updated the search. RCTs comparing systemic oxytocin to placebo or no intervention were eligible for inclusion. Authors of the eligible trials were invited to contribute their individual participant data (IPD) for analysis. The primary outcomes were rate of PPH and rate of severe PPH. PPH was defined as estimated blood loss (EBL)  $\geq 500$ mLs and severe PPH as EBL  $\geq 1000$ mLs. For RCTs where IPD was not obtained, trustworthiness was established based on the TRACT data integrity checklist combined with the authors reasons not to share data.

#### Results

We found 14 RCTs, of which four (2681 participants) contributed raw data (N=1406 oxytocin group; N=1275 placebo/no intervention group). PPH occurred in 89 (6.4%) participants that received oxytocin and 118 (9.3%) participants in the control group (risk ratio (RR) 0.61; 95% confidence interval (CI) 0.48- 0.78). Severe PPH occurred in 15 (1.1%) participants in the oxytocin group and 21 (1.7%) participants receiving no intervention or placebo (RR 0.64; 95% CI 0.35- 1.19). Of the ten RCTs that did not share data seven were categorised as trustworthy and three as untrustworthy. Combined estimate from studies that shared IPD or were trustworthy resulted in a RR for PPH of 0.62 (95% CI 0.53-0.71). Untrustworthy studies, when compared to trustworthy studies and IPD, overstated the risk reduction of oxytocin for the prevention of PPH by 24%. Similarly, they overstated the risk reduction of severe PPH by 51%.

#### Conclusion

Oxytocin is effective in preventing both PPH and severe PPH. However, untrustworthy studies have significantly overreported the impact of oxytocin for these outcomes.

# Meagan Roff

## A Novel Digital Stethoscope for Neonates

Supervisor Names and Institute Affiliations

Supervisor: Atul Malhotra<sup>1,2</sup>, Co-supervisor: Faezeh Marzbanrad<sup>3</sup>

Departments:

<sup>1</sup>Monash Newborn, Monash Children's Hospital

<sup>2</sup>Department of Paediatrics, Monash University

<sup>3</sup>Department of Electrical and Computer Systems Engineering, Monash University



Hi! My name is Meg, and I chose to pursue a BMedSc (Hons) year after completing my fourth year of medical school. This decision was driven by my strong interest in gaining a deeper understanding of the research process and seeking a change of pace from clinical medicine.

The past year, despite its fair share of challenges, has played a pivotal role in my personal growth and the refinement of my research skills. Dedicating a year to research has provided me with invaluable insights into the field that I otherwise wouldn't have had the opportunity to gain.

Throughout this journey, I've developed a deep appreciation for research and its practical applications, something that I am excited to pursue in my future career as a doctor.

## ABSTRACT

### Background

The integration of digital stethoscope technology with Artificial Intelligence in neonatal care represents an emerging field with potential applications across the cardiovascular, respiratory, and gastrointestinal systems. This technology offers objective avenues for automatic vital sign estimation and pathological sound detection (e.g. murmur detection), holding promise for advancing neonatal auscultation. However, current digital stethoscopes produce low-quality sounds when used on neonates, likely resulting from their designs not accommodating the unique size and cardiorespiratory function of neonates, as well as susceptibility to external noise interference (environmental and crying sounds). Consequently, there is a need for digital stethoscope refinement tailored to neonatal care.

### Objectives

This pilot study aimed to evaluate the feasibility of a novel Neonatal Digital Stethoscope (first prototype, developed by Monash engineers) and compare the sound quality of neonatal cardiac sounds recorded with the Neonatal Digital Stethoscope to those captured through two commercially available digital stethoscopes (CliniCloud and Eko Duo).

### Methods

In this prospective observational study, we utilised three digital stethoscopes: the Neonatal Digital Stethoscope, CliniCloud, and Eko Duo. Each device was used to record one-minute of heart sounds from the left anterior chest of healthy, term or near-term newborns while they were settled. Recordings underwent a comprehensive sound quality analysis utilising a suite of specialised neonatal-specific Artificial Intelligence programs. This analysis included an assessment of overall sound quality on a continuous scale ranging from one to five (poor to excellent quality), as well as an evaluation of individual sound quality features, including sound wave distortion, noise interference, and heart sound characteristics.

### Results

We recruited 24 newborns and successfully obtained one-minute heart sound recordings with each of the three digital stethoscopes from all participants. In the overall sound quality assessment, the Neonatal Digital Stethoscope achieved the highest median (IQR) score of 3.29 (1.68), followed by Eko Duo with 3.10 (1.16), and CliniCloud with 2.69 (0.79). Statistical analysis revealed a significant improvement in overall sound quality in the Neonatal Digital Stethoscope compared to the CliniCloud but not compared to the Eko Duo. Notably, the Neonatal Digital Stethoscope displayed essential sound quality features, including minimal distortion from audio clipping, and reduced noise interference from external sources (e.g. environmental noise, crying) and internal noises (e.g. breath sounds), in contrast to both the CliniCloud and Eko Duo. Conversely, Eko Duo captured heart sounds with more distinct features.

### Conclusion

This study suggests that the current prototype of the Neonatal Digital Stethoscope offers a marginal improvement in sound quality when compared to the CliniCloud and Eko Duo digital stethoscopes. However, due to a lack of statistical significance, we could not definitively establish its superiority over the Eko Duo digital stethoscope. Additionally, the Neonatal Digital Stethoscope generally exhibited suboptimal sound quality, limiting its clinical significance at this stage. Nevertheless, these findings are promising as they validate the feasibility of the Neonatal Digital Stethoscope and provide direction for future design enhancements aimed at further improving sound quality.

# Mahesh Sakthivel

## Evaluating pain in infants undergoing open and laparoscopic inguinal hernia repair using the Newborn Infant Parasympathetic Evaluation monitor

Supervisor Names and Institute Affiliations

Dr. Maurizio Pacilli<sup>1,2,3</sup>, A/Prof. Ramesh Nataraja<sup>1,2,3</sup>

<sup>1</sup>Department of Paediatric Surgery, Monash Children's Hospital, Melbourne, Australia

<sup>2</sup>Department of Paediatrics, School of Clinical Sciences, Monash University

<sup>3</sup>Department of Surgery, School of Clinical Sciences, Monash University



My name is Mahesh and I completed my BMedSc(Hons) after fourth year of medical school. I chose to do a BMedSc(Hons) as I have always been curious about research and am interested in potentially pursuing academia alongside clinical practice later in my career. I had limited prior exposure to research coming into the year and the BMedSc(Hons) gave me the opportunity to deep dive into how to conduct a research project from the very beginning to completion.

It was a pleasure to do research in the Department of Paediatric Surgery at Monash Children's Hospital. My supervisors and the research team were very supportive, and there were many phenomenal learning experiences. This year allowed me to develop invaluable skills in scientific writing and academic writing. I learnt how to liaise with clinicians and communicate with patients as a researcher. I also had the opportunity to travel, and to present at an international conference.

If you are considering a BMedSc(Hons) year, particularly in a clinical or surgical project, I am more than happy share my experience further or provide advice at [msak0014@student.monash.edu](mailto:msak0014@student.monash.edu). Good luck!

### ABSTRACT

#### Background

Inguinal hernias are a common paediatric surgical condition that can be managed by open or laparoscopic surgery. The clinical outcomes of the two approaches are overall similar, however, there is little evidence to suggest which approach is less painful. Recently, the Newborn Infant Parasympathetic Evaluation (NIPE) monitor has been used as an objective, non-invasive tool for the assessment of pain in children under 2 years of age. This monitor may therefore be able to objectively identify which of the surgical approaches is less painful.

#### Method

In this prospective observational study, patients were recruited from a tertiary paediatric hospital between March 2023 to September 2023. We included children under 2 years of age with no significant associated co-morbidities (American Society of Anaesthesiologists Class I and II) who are undergoing elective open or laparoscopic inguinal hernia repair. Recruited participants underwent a standardised anaesthetic protocol comprising of general anaesthesia with a caudal block. The primary outcomes measures were intraoperative pain, postoperative pain, and analgesia use. Pain was assessed using the NIPE index and the FLACC scale. The NIPE index ranges from 0-100, where higher values (closer to 100) indicate lower levels of pain. Analgesia use was measured using the analgesia consumption score. For statistical analysis, we performed group comparisons using Mann-Whitney U tests, unpaired t-tests, and Fisher's exact tests.

#### Results

We included 27 patients in our analysis: 18 patients underwent an open repair, and 9 patients underwent a laparoscopic repair. The majority of patients undergoing open surgery had a unilateral repair (83.33%) whereas a majority of patients undergoing laparoscopic surgery had a bilateral repair (66.67%). Intraoperatively, the median NIPE index was higher in the open group compared to the laparoscopic group (76.00 vs. 57.00,  $p=0.0041$ ). In a subgroup analysis, open surgery also had a higher median NIPE index for both unilateral (76.50 vs. 57.00,  $p=0.0426$ ) and bilateral (66.60 vs. 57.00,  $p=0.3571$ ) repairs. The median intraoperative analgesia consumption score was lower in the open group compared to the laparoscopic group (0 vs. 1,  $p=0.0137$ ). Postoperatively, the median NIPE index was higher in the open group compared to laparoscopic group (56.50 vs. 49.00,  $p=0.015$ ). Open surgery had a higher median NIPE index for both unilateral (56.00 vs. 54.00,  $p=0.5257$ ) and bilateral (57.00 vs. 49.00,  $p=0.0476$ ) repairs in the postoperative period. The median postoperative analgesia consumption score was similar between the two surgical groups (0 vs. 0,  $p=0.1517$ ).

#### Conclusions

To our knowledge, this was the first study to objectively investigate pain for open and laparoscopic inguinal hernia repair in children. Intraoperatively, laparoscopic surgery was the more painful technique and was associated with higher levels of analgesia consumption. Postoperatively, laparoscopic surgery resulted in greater levels of pain in the immediate postoperative period. There were similar levels of analgesia consumption for both surgical groups postoperatively. The findings from this study can help guide future research into investigating causative factors of pain and ways to minimise pain for these procedures.

# Mr Anthony Salib

## The Association of Obesity and Coronary Artery Disease Using Computerised Tomography Coronary Angiography

Supervisor Names and Institute Affiliations

Associate Professor Nitesh Nerlekar

Dr Adam Nelson

Victorian Heart Hospital, Melbourne

Monash University, Melbourne



After completing my fourth year of medicine, I decided to undertake a BMedSc (Hons) year at the Victorian Heart Hospital. For me, the BMedSc (Hons) year represented a way to challenge myself academically in a specialty field that I already had a keen interest in. I was fortunate enough to become involved in a project which incorporated many of my academic interests, such as obesity and coronary artery disease. It was a privilege to lead the study from its inception, including conducting a literature review, preparing an ethics application, collecting data, statistical analysis, scientific writing, and oral presentations, all with the expert guidance of my supervisor. These are all skills that are very important for a future career in research, and the BMedSc (Hons) year provides this in a great, structured form that I'd recommend to anyone interested in research. I believe that all clinicians have a duty to contribute to the growing library of medical knowledge, and the BMedSc (Hons) year was just an introduction to what I hope will be a life-long research and clinical career.

Please don't hesitate to email me ([asal0021@student.monash.edu](mailto:asal0021@student.monash.edu)) for any questions regarding my project or the BMedSc (Hons) year.

### ABSTRACT

#### Background

Despite the high prevalence of cardiovascular risk factors in those referred for metabolic (also called bariatric) surgery, there is currently no consensus on pre-metabolic surgery cardiac assessment. Computerised tomography coronary angiography (CTCA) is often used for coronary artery disease (CAD) detection. However, there are feasibility concerns in this cohort, as increasing adiposity is thought to interfere with CTCA image quality and interpretability. Lack of consensus on cardiac assessment is also perpetuated by uncertainty regarding the association of obesity with CAD.

#### Aim

To determine the relationship between obesity (measured as body mass index (BMI)) and CTCA interpretability. To determine the prevalence of CAD in a cohort undergoing cardiac assessment before metabolic surgery and the relationship between BMI and presence of CAD.

#### Method

Single-centre, retrospective cohort study (Global Cardiology, Perth, Western Australia). Individuals aged 40-79 years with no history of atherosclerotic disease who had undergone CTCA assessment for pre-metabolic surgery assessment (considered to potentially be metabolically unhealthy) between January 2018 and July 2023 were included. Consecutive sampling of individuals referred for CTCA for an alternative reason using the same criteria comprised the control cohort. Association of BMI with CTCA image quality, and BMI with CAD presence was investigated by BMI category-based grouping, (normal BMI 18.5-24.9kg/m<sup>2</sup>, overweight BMI 25-29.9kg/m<sup>2</sup>, class 1 obese BMI 30-34.9kg/m<sup>2</sup>, class 2 obese BMI 35-39.9kg/m<sup>2</sup>, class 3 obese BMI >40kg/m<sup>2</sup>). Patient and CTCA characteristics were obtained from electronic medical record. Image quality was assessed using a 4-point Likert scale (non-diagnostic CTCAs defined at patient level if any coronary segment was non-evaluable). CAD was assessed as present or absent. ANOVA and chi-square tests were used to assess between-group differences. Univariate and multivariate logistic regression modelling was performed to adjust for confounding characteristics.

#### Results

Of 703 participants enrolled (mean age 58.7±10.2 years, mean BMI 30.7±9.6 kg/m<sup>2</sup>, 47% male), there were 295 normal weight, 99 overweight, 105 class 1 obese, 98 class 2 obese, and 106 class 3 obese participants. Non-diagnostic CTCA rate was similar as BMI increased from 18.5-40kg/m<sup>2</sup> (4.0%, p=0.97), but was increased in BMI >40kg/m<sup>2</sup> (21.5%, p<0.01). Proximal main epicardial artery segment stenosis severity was still evaluable in 95.65% of non-diagnostic CTCAs respectively. CAD prevalence was similar in those referred for CTCA for pre-metabolic surgery assessment compared to those referred for an alternative reason (79/144, 54.86% vs 313/559, 55.99%, p=0.85). Multivariate logistic regression modelling yielded an independent association of obesity with presence of CAD when BMI >30kg/m<sup>2</sup> (BMI 30-35kg/m<sup>2</sup> OR 1.8 [1.03,3.00], BMI 35-40kg/m<sup>2</sup> OR 1.8 [1.00,3.03], BMI >40kg/m<sup>2</sup> OR 2.6 [1.52,4.39], p<0.01).

#### Conclusion

CTCA is feasible in obese cohorts for the detection of CAD but less reliable with BMI >40kg/m<sup>2</sup>. However, across all groups, CTCA yields a very high diagnostic rate for proximal artery segment stenosis which has significant prognostic implications. Increasing BMI categories associate with higher rates of CAD prevalence regardless of metabolic surgery status. Future analysis of plaque phenotype in those selected for metabolic surgery, as well as those of increasing BMI is now needed to further inform operative and long-term MACE risk.

# Sylvia Sherborne

## On Fertile Grounds: Assessing the Value of Assisted Reproductive Technologies

Supervisor Names and Institute Affiliations

Dr Rebecca Brown (University of Oxford)

Dr César Palacios-González (University of Oxford)

A/Prof Giuliana Fuscaldo (Monash University)



Throughout the first four years of my medical degree, I always looked forward to doing a BMedSc(Hons) as an opportunity to gain some research experience and dive into a project for a full year. I am incredibly grateful to have been able to undertake my research under supervision from the Oxford Uehiro Centre for Practical Ethics.

My project was a fascinating combination of issues related to resource allocation, health economics, the harms caused by involuntary childlessness and the value of procreation. It has been a fantastic opportunity to develop new research skills and pursue my interest in bioethics. Despite having been a steep learning curve initially, with lots of reading, writing and more reading, I have thoroughly enjoyed exploring philosophy and ethics in more depth and attending various relevant talks and tutorials.

The year we spent in Oxford was unforgettable. Being immersed in such a diverse, academic and dynamic environment was, and will continue to be, a source of great inspiration. I am grateful to everyone who made this year possible – both staff and students. I am also happy to be contacted by future students who have questions regarding the BMedSc(Hons) year and the Oxford Bioethics Program.

## ABSTRACT

### Background

Assisted reproductive technology (ART) is increasingly being sought by those who are involuntarily childless, for medical and non-medical reasons. ART is costly; decisions around its funding allocation are challenging and require medical, social, and ethical consideration. In places where it is state funded, allocation is often inconsistent and insufficient, governed by strict eligibility criteria. This leaves many people unable to access a service that would allow them to have genetically related children, something that, for many, is deemed an incredibly valuable life project. Traditionally, health technology assessments (HTAs) used to inform funding decisions have calculated the cost-effectiveness of ART using quality-adjusted life years (QALYs), which measure an individual's health benefit from a treatment. However, it has been suggested that there exists a broader value to fertility treatment than that accounted for in these measures; a value which, if recognised, might influence funding provision.

This project explores public attitudes towards state funding of ART, specifically examining whether the public attribute value to its functions outside of disease amelioration. In so doing, the empirical component aimed to inform whether people indeed perceive a broader value of fertility treatment than currently accounted for in HTAs. The hypotheses were that current funding models may not capture the full range of values attributed to ART by the public and that valuing benefits independent of disease amelioration may predict public support of funding.

### Method

A quantitative, online survey of 174 UK participants was conducted using experimental vignettes from which participants provided their 'willingness-to-fund' in vitro fertilisation (IVF) through the National Health Service. Four vignettes were systematically manipulated around a) a medical or non-medical cause of involuntary childlessness, and b) whether having a child would have a significant impact on the subject's life satisfaction and happiness. Background attitudes towards infertility, its treatment, and parenthood were collected.

### Results

Happiness-benefit and disease-amelioration were each independently shown to significantly increase willingness-to-fund judgements. Most participants supported state-funding IVF for both disease- and happiness-benefits (83%), while 48.8% and 40.9% were supportive in the case of happiness-benefit-only and disease-amelioration-only, respectively. Only 21.4% supported state-funding IVF when it benefitted neither variable. Background attitudes recognising the impact of involuntary childlessness on wellbeing were also significant predictors of participant willingness-to-fund. These findings add support to claims in current ethical literature; proposals to focus on the harms of involuntary childlessness rather than medical causes, perspectives on the special value of parenthood, and state obligations to promote welfare and alleviate involuntary childlessness-related harm.

### Conclusions

This novel empirical evidence on public willingness-to-fund ART suggests that allocating resources on the grounds of QALY-benefit alone may not adequately reflect the value that the public attach to ART, owing to a willingness to support both disease and broader wellbeing improvements. Drawing on principles from Collective Reflective Equilibrium in Practice, I conclude that, these empirical findings can be used to inform normative claims on how ART funding should be allocated. This project contributes to existing discussion around re-evaluating resource allocation decisions for ARTs and the incorporation of non-medical benefits into current HTA frameworks.

# Virginia Su

## Development and Validation Study of a Novel Laparoscopic Paediatric Simulation Model for Pyloromyotomy

Supervisor Names and Institute Affiliations

A/Prof Ram Nataraja

Dr Maurizio Pacilli

Monash Children's Simulation, Departments of Surgery & Paediatrics, School of Clinical Sciences, Monash University  
IMRA Surgical



Hi I'm Virginia! I completed my BMedSc(Hons) year after my 4<sup>th</sup> year of Medicine. I was really interested in research and learning more about the processes involved in such. I was also interested in pursuing paediatrics or surgery as a future career path, so I was very lucky to find a project in Paediatric Surgery for my honours year.

A BMedSc(Hons) year was a great way to take a break from clinical medicine, contribute to the evidence-based medicine we practice, and learn some new skills as well. The best part of this year for me was making new friends and connections in the research team — it was a very supportive environment. However, it definitely does take a lot of work and if there's one thing I've learnt it's that things will never go the way you plan. There were a lot of challenges I've had to overcome this year, but it's definitely taught me resilience, critical thinking and adaptability, and lot of important lessons in both self-development and research skills.

If you'd like to ask me any questions, feel free to contact me at [vivisu2000@gmail.com](mailto:vivisu2000@gmail.com)!

### ABSTRACT

#### Background

Paediatric surgery is a crucial medical intervention and often the definitive treatment for paediatric conditions such as pyloric stenosis. Surgical training is traditionally conducted following only an apprenticeship model, however, changes in the healthcare system creates a demand for surgical training curriculums to incorporate simulation-based education (SBE) to ensure competency. 3D-printed models are a modality of SBE that enables high realism and functionality, allowing repetitive practice of surgical skills. However, due to heterogeneity in the validation of SBE models, further research is needed to validate models that are focussed on functionality.

#### Aims

The primary aim was to develop and validate a novel paediatric surgical simulation model for pyloromyotomy. We aimed to establish 'face' and 'content' validity of the model, referring to its realism and suitability as a training tool for the development of laparoscopic paediatric surgical skills.

#### Methods

This was a prospective validation study. A novel paediatric surgical simulation model was developed in conjunction with an industry partner in a testing and development phase. Consultant paediatric surgeons were recruited to conduct trials on the model. Participant trials were recorded, and participants asked to complete a post-trial validation questionnaire on the accuracy and suitability of the model as a surgical training tool. Data analysis comprised of descriptive statistics, Cronbach's Alpha, and the Mann-Whitney U test.

#### Results

Six consultant paediatric surgeons were recruited. All accuracy items on the validation questionnaire had mean scores of approximately 5.0 indicating they were 'slightly inaccurate' and required some improvement: visual realism (4.3), anatomical accuracy (5.8), stabilisation of the pylorus (3.8), force for incision (5.5), depth of incision (5.8), initial spreading of the muscle layer (4.5), completion of spreading (4.8), overall experience (6.0). There was large variation in data signified by SD of 1.47-3.08. A trend was observed in which the mean scores for the model's utility as a training tool were higher than accuracy mean scores: useful training tool for junior surgeons (7.2), for qualified paediatric surgeons (5.7), for laparoscopic surgical skills (6.8). There was no statistically significant difference in scores when comparing participants' previous experience with simulation-based education.

#### Conclusion

The results indicate that the novel paediatric laparoscopic model for pyloromyotomy is a valuable training tool for junior surgeons and laparoscopic surgical skills. However, it requires further development and refinement to improve its accuracy in simulating visual and functional aspects of a pyloromyotomy, specifically in the initial spreading of the muscle layer, stabilisation of the pylorus, depth of incision and accurate simulation of the mucosa.

# Ann Thomas

## Successful Weaning from Non-Invasive Ventilation (Niv) in Very Preterm Infants: Investigating the Utility of Oximetry and Patient Predictive Factors

Supervisor Names and Institute Affiliations

Main supervisor: A/Prof Kenneth Tan, Co-supervisor: Dr. Risha Bhatia

One of my most memorable and interesting rotations during fourth year was my week on neonatology at the Monash Children's Hospital. This greatly influenced me to pursue a project within the neonatal medicine field. This Honours year was a steep learning curve, that really challenged my ability to manage my own time and to plan, execute and troubleshoot my own project. It really helped to build confidence in communicating with fellow clinicians and researchers. Although there were many moments during the year when I felt incredibly overwhelmed and anxious, regularly checking in with my fellow Honours students was always a great source of reassurance. My advice for future BMedSci (Hons) students would be to choose a project that you find interesting or are passionate about, to be enthusiastic in learning new research skills and to take pride in becoming an expert on your selected topic.

### ABSTRACT

#### Background

Preterm infants born <32 weeks' gestation have underdeveloped lungs and often need ventilatory support from nasal CPAP (nCPAP) or nasal high flow cannula (nHF). Infants must be weaned from nCPAP and nHF in a timely manner. Weaning too early before an infant is ready to breathe independently leads to failed weaning and repeated weaning attempts while weaning too late leads to prolonged time spent on respiratory support. Failed weaning, repeated weaning attempts and prolonged time on respiratory support can cause lung injury to the vulnerable preterm lungs and result in abnormal lung development referred to as Bronchopulmonary Dysplasia (BPD). BPD is associated with long term deficits in lung function and cardiopulmonary morbidity. Current weaning outcomes are suboptimal. Studies show that >50% of infants fail to wean in the first attempt and spend an unnecessarily prolonged duration on support. Hence, current criteria is shown to lack accuracy in predicting an infant's readiness to wean from nCPAP and nHF. Better predictors of weaning readiness are needed. Clinical factors that influence weaning success have been identified but are poorly defined.

#### Method

This was a prospective observational cohort study of preterm infants <32 weeks gestation who had yet to undergo any weaning attempts at Monash Newborn neonatal unit. The primary outcome of interest was success or failure to wean in the first attempt. For eligible infants, oxygen saturation trend data of interest was recorded and downloaded from bedside monitors. Patient clinical data was extracted from medical records. Logistics regression was used to determine the factors that influence weaning success. Average oxygen distributions between successful weaning and failed weaning groups were compared.

#### Results

68 infants were included in the study. 36 weaned successfully in their first attempt and 32 failed. Oxygen histogram data was obtained for a subset of 21 infants of which, 9 infants were successful, and 12 failed. Infants in the successful group had higher median corrected gestational age (CGA) in weeks (35.5 vs. 33,  $p=0.07$ ), higher median weight at wean at wean (2079g vs 1632g,  $p=0.04$ ) and higher rates of exposure to antenatal steroids (97% vs. 81%,  $p=0.03$ ). Factors found to be predictors of successful weaning after being adjusted for confounders were increasing CGA in total days (OR = 1.11 95%CI 1.05-1.17,  $p<0.001$ ) and increasing haemoglobin (g/L) (OR=1.03 95%CI 1.002-1.05]  $p<0.05$ ). Having BPD was found to reduce likelihood of weaning success by 91% (OR=0.09 95%CI 0.01-0.48,  $p=0.005$ ). Successful infants spent more time at SpO<sub>2</sub> of 100% compared to failed infants ( $p<0.001$ ).

#### Conclusions

CGA, haemoglobin level and BPD are predictive of weaning success in the first attempt. Oxygen histograms may have a potential role in clinical decision-making. There is feasibility to improve criteria for assessing weaning readiness. Findings need to be expanded with a larger sample population to further refine this predictive model.

# Yantong (Meredith) Wang

## Radial Artery Conduit Use After Transradial Catheterisation

### Supervisor Names and Institute Affiliations

Prof. Silvana Marasco, Cardiothoracic Surgery, The Alfred

A/Prof. Chris Merry, Cardiothoracic Surgery, The Alfred



My name is Meredith, and I have finished Year 4C before the commencement of BMedSc (Hons). I have always been passionate about the anatomy of the heart and lungs, and I am always interested in the physiology behind the cardiovascular and respiratory systems. Thus, cardiothoracic surgery seems to be the perfect career choice for me. My project this year has been interesting and was a combination of interventional cardiology and cardiothoracic surgery. As a beginner to research, this year has truly given me enough time and support to be familiarized, as well as practice conducting clinical research. I am also very grateful to have two knowledgeable and supportive supervisors, who are both highly experienced surgeons in the field as well. For all future BMedSc (Hons) students, this year is nowhere close to a break from medical school, yet it is also a special year where you will learn a tremendous amount of research skills that will all be helpful to your future career, no matter which type of doctors you eventually become. All the best!

## ABSTRACT

### Background

Transradial catheterization (TRC) via the radial artery (RA) is now the default approach for coronary angiography, which is the gold standard diagnostic tool for coronary artery disease. However, studies have shown that TRC is associated with endothelial damage and vasodilatory dysfunction of the radial artery. Nonetheless, the RA is also a popular choice of bypass conduit for coronary artery bypass grafting (CABG) surgery. Therefore, a previously catheterized radial artery may be utilized as a bypass conduit. To date, there is insufficient evidence regarding the impact of TRC on RA graft patency.

### Method

This retrospective cohort study was conducted at two major hospitals in Victoria, Australia. Patients who underwent CABG at participating institutes between January 2011 and March 2023 were screened for eligibility. We retrospectively collected the data and imaging reports of eligible patients who underwent follow-up imaging after CABG. Other eligible patients who had not undergone any follow-up imaging were invited via phone calls to undergo computed tomographic coronary angiography to assess graft status. Statistical analysis was conducted to compare graft patency, and univariate analysis was conducted to identify potential factors that may influence catheterized radial artery graft patency.

### Results

We recruited 68 eligible patients for this study, including 90 left radial artery (LRA) grafts (non-catheterized) and 76 right radial artery (RRA) grafts (previously catheterized). Previously catheterized RRA grafts had a significantly lower patency (72%) than LRA grafts (87%). There were also significantly more RRA grafts (62%) anastomosed to the right coronary circulation than LRA grafts (27%). Female sex, peripheral vascular disease, and a history of myocardial infarction were associated with RRA graft occlusion. Severe right coronary artery stenosis was associated with RRA graft patency.

### Conclusions

Previously catheterized radial artery grafts had a significantly lower patency than non-catheterized radial artery grafts. Surgeons should use previously catheterized radial arteries as bypass conduits with caution, especially in female patients, patients with peripheral vascular disease and those with a history of myocardial infarction. However, previously catheterized radial arteries should still be considered a useful conduit option especially when other conduit choices are limited.

# Zoe Weimar

## Impact of the Neonatal Resuscitation Video Review Program as a Educational Tool for Perinatal Staff: A Qualitative Assessment

Supervisor Names and Institute Affiliations

Dr Douglas Blank

Associate Professor Arunaz Kumar

Department of Paediatrics, School of Clinical Sciences, Monash University, Clayton  
Monash Newborn, Monash Health, Clayton



After completing year 4C in 2022, I wanted to try something different from clinical medicine and learn more about research. I really enjoyed my paediatrics rotation, and therefore chose to do a project in neonatal resuscitation! It was important to me that my project allowed me to maintain some clinical exposure — and my project was fantastic in this regard. I was able to attend many complex deliveries — and learn all about resuscitation and teamwork from the skilled clinicians who work in the NICU.

Personally, I found my honours year to be the most challenging year of University I've done yet. It's allowed me to greatly develop my critical thinking, planning, and communication skills — and I would highly recommend it to other students for this reason.

I would like to thank my supervisors — Dr Doug Blank and A/Prof Arunaz Kumar — for guiding and supporting me this year. I've learned so much from them, and they have helped make this year interesting and enjoyable.

I would advise prospective students to reflect on what they want from an honours project, whether it be flexibility, clinical exposure, or lab exposure. Research is challenging, but also greatly rewarding. I'm happy to be contacted at [zwei0014@student.monash.edu](mailto:zwei0014@student.monash.edu)

### ABSTRACT

#### Background

Neonatal resuscitation is a common medical emergency which requires a group of clinicians work effectively as a team. Ongoing, high-quality education is essential in improving and maintaining healthcare providers' knowledge and skill. Video review (VR) is an emerging form of education that provides the opportunity to review real resuscitations and identify points of improvement. Video review has been shown to improve teamwork, increase compliance to guidelines, and improve knowledge retention in neonatal resuscitation. There are no published studies evaluating healthcare workers' perceptions of VR in neonatal resuscitation.

#### Objectives

To evaluate clinicians' attitudes and perceptions of reviewing videos of neonatal resuscitations for ongoing education

#### Method

Doctors and nurses from the Monash Health Neonatal Intensive Care Unit (NICU) who had attended neonatal resuscitation video review (NRVR) teaching sessions approached for interview. Interviews were audio recorded and converted into written transcripts, which were thematically analysed collaboratively by 5 researchers.

#### Results

Twenty clinicians (11 nurses, 9 doctors) completed individual semi-structured interviews. All interviewed participants voiced positive attitudes towards VR in neonatal resuscitation and expressed interest in attending future sessions. Four major themes were identified in participant responses: (1) Learning from reality - participants noted that being exposed to real life resuscitations allowed them to practice their clinical appraisal skills and easily relate teaching points to their clinical practice. (2) - Capacity to promote reflection - participants who had been able to watch videos of themselves described that this helped align their memory of the event with objective documentation - and that this process often helped alleviate lingering self-criticism. (3) Complexities in participant psychological safety - All participants noted that they personally were comfortable with watching videos of real resuscitations but acknowledged this had capacity to be confronting to others. Many participants expressed self-consciousness at watching themselves on video and a fear of being judged by others watching those videos, though the educational benefit of VR superseded these anxieties. (4) - Beneficial group dynamics - participants expressed that NRVR promoted positive group discussion, which allowed them to learn from their colleagues.

#### Conclusions

VR was shown to be perceived as an acceptable and effective educational tool in neonatal resuscitations, though self-consciousness and fear of being judged may present barriers to its effectiveness.

# Emily Whalen

## Assessing Sulforaphane And Metabolites In Maternal And Fetal Circulation

Supervisor Names and Institute Affiliations:

Dr Sarah Marshall and A/Prof Kirsten Palmer

The Ritchie Centre

Hudson Institute of Medical Research



My name is Emily and I have completed my fourth year of Medicine and am currently undertaking a BMedSc(Hons) year! Since I began my medical journey, I have always been interested in the field of Obstetrics & Gynaecology. This year, I have had the pleasure of working on a clinical research study investigating preeclampsia, a complicated and dangerous condition of pregnancy. Throughout this project, I have learnt numerous valuable skills within the realm of translational research, such as the process of gaining ethical approval, recruiting patients, communicating with trial participants and their families, learning basic laboratory skills and all the documentation duties required of a research study. I have had the privilege of working with a wonderful team of inspiring, cheerful and hard-working colleagues and I am incredibly grateful for their time, effort and wisdom. I am more than happy to be contacted by prospective students to offer my advice on the Honours program!

### ABSTRACT

#### Background

Preeclampsia is a multisystem, hypertensive disorder of pregnancy characterised by hypertension combined with maternal organ dysfunction and/or intrauterine growth restriction. Preeclampsia is a leading cause of perinatal morbidity and mortality worldwide, however, current treatments centre around symptom management, without targeting the complex pathophysiology. As a disease of oxidative stress underlying endothelial dysfunction, recent research has explored the utility of antioxidants as potential therapeutics. Sulforaphane, a naturally occurring antioxidant found in broccoli sprouts, has received recent attention for its vasoprotective and vasodilatory qualities. With its ability to mitigate oxidative stress and attenuate the injurious impacts of systemic endothelial dysfunction in vitro, sulforaphane is uniquely positioned to protect against the harmful maternal and fetal effects of preeclampsia. However, the transferability of sulforaphane from mother to fetus or baby remains undetermined.

#### Method

Pregnant patients over 37 weeks' gestation with uncomplicated pregnancies were recruited from Monash Medical Centre and Jessie McPherson Private Hospital. All participants were scheduled for elective caesarean sections and provided written and informed consent. Part One of the study occurred on the day of caesarean section. Maternal demographics were recorded and baseline vital signs, blood and urine samples collected. A single dose of EnduraCell, a broccoli sprout extract (equivalent to 21mg of sulforaphane), was administered ~2-3 hours prior to caesarean section. At the time of operation, vital signs and maternal samples were collected again, alongside umbilical cord blood and the placenta. Part Two of the study occurred ~2-4 days post-delivery. Participants were administered a second dose of EnduraCell. Two hours later, maternal bloods and breastmilk were collected. All samples were processed and frozen in the laboratory at The Ritchie Centre, Hudson Institute of Medical Research. Maternal samples were sent to the Monash Institute of Pharmaceutical Sciences for analysis by liquid-chromatography mass-spectrometry (LC-MS) to measure sulforaphane and metabolites. Statistical analysis was performed using GraphPad Prism to assess statistical significance for changes within maternal vital signs.

#### Results

A total of eight participants were recruited to the study. The average age was 34.75 years 1.934 and average body mass index was 37.95 2.94 at time of birth. All participants had healthy pregnancies and uncomplicated caesarean sections. Besides an increase in peripheral diastolic blood pressure on the day of caesarean section ( $p=0.0177$ ), there were no changes in maternal blood pressure or heart rate after ingestion of EnduraCell. Analysis via LC-MS indicated presence of sulforaphane metabolites within the umbilical cord blood, proving the maternal-fetal transfer of sulforaphane.

#### Conclusions

This is the first study to assess the maternal-fetal transfer of sulforaphane in human pregnancy. These results demonstrate acute exposure to sulforaphane via a broccoli sprout extract did not reduce maternal blood pressure or heart rate. Our results also demonstrate sulforaphane and its metabolites within the umbilical cord blood ~2-4 hours post ingestion. This finding provides the first evidence of maternal-fetal sulforaphane transfer and opens avenues for future research into the fetal implications of sulforaphane exposure during pregnancy.

# Vivian Yuewei Xiao

## Adults with Major Blunt Traumatic Brain Injuries – Changes in Outcomes Over 20 Years

Supervisor Names and Institute Affiliations

Professor Mark Fitzgerald<sup>1,2,3</sup> and Dr Yen Kim<sup>1,2</sup>

<sup>1</sup>Central Clinical School, Monash University, Melbourne, Australia;

<sup>2</sup>National Trauma Research Institute, Melbourne, Australia

<sup>3</sup>Trauma Service, Alfred Health, Melbourne, Australia.



I completed my BMedSc(Hons) after finishing my fourth year of medicine. I was interested in critical care and trauma and saw this year as an opportunity to gain further insight into the field as well as a chance to get involved with the ins and outs of research - from project design to writing and presentation.

I was fortunate enough to come across the NTRI and my supervisors, under whom I completed a data-based project looking at head injury mortality outcomes over the last 20 years. Despite all the challenges along the way, it was a very rewarding experience that allowed me to develop my critical thinking as well as other invaluable skills in data analysis and scientific writing. It was such a great experience, and I highly recommend the year for anyone who may be interested in research or want to see another side to improving clinical care.

I would recommend prospective students to reach out to various previous students and potential supervisors to get a sense of what they are looking for in a project and which supervisors they feel they would work with best. Feel free to contact me at [yxia0061@student.monash.edu](mailto:yxia0061@student.monash.edu).

### ABSTRACT

#### Background

Traumatic brain injury (TBI) is the leading cause of injury-related mortality and disability worldwide. It has been difficult to capture the progress of TBI outcome improvements due to incomplete epidemiological data collection and a lack of recent clinical treatment breakthroughs. Whilst trauma systems have been effective at reducing overall injury mortality, it remains unknown if TBI mortality has also benefitted. There is also a lack of understanding of TBI mortality trends in Australian trauma systems and centres.

This study aimed to examine whether major TBI mortality outcomes have changed over 20 years at The Alfred Hospital – the largest trauma centre in Australasia. The secondary outcome was to identify if functional independency outcomes after TBI have changed over the same period, as measured through the proportion of patients discharged to home.

#### Method

A retrospective cohort study of patients with major TBI (head Abbreviated Injury Score greater than 2) who presented to The Alfred Trauma Service between 1st January 2002 and 31st December 2021 was conducted. Only adult patients aged 16-70 years were examined. The data for this study was extracted from the Alfred Health Trauma Registry (AHTR). This study describes the incidence of annual TBI presentations, TBI mortality rates and discharge destinations. Logistic regressions were used to determine trends in mortality, discharges to home and subgroup mortality, including sex, age, Abbreviated Injury Scores, Injury Severity Scores and isolated TBI versus TBI presenting in polytrauma. A multivariable regression was used to assess the trends in mortality, adjusting for confounding factors.

#### Results

A total of 8,222 patients presented with major TBI over the 20 years with a total of 692 total deaths (mean, 34 per year). The mortality rate declined significantly over the period from 12% in 2002 to 4% in 2021. This represented a 4% decrease in the odds of death per year (OR 0.96, 95% CI 0.95-0.97,  $p < 0.001$ ). The average annual reduction in mortality was greatest for the oldest subpopulations aged 50-59 (0.4% p.a.,  $p < 0.001$ ) and ages 60-70 (0.5% p.a.,  $p < 0.001$ ) as well as those with the most severe head injuries (head AIS=5; 0.6% p.a.,  $p < 0.001$ ). The critically injured also had a significant reduction in their average annual mortality (0.3% p.a.,  $p < 0.001$ ). The proportional declines were similar between men and women (51% and 50% respectively, 2002-21) as well as between isolated TBI and TBI in polytrauma cases (49%, 2002-21). Functionality after TBI had significantly improved over the period, with the proportion discharged to home increased from 31% to 61% (OR 1.05, 95% CI 1.04-1.06,  $p < 0.001$ ).

#### Conclusions

The significant improvement in mortality and functionality after TBI suggest that changes to management in the Victorian State Trauma System and The Alfred Hospital have been effective. This study identified that there may be further work to be done in reducing the mortality of high risk subgroups, including older populations and those with the most severe head injuries (head AIS=5). Causes for changes in mortality should be explored to identify areas of improvement in current strategies of care and clinical management.

# Michelle Xing

## The Effect of Oral Acetic Acid on Blood Pressure

Supervisor Names and Institute Affiliations

Associate Professor Anthony White, Associate Professor Barbara Kemp-Harper

Victorian Heart Institute



I had the privilege of undertaking a BMedSc(Hons) year at the Victorian Heart Hospital after completing my fourth year of medicine. Having thoroughly enjoyed my third-year cardiology rotation at MonashHeart, I was keen to explore the discipline in greater depth and felt that getting involved with the research side of cardiovascular medicine would be a great way to accomplish this. Whilst the decision to extend my degree by an extra year and miss out on graduating with many of my friends wasn't an easy one, it's definitely not one that I regret.

Previous students had described this year as "a break from clinical medicine", and whilst it's true that it came with a lot of newfound independence and self-directed learning, I would hesitate to characterise it as a break. My project was both clinical and lab-based, and we definitely ran into our fair share of barriers along the way, although ultimately, these only amplified the sense of accomplishment we felt when we eventually succeeded, and ended up translating into great learning experiences.

My advice to any students considering a BMedSc(Hons) would be to be upfront with potential supervisors about your expectations. I'm very happy to be contacted via email: [mxin0002@student.monash.edu](mailto:mxin0002@student.monash.edu).

## ABSTRACT

### Background

Despite improvements in detection and management, hypertension remains the leading preventable contributor to global premature death. Therefore, there is a compelling need for research into novel mechanisms of blood pressure (BP) regulation to facilitate the development of alternative antihypertensive therapies. The gut microbiome and its metabolites, including short-chain fatty-acids such as acetic acid, have been posited as one such mechanism. However, little is understood about the role of these molecules in human BP regulation. Preliminary data from our laboratory suggest that ingestion of indigestible carbohydrates is correlated with an increase in plasma acetate concentration and a decrease in systolic blood pressure (sBP). We aimed to clarify whether this increase in plasma acetate concentration was directly correlated with the observed reduction in sBP.

### Methods

This study comprised two consecutive protocols, the first of which was a single-centre, prospective observational cohort study of 10 normotensive adults ( $22.5 \pm 0.2$  years, 5/5 female/male) to determine the time-course of plasma acetate concentration following ingestion of acetic acid. Participants each ingested 20 x 40 mg (= 800 mg) acetic acid capsules, and blood samples were collected at baseline (defined as  $T = 0$ ), 30, and either 15 or 120 minutes post-ingestion. A colourimetric assay was used to derive the acetate concentration in each sample, and the calculated peak plasma acetate concentration time of  $T = 15$  minutes was used to inform the subsequent protocol.

Protocol 2 was a single-centre, randomised, double-blind, placebo-controlled crossover trial of 30 normotensive adults ( $23.0 \pm 0.2$  years, 15/15 female/male) to assess the effect of acetic acid on BP. Participants were randomised to ingest either 20 acetic acid capsules or 20 placebo capsules, then underwent a washout period before returning to receive the opposite treatment. We measured BP and heart rate and collected blood samples from each participant at baseline and 15 minutes post-ingestion, although we were unable to measure plasma acetate concentration in these samples due to supply issues with the colourimetric assay kit.

### Results

Protocol 1 demonstrated an apparent, albeit nonsignificant 1.3-fold rise in plasma acetate concentration from  $2011.0 \pm 300.5 \mu\text{mol/L}$  at baseline to  $2691.0 \pm 747.9 \mu\text{mol/L}$  at 15 minutes post-ingestion, before a return to baseline levels by 30 minutes.

Protocol 2 demonstrated that by 15 minutes post-ingestion, acetic acid had caused a statistically significant decrease in sBP by  $3.9 \pm 1.0$  mmHg from  $118.8 \pm 1.7$  mmHg at baseline to  $114.9 \pm 1.8$  mmHg, when compared with placebo ( $p < 0.01$ ). A nonsignificant decrease in diastolic BP by  $2.6 \pm 1.0$  mmHg was also observed in the intervention group. Acetic acid administration was not shown to impact on heart rate, as compared to placebo.

### Conclusions

Our results demonstrate that plasma acetate levels peak at approximately 15 minutes post-ingestion of acetic acid capsules, and this is associated with a statistically significant reduction in sBP in normotensive individuals. These relatively acute effects are likely the result of local vasodilatory mechanisms. Ultimately, these observations support the future investigation into acetic acid supplementation as a novel adjunct antihypertensive therapy.

# Jessica Yu

## The Utility of Imaging in Acute Pyelonephritis in the Emergency Department

Supervisor Names and Institute Affiliations:

Supervisors: Prof. Biswadev Mitra, A/Prof. de Villiers Smit

Institute Affiliations: Monash University School of Public Health and Preventive Medicine, Alfred Health



Hi! I'm Jess, I completed a BMedSc(Hons) after Year 4C at the School of Public Health and Preventive Medicine. I decided to undertake an Emergency Medicine project spanning across a few disciplines (a little bit of ID, a little bit of urology, a little bit of critical care), and had the opportunity to occasionally head into the ED for a shift. This year has given me so much hands-on experience and insight into the process of medical research, from submitting the ethics application all the way to amending the final manuscript.

Coming out of two years of full-time clinical placement, I can certainly say that the change of pace this year offered was very refreshing. Outside of the project, it's been fantastic having a more flexible university schedule, and I've really enjoyed being able to dedicate time towards extra-curricular activities and exploring new (and re-discovering old!) hobbies.

I would be more than happy to chat about my year and project, feel free to send through an email at [jessicayu8862@gmail.com](mailto:jessicayu8862@gmail.com).

### ABSTRACT

#### Background

Acute pyelonephritis (APN) is a common diagnosis among patients presenting to the Emergency Department (ED). The role of imaging is poorly understood, with clinical guidelines showing significant variability for when patients should be imaged, as well as what modality of imaging to use.

To understand the current literature available on this topic, we conducted a systematic review to assess current trends for APN imaging with US and CT, the proportion of imaging with abnormalities, and the proportion of patients with a change in management due to imaging findings. We identified a general paucity of literature on the impact of imaging on management, and more specifically, identified no studies set in the emergency medicine setting in Australia.

This thesis aimed to characterise the prevalence and role of imaging for APN in the Australian ED setting.

This was done by:

Identifying the proportion of patients with APN who receive imaging in the ED

Identifying the abnormalities present on imaging in APN

Identifying the clinical variables associated with inpatient admission (compared with discharge from the ED)

#### Method

A single-centre retrospective review of patients with a discharge diagnosis of APN at an adult tertiary referral hospital over a five-year period (2018-2022) was conducted. The number of patients with APN receiving imaging was reported as a proportion. Abnormalities on imaging were categorised and reported as proportions. To assess association with inpatient admission, univariable and multivariable analyses were performed on demographic, clinical, biochemical, and radiological variables.

#### Results

There were 778 patients included for analysis after manual record review.

We identified that 27% of our patients received ultrasound (US) and/or computed tomography (CT) imaging in the ED. US was the most performed modality of imaging (12%), followed by CT without contrast (9%), and CT with contrast (6%).

Out of the 214 imaging reports available, 102 were normal, and 112 were abnormal. While US was the most frequently performed modality of imaging, it was least likely to show an abnormal result (34% abnormal). CT with contrast was the least frequently performed modality of imaging and most likely to show an abnormal result (86% abnormal).

Our results showed an association between biochemical, clinical, and radiological features with inpatient admission. These were temperature, heart rate, white cell count, C-reactive protein (CRP), and estimated glomerular filtration rate (eGFR), and imaging. Imaging had an adjusted odds ratio of 5.28 for inpatient admission, while abnormal imaging had an adjusted odds ratio of 4.51. 14% of patients with no imaging were admitted, 37% of patients with normal imaging were admitted, 67% of patients with an abnormality on any imaging were admitted.

#### Conclusions

An association between abnormal imaging with inpatient admission was observed, suggesting possible utility of early and routine imaging to allow clinicians to efficiently make decisions about patient disposition. These results indicate a need to characterise the role of imaging in a prospective setting, to help identify variables that put a patient at highest risk of abnormal imaging for risk stratification.

# Xenia Zubenko

## Traumatic Cauda Equina Syndrome in Victoria

Supervisor Names and Institute Affiliations:

Professor Belinda Gabbe, Associate Professor Susan Liew, School of Public Health and Preventive Medicine



I chose to do an honours year as I had never done any research before this year, and wanted to test the waters. I'm so glad I did, as it turns out I have a big passion for research! This year has been a wonderful opportunity to fully immerse myself into this world and be responsible for contributing knowledge to the medical field. The more I've researched traumatic cauda equina syndrome, the more I've become interested in this topic and I have more questions I'd love to answer in the future someday. I'm also very grateful I've had amazing supervisors, and I really recommend future students interested in doing an Honours to choose their project by the supervisor, as it can make or break your year. More than happy to be contacted by future students to chat about Honours.

### ABSTRACT

#### Background

Little is known about the incidence, management or long-term outcomes of traumatic cauda equina syndrome, with most of the existing literature consisting of case reports and case series.

#### Method

This study was a registry-based cohort study, involving 94 patients with a diagnosis of cauda equina syndrome from 2010 to 2022. Eligible participants were from the Victorian State Trauma Registry. Patients were routinely followed up at six, 12, and 24 months, with a focus on health-related quality of life outcomes using the EQ-5D scale, level of disability using the World Health Organization Disability Assessment Schedule (WHODAS) score and return to work outcomes. An additional telephone interview was undertaken, at a median 6.9 years post-injury to collect the EQ-5D, as well as bowel and bladder symptoms. Descriptive statistics were used to analyse the data. Mixed effects regression modelling was used to model EQ-5D outcomes over time.

#### Results

This study revealed that most patients with this injury were men with a median age of 41 years, and the most common cause was road trauma. The incidence rate ranged from 0.43 per million to 2.01 per million, indicating this is a rare injury. Most patients reported problems on the EQ-5D at all four follow-up time points. There was no clear improvement in EQ-5D outcomes over time. Almost half (47%) of patients had not returned to work 24 months after injury. Many patients experience bowel and bladder symptoms, with the additional follow-up revealing that 41% of patients experience constipation, and 51% report almost losing bladder continence at least weekly.

#### Conclusions

Overall, this study showed that most patients experience some long-term sequelae from their injury. This study was the first cohort study to describe multiple long-term outcomes greater than 12 months, and was the first to establish an incidence rate for traumatic cauda equina syndrome. Multijurisdictional studies may be needed in the future to have sufficient power to further analyse this injury.



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