

A man with short, light brown hair and a slight smile stands with his arms crossed. He is wearing a light blue button-down shirt and tan trousers with a black belt. The background is a modern building with large glass windows and a white wall with some green and blue graphics. The text 'Toby Richards Research Group' and 'Annual Report 2021' is overlaid on the right side of the image.

Toby Richards Research Group
Annual Report 2021

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We use
research to
solve clinical
problems
in everyday
patient centred
clinical care.



Introducing Professor Toby Richards

BSc. MBBS. MRCS. FRCS. MD. FRACS

Lawrence-Brown Professor of Vascular Surgery
Consultant Vascular & Endovascular Surgeon
Head, UWA Division of Surgery Director, UWA Clinical Trials Unit Adjunct Professor Anaesthesia, Monash University Honorary Professor UCL Institute of Clinical Trials.

The fundamentals of Research are Quality, People, and Collaboration.

We focus on the development and delivery of a high-quality research supported by our CoRE research team through collaborative networks of undergraduate and postgraduate researchers. This foundation has enabled and facilitated a series of successful research projects from medical students through masters and PhD students to international clinical trials.

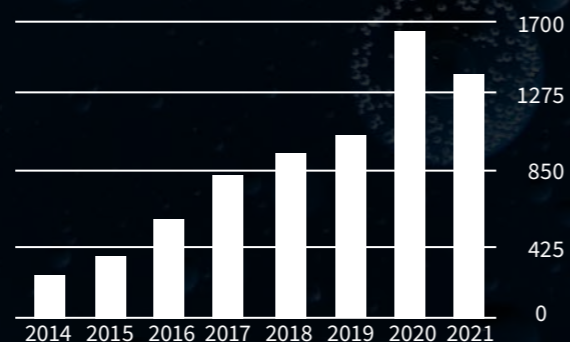
2020 & 2021 saw highly successful outputs with 15-20 manuscripts published p.a. including The Lancet, BJA and BJS reaching a total of 190 peer reviewed publications cited > 8000 times with > 25,000 downloads. Importantly a notable shift to anonymous collaborative outputs, highlighting and supporting inclusivity and facilitation for the next generation of researchers. Overall funding and awards now total \$6M in W.A. contributing to an overall total > \$17M from 40 grant awards.

In 2020 the research team lead the research drive to meet the COVID pandemic with development of the COVID Research Response Trial (CRR). This was the first Pan-Western Australian platform for high quality clinical research incorporating all metropolitan healthcare services and facilitating numerous clinical projects, as well as significant collaboration with the Australian National Phenome Unit with far reaching and international acclaim.

Building on our international collaboration and the statewide STRIVEwa network has been pivotal to the COVIDsurg plethora of publications. Participating in the largest ever global surgical trial with >180,000 patients, results have pioneered global guidelines in surgical care during the pandemic.

Ongoing work looking to the future is focused on team quality and collaboration, to build the UWA CTU to facilitate translational and clinical trial work for researchers of the future.

	All	Since 2016
Citations	8050	6509
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Citations	116	103



Summary

Professor Richards is the Lawrence Brown Chair in Vascular Surgery, Head of Division of Surgery and Director of the Clinical Trials Unit at University of Western Australia (UWA). He is also Honorary Professor at the Institute of Clinical Trials and Methodology, University College London (UCL) and Honorary Professor of Anaesthesia at Monash University

Professor Richards developed the Centre for Research Excellence (CoRE) to promote quality and collaboration to facility research and clinical trials. CoRE operational management by Giuliana D' Aulerio, a senior trial manager, includes database and IT support from Doug Robb, ethics and governance through Jun Khai Wong and Biobanking by Mike Epis. Through CoRE, Professor Richards has set up and leads clinical trials and research projects translating from molecular exploration, physiological and mechanistic analysis to international trials focusing on world leading research. Collaborations exist with the Australian National Phenome Centre, Monash and Melbourne universities, UCL, throughout the UK and internationally.

The last 2 years has seen numerous successes in publications and grants; four LANCET series including the pivotal NIHR HTA funded PREVENTT trial with results from 487 patients in 42 hospitals. Ongoing secondary analyses include predefined sub analyses with the original team in Europe with further additional laboratory research for the molecular control of iron metabolism with Linda Wijaya at UWA. Ongoing NHMRC trial ITACS jointly chaired by Professor Richards and Paul Myles (Monash) has pushed through 2020 with 700 of 1000 patients recruited internationally. Parallel translational research with PhD student Katerina Cabolis and Post Doc Marija Sajic is exploring detailed physiological experimentation focusing on mitochondrial function at UCL. And, with PhD student Cory Dugan and UWA student Amelia Davies to understand the incidence and physiological impact of iron deficiency on physical performance in female athletes, the IRONWOMAN RCT.

STRIVEwa has lead the POSTvenTT trial, the largest ever Surgical trial in ANZ, results from which will inform the POSTvenTT mechanistic clinical trial to be run in perioperative patients by PhD student Beth MacLean at FSH. Data will also support submission of the NHMRC CTC phase 4 POSTvenTT RCT as well as Phase 2b clinical trial on novel therapeutic agents in development with BioAGE labs.



These projects form the foundation and breadth of research that UWA has been pivotal in supporting Surgical research with local master's and PhD projects and to build collaborative research programs in Perth, throughout Australia, New Zealand and internationally.

Local Projects include the NHRC Ideas grant ABLE with Professor Karol Miller to support PhD student Farah Alkahtib to explore the biomechanics of Aortic Aneurysms. The MRFF ICTC grant with Peter Pockney and the RACS CTANZ to run the student and trainee multicentre RCT SUNRRISE with the MLB masters student Jess Vo on surgical wound healing. The VOLUME trial with MLB masters student Jani Moss to assess the huge issue of venous disease in W.A. Additionally, we have set up a framework for UWA academic activity training, with regular seminars and journal club. As well as direct support for the STRIVEwa network for student collaborative research in WA.



The CoRE Team



Giuliana D'Aulerio

Bachelor of Science, Major in Pharmacology. (UWA)

Master of Public Health (UWA)

Research Operations Manager

It's not all about process but how well you communicate, collaborate, connect, and engage with people you're trying to help.

Giuliana oversees research operations, clinical trials and audit, and undergraduate and postgraduate research students at UWA. She also leads research start-up activities, including facilitation and promotion of overarching ethics and governance structures to support health and medical research across tertiary hospitals in WA. She engages with leaders and students in developing a research culture, building collaborative networks and promoting excellence in patient outcomes.

Giuliana also engages with executives, senior management and clinical staff in developing and promoting research management and governance methodologies, capacity building and efficient utilisation of valuable research resources. She works with teams and individuals to facilitate research projects including design, budget and contract management.

Her role builds the team's capability in health and medical research by managing effective collaboration between disparate divisions and facilities to support research in a broad range of therapeutic areas.



Doug Robb

Bachelor of Engineering (Electronics) (UWA)

Master of Commerce (with Distinction) (UWA)

Informatics and Data Management

Integration, analysis, and management of research data are critical elements of research projects.

Doug leads the development and application of technology ecosystems that underpin data driven research. Parsimony, good design principles and precise use of tools are core skills for supporting high-quality research and he complements technical leadership with strong communication and stakeholder engagement. The key deliverables are design and delivery of infrastructure and software as a service to facilitate and support analytical, statistical, computational, data capture and management platforms supporting researchers to develop and interpret data-driven solutions to solve difficult research challenges.

His knowledge and experience in both research and operational settings are invaluable in helping coordinate the technical, human and resource challenges to research projects.



Jun (Khai) Wong

Bachelor of Biomedical Science, Minor in Forensic Biology (Murdoch University)

Master of Biomedical Science, Specialising in Neuroscience (UWA)

Clinical Trials Coordinator

As Clinical Trials Coordinator Khai liaises with the Principal Investigator, assessment offices, governing bodies, clinical and non-clinical managers, clinicians, and sponsors on ethical and governance requirements and coordinates study management.

Khai engages with sponsors and supporting teams to activate study sites and coordinate communication with stakeholders and supporting teams during the study lifecycle. Prior to joining CoRE Khai worked in a variety of trial settings and roles ranging from creation and management of documentation, sample collection and processing through to coordination of patient-related clinical activities.

This experience allows Khai to have a clear understanding of how to navigate through all aspects of clinical trial coordination.



Michael Epis

Bachelor of Science in Biotechnology with Honours in Molecular Biology (Murdoch University)

Bio-sample Repository Manager (UWA)

It is our goal to create a state-wide Biobank to support and service research initiatives for the benefits of health and medical research in WA.

For 15 years Michael was involved in or led projects spanning RNA Biology, gene regulation, hormone resistance and microRNAs in cancers, with specific focus on Prostate Cancer, with Professor Peter Leedman at the WAIMR/Harry Perkins Institute of Medical Research. Since 2018 he has managed the WA DNA Bank holding bio samples for numerous research groups before becoming the bio sample repository manager.

Michael provides biospecimen consultancy and laboratory services, specimen collection management and storage services to facilitate research groups in their ongoing research needs. He can also provide nucleic acid services including sample collection, DNA and RNA extraction from patient samples, long-term bio banking and storage of nucleic acids and biological samples for contributing researchers and supply and service of samples for these studies.

Iron Woman Trial



Cory Dugan testing live on
ABC news abc.net.au/radio/perth/programs/mornings/iron-deficiency-in-women/13226720.

PhD student Cory Dugan is supported by the Australian Government Research Training Award (\$180,000) supervised by Professors Toby Richards and Peter Peeling. Cory is investigating the impact of iron deficiency on skeletal muscle physiology and overall physical fitness. Cory's individual patient meta-analysis of existing randomised controlled trials built on previous collaboration with the St Marys Institute of sport and UCL and revealed considerable heterogeneity on the effect of iron supplementation on physical function. Promoting the need for a quality RCT, and therefore the IRONWOMAN trial lead at UWA.

To facilitate recruitment, we developed a novel screening tool to assess for anaemia and iron deficiency in fit and healthy women. Testing supported by Amelia Davies and STRIVewa at sporting events throughout WA has recruited >1,500 with publicity in several broadcasts and the team were invited to appear on ABC news.

Female Athletes with iron deficiency enrolled into the IRONWOMAN RCT, are randomised to intravenous iron or placebo, with full submaximal exercise testing performed at baseline 4 days, 4 weeks, and 4 months. Outcomes will address the physiological impact of iron deficiency on skeletal muscle performance outcomes, quality of life and mood state. Results will inform further studies (PhD Beth MacLean) to assess how we can enhance patient recovery after major surgery.

Funding (> \$200,000 in research funding)

Australian Government research training program (RTO) fees offset scholarship and RTP Stipend (\$180,000) (2020)

Telethon Kids Institute- Children's Diabetes Centre Seeding Grant (\$17,000) (2019)

The Frank Pyke Memorial Scholarship (Sports Science Honours) (\$5000) (2018)

NHMRC Centre of Research Excellence in Type 1 Diabetes Honours Scholarship (\$5000) (2018)

UWA ethics committee 2018 application of the year award (\$5000) (2018)

Publications

1. Dugan, C., MacLean, B., Cabolis, K., Abeysiri, S., Khong, A., Sajic, M., Richards, T. and (2021), The misogyny of iron deficiency. *Anaesthesia*, 76: 56-62. <https://doi.org/10.1111/anae.15432>

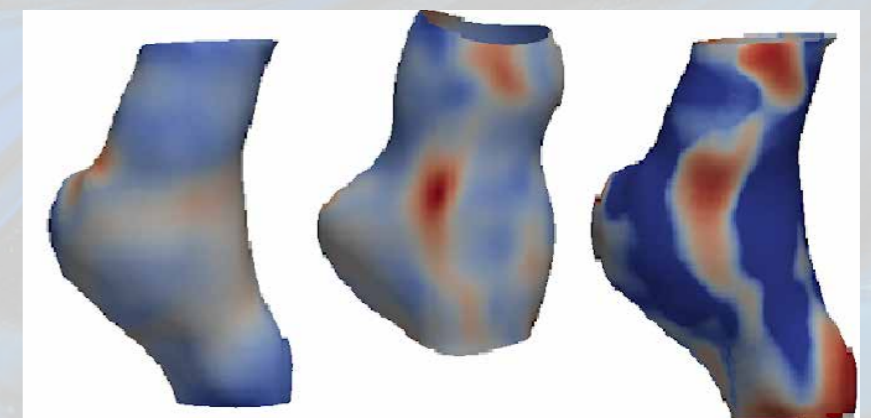
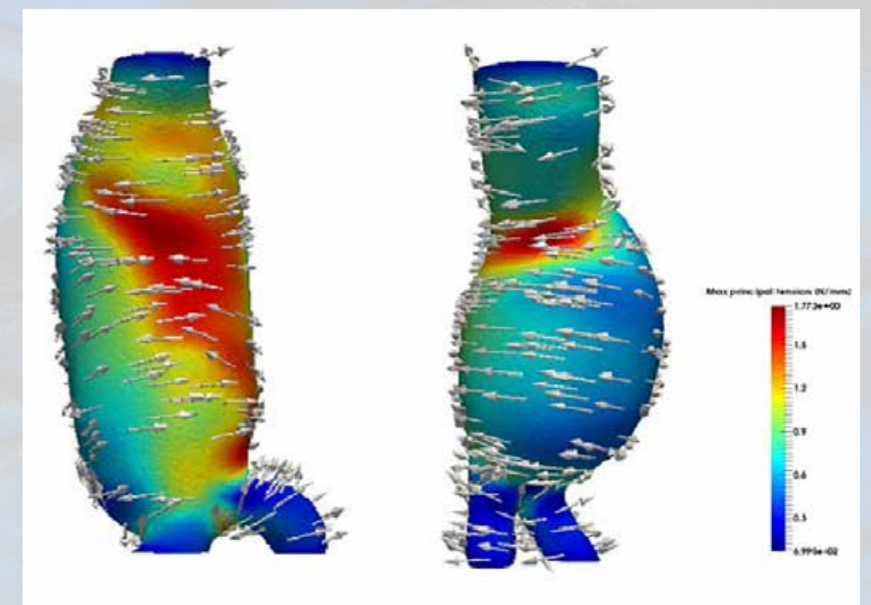
Abdominal Aortic Aneurysm Bio-mechanical Longitudinal Expansion (ABLE)

Farah Alkahtib (Phd Candidate)

Abdominal aortic aneurysm is an irreversible dilatation in the lower part of the aorta. The risk of rupture is related to the size and expansion rate of the aneurysm. Intervention is common and increasingly in elderly and comorbid patients with often complex interventions. However, there is no good quality means to assess the risk of the AAA to patients. Risk of the AAA could be due to patient factors or the biomechanical properties of the AAA itself.

In collaboration with Professor Karol Miller at the School of Mechanical Engineering UWA CoRE are supporting PhD student Farah Alkahtib who aims to use a combination of biomechanics and advances in medical image analysis to determine the relationship between the growth rate and structural weakness in the aneurysm wall.

The ABLE study, funded by a successful NHMRC grant (TR & KM) run by CoRE has recruited patients with known AAA in a prospective Cohort to undergo routine 4D CT scanning to assess AAA measurements between systole and diastole over a period of 3 years. Utilising a computational model to measure and predict the stresses and strains exerted on the diseased wall and predict the progression of the aneurysm.



BioPARR stress computation; stretch measured using 4D ultrasound; computed SII; computed RSII, showing location of the lowest 10% of the values (<0.48). Red indicates areas of interest (high stress/stretch and low SII/RSII). Not surprisingly, small RSII values correspond to high stretches. These preliminary AAA data were obtained at FSH, ethics approval: SMHS HREC #RGS0000003501.

Scholarly Activities

The CoRE team supports 4-8 medical students every year for training in clinical research including literature searches and formalised audit or research projects. The focus is on training in quality research methodology and supporting meaningful outputs for the work undertaken.

Amelia Davies was selected as a top 8 UWA student for MD Scholarly Activity Graduate Research Scholarship 2020

Amelia is supporting PhD Student Cory Dugan in the identification and screening for female athletes with iron deficiency. Utilising a validated risk and symptom questionnaire augmented by fingerpick haemoglobin levels this has facilitated algorithm development to accurately predict iron deficiency. The skill sets learned by the academic activity students include; GCP, data and database management, statistics including multivariate regression and patient public interaction and newsletter outputs.

In collaboration with colleagues at University of Melbourne we are undertaking a literature review of novel therapies for the treatment of anaemia. This is focused on the novel HIF-1 PHD- that have been explored in renal medicine but have far reaching potential not only in anaemia management but also aging, reperfusion and cachexia. All valuable diagnostic targets in vascular surgery.

Prizes

MD Scholarly Activity Graduate Research Scholarship 2020 (Scholarly+)

Top 2% of Graduating Class of 2020 (Bachelor of Biomedical Sciences)

Hugh Owen Memorial Prize 2020

Top student in PUBH2209, PUBH2204, IMED3001, ARCY2006

The UWA MD Scholarly Activity program provides a valuable opportunity to engage medical students with research, enabling and training students to prepare for their future careers by expanding their skills and pursuing academic interests.



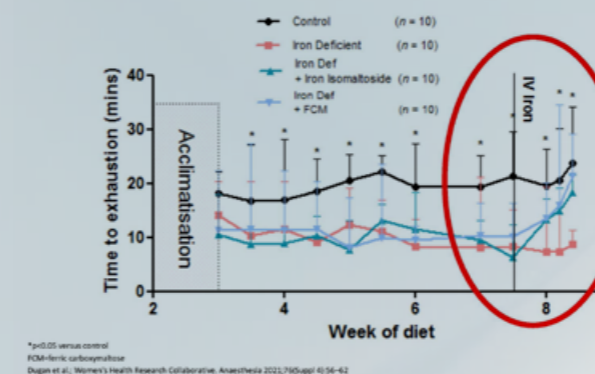
Dr Marija Sajic



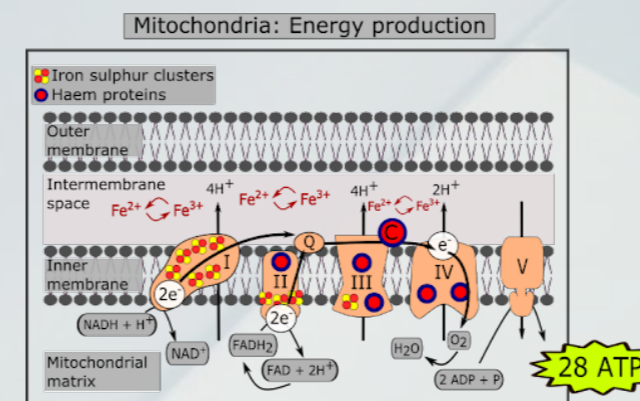
Katerina Cabolis

Exploring Muscle Function and Mitochondrial respiration.

Exercise function – restored



In collaboration with Dr Marija Sajic our translational research supports PhD student Katerina Cabolis. Katerina who is investigating the physiological impact of iron deficiency and iron repletion on energy production in the body, specifically by examining the role iron plays in the structure and function of mitochondria in skeletal muscle tissue. Iron is essential for many biological processes in the body including energy production within the mitochondria. Given the importance of adequate energy levels in energy demanding tissue such as the muscle and brain, it is likely that in a state of iron deficiency, energy levels may be lower than required leading to sarcopenia and frailty, sequelae common in surgical patients.

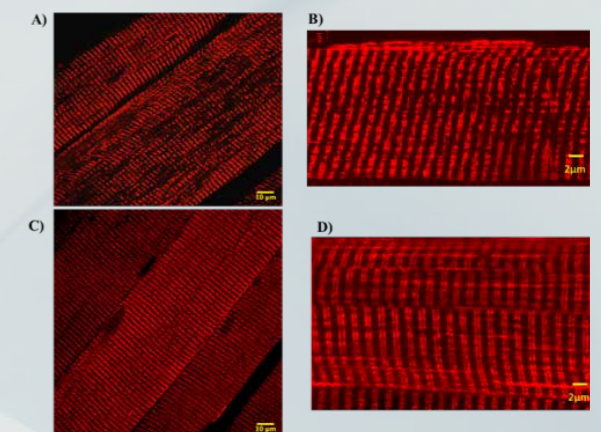


Above: Diagram depicting the protein complexes involved in energy production within the mitochondria, highlighting all the iron containing proteins; iron sulphur clusters and haem proteins.

Mitochondria are known to be the power-house of the cell as mitochondrial energy production is the most efficient way of producing energy in the body. All proteins involved in mitochondrial energy production are iron-dependent; yet, the role of iron in energy production remains massively understudied.

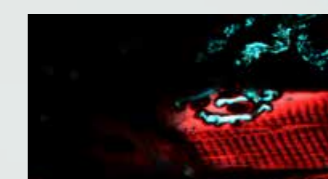
Using an animal model of iron deficiency, we can examine how iron deficiency impacts the body on a behavioural level as well as a cellular level. Specifically, the experiments conducted involve examining how long mice who are put on an iron deficient diet can run on a treadmill, which gives an indication of the levels of fatigue these mice experience. Later, we examine how iron deficiency as well as fatigue impact the cellular structure of skeletal muscle tissue. Through the use of various laboratory techniques, we can look into how iron impacts the efficiency with which mitochondria can produce energy as well as examine changes in how mitochondria are structured.

“Fundamental processes of life and health hinge on mitochondria – the ancient organelles pervade all tissues and organs acting as a regulatory and communication network which harmonises the function of the body in its entirety.”



Above:

A) Confocal image of labelled mitochondria (red) in skeletal muscle of an iron deficient mouse shows numerous unlabelled areas scattered thorough muscle fibres, indicating loss of mitochondrial polarization within those areas. B) A high-power confocal image of labelled mitochondria in skeletal muscle. C) Confocal image of labelled mitochondria in a control mouse. In contrast to ID mouse, mitochondrial labelling is uniform within the fibre. D) A high-power confocal image of labelled mitochondria showing a uniform distribution, highly organized network and uniform morphology and polarization level (brightness) in a control mouse.



Left: Confocal image of neuromuscular junction (blue) and labelled mitochondria (red) of iron deficient mouse.



Wound Healing and the SUNRRRISE trial

Dr Jess Vo is the Michael Lawrence Brown Masters Student located at FSH. She has led a stepwise series of projects over the last two years to become a senior researcher with numerous publications and successful delivery of clinical trials.

The aim of the master’s degree in clinical research was to train, enable and empower future researchers, with knowledge in protocol design & clinical research skills. This was developed under the umbrella of the SUNRRRISE randomised controlled trial. SUNRRRISE RCT was led nationally throughout Australia and New Zealand by Professor Toby Richards, associate Professor Pete Pockney and Professor David Watson, forming the first randomised controlled trial led through the Royal Australasian College of Surgeons. Jess was the trainee lead, responsible for running the trial including all patient recruitment, data collection, data ascertainment, and results reporting at FSH. This expanded to lead recruitment across WA with SJOG Subiaco and Sir Charles Gairdner Hospital. Overall, Western Australia contributed significantly to the success of the trial in Australia and New Zealand. The trial was completed ahead of schedule with 40% additional numbers.

Additional international collaboration enabled involvement with the STARSurg international RECON study. Jess rapidly and capably stepped-up during onset of the 2020 pandemic as principal investigator at Fiona Stanley Hospital and Western Australian coordinator for many GlobalSurg observational studies during the COVID pandemic, including the COVIDSurg Cancer study, and COVIDSurg Week study. Jess is also part of the Project Management Group for POSTventTT



Top five publications:

COVIDSurg Collaborative; GlobalSurg Collaborative. Timing of surgery following SARS-CoV-2 infection: an international prospective cohort study. *Anaesthesia*. 2021 Jun;76(6):748-758.

COVIDSurg Collaborative. Head and neck cancer surgery during the COVID-19 pandemic: An international, multicenter, observational cohort study. *Cancer*. 2020 Dec 21.

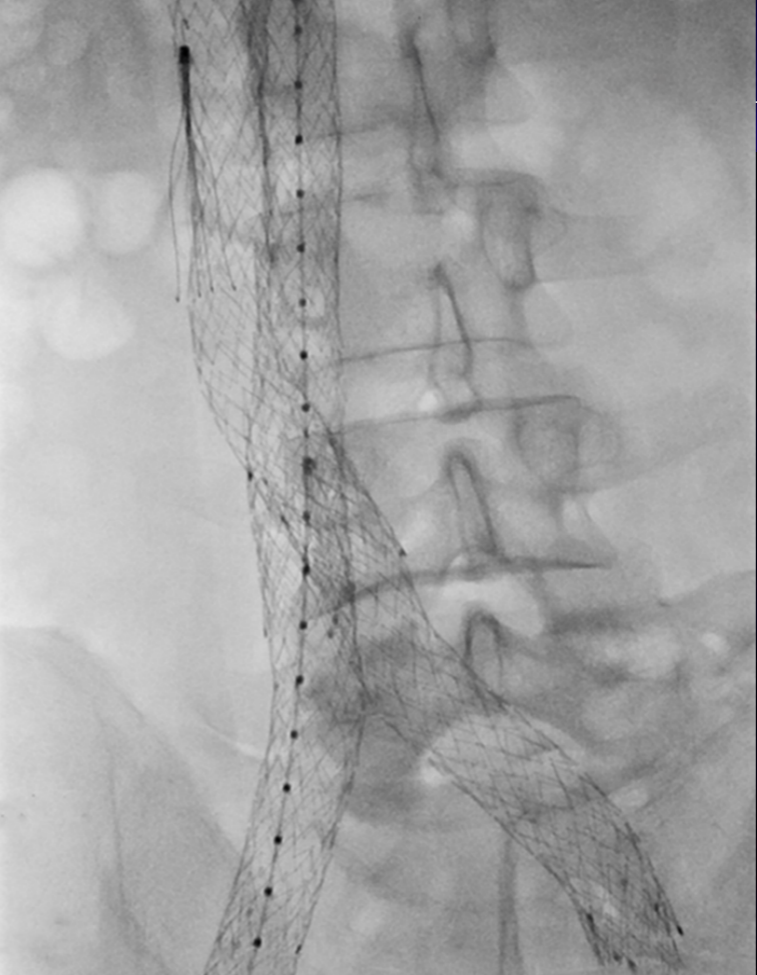
SUNRRRISE Study Group on behalf of the Northwest Research Collaborative and the West Midlands Research Collaborative. An international pragmatic randomised controlled trial to compare a single use of negative pressure dressing versus a surgeon’s preference of dressing to reduce the incidence of surgical site infection following emergency laparotomy: the SUNRRRISE Trial Protocol. *Colorectal Dis*. 2020 Dec 4.

COVIDSurg Collaborative. Outcomes from elective colorectal cancer surgery during the SARS-CoV-2 pandemic. *Colorectal Dis*. 2020 Nov 15:10.

COVIDSurg Collaborative. Preoperative nasopharyngeal swab testing and postoperative pulmonary complications in patients undergoing elective surgery during the SARS-CoV-2 pandemic. *Br J Surg*. 2020 Nov 12.

Media release:

<https://www.surgeons.org/en/News/media-releases/australian-patients-should-receive-covid-19-vaccine-before-surgery>



Venous Disease

Dr Jani Moss

Jani is the Michael Lawrence Brown Masters Student located at FSH, and is a current candidate for the Master of Surgery by Research at The University of Western Australia. Her research focuses on the surgical treatment of venous leg ulcers and deep venous disease. Obesity is common in W.A. and 40% of patients with VLU have super obesity (BMI>40). However, her literature review revealed that data in clinical trials to date have excluded this population. It is not known how obese patients respond to venous intervention.

The VOLUME trial is a prospective protocol driven observational trial to explore the management of venous leg ulcers in obese patients. Data suggest this population has greater duration and impact of symptoms but are less likely to be offered treatment. However, prospective analysis of assessment revealed they have the same pattern of venous disease compared to the non-obese population.

Professor Richards has set up and led the complex venous reconstruction service at FSH. Jani, supported by Medtronic, has led the first state-wide venous seminar and developed interactive online training for complex venous reconstruction for venous disease. This includes several Australian ‘firsts’ for total IVC reconstruction and novel technologies.

As part of the CoRE research team Jani has had the opportunity to become the trainee lead for the Australian Vascular Trials Network and ongoing COVIDSurg and POSTventTT studies.

Prizes

WAVES 2021, Medtronic Oral Presentation, 2nd Prize

Publications

Benson RA, Nandhra S. Outcomes of Vascular and Endovascular Interventions Performed During the Coronavirus Disease 2019 (COVID-19) Pandemic. *Ann Surg*. Apr 1 2021;273(4):630-635. doi:10.1097/SLA.0000000000004722

Benson R, The Vascular and Endovascular Research Network (VERN) COVER study collaborative (Moss J, collaborative author) Global impact of the first coronavirus disease 2019 (COVID-19) pandemic wave on vascular services. *British Journal of Surgery*. 2020;107(11):1396-1400.

Glasbey JC, Bhangu A, on behalf of the COVIDSurg Collaborative (Ballal M, Gibson D, Hayne D, Moss J, Richards T, Viswambaram P, Vo UG: Fiona Stanley Hospital collaborative authors) Elective Cancer Surgery in COVID-19–Free Surgical Pathways During the SARS-CoV-2 Pandemic: An International, Multicenter, Comparative Cohort Study. *Journal of Clinical Oncology*.0(0):JCO.20.01933.

Glasbey JC, Omar O, COVIDSurg Collaborative (Ballal M, Gibson D, Hayne D, Moss J*, Richards T, Viswambaram P, Vo UG, Fiona Stanley Hospital Collaborative Authors) Preoperative nasopharyngeal swab testing and postoperative pulmonary complications in patients undergoing elective surgery during the SARS-CoV-2 pandemic. *British Journal of Surgery*. 2020

Li E, Glasbey JC, Nepogodiev D, Simoes JF, COVIDSurg Collaborative (Moss J, collaborative author). Outcomes from elective colorectal cancer surgery during the SARS-CoV-2 pandemic. *Colorectal Disease*. 2020.

Benson RA, Nandhra S. (Moss J, Collaborative Authorship) Outcomes of Vascular and Endovascular Interventions Performed During the Coronavirus Disease 2019 (COVID-19) Pandemic: The Vascular and Endovascular Research Network (VERN) Covid-19 Vascular Service (COVER) Tier 2 Study. *Ann Surg*. 2020;Publish Ahead of Print.

COVIDSurg Collaborative. (Moss J, Collaborative Authorship) Head and neck cancer surgery during the COVID-19 pandemic: An international, multicenter, observational cohort study. *Cancer*. 2020.

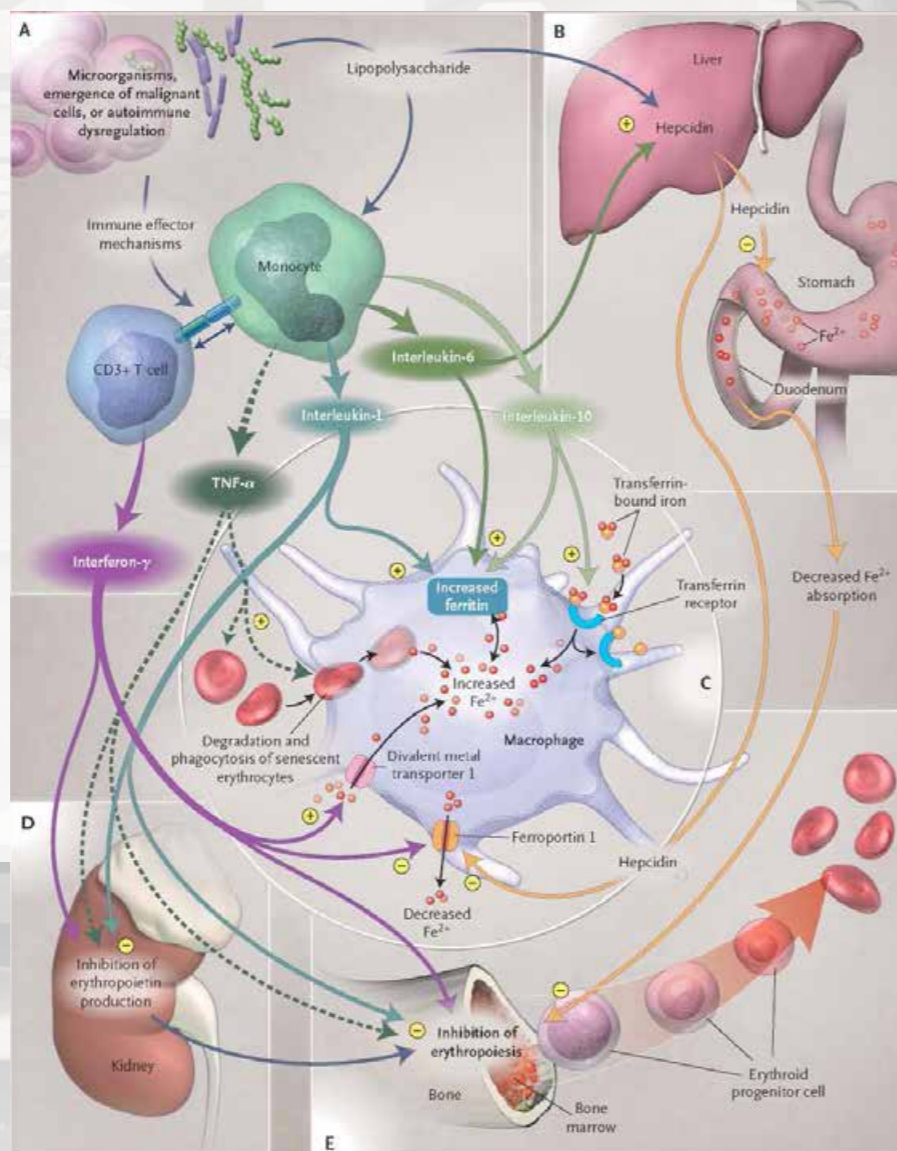


Post Doc

Dr Wijaya is a biomedical researcher with over 15 years of experience in laboratory research and clinical trials. She recently completed her PhD in biomedical sciences.

Dr Wijaya joined the team from 2020 and is leading the laboratory analysis of protein markers involved in iron metabolisms from the PREVENTT clinical trial, a phase III double-blind randomised controlled trial that compared the use of intravenous iron with placebo in anaemic patients undergoing major open abdominal surgery.

Specifically, to look at the role of biochemical makers; Hepcidin, Erythroferrone, IL6, CrP to better define the criteria of 'Good Responders' and to identify which markers of iron status are associated with responsiveness to intravenous iron. She has also addressed the important question on the role of iron carboxymaltose in phosphate metabolism via FGF-23 induction.



Future Research and Projects

Carotid Artery Disease

Carotid Artery Disease is a preventable cause for stroke. Intervention in patients with recently symptomatic disease is well proven to reduce future risk of stroke.

However, in patients with incidental asymptomatic carotid artery disease it is not clear in whom intervention, or by what method would best benefit patient outcomes. Having lead the European Carotid Surgery Trial 2 in the UK and personally recruiting over 100 patients, Professor Richards has bought the Carotid Revascularization and Medical Management for Asymptomatic Carotid Stenosis Trial (CREST-2) to Australia, with UWA being the National sponsor.

'in patients where we have traditionally had equipoise we now have a superb treatment option, to be part of a clinical trial'

'By enrolling in a clinical trials patients can be assured that they are getting the very best care, with treatment options at the cutting edge of science.'



Carotid Plaque.

'Being part of a clinical trial is becoming part of the team with precision protocol driven care'

'Patients are helping us to help patients in the future'

CREST 2 will recruit patients from across W.A. who have been found to have incidental severe atherosclerosis of the carotid arteries. Following detailed assessment and review they will be randomised either to carotid endarterectomy, carotid stenting or conservative management. All patients will receive optimised goal directed medical care and be followed up for 4 years.

The benefit to implementation of CREST 2 to will be the development of protocol driven harmonised care pathways of care. Also to explore parallel 'bolt on' projects specifically with detailed imaging with Professor Paul Parizel. In a recent such study we quantitatively assessed cerebral perfusion to identify the 'at risk brain' in whom revascularisation to improve blood supply may benefit patients.



WA Covid-19 Research Response

Professor Toby Richards
Coordinating Principal Investigator

“In WA the Covid Research Response is a clinical trial platform where any patient seen in any public hospital can volunteer to help. Their data and samples can be collected in a unified manner to support WA researchers, no matter which hospital and with minimal paperwork.”

Publications

1. Global outbreak research: harmony not hegemony *The Lancet Infectious Diseases* 20 (7), 770-772 ISARIC clinical characterisation group june 02.2020 [https://doi.org/10.1016/S1473-3099\(20\)30440-0](https://doi.org/10.1016/S1473-3099(20)30440-0)

2. Integrative Modeling of Quantitative Plasma Lipoprotein, Metabolic, and Amino Acid Data Reveals a Multiorgan Pathological Signature of SARS-CoV-2 Infection Torben Kimhofer, Samantha Lodge, Luke Whiley, Nicola Gray, Ruey Leng Loo, Nathan G. Lawler, Philipp Nitschke, Sze-How Bong, David L. Morrison, Sofina Begum, **Toby Richards**, Bu B. Yeap, Chris Smith, Kenneth G. C. Smith, Elaine Holmes, and Jeremy K. Nicholson. *Journal of Proteome Research* 2020 19 (11), 4442-4454. DOI: 10.1021/acs.jproteome.0c00519

3. NMR Spectroscopic Windows on the Systemic Effects of SARS-CoV-2 Infection on Plasma Lipoproteins and Metabolites in Relation to Circulating Cytokines Samantha Lodge, Philipp Nitschke, Torben Kimhofer, Jerome D. Coudert, Sofina Begum, Sze-How Bong, **Toby Richards**, Dale Edgar, Edward Raby, Manfred Spraul, Hartmut Schaefer, John C. Lindon, Ruey Leng Loo, Elaine Holmes, and Jeremy K. Nicholson. *Journal of Proteome Research* 2021 20 (2), 1382-1396. DOI: 10.1021/acs.jproteome.0c00876

4. 3Diffusion and Relaxation Edited Proton NMR Spectroscopy of Plasma Reveals a High-Fidelity Supramolecular Biomarker Signature of SARS-CoV-2 Infection Samantha Lodge, Philipp Nitschke, Torben Kimhofer, Julien Wist, Sze-How Bong, Ruey Leng Loo, Reika Masuda, Sofina Begum, **Toby Richards**, John C. Lindon, Wolfgang Bermel, Tony Reinsperger, Hartmut Schaefer, Manfred Spraul, Elaine Holmes, and Jeremy K. Nicholson. *Analytical Chemistry* 2021 93 (8), 3976-3986. DOI: 10.1021/acs.analchem.0c04952

5. Systemic Perturbations in Amine and Kynurenine Metabolism Associated with Acute SARS-CoV-2 Infection and Inflammatory Cytokine Responses Nathan G. Lawler, Nicola Gray, Torben Kimhofer, Berin Boughton, Melvin Gay, Rongchang Yang, Aude-Claire Morillon, Sung-Tong Chin, Monique Ryan, Sofina Begum, Sze How Bong, Jerome D. Coudert, Dale Edgar, Edward Raby, Sven Pettersson, **Toby Richards**, Elaine Holmes, Luke Whiley, and Jeremy K. Nicholson. *Journal of Proteome Research* 2021 20 (5), 2796-2811. DOI: 10.1021/acs.jproteome.1c00052

6. Incomplete Systemic Recovery and Metabolic Phenoreversion in Post-Acute-Phase Nonhospitalized COVID-19 Patients: Implications for Assessment of Post-Acute COVID-19 Syndrome Elaine Holmes, Julien Wist, Reika Masuda, Samantha Lodge, Philipp Nitschke, Torben Kimhofer, Ruey Leng Loo, Sofina Begum, Berin Boughton, Rongchang Yang, Aude-Claire Morillon, Sung-Tong Chin, Drew Hall, Monique Ryan, Sze-How Bong, Melvin Gay, Dale W. Edgar, John C. Lindon, **Toby Richards**, Bu B. Yeap, Sven Pettersson, Manfred Spraul, Hartmut Schaefer, Nathan G. Lawler, Nicola Gray, Luke Whiley, and Jeremy K. Nicholson. *Journal of Proteome Research* 2021 20 (6), 3315-3329. DOI: 10.1021/acs.jproteome.1c00224

“The only way to develop the best COVID treatment options is in a robust scientific environment. In WA, we have had time to catch our breath, watch and learn from the rest of the world. The key is collaboration to bring together WA’s best doctors, researchers and scientists in a cohesive platform.”

Summary

A genuinely unique West Australian driven translational response to the viral threat

- The CRR platform facilitates efficient capture of both clinical data and biospecimens
- Capture and linkage of clinical data within the West Australian health care system
- A generic research platform to support major clinical trials in COVID disease

Legacy

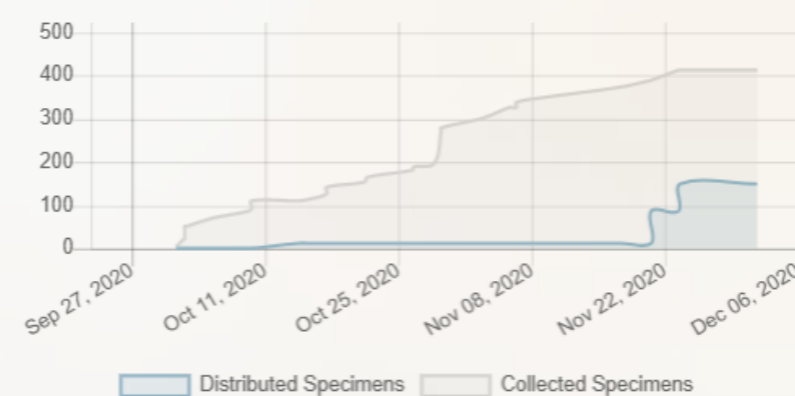
- Largest most successful COVID trial in Australia & facilitated largest global study
- State-wide platform of harmonised research governance
- Successful development and operationalisation of a WA Biobank
- THE STUDY
- Based on the international ISARIC/WHO clinical characterisation protocol for severe
- emerging infections with national & international data sharing
- A harmonised protocol for patient data and bio sample collection
- State-wide collaboration with all metropolitan and country health services included
- State-wide ethics and governance framework (> 30 agreements)
- Safe effective patient sample and laboratory samples integrated to routine clinical care
- Distribution of data and samples to multiple researchers
- Springboard to enable multiple trials based in WA

Data at a glance

324 Participants 3,073 Primary Specimens 2,362 Stored Specimens

2,666 Available Specimens 951 Distributed Specimens

Specimen collection and distribution in last quarter



Available specimen by type

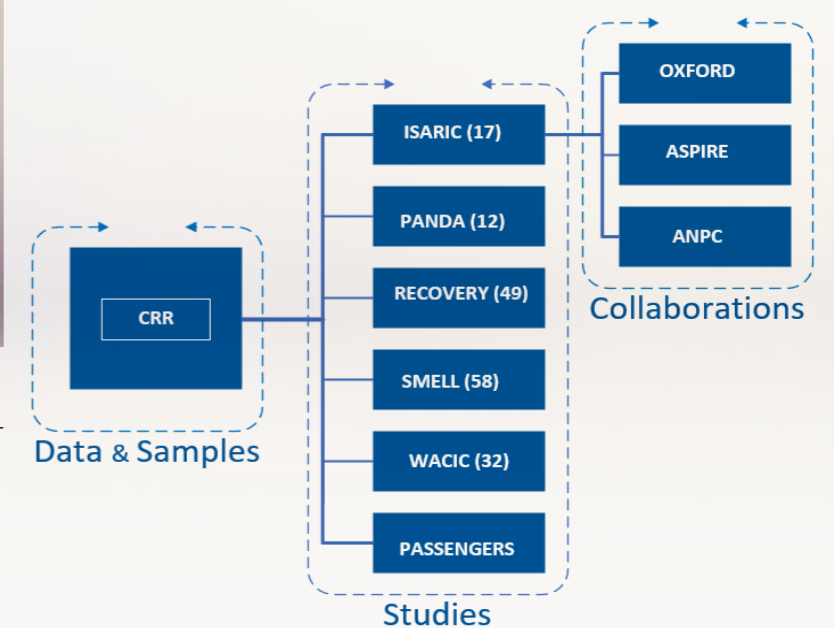
EDTA Plasma	Serum
LiHep Plasma	Urine
PBMC	EDTA Buffy
Saliva	LitHep Buffy
Whole Blood	Granulocyte

The Biobank

- Rapid specimen sharing
- OPENSPECIMEN logistics
- UWA on premise servers
- Fully operational
- Collaborative Scientific Advisory Committee
- Standardised collection protocols
- Rapid specimen sharing

The CRR Research Platform

- Cost effective
- Customisable
- Prioritises deployment over development
- Sustainable and scalable



STRIVE WA

STRIVE WA is a WA state-wide network which advocates for medical student and junior doctor involvement in clinical research.

The organisation emphasises a collaborative student- and trainee-led approach and, since conception in 2018 has grown to include 130 GCP trained medical students. As well as creating opportunities for involvement in external projects, STRIVE WA also develops independent projects which are adapted to suit the unique needs of junior researchers.

Utilising the background knowledge of clinical trials in CoRE, the RACS CTANZ and by linking into TASMAN the Post-Operative Variations in Anaemia Treatment and Transfusions (POSTvenTT) project was initiated.

Matt Pugliese led STRIVE WA with mini-team coordination, conducting pilot studies and offering ongoing support to the many medical student and junior doctor study collaborators in hospitals across WA.

“STRIVE WA allows medical students from across the state to work together and contribute to something much greater than the sum of its parts. The skills learned and exposure to clinical research in a supportive environment is unparalleled by any other program, and recognition of effort is guaranteed in an equitable manner through collaborative authorship. I would encourage every medical student, regardless of disposition, to apply!”



POSTvenTT has pivoted STRIVE WA onto the national platform. With CoRE support led by Giuliana with database and IT leadership from Doug Ethics and governance was set up across 52 sites in Australia and New Zealand launched on 1 July. Leadership from MLB masters students Jess Vo and Jani Moss facilitated 568 researchers throughout these hospitals that recruited over 500 people per week during July making this the largest surgical research project and largest collaborative ever initiated and run throughout Australia and New Zealand.

Developing projects forwards across the network of researchers throughout metropolitan and rural areas in WA, STRIVE WA is in a unique position to assess COVID vaccine hesitancy in rural, remote and metropolitan sites. This study represents the first of its kind as a student-led collaborative study in the GP setting and has received approval, with data collection underway as we speak.

STRIVE WA represents the future of student- and trainee-led research in Australia and is quickly setting a precedent for the quality and quantity of research output possible with modern research collaboratives.



Presentations and Awards

James Leigh and Kyle Raubenheimer on behalf of STRIVE WA won Best Conference Poster at Science on the Swan 2021 for The Student Research Initiative Western Australia (WA) for the poster “Benefits of participating in audit and research: opinions of medical students”.

Marcel Nejatian, Salar Sobhi and Blake Sanchez on behalf of STRIVE WA won Best Poster Presentation at the International Surgical Students Conference 2019 for the RECON Study.

Student opinions of audit and research abstract accepted as a poster presentation for RACS ASC 2020 (cancelled due to COVID-19).

Publications

STARSurG Collaborative. REspiratory COmplications after abdomiNal surgery (RECON): study protocol for a multi-centre, observational, prospective, international audit of postoperative pulmonary complications after major abdominal surgery. *Br J Anaesth.* 2020; **124** (1): e13-6.

Hunter SPARTAN, QUEST, STARC, STORCC, STRATA, STRIVE WA, TASMAN, VERITAS. Trainee and student led research networks: promoting research skills and competency through collaboration. *ANZ J Surg.* 2020; **90** (11): 2177-2179. doi: 10.1111/ans.16333

Leigh J, STRIVE WA Collaborative. The benefits of participating in audit & research: opinions of medical students. In: Abstract Journal Surgical Education. *ANZ J Surg.* 2020; **90** (S1): 210.

COVIDSurg Collaborative and GlobalSurg Collaborative. Timing of surgery following SARS-CoV-2 infection: an international prospective cohort study. *Anaesthesia.* 2021; **76**: 748-58.

STRIVE WA. Medical student learning in lockdown. Manuscript under review.

Designing student and trainee led collaborative research: Developing the POSTVenTT trial

Matthew Pugliese¹, Hayley McMillan¹, Matthew Mann¹, Aurelne Thian¹,
Uyen Giao Vo^{2,3}, Jana Lee Moss^{2,3}, Toby Richards^{2,3}, STRIVE WA Collaborative⁴



Background

Clinical issue – Perioperative anaemia is common

- Patient blood management guidelines
- Impact of discharge haemoglobin is unknown

Literature review

- We conducted a mapping review assessing the impact of anaemia at discharge and effectiveness of IV iron
 - More prospective data required

POSTVenTT

- A student- and trainee-led collaborative prospective audit assessing adherence to anaemia management guidelines
- Medical students as primary data collectors with clinician support – *Mini Teams*

STRIVE WA

- A student-led research collaborative in WA

Aim

To assess the **feasibility** of conducting the POSTVenTT study

- a) Practicality of the POSTVenTT protocol
- b) Viability of student- and junior doctor-led data collection

Acknowledgements

We would like to thank the Centre of Research Excellence team for helping with the organization of this study. 4: STRIVE WA Pilot Study Collaborators: Paparo A, Pradhan S, Thevar A, Oliveri M, Yek WY, Tan PS, Davies A, D'Silva J, Macpherson K

1. School of Medicine, Faculty of Health and Medical Sciences, The University of Western Australia
2. Department of Surgery, University of Western Australia
3. Department of Vascular Surgery, Fiona Stanley Hospital

Methods: pilot studies

- **Three pilot studies** to refine protocol
- 13 collaborating medical students and 58 patients
- Consecutive patients presenting to FSH for major surgery
- Outcomes
 - (1) **Percentage data completion** in each pilot
 - (2) **Subjective feedback** from collectors
 - (3) **Adherence to anaemia management guidelines**

Results

- (1) **Percentage data completion** improved with each pilot
- (2) **Qualitative feedback** identified **methodological problems** and the **importance of oversight**
- (3) **Sufficient type and quality of data** was collected from Pilot 3 for assessment of adherence to guidelines

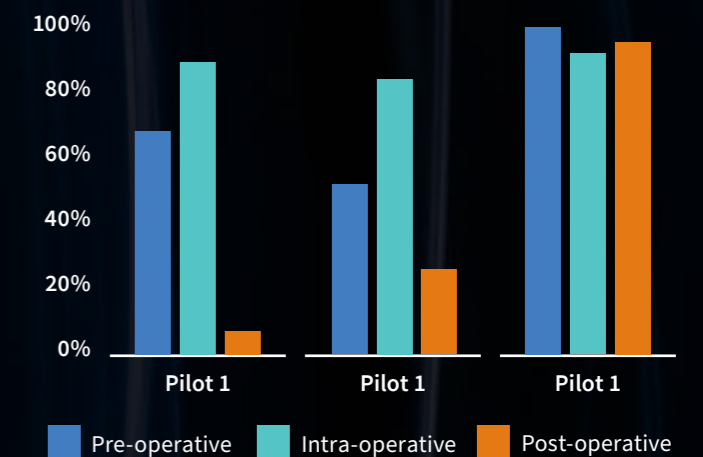


Figure 1. Average percentage data completion



Conclusion

- We have developed the **largest Australian multicentre trial** in surgery
- **Pilot studies** are **essential** to endure data completeness
- A **prospective design**, **clear communication** and **clinician-student oversight** are key

MLB report as per the MOU

KPI reporting in the MOU

Research Output

- Publications in reputable, peer-reviewed journals at a rate commensurate with equivalent Professional level posts
- Presentations at national and international meetings

Research Collaboration

- Research students directly supervised in recognised postgraduate programs (PhD, Masters, Science Honors etc)
- Evidence of mentorship/development of young researchers
- Evidence of involvement in national or international research collaborations

Research Funding

- Competitive research grant success (national or international grants) (\$benchmark to be established at annual review)

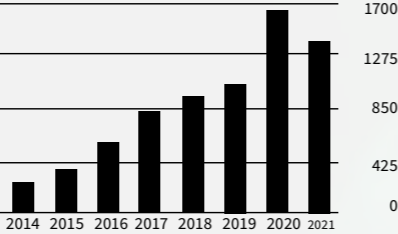
Publications

Original Articles	123
Reviews	22
Book Chapters	4
Case Reports	14
Letters	27
TOTAL	190

(Excluding published abstracts and submitted articles)

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scholar.google.com/citations?hl=en&user=tFTSt5wAAAAJ&view_op=list_works&sortby=pubdate
researchgate.net/profile/Toby_Richards?ev=hdr_xprf&_sg=34E5plGAjhNVF7SZC007_J1Y5BioEqPexBQFvtGLCUCLOmlyyER4mE4OyCAVVRgz

	All	Since 2016
Citations	8050	6509
h-index	44	40
Citations	116	103



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Presentations (* Invited speaker/chair/faulty)

2021	Vifor Symposium	Perth*
2021	ANZSCA the Increibles	Melbourne /Online*
2021	ANZSCA Blood & Iron	Melbourne /Online*
2021	NATA	Online*
2021	Anaemia talks (3)	Australia,China,UK*
2021	WAHTN Science on the Swan	Perth
2021	Perioperative Medicine	Peter Mac*
2021	AAGBI Perioperative Symposium	Wales*
2021	PREVENTT webinar	Portsmouth*
2021	PREVENTT Journal club	Ontario*

2020	ASGBI Bleeding Clotting Haemorrhage	UK / Online*
2020	RACS Academic Surgery	Melbourne/Online *
2020	RACS CTANZ	Melbourne/Online *
2020	AUSIRON	Brisbane/Online*
2020	AAGBI PREVENTT webinar	Online*
2020	FIGO Webinar	Online*
2020	RACS AGM	Brisbane*
2020	ANZSCA SIG	Online*
2020	Red Cross	Brisbane*
2020	Anaesthesia ANZ	Perth*
2020	NATA	Athens*

Prizes

Prizes represent awards from international meetings for the best research presented. In the last decade these represented awards to my research team.	
2021	WAHTN best presentation
2021	Honorary Professor of Anaesthesia Monash university
2021	Poster Prize NATA (4)

PHD Students

	Student	2nd Supervisor	Location
2021	Beth MacLean	Pending	UWA
2020	Cory Dugan Iron Deficiency and Physiological function	Pr. Peter Peeling	UWA
2020	Farah Alkhatib Biomechanics of AAA growth	Pr. Karol Miller	UWA
2019	Ms Sandy Abey Siri Intravenous iron in Surgery	Pr. Nick Freemantle	UCL
2018	Katerina Cabolis Iron and the Mitochondria	Dr Marija Sarjic	UCL

Master Students

	Student	Location
2019	Dr Jani Lee Moss Venous Disease & VOLUME trial	UWA
2019	Dr Jess Vo Collaborative clinical trials	UWA
2019	Dr Ben Harrison Remote Patient monitoring - completed	Edinburgh
2018	Dr Ian Barry Surgical Site Infection - completed	Edinburgh

Academic Activity Students

Amelia Davies	Matthew Pugliese
Matthew Mann	Aurelne Thian
Hayley McMillan	Joel Seto
Peng Sheng Tan	

Mentorship

Professor Richards has supervised 16 PhD and > 60 graduate research projects (Masters/ MSc/ BSc). He is a mentor to trainees in surgical researchers internationally. TR is actively engaged the international trials networks; the International VASCC & UK VERN Research Group in vascular surgery. He has been actively involved with STARSurg and GLOBALSurg collaborative research teams for the last decade, that have become leaders internationally.

He is the founder and director of STRIVEwa the pan-WA student network with over 130 GCP trained medical students involved in research. With RACS CTANZ and TASMAN he is leading the largest Australian and New Zealand clinical trial in surgery, POSTvenTT with over 540 collaborators.

He has personally enrolled over 1000 patients to more than 20 major clinical trials in the last decade.

As Director of the UWA CTU he has developed and promoted clinical trials for several members of the UWA faculty including Professor Dickon Hayne and Professor Sean Hood. With rising profile the CTU is aiming to support a dozen such trials and researchers over the next few years.

Advocacy: Professor Richards runs large support groups for patients with over 75,000 patients in 7 different social media forums as well as the FIGO and NATA organisations.

Teaching: Professor Richards was nominated by students for 3 separate awards in 2020



Involvement in National and International Research Collaboratives

Professor Richards sits on over twelve Data and Safety Monitoring Boards and Trial Steering Committees, the Australian Clinical Trial Alliance ACTA working group, RACS Academic Committee, as well as the RACS and Vascular Surgery CTANZs.

Internationally, he is part of the international BJA StEP guideline working group to harmonise endpoints in clinical trials and PRATO group on trials in perioperative medicine. He is Chair of the International Iron Trialists Collaboration and board of the Network for the Advancement of Patient Blood Management, Haemostasis and Thrombosis (NATA). He sits on working groups for the Federation of International Gynaecologist and Obstetricians European Anaesthesiology and Intensive care and British Society of Haematology. He is an associate editor for the MJA and regular contributor/reviewer for the BJS, BJA and Anaesthesia.

Board Membership and Committees

2021	WA State Senate RACS.
2019	STudent Research Initiative Western Australia (STRIVE)
2019	Royal Australian College of Surgeons Academic Committee
2018	RACS CTANZ board
2017	International Iron Trialists Collaboration (Chair)
2016	International Network for Advancement of Transfusion Alternatives Board
2019	Australian & New Zealand College of Surgeons Journal, associate editor
2019	Medical journal of Australia, Editorial Advisory Board
2019 - 2021	Australian Clinical Trials Alliance Group B
2020 - 2021	Guidelines on Anaemia management in Surgery; British Society of Haematology working group

Board Membership and Committees

Senior roles either a Trial Steering or Data Monitoring Committee to guide, advise and direct international or national major clinical trials.	
POSTvenTT	Chief Investigator
PREVENTT	Chief Investigator (clinicaltrials.gov/ct2/show/NCT01692418?term=toby+richards&draw=2&rank=2)
ITACS	Co Chair TSC (and TSC on HERROS substudy) (clinicaltrials.gov/ct2/show/NCT02632760?term=ITACS&draw=2&rank=1)
SUNRISE	TSC and lead Pi (isrctn.com/ISRCTN17599457)
POISE 3	TSC (clinicaltrials.gov/ct2/show/NCT03505723?term=POISE+3&draw=2&rank=2)

Awards & Prizes

Grants Raised @UWA			
2021	Heart Foundation (OPTIMAL)	CiE	\$1,000,000
2021	NHMRC IDEAS (ABLE Trial)	CiB	\$1,324,897
2020	WAHTN (CRR trial)	Ci	\$804,623
2020	Spinnaker (CRR Trial)	CiB	\$500,000
2020	WA DoH (Data linkage)	CiB	\$150,000
2020	MHRIF 23	Ci	\$34,005
2019	RTP PhD Studentship (IRONWOMAN)	Ci	\$190,500
2019	Vifor Pharma (PREVENTT Lab)	Ci	\$378,619
2019	FHMS	Ci	\$63,669
2019	MRFF (SUNRRISE Trial)	CiC	\$782,256
2019	MHRIF 22	Ci	\$38,682
2018	Pharmacosmos (IRONWOMAN)	Ci	£287,000
2016	Vifor Pharma (IRONMOUSE)	Ci	£96,286
TOTAL			\$5,976,380

We focus on the development and delivery of a high-quality research supported by our CoRE research team through collaborative networks of undergraduate and postgraduate researchers.

