Australian Government
National Health and Medical Research Council

BUILDING
A HEALTHY
AUSTRALIA

10 OF THE BEST

NHMRC

NHMRC RESEARCH PROJECTS

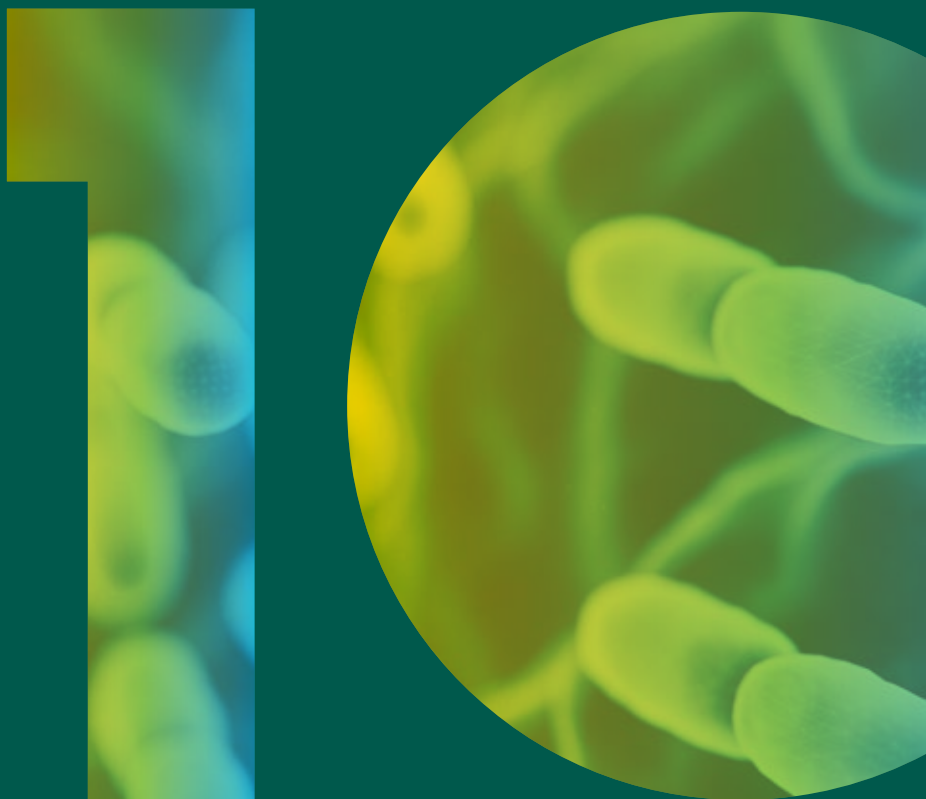
FOURTEENTH EDITION

SHOWCASING SIGNIFICANT PROJECTS THAT SUPPORT THE IMPROVEMENT OF HUMAN HEALTH

NHMRC RESEARCH PROJECTS
FOURTEENTH EDITION

CONTENTS

Welcome to NHMRC's 10 of the Best – Fourteenth Edition, a tribute to the exceptional researchers and their teams around Australia who are adding new evidence to our mounting knowledge and understanding of health by addressing Australia's greatest health challenges.



FOREWORD

PROFESSOR STEVE WESSELINGH

Research is critical to understand, prevent, detect, and treat disease. NHMRC, as the Australian Government's lead agency for the support of health and medical research, plays a key role in funding research that has the potential to improve the lives of millions with the ultimate vision of *building a healthy Australia.*

In this publication, we showcase ten research projects funded from 2019–2020 that exemplify the extraordinary quality and diversity of projects funded by NHMRC during that funding period. From delivering culturally safe maternity care for Aboriginal women, discovering, and developing better pain treatments, improving in-vitro fertilisation (IVF) treatment methods, and harnessing the body's own immune system to improve vaccines is just a little taste of what these stories are about.

Under our grant program, NHMRC funds projects that span the spectrum of health and medical research, working across the full extent of biomedical, clinical, public health and health services. Collaboration is a core component of our grant schemes, as health and medical research is most commonly the result of brilliant minds coming together across disciplines to conceive, plan and deliver projects that produce groundbreaking achievements.

Many researchers are driven to ensure health equity for all Australians. Supporting Indigenous health research that provides better outcomes for Aboriginal and Torres Strait Islander peoples is a key activity of NHMRC's investments. This edition of 10 of the Best highlights several projects that build and strengthen Aboriginal and Torres Strait Islander researcher capacity, empowering these leaders to improve the health and well-being of their communities.

On behalf of NHMRC, I thank our highly valued researchers who have dedicated their careers to pushing the limits of science and providing breakthrough answers to some of the biggest health issues faced by many. Selecting just ten of the thousands of shortlisted reports was not a simple task considering the talent of Australian researchers.

The projects showcased in this edition are just a small sample of the outstanding health and medical research funded each year by NHMRC, and I personally hope you enjoy reading them as much as I have.

Congratulations to the teams profiled for their outstanding work, passion, and achievements. The future is bright for Australia's health and medical research sector and the generations who will benefit from their work for years to come.

Professor Steve Wesselingh
CEO

DELIVERING A LEGACY OF CULTURALLY SAFE MATERNITY CARE

PROFESSOR RHONDA MARRIOTT AM

Professor Rhonda Marriott AM, a descendant of Nyikina people of the Kimberley, has devoted five decades to nursing and midwifery in clinical, academic and research roles.

She has also led a ground-breaking study based on four generations of Aboriginal women's stories, experiences and expressions of giving birth in urban settings, which highlighted the fact that maternity care changes across time have failed to acknowledge and support Aboriginal women's cultural needs.

Birthing on Noongar Boodjar ('Birthing on Noongar Country') captured stories of First Nations Australian women from the south-west corner of Western Australia[1], including Whadjuk Boodjar (metropolitan Perth). Seventy-four women bravely shared their maternity experiences, documenting how they maintained cultural birth practices in the urban setting and interactions they had with health care providers, particularly midwives.

"The project gave us the opportunity to understand from Aboriginal women's perspective, their experience of that intersection with the health system, the maternity system, at a time when they were giving birth," Professor Marriott says.

The researchers heard from 71 midwives too – about the limited knowledge of Aboriginal culture and the systematic culture bias in maternity care.

The research team developed recommendations for an efficient, effective, integrated and culturally secure maternity care system that can respond to Aboriginal women and their families during childbearing.

"The fact that we have births taking place in the hospital system does not mean to say that it needs to be so clinical that it becomes dispassionate," Professor Marriott says.

"It's about being able to bring all of this together in a way that is culturally safe and clinically safe whilst meeting critical Close the Gap Targets."

Birthing on Country refers to culturally safe birthing practices that respect the thousands of years of knowledge and practice of Aboriginal people. This philosophy is culturally significant for the future of the baby, providing ancestral and familial connection and belonging to their country.[2,3] This Way of Being is rarely understood by non-Aboriginal people, including health professionals involved in maternity care.[4]

"It's about being able to bring all of this together in a way that is culturally safe and clinically safe whilst meeting critical Close the Gap Targets."

Professor Marriott

"You are welcoming that baby into a culture that's been there for 60,000 years and continuing, and this new infant is going to be part of that," says Professor Marriott.

A scarcity of literature about women's experiences when their Country is in an urban environment[5] may have contributed to a misconception that *Birthing on Country* is only relevant to Aboriginal people living and birthing in a rural or remote setting.

An unexpected outcome of the project was the collation of 12 birthing stories from Elders and senior Aboriginal women who have birthed on Noongar Boodjar into a book titled *Ngangk Waangening* ('Mothers' Stories').

The women shared their birthing stories as a legacy for their communities and as an educational tool.

"The elders, Aunty Doreen Nelson in particular, were saying, 'We have to have this legacy, our stories can't just stop here'.

"It has to be there for our families and our kids ...this has to be a teaching tool for midwives."

CULTURAL SECURITY AND ABORIGINAL BIRTHING WOMEN

◂ **PHOTO:** Professor Rhonda Marriott AM from Murdoch University.

MURDOCH UNIVERSITY

Partnership Project for Better Health

TEAM MEMBERS

Professor Rhonda Marriott AM
Associate Professor Roz Walker
Mrs Tracy Martin
Mrs Terri-Lee Barrett
Associate Professor Tracy Reibel
Professor Fiona Stanley AC
Professor Cheryl Kickett-Tucker
Professor Julianne Coffin
Professor Yvonne Hauck
Alison Gibson

PROGRAM GRANT

$1,028,679
2014–2019

Next steps

Professor Marriott continues to support maternity services on Noongar Boodjar to implement Birthing on Country principles.

She leads the *Ngangk Yira Institute for Change*, which focuses on research that benefits Aboriginal people and communities. Ngangk means both 'mother' and 'sun', and alongside Yira, the meaning expands to the rising sun or the presence of mothers across the journeys of our lives.

A second book is in the works, with 25 more stories to be accompanied by video and digital content. Its title, *Because of her we will*, refers to the instrumental role elder Doreen Nelson has played in the creation of this tangible legacy.

The project team acknowledges the Whadjuk people of the Noongar Nation, on whose land this research was conducted, and we pay our respects to Elders past, present and future, and to all the women, men and children who make up the Noongar Nation.

ENHANCING FUTURE PAIN TREATMENTS USING VENOMS

PROFESSOR RICHARD LEWIS

Professor Richard Lewis and his team from the Institute of Molecular Bioscience at University of Queensland made a notable discovery early in their research after a lab assistant observed one could milk cone snails for venom much more quickly if you gave them "a poke or two".

Cone snails are a highly venomous sea snail which produce venom peptides that act very selectively across a range of neurological targets associated with pain pathways, presenting a unique opportunity to develop new pain therapies.

The lab assistant, Dr Sebastien Dutertre, compared the samples of the venoms collected and discovered cone snails produce one type of venom when in attack mode (after a poke), and another when hunting for their prey (either fish, worms or other molluscs, depending on the species).

"Similarly to cone snails, spiders love to make venom peptides."

Professor Lewis

"The discovery of these attack and defence peptides [peptides are miniproteins] in different venom allowed us to think more broadly about the evolutionary drivers of selection for these," Professor Lewis says.

The team focused their hunt for pain target modulators in the defensive venoms, isolated these to purity, and studied how selective and potent they were.

"We found we could get good inhibition at certain calcium and sodium channels important in pain pathways, but they were highly selective and didn't work on related channels that might cause side effects."

NHMRC Program Grant funding provided support for teams of researchers to persue broadly-based, high-quality, collaborative research addressing complex problems.

Professor Lewis' team brought in another collaborator, Professor Glenn King, into its third round of funding to broaden its scope from cone snails to include Australian spiders. Professor King is co-founder of Ifensa Bioscience, a start-up trialling a drug candidate discovered in funnel web spider venom and designed to prevent tissue damage caused by heart attack and stroke.

"Similarly to cone snails, spiders love to make venom peptides," Professor Lewis says.

The team also collaborated with Professor David Julius of the University of California, a recipient of a Nobel Prize for his work on molecular mechanisms of pain sensation and heat, and Adelaide-based Professor Stuart Brierley, whose expertise on the causes of and treatments for Irritable Bowel Syndrome (IBS), supported their discovery of a new way to treat IBS-related gut pain.

Successive grants over 15 years allowed the team to work together with complementary subject matter experts when they needed to.

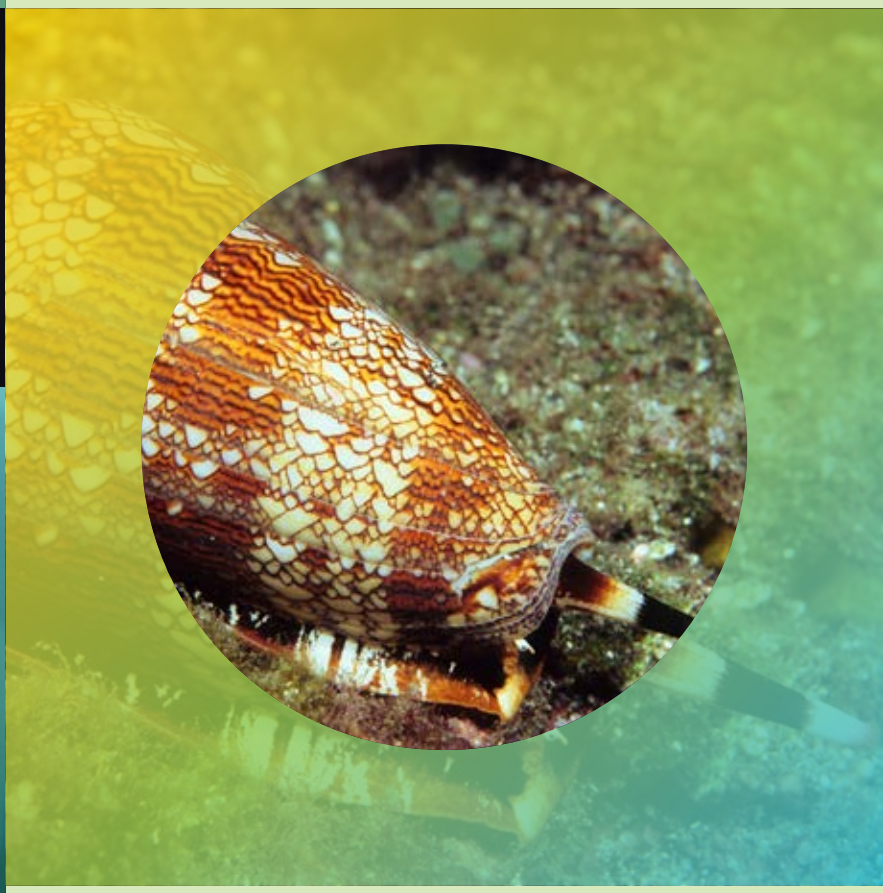
"This allowed the team to efficiently cover a broad range of research areas and pursue discoveries in fantastic depth,"

"The three grants gave us the best research opportunities we could imagine."

Professor Lewis's previous research into cone snail venom and pain relief was also part of NHMRC's Ten of the Best — Research Projects 2011.

DISCOVERY AND DEVELOPMENT OF BETTER PAIN TREATMENTS

◂ **PHOTO:** Professor Richard Lewis from the University of Queensland.



UNIVERSITY OF QUEENSLAND

TEAM MEMBERS

Professor Richard Lewis
Emeritus Professor Paul Alewood
Professor David Adams
Professor Macdonald Christie
Professor Glenn King
Professor Irina Vetter
Professor Rob Capon
2021 Nobel Laureate
Professor David Julius
Professor Stuart Brierley
Professor Patrick Sexton
Professor Arthur Christopoulos

PROGRAM GRANT

$9,633,658
2015–2019

Next steps

This NHMRC-funded research program led to the identification of new analgesic drug targets and pathways associated with specific types of pain and developed compounds that can potentially and selectively inhibit these targets. These discoveries promise to alleviate chronic and severe pain without the addiction, tolerance issues or side effects that currently limit the usefulness of pain drugs.

While cone snails had always been collected and brought to the lab from the Great Barrier Reef, the team found that some of the cone snails in the tanks were laying eggs. It was discovered that the juvenile cone snails could be grown in tanks, and be milked and studied on site, revealing that juvenile cone snails target different prey (worms vs fish) and produce venom peptides that are distinctly different to those of adults.

Breakthroughs like these enhance University of Queensland's reputation as the leading institute for venom-based drug discovery in the world, and help inspire the next generation of researchers.

DRIVING CHANGE IN AGED CARE PHARMACY PRACTICES THROUGH DATA

DR LISA PONT

Having practised as a hospital pharmacist by day and a residential aged care pharmacist by night, Dr Lisa Pont naturally began to think about how pharmacists could work differently as part of her research.

As a clinician-researcher, she understood the challenges at the patient level and knew data driven research could help.

"I always say I have one foot in the clinical camp, but I have one foot in the research camp, and it means that I see things from both perspectives," says Dr Pont, who is now at University of Technology Sydney.

In 2016, Dr Pont received a Translating Research into Practice Fellowship to lead a research program exploring potentially harmful medicine use in Australian nursing homes and trialled strategies to reduce prescribing of these medicines.

"It takes it out of a clinical trialsetting and it allows us to start understanding what is happening with medicines in the actual population,"

Dr Pont

Polypharmacy, the use of multiple medicines, is commonly defined as the concurrent use of five of more medicines by the same person.

According to the Australian Commission on Safety and Quality in Health Care, prevalence of polypharmacy ranges between 43% and 95%, with people in hospitals and aged care homes at the higher end.[6]

Many aged care residents experience medicine-related problems, such as incorrectly prescribed doses, use of unnecessary or harmful medicines, or use of medicines which interact with each other.[7]

During the program, Dr Pont used real world data sourced from the community pharmacies supplying the nursing homes in question. This data is routinely collected and accurately captures details of medicines delivered within the facility.

"It takes it out of a clinical trial setting and it allows us to start understanding what is happening with medicines in the actual population," Dr Pont says.

The dataset is continously updated as healthcare is delivered.

"That's something I can't get with a traditional data collection method," she says.

Dr Pont worked with independent not-for-profit NPS Medicine Wise to bring the findings back to the aged care facilities, alongside the tools they needed to make a change.

"By bringing that data in, we were giving people feedback on what was happening in their facilities, but also giving them support about things that they might use to change," Dr Pont says.

"It was all about empowering the facility, which is again, commonplace these days. But at that time, that was something quite different … people saw medicines as the domain of the doctor."

Dr Pont's research highlighted the systemic need for better use of medicines in aged care, which formed part of the evidence base of the Australian Royal Commission into Aged Care Quality and Safety's recommendations on pharmacists and residential aged care.

The research highlighted the potential to use routinely collected health data to monitor for the use of unnecessary or harmful medicines in aged care facilities.

Dr Pont now sits on an expert advisory group for the Australian Pharmacy Council, where the integration of data analysis, non-drug therapies and multidisciplinary teams in pharmacy education is being mapped out.

"At the moment, it's you're a data analyst, or you're a pharmacist," she says.

"But I think that's changing … the use of data is becoming much more essential in healthcare delivery."

Equipped with these additional skills, pharmacists will be able to interpret real data to understand a facility's medicine usage, informing and evaluating clinical practice. They will be able to work more collaboratively with other health professionals to incorporate non-drug therapies within the facility.

IMPROVING QUALITY USE OF MEDICINES IN RESIDENTIAL AGED CARE

◀ **PHOTO:**
Dr Lisa Pont from Macquarie University.

MACQUARIE UNIVERSITY

Translating Research into Practice (TRIP) Fellowship

PROGRAM GRANT

$178,158
2016–2018

Next steps

The research identified significant variations between facilities in the frequency of usage for certain types of medicine. Dr Pont is now investigating the variation to better understand its drivers.

As the incoming President of the International Society of Pharmacoepidemiology*, Dr Pont is collaborating with colleagues around the globe on the use of real world data in pharmacy research.

* Pharmacoepidemiology is the study of the uses and effects of drugs in well-defined populations.

MENTORS INSPIRE AN INDIGENOUS RESEARCH CAREER WITH IMPACT

PROFESSOR CATH CHAMBERLAIN

Professor Cath Chamberlain, a Palawa woman of the Trawlwoolway clan (Tasmania), received an NHMRC Early Career Fellowship in 2014 to find culturally safe ways to improve cardiometabolic health outcomes in Aboriginal and Torres Strait Islander mothers.

During the four-year fellowship, Professor Chamberlain discovered that many interventions to reduce cardiometabolic risk in this cohort had failed. She wanted to understand why.

"I was trying to find [interventions] that would work for Aboriginal and Torres Strait Islander women," the Melbourne-based researcher says.

"There had been quite a lot of things tried, and a lot of time and money spent, but it was mostly all failing".

Her passion for learning and being helpful landed her in the research sector working alongside leading Indigenous researchers.

Cardiometabolic risk refers to risk factors that increase the likelihood of experiencing vascular events or developing diabetes.[8] Cardiovascular disease is more common among Aboriginal and Torres Strait Islander people than non-Indigenous Australians and its onset tends to occur between 10 and 20 years younger than among non-Indigenous Australians.[9]

Professor Chamberlain always wanted to be a nurse and a midwife, and worked as a nurse in Perth, Kalgoorlie and Alice Springs, and as a midwife in Africa and back in Western Australia. Her passion for learning and being helpful landed her in the research sector working alongside leading Indigenous researchers.

Following an unexpected move to Melbourne, Professor Chamberlain undertook a Master of Public Health (International Health) at Monash University. Here, she was able to do some reflective learning from her time overseas, before being accepted into the Victorian Public Health Training Scheme. This is where she completed a Master of Science in Public Health Practice and undertook a placement with Professor Judith Lumley.

"[Professor Lumley] was really instrumental, and one of my first mentors in research," Professor Chamberlain says.

The pair worked on a rigorous systematic review of smoking cessation interventions, where Professor Chamberlain learnt of the importance of strong evidence from randomised control trials for influencing policy and guidelines, national and internationally.

After a few years of working guideline development and implementation, an opportunity arose to start a PhD.

"I was lucky to be able to work with Professor Sandra Eades, as my PhD supervisor, on implications of new guidelines for diabetes in pregnancy."

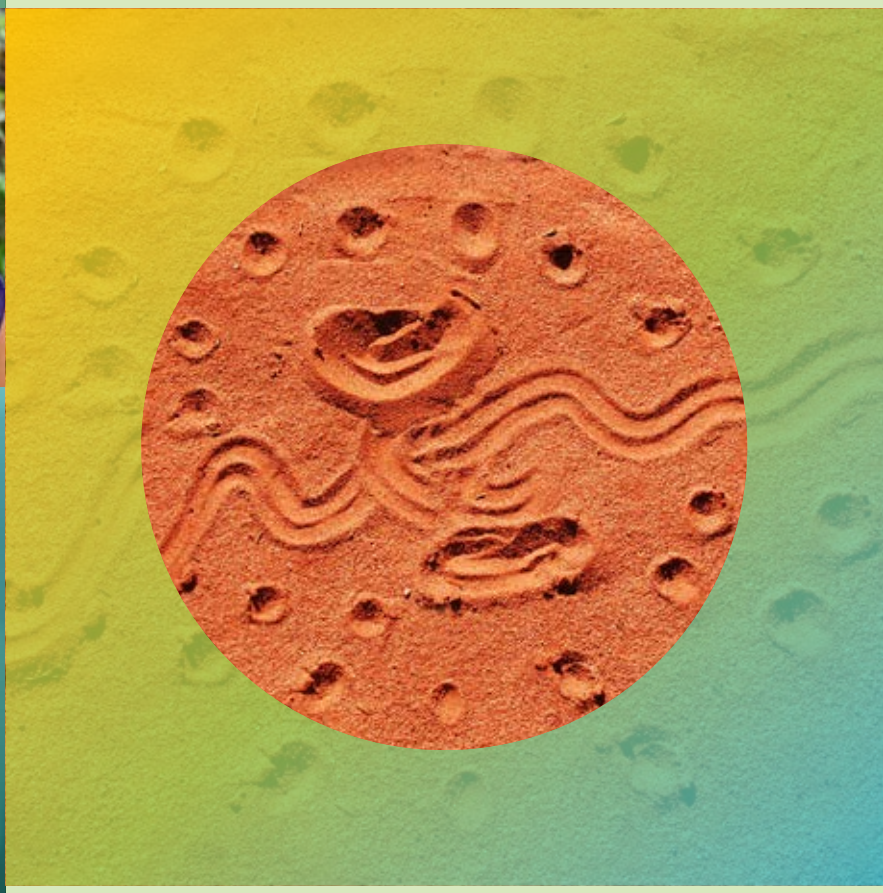
Having gained an understanding of the complex influences on maternal health among Aboriginal and Torres Strait Islander communities, Professor Chamberlain shifted her focus to what could be done to reduce cardiometabolic risk.

"The starting point is looking at what is already known about an issue and making sure that you honour and respect all that knowledge and learning that has been before seeing how you can contribute," Professor Chamberlain says.

"I was reading those articles around some of the symptoms of complex trauma and intergenerational trauma in describing why [interventions] failed. I thought, 'this is something I need to try to understand a bit better'."

IMPROVING CARDIO-METABOLIC HEALTH OUTCOMES IN INDIGENOUS AUSTRALIAN MOTHERS

◀ **PHOTO:** Professor Cath Chamberlain from La Trobe University.



LA TROBE UNIVERSITY

Early Career Fellowships

PROGRAM GRANT

$320,891
2015–2018

Next steps

The 2014 fellowship supported Professor Chamberlain to complete the groundwork for her next NHMRC project in 2017, called *Healing the Past by Nurturing the Future*, followed by her Career Development Fellowship, from 2019–2022.

This 2017 project sought to develop better ways to identify and support Aboriginal and Torres Strait Islander parents who may be experiencing complex trauma.

“Intergenerational and complex trauma is a really critical issue for parents caring for a new baby, and there’s considerable evidence suggesting that compounding cycles of trauma may be driving persistent health inequities.” said Professor Chamberlain.

Her research has has led to co-design of a range of perinatal strategies to support Aboriginal and Torres Strait Islander families transform cycles of trauma and hurt to cycles of nurturing and recovery, by improving awareness, safe recognition and assessment. This model of care is currently being piloted across other related initiatives.

IMPROVING FERTILITY TREATMENT THROUGH INNOVATION

PROFESSOR ROBERT GILCHRIST

Professor Robert Gilchrist is a part of a bench-to-bedside research success story, innovating existing infertility treatments to offer a less invasive and cheaper alternative to in-vitro fertilisation (IVF).

Infertility affects 1 in 6 couples globally.[10] According to the World Health Organization, infertility is a disease of the male or female reproductive system, defined by the failure to achieve a pregnancy after 12 months or more of regular unprotected sexual intercourse.

Whilst assisted reproductive technologies, like IVF, are effective for some couples facing infertility, 4 out of 5 couples are unsuccessful when trying to conceive a baby using IVF treatment.[11]

Professor Gilchrist, a University of New South Wales (UNSW) translational research scientist specialising in reproductive biology, says IVF is not suitable for everyone.

"Polycystic ovary syndrome, or PCOS, is the most common endocrine disorder in women and a major cause of infertility. It can be difficult to treat with IVF."

A standard IVF cycle typically takes around 6–8 weeks. The process requires women to inject follicle-stimulating hormones for 2 weeks to stimulate egg growth before collection of mature eggs from the ovary. Women with PCOS are very sensitive to these hormones.

Professor Gilchrist, along with an international team of researchers, have improved the fertility treatment, known as in-vitro maturation (IVM).

IVM is the process of maturing eggs in a laboratory instead of inside the ovary, which removes the need for about 2 weeks of hormone injections associated with traditional IVF. IVM technology has been around since the 1960s, but there has been little progress in improving this technology.

Using funding from an NHMRC Development Grant, a scheme intended to increased rates of translation of health and medical research into commercial outcomes, Professor Gilchrist and his colleagues have improved existing IVM technology through innovation, discovering new ways to assist egg maturation outside of the body.

An international team of researchers, led by Professor Johan Smitz (Vrije Universiteit Brussel, Belgium) and Professor Gilchrist, discovered a unique way to mimic the environment inside a women's body in the laboratory.

"This new method, called CAPA-IVM, switches off the progression of the egg for 24 hours. So [the egg] grows more slowly, and it matures more healthily. And it's more fertile when you introduce it to the sperm. It's giving us a longer window of time to work with the egg."

This novel treatment is now available in the clinic at The Royal Hospital for Women in Sydney.

Professor Gilchrist says "translating research from laboratory science to the clinic is incredibly challenging and rare but investing in fundamental biology research results in significant discoveries over time."

Around 15% of women who currently experience fertility issues will be eligible for the new CAPA-IVM treatment.

"The major advantage of this treatment is that it reduces the use of hormones, offering a less invasive, cheaper and quicker alternative to IVF," Professor Gilchrist says.

Whilst CAPA-IVM treatment is not suitable for everyone, it is particularly promising for women with PCOS and those diagnosed with cancer and who are seeking urgent fertility preservation.

Professor Gilchrist says "translating research from laboratory science to the clinic is incredibly challenging and rare but investing in fundamental biology research results in significant discoveries over time."

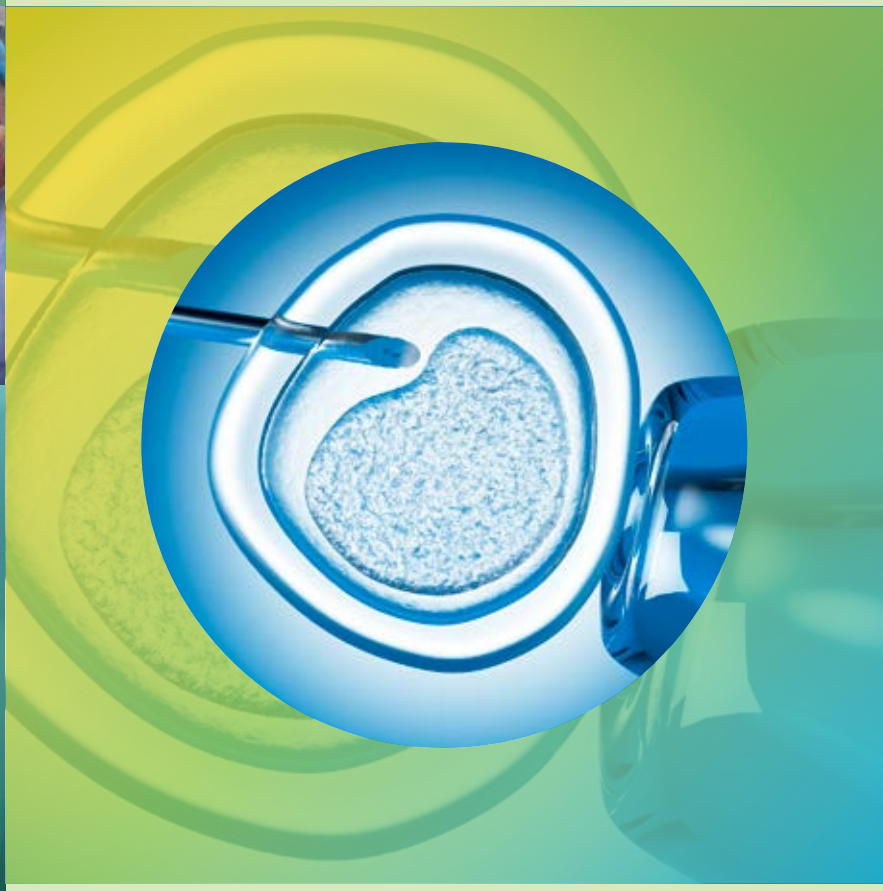
Infertility caused by cancer treatment can have significant psychological impacts for cancer patients and survivors. While the success rates for IVM may not be as high as for IVF, it remains an important technology for women diagnosed with cancer who commonly require fertility preservation procedures.

Professor Gilchrist explains there is often not enough time for women receiving a cancer diagnosis to undergo a cycle of traditional IVF before starting their cancer treatment.

"The psychological benefit of an alternative to traditional IVF is essential to patient well-being."

TECHNOLOGY FOR HORMONE-FREE INFERTILITY TREATMENT

◂ **PHOTO:** Professor Robert Gilchrist from University of New South Wales.



UNIVERSITY OF NEW SOUTH WALES

TEAM MEMBERS

Professor Robert Gilchrist
Professor Johan Smitz
Professor William (Bill) Ledger
Professor Jeremy Thompson
Dr David Mottershead

PROGRAM GRANT

$568,073
2014–2017

Next steps

CAPA-IVM was launched at The Royal Hospital for Women in Sydney in July 2022.

"Clinically, we are in the process of refining the procedure to improve it, identifying the suitability of certain patient groups, increasing patient and clinician awareness of the availability of the procedure, and implementing it in more hospitals in Australia and globally," Professor Gilchrist says.

The laboratory-based research team will continue to work on improving our understanding of egg maturation both inside the body (in vivo) and inside the laboratory (in vitro) to deliver improved procedures to patients.

FIGHTING BIOFILMS WITH A TROJAN HORSE

DR NICKY THOMAS

Dr Nicky Thomas started his career as a pharmacist. During his PhD, he was investigating how encasing medicine in lipid droplets could improve its efficacy when he was asked: "can this lipid technology be used to treat biofilms?"

Biofilms are present in our everyday lives. They can grow on plants, on rocks, on our teeth as plaque and on implanted medical devices such as catheters and pacemakers as chronic infections.

"If you don't brush your teeth for the entire day you can feel a slimy layer forming, that is a biofilm," Dr Thomas explains.

A biofilm consists of a slimy matrix of extracellular substances which allows bacteria and other microorganisms to work together to defend themselves from their environment.[12] They are 1000 times more difficult to control than microbes that do not reside in biofilms.[13]

"If you give the biofilm something that looks like food, the bacteria will start nibbling on that," he says.

"The slime is an impenetrable surface, protecting the bacteria from external stress and changes in their environment," Dr Thomas says.

While antibiotics can be used to eliminate individual bacteria in a laboratory test tube, the same technique won't work on a more complex biofilm because of the protective layer surrounding the bacterial community.[14]

"Antibiotics are designed using our traditional understanding of bacteria existing as individual units, but bacteria are more likely to exist as biofilms and are therefore more difficult to treat," Dr Thomas says.

But the bacteria in biofilms still need energy to survive – and for that they look to their external surroundings.

With a team of researchers, Dr Thomas developed a Trojan-horse delivery system for antibiotics, using a technique where antibiotics are hidden in tiny particles of food-grade lipids.[15]

He says the delivery system is like offering a human a French fry: they can't resist taking a bite.

"If you give the biofilm something that looks like food, the bacteria will start nibbling on that," he says.

The team of researchers found that the Trojan-horse delivery system of antibiotics is significantly more effective in treating wound and lung infections than standard methods of treatment.[16,17]

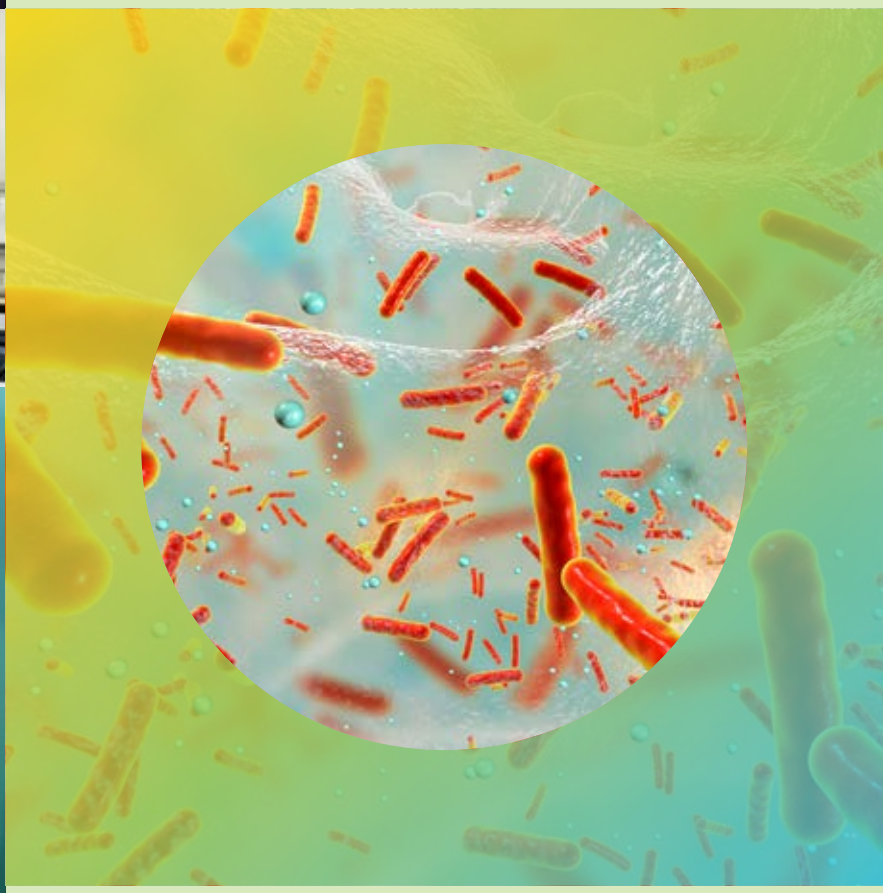
Through the Early Career Fellowships funding provided by NHMRC, Dr Thomas was able to visit labs around the world to learn more about biofilms, bringing this knowledge back to Australia. He says he had the chance to stand at the frontier of existing knowledge and is grateful for the opportunity to work with great people.

"I founded the Adelaide Biofilm Testing Facility, a service for researchers to have new medicines tested in specific [biofilm] models that were not available in Australia," Dr Thomas says.

STRUCTURE AND FUNCTION OF ANTIMICROBIAL THERAPIES AND THEIR INTERACTION WITH UPPER RESPIRATORY BIOFILMS

◀ **PHOTO:** Team members Dr Chelsea Thorn and Prof. Clive Prestidge at the SA Science Excellence Award Night where Dr Thorn received an Award for PhD Research Excellence.

Below left: Dr Nicky Thomas from the University of South Australia.



UNIVERSITY OF SOUTH AUSTRALIA

Early Career Fellowships
Peter Doherty Biomedical ECF

TEAM MEMBERS

Dr Nicky Thomas
Professor Clive Prestidge
Professor Peter Wormald
Professor Ben Boyd
Professor Lynne Howell
Professor Claus Michael Lehr
Dr Chelsea Thorn
(now at Pfizer USA);
Dr Muhammed Awad
(now at Basil Hetzel Institute for Translational Health Research, SA)

PROGRAM GRANT

$320,891
2015–2018

Next steps

Pre-clinical studies have shown this novel treatment disrupts the protective biofilm structure, so antibiotics can work more effectively against bacteria in biofilms. This method results in significant improvement, up to 100-fold, in cystic fibrosis lung infections and wound infections.

More recently, the team have combined Trojan-horse style delivery systems with compounds that harness the antimicrobial action of light and are looking to translate these treatments to the clinic. This will further reduce the likelihood of development of antibiotic resistance towards conventional antibiotics, a key requirement in worldwide efforts to save millions of lives.

COMMUNITY-DESIGNED AND DELIVERED SUICIDE INTERVENTION

PROFESSOR MAREE TOOMBS

A self-described grassroots Aboriginal researcher, Professor Maree Toombs is responsible for developing the first Indigenous-led and designed suicide intervention training program in Australia, creating space for connection to traditional lands and culture as part of life-saving support.

Before applying for a research grant in 2014, Professor Toombs asked her supervisor, "How about I go and yarn with mob and see what their interests are in terms of making a difference?"

"And that's what I did," she says.

Professor Toombs visited eight communities in south-east Queensland to listen to their needs. She heard consistent feedback - the crucial areas requiring research were mental health, suicide and chronic diseases. These conversations informed Professor Toombs' application to the Targeted Call for Research (TCR) into Suicide Prevention in Aboriginal and Torres Strait Islander Youth.

In 2018, suicide was the leading cause of death for Aboriginal and Torres Strait Islander children, accounting for more than a quarter (26.5%) of child deaths.[18]

Professor Toombs used the skills she had learnt during the ASIST workshop to speak to her brother, help him in his time of crisis and save his life.

Upon receiving NHMRC funding, Professor Toombs began investigating suicide intervention models in Australia, finding most programs were aimed at prevention rather than intervention.

In 2014, Professor Toombs attended the five-day LivingWorks Applied Suicide Intervention Skills Training (ASIST) training for trainers, which was the only workshop of its kind in Australia. She was inspired by the model of suicide intervention.

Suicide intervention training gives people the skills to help their families, friends or a member of their community who is/may be having thoughts of ending their own life.

The training immediately made a difference in Professor Toombs' life.

"On the second day of the ASIST training, I knew without a doubt that my brother was at risk of suicide."

Professor Toombs used the skills she had learnt during the ASIST workshop to speak to her brother, help him in his time of crisis and save his life.

The framework inspired Professor Toombs to take this back to the people facing high rates of suicide in their communities.

With the help of people from 94 communities across Australia, and under the leadership of proud Euralie and Kooma woman Professor Toombs, the research team spent the next four years carefully developing the Indigenous Suicide Intervention Skills Training (I-ASIST) protocol.

"I-ASIST is for Indigenous workforces, people who work with Indigenous communities, as well as schools, community groups, and sports clubs."

"Virtually anyone age 16 or older, regardless of prior experience or training, can become an I-ASIST trained helper."

Elders and service providers are engaged before a workshop, to ensure the training is shaped to suit the community's needs and to ensure delivery is culturally appropriate and emphasise the importance of community engagement before training begins.

I-ASIST also provides a peer support network for ongoing training and support.

Over 8000 people have attended this training. During the first three months, 120 life-saving interventions were reported by participants.

"This training belongs to the community."

Caution: Some people may find parts of this content confronting or distressing. If this material raises concerns for you, contact Lifeline on 13 11 14, Call 13YARN or Kids Helpline on 1800 55 1800.

TARGETED CALL FOR RESEARCH — SUICIDE PREVENTION IN ABORIGINAL AND TORRES STRAIT ISLANDER YOUTH

◂ **PHOTO:** Professor Maree Toombs from Indigenous Network Suicide Intervention Skills Training (Insist).

INDIGENOUS NETWORK SUICIDE INTERVENTION SKILLS TRAINING (INSIST)

TEAM MEMBERS

Professor Maree Toombs
Professor Steve Kisely
Professor Noel Hayman
Professor Leanne Hides
Professor Geoffrey Nicholson
Professor Geetha Ranmuthugala
Associate Professor Neeraj Gill
Associate Professor Srinivas Kondalsamy Chennakesavan
Professor Sharon Brennan-Olsen

PROGRAM GRANT

$828,216
2014–2020

Next steps

I-ASIST is a social enterprise model that has grown exponentially since its creation, including being implemented across schools in NSW and public health networks in Victoria. Over the next 3 years, I-ASIST will be used to deliver 50 “train the trainer” workshops across Australia. These trainers will in turn provide suicide intervention training to an estimated 50,000 Indigenous Australians.

Professor Toombs will use her most recent NHMRC funding to continue to develop an I-ASIST mobile application designed to support participants and collect data to inform further programs and policies in suicide intervention.

HARNESSING THE POWER OF NATURAL IMMUNITY TO EXTEND VACCINE PROTECTION

ASSOCIATE PROFESSOR LINDA WAKIM

Associate Professor Linda Wakim is focused on using our body's own immune defence system to improve vaccines by providing longer lasting protection against viruses.

Up to 650,000 people die of respiratory diseases linked to seasonal influenza (flu) worldwide each year.[19]

Currently an annual vaccination is the best way to prevent influenza.

"We want to make a flu vaccine that you get once a decade, rather than once a year," Associate Professor Wakim says.

Influenza vaccines typically stimulate the production of antibodies that attach to outer structures and disable the virus. These antibodies provide short-term protection from viruses with the same outer structure.

Unfortunately, the outer structures of viruses are constantly changing, so a new vaccine is needed each year to target those structures on the circulating influenza strains.

Vaccines stimulating the development of T-cells, a type of white blood cell that fights infections, are likely to offer longer lasting immunity. Whilst antibodies are good at recognising the proteins on the outside of a virus, T-cells can recognise invariant proteins on the inside of the virus.

"These cells are long lived and respond to highly conserved components of the influenza virus, as such, they can provide long term protection against a wide breadth of influenza virus strains," Associate Professor Wakim says.

Along with a team of collaborators, Associate Professor Wakim found that by lodging memory T-cells in the upper respiratory tract, they blocked an inhaled influenza virus from reaching the lung, ultimately preventing the development of severe pulmonary disease.[20]

The team found key requirements for T-cells to lodge in the upper respiratory tract. Using this knowledge, they developed a proof-of-concept intranasal vaccine candidate, delivered through a nasal spray, and designed to specifically encourage resident memory T-cell development.

"We want to make a flu vaccine that you get once a decade, rather than once a year," Associate Professor Wakim says.

"We are now in a position where we can leverage the knowledge we have gained from the many years of performing basic research to design new and improved influenza vaccines, which will save lives, reduce health care costs, and reduce lost economic productivity," Associate Professor Wakim says.

"It is very satisfying when, after years researching a specific question, all the pieces finally fit together."

After undertaking postdoctoral research at the University of Washington in Seattle, USA, Associate Professor Wakim returned to Australia to continue her research, to find the only virus the laboratory had in the freezer was influenza.

"[This] turned out to be the perfect model pathogen for me to continue this research," she says.

LODGING RESIDENT MEMORY T-CELLS ALONG THE RESPIRATORY TRACT AS AN APPROACH TO PROTECT AGAINST INFLUENZA VIRUS INFECTION

◀ **PHOTO:** Asscoiate Professor Linda Wakim from the University of Melbourne.

UNIVERSITY OF MELBOURNE

The Peter Doherty Institute for Infection and Immunity

TEAM MEMBERS

Professor Linda Wakim
Professor Glen Westall
Professor Katherine Kedzierska
Professor Patrick Reading
Dr Angela Pizzolla
Associate Professor Irina Caminschi
Associate Professor Mireille Lahoud

PROGRAM GRANT

$644,624
2017–2019

Next steps

The research team is aiming to develop a novel "one-shot" intranasal influenza vaccine that provides long term, cross strain protection against seasonal and newly emerging pandemic strains. The technology will lodge influenza reactive resident memory T-cells along the respiratory tract.

Associate Professor Wakim says the team are currently optimising formulations and hope to test these candidates in vivo within the next 12 months, ultimately translating the findings from the basic research project to development of an intranasal influenza vaccine candidate.

ACCELERATING CHANGE IN DRIVER SAFETY SCREENING

PROFESSOR KAARIN ANSTEY

While many older Australians value the independence of driving and continue to do so safely throughout their lives, for others, the changes that occur with aging may take them off the road.

Changes in our vision, hearing, mobility and cognitive abilities, such as processing speed, memory and executive function, can impact on our ability to drive safely.[21,22]

"We observe quite big changes in cognition with normal aging, and then on top of that you have eye diseases, cataracts, glaucoma and age-related macular degeneration," says Professor Kaarin Anstey, a pioneer in the study of ageing, who focuses on the consequences and prevention of cognitive ageing and dementia.

Driver health and fitness to drive are critical in supporting the safety of Australians who use the roads, and screening tests for over 75s are part of this in some Australian states. However, Professor Anstey and her colleagues have found that despite several tests being marketed for this purpose, none had a strong evidence base.

Over a decade, Professor Anstey and her colleagues developed a brief off-road test, Multi-D, as a cost-effective and objective tool to screen older drivers. The Multi-D test assesses multiple abilities, including complex reaction time and executive function, good balance, and motion detection, making it highly relevant and sensitive to age-related changes that may affect driving performance. The test was designed to be used in both clinical and driver assessment settings to identify candidates who may require a referral for an on-road test.

Professor Anstey and her colleague, Professor Joanne Wood, received NHMRC funding to validate the Multi-D test, alongside seven others, against an on-road driving test. This was the first time a single study validated multiple tests simultaneously against the costly on-road driving test.

"No one had actually got all the tests together and said, 'Let's put them all under the same conditions, same people, against the same outcome' and that's what we did in this study," Professor Anstey says.

The research team recruited 560 drivers from Canberra and Brisbane, aged between 63 and 94 years old who were potentially at risk of being unsafe drivers due to visual, cognitive or medical problems. The participants took each of the eight off-road driving tests before completing the on-road driving test with an occupational therapist.

"No one had actually got all the tests together and said, 'Let's put them all under the same conditions, same people, against the same outcome' and that's what we did in this study,"

Professor Anstey

The study concluded that off-road screening tests could reliably identify older drivers who have a strong probability of failing the on-road driving tests and those who are likely to continue driving safely.

"Ultimately, the more accurate we are at identifying unsafe drivers of all ages, not just older adults, and intervening, the better," Professor Anstey says.

"We want to prevent injury and crashes."

AN EVALUATION OF HOW WELL BRIEF SCREENING INSTRUMENTS CAN CLASSIFY SAFE AND UNSAFE OLDER ADULT DRIVERS

◀ **PHOTO:** Professor Kaarin Anstey.

UNIVERSITY OF NEW SOUTH WALES

TEAM MEMBERS

Professor Kaarin Anstey
Professor Joanne Wood

PROGRAM GRANT

$912,212
2013–2017

Next steps

Professor Anstey is now looking to commercialise the test to allow for its implementation. She is also conducting her third intervention to improve older driver safety, an NHMRC-funded randomised control trial, to assess the effectiveness of education types on safety outcomes for older adults. The relative effectiveness of tailored lessons, road-rule workshops and tailored feedback on on-road driver performance will be assessed.

“There is a whole group of people who we feel would benefit from an intervention to improve their safety to enable them to keep driving. They’re not going to fail a driving test, but we know we can make them safer on the road through an intervention.”

“Consumers want to be responsible and do some driving training, but it has to be evidence-based.”

The ‘Better Drive Trial’ was a result of participant feedback, and a consumer need for an intervention.

GROWING UP AND GETTING STRONGER: IMPROVING THE LONG-TERM HEALTH OF PREMATURE BABIES

PROFESSOR LEX DOYLE

In the early 1970s, Professor Lex Doyle watched as ventilators were introduced in Australian hospitals to help premature babies breathe.

"Ventilators had some success, but a lot of the babies still died, and I wanted to know how to improve this process," Professor Doyle says about his time as a trainee doctor at the Royal Women's Hospital in Melbourne.

A baby born before week 37 of pregnancy is a premature or pre-term baby.[23] Professor Doyle works predominantly with babies born before 30 weeks, who are called extremely preterm babies, and their families. These tiny babies often weigh less than 1000 grams.

"Watching these tiny babies become young adults has been the best thing," he says.

Although those born extremely preterm who survive into adulthood mostly have good health, as a group they have higher rates of ill-health in many different areas.[24]

Professor Doyle "wandered into the wilderness of research" after completing his clinical training in the late 1970s and started looking at the long-term impacts of various medical interventions in premature babies, from oxygen-enriched air to ventilators.

Funding from NHMRC's Centre of Research Excellence (CRE) scheme supported Professor Doyle and a multidisciplinary group of experts to improve techniques for helping newborn infants breathe, both immediately after birth and later, in the neonatal intensive care nursery. Many of these techniques are now incorporated into guidelines to support the breathing of babies around the world.

"Premature Babies had less than a 10% chance of survival before the 1970s, but today you see survival rates of more than 90%," Professor Doyle says.

The research team have also spent decades investigating the short- and long-term health of high-risk newborn infants, contributing to increased knowledge about interventions that may lead to adverse outcomes as these tiny babies grow into adults.

Funding over the last 15 years from NHMRC has allowed the team of experts to check in with babies born in the early '90s as they progress into young adulthood.

"You have to be very patient," Professor Doyle explains when reflecting on the long-term nature of his research.

Now one of the most respected researchers in the field of paediatrics and child health globally, Professor Doyle says having the opportunity to help these children, and their families, has been the most rewarding part of his career.

"Watching these tiny babies become young adults has been the best thing," he says.

Including these children and their families in the research from the very beginning, is of critical importance to Professor Doyle.

The CRE in Newborn Medicine at Murdoch Children's Research Institute was one of the first to include a consumer as an investigator on a grant application.

"We wanted to increase the involvement in our research of families and survivors themselves who have been born too early or too sick," Professor Doyle says.

This enables the viewpoint of those most affected to help guide the research to answer the critical questions in the care of preterm babies and their families.

Professor Doyle is now supporting the next generation of researchers to continue these investigations and ask answerable questions. He says that with every question answered in research, more questions arise.

"The need for research is increasing exponentially."

CENTRE OF RESEARCH EXCELLENCE IN NEWBORN BABIES MEDICINE

◂ **PHOTO:** Professor Lex Doyle from the Murdoch Children's Research Institute.

MURDOCH CHILDREN'S RESEARCH INSTITUTE

Centres of Research Excellence

TEAM MEMBERS

Professor Lex Doyle
Professor Peter Davis
Professor Peter Anderson
Professor Rod Hunt
Professor Jeanie Cheong
Associate Professor Susan Jacobs
Associate Professor Gehan Roberts
Dr Jennifer Dawson
Professor Alicia Spittle
Associate Professor Deanne Thompson

PROGRAM GRANT

$2,622,320
2014–2018

Next steps

While survival rates of those born extremely preterm have improved over the last 50 years, these babies have not yet reached later adulthood. Researchers will continue to follow tiny survivors of modern neonatal intensive care to understand what happens to their health after the first few decades.

"Although we are good at keeping infants born extremely preterm alive, they still have ongoing breathing problems in the nursery that lead to lung damage, with long-term adverse consequences for their breathing ability and for their brain function in later life," Professor Doyle says.

"Moreover, we need to understand better what it is about the brain that leads to higher rates of problems with thinking and movement in later life."

The team are now conducting clinical trials to reduce lung and brain damage in the newborn, with the aim of improving respiratory and brain function in the long term.

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