MACQUARIE University
SYDNEY·AUSTRALIA

Australian Institute of Health Innovation

ANNUAL REPORT

2020

Contents

Founding Director's report

The year under review, 2020, has been memorable. Clearly, the impact of the COVID-19 pandemic on individuals, patients, the community and health professionals remains etched in our collective psyche.

Although Australia has faced its own challenges, thanks to a wonderful community response, we have been relatively unaffected, compared with other countries – some, with hundreds of thousands of cases, and deaths. Yet the human spirit is indomitable – and, with an international vaccination regime being put in place as I write, we look forward with great doses of optimism for the world. Everywhere, health systems and clinicians are serving their communities extremely well in the most trying of circumstances.

At the Institute, while the impact of COVID-19 has been felt and notwithstanding the challenges, we successfully navigated the unique pandemic-induced work and research environment, and remained extremely productive. I have the highest praise for everyone's resilience.

The Institute was called upon for consultation on COVID-19 related matters by media, government, and health organisations in Australia and overseas. We published in peer-reviewed journals, presented at, and attended, conferences remotely, began multiple new projects and successfully adapted to COVID-safe work practices. Notably, publications output remained high, mostly in international journals, and several in high-impact journals such as *BMC Medicine*, *JAMIA*, *JAMA* and the *BMJ*.

While the emphasis remained on our existing and substantial research endeavours, plus two new National Health and Medical Research Council (NHMRC) Investigator Grants, a new Medical Research Future Fund Project and a Partnership Project, we also contributed to the body of knowledge on COVID-19, including:

- a survey of 3000 over 55-year-olds on "How is COVID-19 impacting your well-being and healthcare access?" conducted by the Centre for Health Systems and Safety Research
- a survey with the International Society for Quality in Health Care (ISQua) and the Italian Network for Safety in Healthcare of over 1000 healthcare workers on the management strategies of different countries during the COVID-19 outbreak
- research by the Centre for Healthcare Resilience and Implementation Science identifying the key factors for managing COVID-19 in health systems across the world – a large study of 40 health jurisdictions

In addition, the Australian Alliance for Artificial Intelligence in Healthcare (AAAiH), established by the Centre for Health Informatics, is creating a National COVID-19 AI Research Platform. Plus, we created five new PhD scholarships for COVID-19 and health system crisis preparedness research.

Our NHMRC Partnership Centre for Health System Sustainability (PCHSS) contributed to the national debate on topics such as the use of technology and shared data and achieving value for the health dollar, including releasing an authoritative report on managing surgical waitlists which was circulated to every Australian health jurisdiction. The work of the Institute and the PCHSS on guiding the optimisation of telehealth during the lockdown periods was timely and invaluable.

So: congratulations to all our staff, students and partner individuals and organisations. You have been magnificent.

I am also very proud to report that we were able to maintain our teaching and supervising responsibilities during the pandemic and that the Macquarie University Doctor of Medicine (MD) program now has three cohorts of students, all doing research coordinated and supervised by the Institute.

What, then, is the outlook for 2021? My sense is that the world will do well in combatting the pandemic, and despite newly emerging variants of the disease, will slowly enter a new normal.

Australia is well-placed to emerge from the pandemic very well indeed, and will again thrive. And the Institute? We have world-class researchers, an energetic and supportive Faculty, and a skilled and talented University leadership with a very clear vision for the future. Despite the difficulties, we are positioned to excel. We have a platform of success and achievement, and are very committed to build on this for the benefit of all our stakeholders. That's what we do, and are determined to do more: provide the best research we can to underpin strong, highly performing clinical services, healthcare organisations, and caring systems at micro, meso and macro levels.

Professor Jeffrey Braithwaite
FOUNDING DIRECTOR

We have world-class researchers, an energetic and supportive Faculty and a skilled and talented University leadership with a very clear vision

Australia's first university-led teaching hospital on campus

Ranked in the top 1 per cent of universities in the world
(QS WORLD UNIVERSITY RANKINGS, 2019)

Who we are

Research is what we do at the Australian Institute of Health Innovation (AIHI). It is how we realise our steadfast commitment to improving healthcare services and health systems. We question deeply and creatively, designing research and interventions to heal, learn and discover.

AIHI is globally recognised through fruitful and highly valued collaborations with patients, clinicians, policymakers, health sector organisations and researchers in Australia and internationally. We are embedded within Macquarie University and integral to MQ Health, Australia's first fully integrated academic health sciences centre.

Our partnerships with those providing or receiving health services in real-life contexts ensure that our research has a positive influence on patients, health professionals and society more broadly.

AIHI comprises three independent, complementary and highly collaborative research centres, each of which takes a systems perspective to solve healthcare problems, utilising highly innovative and wide-ranging research methods.

· Centre for Healthcare Resilience and Implementation Science
· Centre for Health Informatics
· Centre for Health Systems and Safety Research

Our leadership in translational health services research is further evidenced by the innovative work of our three National Health and Medical Research Council (NHMRC) funded centres:

· NHMRC Partnership Centre for Health System Sustainability
· NHMRC Centre of Research Excellence in Digital Health
· NHMRC Centre of Research Excellence in Implementation Science in Oncology

Reflecting our consistently high-value research contribution, in 2020 AIHI managed grants and contracts in excess of $35 million. We also contributed to research associated with a further $48 million worth of grants administered by other institutions.

Our highly successful approach is contributed by academics and visiting researchers, supported by a skilled team of professional staff. We value our 31 higher degree research (HDR) students, are contributing to the Macquarie University Master of Public Health Program, and administering research projects and teaching in the Macquarie University Doctor of Medicine Academic Teaching Program.

Reflecting our consistently high-value research contribution, in 2020 AIHI managed grants and contracts in excess of $35 million

AIHI at a glance

HEAL. LEARN. DISCOVER.

OUR RESEARCH AND PROJECTS

$35.9m

Enterprise value
of projects under
AIHI management

$48m

Enterprise value of grants
administered elsewhere
involving AIHI

$6.8m

New research
funding for 2020

27

New projects
commenced in 2020

$23m

Category 1
funding for grants under
management 2020

189

Researchers, visiting
appointees and
professional staff

31

HDR students

242

Peer-reviewed
journal articles

91

Research projects under
AIHI management

18

Projects administered
elsewhere involving AIHI

WE PROVIDE THE RESEARCH EVIDENCE
TO IMPROVE HEALTHCARE

Improve the safety and quality of care for patients and staff

Support better aged and community care

Enhance services for people with chronic ill-health

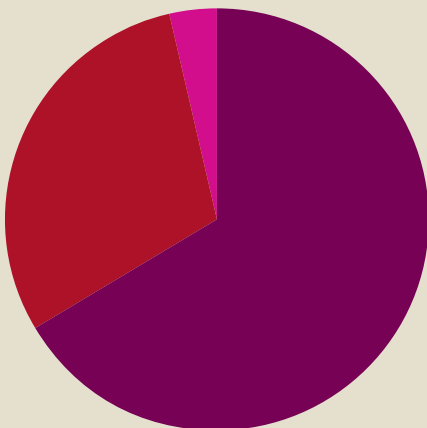Optimise AI and machine learning, for safe, efficient and ethical support

Integrate services, making delivery and access easier

Build a sustainable health system for future generations

GRANTS UNDER MANAGEMENT 2020
BY FUNDING CATEGORY

CATEGORY 1
Grants awarded from the Australian Competitive Grants Register

CATEGORIES 2 & 3
Other Public Sector and R&D Income

OTHER
Industry and Other R&D Income

Our Board

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Patrick McNeil
Chair

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Jeffrey Braithwaite

MACQUARIE UNIVERSITY
Professor
Johanna Westbrook

MACQUARIE UNIVERSITY
Professor
Enrico Coiera

MACQUARIE UNIVERSITY
Professor
Cliff Hughes AO

MACQUARIE UNIVERSITY
Professor
Lesley Hughes

NSW HEALTH SYSTEM
Professor
Adam Jaffé
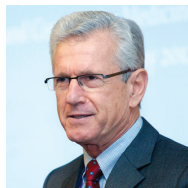
NSW HEALTH SYSTEM
Professor
George Rubin
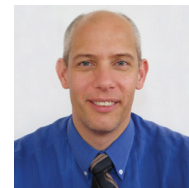
NSW HEALTH SYSTEM
Professor
Patrick Bolton

NSW HEALTH SYSTEM
Professor
Sally Redman AO

NSW HEALTH SYSTEM
Ms Carrie Marr

INDEPENDENT MEMBER
Professor
Les White AM

INDEPENDENT MEMBER
Dr Karen Owen

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Ms Sue Christian-Hayes
Ms Chrissy Clay

Our partners

The Australian Institute of Health Innovation is proud to partner with a broad range of government, industry, health services and research institutions. We also highly value our engagement with health consumers through advocacy groups and clinical trials. A full list of our national and international partners can be found on our website at **aihi.mq.edu.au** with a selection listed here.

Hospitals

Academia

Clinicians

Industry

Health consumers

Peak bodies

International bodies

Government

- ACT Health
- Aged Care Quality and Safety Commission
- Agency for Clinical Innovation NSW
- Anglicare
- Annalise.ai
- Australasian Institute of Digital Health
- Australian Commission on Safety and Quality in Health Care
- Australian Defence Force
- Australian Genomics Health Alliance
- Australian Government Department of Health
- Australian Research Council
- Black Dog Institute
- Bond University
- Brain and Mind Centre
- Bupa Health Foundation Australia
- Bureau of Health Information
- Cancer Institute NSW
- Children's Cancer Institute Australia
- Clinical Excellence Commission NSW
- Cochlear Ltd
- Consumers Health Forum of Australia
- CSIRO Australian e-Health Research Centre
- CSIRO Data61
- Curtin University
- Deakin University
- Dementia Australia Research Foundation Limited
- Eastern Melbourne Primary Health Network
- eHealth NSW
- Evidentli
- Flinders University
- Gippsland Primary Health Network
- Harrison.ai
- Harvard Medical School (USA)
- Health Quality & Safety Commission New Zealand
- Healthdirect Australia
- Independent Hospital Pricing Authority
- International Medical Informatics Association
- Karolinska Institutet (Sweden)

- Kolling Institute of Medical Research
- KPMG Australia
- Local Health Networks – various
- Melanoma Institute Australia
- Mito Foundation Australia
- Monash University
- MQ Health
- Murdoch Children's Research Institute
- National Children's Digital Health Collaborative
- National Health and Medical Research Council
- National Library of Medicine (USA)
- NSW Department of Communities and Justice
- NSW Health
- NSW Health Pathology
- NT Health
- Optus Macquarie University Cyber Security Hub
- Outcome Health
- Primary Health Networks – various
- Queensland Health
- Research Australia
- Royal College of Pathologists of Australasia
- Royal Commission into Aged Care Quality and Safety
- SA Health
- Sax Institute
- St Vincent's Health Australia
- Sydney Children's Hospital Network
- Tasmanian Department of Health
- University College London (UK)
- University of Cambridge (UK)
- University of Melbourne
- University of New South Wales
- University of Notre Dame Australia
- University of Oxford (UK)
- University of Queensland
- University of South Australia
- University of Sydney
- University of Western Australia
- University of Wollongong
- Victorian Department of Health
- WA Health

Our Directors

PROFESSOR JEFFREY BRAITHWAITE

Founding Director, Australian Institute of Health Innovation

Director, Centre for Healthcare Resilience and Implementation Science

Professor of Health Systems Research, Macquarie University

Professor Jeffrey Braithwaite is a leading health services and systems researcher, with a highly regarded global profile. He has considerable expertise in researching the culture and structure of acute settings, leadership, management and change in healthcare, quality and safety in healthcare, accreditation and surveying processes in international contexts and the restructuring of health services. He has published extensively, with over 654 refereed contributions and over 20,074 citations.

Professor Braithwaite is the recipient of research funding of over $149 million spread over 109 grants. More than 77% of his funding is at the Category 1 level.

His cutting-edge research on culture, reform and resilience has produced an extensive body of work that includes 14 highly regarded books. Professor Braithwaite has also led research laying new underpinnings of the discipline, particularly applying complexity science to healthcare improvement and reform. The International Society for Quality in Health Care has indicated his research is the most valuable international research in the field and, among others, many national governments and health

systems, the WHO and OECD have made extensive use of his work on quality indicators and Safety-II.

A major breakthrough is represented in papers providing advances in healthcare structural change, and the need to deploy more sophisticated change strategies; for example, culture change or organisational change through collaborative networks. In 2019, he successfully secured, as lead investigator, a $1.5 million Medical Research Future Fund Grant for keeping people out of hospitals.

Benchmarked by SciVal's Field-Weighted Citation Impact, AIHI's publications are cited at a rate of 78% above world standard.

He was also awarded an NHMRC Leadership Award in the form of an Investigator Grant to examine genomics medicine implementation, creating a genomics learning organisation, valued at $1.35 million.

In 2020, Professor Braithwaite was inducted as President of the International Society for Quality in Health Care.

PROFESSOR JOHANNA WESTBROOK
Director, Centre for Health Systems and Safety Research

Professor Johanna Westbrook is internationally recognised for her research evaluating the effects of information and communication technology (ICT) in healthcare. Professor Westbrook has led

research in the development and application of approaches to evaluate ICT, including new tools and methods which have been adopted internationally. She has extensive expertise in the study of medication safety.

Professor Westbrook has contributed to theoretical models regarding the design of complex multi-method ICT evaluations and conducted large trials of their effects. Integral to assessing the effectiveness of ICT to innovate work, and improve safety and quality of care, is gaining a deep understanding of clinical work and communication processes. Professor Westbrook's research has included the development of the Work Observation Method by Activity Timing (WOMBAT) software to support the conduct of observational workflow studies, which has been used by 30 research teams across 12 countries.

Professor Westbrook's research has led to significant advances in our understanding of how clinical information systems deliver (or fail to deliver) expected benefits and supported translation of this evidence into policy, practice, and IT system changes. Research findings led by Professor Westbrook

Professor Westbrook, Professor Braithwaite, Professor Coiera

have been extensively referred to by the Royal Commission into Aged Care Quality and Safety.

Professor Westbrook has over 500 publications and has been awarded more than $50 million in research grants.

In 2020, Professor Westbrook was awarded the NHMRC Elizabeth Blackburn Investigator Grant Award for Leadership in Health Services Research; and was appointed as a Co-Director of the Safety, Quality, Informatics and Leadership Program for Harvard Medical School. Between 2016 and 2019, she was appointed by the Federal Minister for Health to the Board of the Australian Digital Health Agency and in 2014 was named Australian ICT Professional of the Year by the Australian Information Industry Association. Professor Westbrook is Chair of the Deeble Institute of Health Policy Advisory Board, Australian Healthcare and Hospitals Association, and a member of the Boards of the Sax Institute and the International Medical Informatics Association.

PROFESSOR ENRICO COIERA
Director, Centre for Health Informatics

Trained in medicine and with a computer science PhD in Artificial Intelligence (AI), Professor Enrico Coiera is Foundation Professor in Medical Informatics at Macquarie University and Director of the Centre for Health Informatics, a group he co-founded in 2000. He is also Director of the NHMRC Centre of Research Excellence in

Digital Health and founder of the Australian Alliance for Artificial Intelligence in Healthcare (AAAiH).

With a research background in industry and academia, Professor Coiera has a strong international reputation for his work on decision support and communication processes in biomedicine. His research takes place at the boundaries of computer science, AI, cognitive science and biomedical systems science. For a decade, Professor Coiera was with the prestigious Hewlett-Packard Research Laboratories in Bristol, UK, leading numerous health technology projects. He has overseen the development and trial of multiple e-health interventions, including the Healthy.me consumer app and clinical decision support systems. The third edition of his textbook, *Guide to Health Informatics,* has been translated into several languages and is widely used internationally.

In 2015 he received the International Medical Informatics Association (IMIA) François Grémy Award for Excellence, the field's highest award from its peak international organisation,

and only the fifth time it has been given since the first award in 2001. In 2017 he was one of 100 scientists worldwide elected as a Foundation Member of the International Academy of Health Sciences Informatics, the peak international Academy for his discipline. Professor Coiera is a Fellow of the Australian Academy of Health and Medical Sciences and a member of the International Academy of Quality and Safety in Healthcare.

In 2017, he initiated the first formal Fellowship training pathway in health informatics through the Australasian College of Health Informatics (ACHI), a college he founded in 2002. In 2020, Professor Coiera was appointed to the Global Partnership on Artificial Intelligence (GPAI).

Professor Enrico has been a chief investigator on competitive grants worth over $48 million, has over 360 publications and over 17,700 citations in Google Scholar with an h-index of 66 (Google Scholar). Of these publications, 42 have more than 100 citations, 10 have more than 300 citations and one has more than 2100 citations.

Key grants
for 2020

NHMRC INVESTIGATOR GRANT
Delivering safe and effective medication management technology now and for the future

The effective use of information technology is a potential game changer in reducing medication errors in hospitals, which constitute a major patient safety challenge. This innovative $2.5 million project led by Professor Johanna Westbrook, will generate the new evidence, policy and practice urgently needed to optimise electronic medication management systems to reduce medication errors and save lives.

NHMRC INVESTIGATOR GRANT
Designing and implementing a real-world learning healthcare system: operationalising knowledge, data and practice for clinical microsystems of the 21st Century

This groundbreaking project will improve care for children and adolescents by developing a strategy to integrate precision medicine into paediatric oncology. Led by Professor Jeffrey Braithwaite, the $1.35 million project will lay the foundation for leveraging sophisticated information technologies, data mining, machine learning and genomics to capture all the evidence a clinical team requires to determine a patient's unique needs.

NHMRC PARTNERSHIP PROJECT
A dashboard of predictive analytics and decision support to drive quality and person-centred outcomes in aged care

Addressing several important issues raised by the Royal Commission into Aged Care Quality and Safety, this project will mobilise technology to develop an innovative digital dashboard of integrated data. Led by Professor Johanna Westbrook, this $1.8 million project with Anglicare will provide aged care residents, families and care providers with actionable information to monitor and improve health and wellbeing outcomes.

MEDICAL RESEARCH FUTURE FUND
Keeping Australians Out of Hospital

This $1.5 million project, led by Professor Jeffrey Braithwaite, will help to identify high-value care by providing evidence of system and project performance within the NSW Health Leading Better Value Care program and developing a roadmap for implementation across other jurisdictions.

Mitochondrial Disease Triage Tool

This project with the Kolling Institute will deliver rapid and precision diagnosis to patients suspected of having Mitochondrial Disease (MD). Led by Associate Professor Shlomo Berkovsky, it will create an online resource to integrate patients with their primary care providers and facilitate access to appropriate expert services to diagnose, counsel, inform and treat affected individuals.

Discovering the key to COVID-19 management

A study of 40 health systems and their approach to managing the COVID-19 pandemic provided the first proof that testing is critical for reducing casualties.

The research examined the health systems of 40 countries, comparing each country's preparedness pre-pandemically; the way they responded with stringency measures (lockdown, masks, social distancing); and testing. The consequence for each national response was measured against the number of COVID-19 deaths and COVID-19 cases between March 1 and April 30 2020.

Testing was found to be the key factor for not only reducing deaths but also offering a pathway out of lockdowns that is supportive of economic recovery. The research showed that early stringency measures were necessary but not sufficient on their own. They are also not sustainable in the long term. Broad testing in tandem with stringency measures were central to improving outcomes.

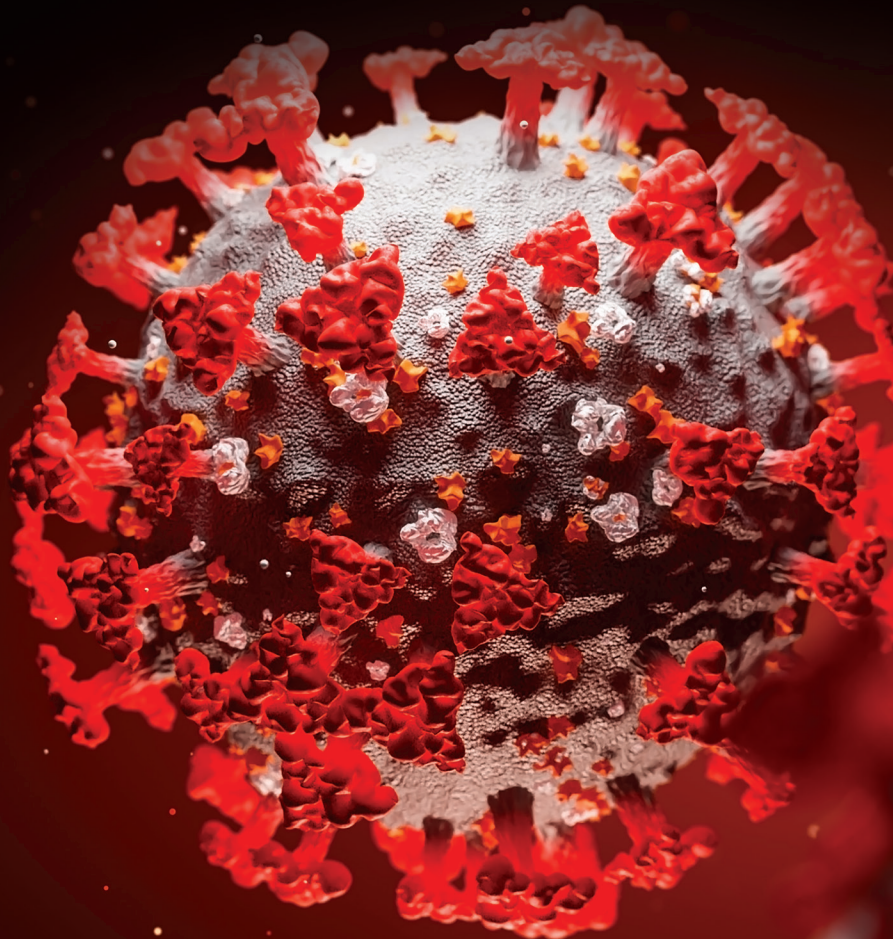Attracting widespread interest, this research provided an early key to managing the COVID-19 pandemic.

Testing was found to be the key factor for not only reducing deaths but also offering a pathway out of lockdowns

Braithwaite J, Tran Y, Ellis LA, Westbrook J. The 40 health systems, COVID-19 (40HS, C-19) study. *International Journal for Quality in Health Care*. 2020 Sep 30.

IMPACT STORIES
Making a positive impact on healthcare

New book released to transform healthcare

With a powerful combination of passionate writing, overlaid with rigorous science, the new book, *Transforming Healthcare with Qualitative Research,* is a uniquely valuable resource for academic researchers, healthcare professionals and policymakers alike.

Edited by Professors Frances Rapport and Jeffrey Braithwaite, the book draws on the knowledge and experiences of world-renowned scientists and healthcare professionals, bringing together academic, medical and health systems accounts of the impact of applying qualitative research methods to transform healthcare behaviours, systems and services.

Each chapter strives to find solutions to healthcare problems, improve systems for the benefit of those receiving and delivering care, and understand how qualitative data can make a difference.

Full of novel ideas and innovative solutions from around the world, all underpinned by qualitative methods and methodologies, this book is an important contribution for advanced students, practitioners and academics interested in health services research, research methods and the sociology of health and illness.

Rapport F, Braithwaite J. Transforming healthcare with qualitative research. New York: Routledge, 2020. 244 p. (Routledge Studies in Health and Social Welfare).

Applying qualitative research methods to transform healthcare behaviours, systems and services

IMPACT STORIES
Making a positive impact on healthcare

Computer games reduce social isolation during COVID-19

A world-first study investigated the effect of video games on physical and mental health during the COVID-19 pandemic.

Social isolation due to COVID-19, drove many people to seek out digital entertainment, with downloads skyrocketing to the largest number of mobile game downloads in history. The study found that those playing location-based games (such as Pokémon GO and Harry Potter: Wizards Unite) which require players to move around, used the games to retain physical exercise routines and social connections. Most players were using these video games to positively modulate their own mental health.

The study found that more time spent playing location-based games was directly related to increased duration of exercise, and less gameplay was linked to poorer mental health. Participants reported exercising for an average of 6.5 hours per week even during COVID-19 lockdowns. They used video games to entertain, to escape, and to maintain social connections.

Findings are now being used to investigate how to improve the provision of preventative mental health services digitally.

Dr Jim Smith and Dr Kathleen Yin

More time spent playing location-based games was directly related to increased duration of exercise

Ellis LA, Lee MD, **Ijaz K**, **Smith J, Braithwaite J, Yin K.** COVID-19 as 'Game Changer' for the Physical Activity and Mental Well-Being of Augmented Reality Game Players During the Pandemic: mixed methods survey study. *Journal of Medical Internet Research* 2020; 22(12):e25117.

IMPACT STORIES
Making a positive impact on healthcare

AI improves diagnosis of brain diseases for precision medicine

A pioneering application of AI has been used to analyse MRI and surgical samples of brain tumours to predict outcomes and identify patients who will benefit from different treatments.

The AI method is faster and cheaper than the current gold standard – immunohistochemistry and genetic sequencing – showing great potential to shift investigation from slow and expensive procedures to much faster and cheaper MRI and microscope slides. In addition, the AI model can be trained in a few hours to equal or even better, the performance of pathologists with several years of training.

The multinational research looked at patients affected by gliomas – the most common primary brain tumours. This study is the first to use AI to identify a particular mutation in the DNA, in the IDH gene. It allows doctors to confirm the diagnosis of a type of glioma that has a better prognosis.

Dr Sidong Liu

AI method is faster and cheaper than the current gold standard

Liu S, Shah Z, Sav A, Russo C, **Berkovsky S**, Qian Y, **Coiera E**, Di Ieva A. Isocitrate dehydrogenase (IDH) status prediction in histopathology images of gliomas using deep learning. *Scientific Reports*. 2020 May 7; 10:1-11. 7733.

Gao Y, Xiao X, Han B, Li G, Ning X, Wang D, Cai W, Kikinis R, **Berkovsky S**, Di Ieva A, Zhang L, Ji N, **Liu S**. Deep learning methodology for differentiating glioma recurrence from radiation necrosis using multimodal magnetic resonance imaging: algorithm development and validation. *JMIR Medical Informatics*. 2020 Nov 17; 8(11):1-15. e19805.

Di Ieva A, Russo C, **Liu S**, Jian A, Bai MY, Qian Y, Magnussen JS. Application of deep learning for automatic segmentation of brain tumors on magnetic resonance imaging: a heuristic approach in the clinical scenario. *Neuroradiology*. 2021 Jan 26

Real-time GP data is key to effective care and best-practice policy

An innovative new collaboration between general practitioners, digital health specialists and policymakers has produced a real-time reporting system that shows where and how COVID-19 is affecting Australia's health system.

The interruption of normal patterns of healthcare and the suspension of services means that the pandemic has had a major impact on the detection and treatment of many non-COVID-19 conditions. Electronic general practice data are a valuable resource which can be used to inform population and individual care decision-making.

The project uses a secure digital health platform, Population Level Analysis & Reporting (POLAR), to generate near real-time reports to identify emerging trends related to COVID-19, its diagnosis, treatment and medications prescribed, and its impact on patients.

Hardie R-A, Sezgin G, Dai Z, Georgiou A. The uptake of GP telehealth services during the COVID-19 pandemic. COVID-19 General Practice Snapshot. Issue 1: 2 December 2020. Sydney: Macquarie University; 2020.

Real-time reporting system shows COVID-19 impact on the health system

WOMBAT for iOS improves capture of activity data

WOMBAT 1.0 (2006–2011)

WOMBAT 2.0 (2011–2019)

WOMBAT 3.0 (2019–current)

Work
Observation
Method
By
Activity
Timing

Due to increased demand internationally, the Work Observation Method by Activity Timing (WOMBAT) research technique and tool is now available for iOS devices.

WOMBAT is used to collect data when undertaking direct observational time and motion studies. Using WOMBAT, observers capture multi-dimensional aspects of the activities being observed, record all activities as they are taking place, and capture interruptions and multitasking. All data entry is automatically time-stamped.

WOMBAT allows researchers to use either validated data collection templates or design their own. Thus, WOMBAT can support the collection of data to answer a wide range of questions about the work of different professional groups; the impact of interventions and reforms; interactions among teams; or patients and their care. While originally developed for the health domain, WOMBAT can be used in any field.

Researchers of the future

DR KRISTIANA LUDLOW

I am passionate about collaborating with healthcare users and workforces to ensure that services, systems and interventions meet their needs and preferences. My PhD explored care prioritisation in residential aged care facilities from the perspectives of clinical and non-clinical staff members, residents, and family members. After completing my PhD, I joined the Aged Care Evaluation and Research (ACER) team at AIHI. I have gained invaluable experiences, including presenting at international conferences, meeting world-renowned experts in my field, and consulting with media outlets about my research. Most importantly, AIHI has enabled me to make real-world differences in the lives of older Australians. AIHI is an outstanding place to study and work, providing exceptional mentorship and supervision, as well as opportunities to collaborate and network with incredibly talented researchers.

DR CRAIG CAMPBELL

My PhD, titled 'The implementation of safe and effective critical result management practices in pathology and evaluation of their effectiveness', addressed the need for evidence-based and standardised alert thresholds and time frames. It also specified procedures for fail-safe communication of test results that pose a critical or significant risk to patient safety.

During my PhD I undertook a review of critical result management practices and this informed recommendations published by the Royal College of Pathologists of Australasia and the Australasian Association of Clinical Biochemists. The National Pathology Accreditation Advisory Council is also drawing on these recommendations to develop a national standard for the communication of high-risk pathology results.

DR SAMIA AMIN

I am a medical doctor and public health researcher. My thesis examined how social factors can influence the uptake of e-cigarettes in Australia. During my candidature, I published a systematic review which attracted substantial media interest and received the AIHI Centre for Health Informatics Publication Award due to the high number of citations it received. I have also published three papers related to my thesis and presented at leading international and local conferences. My travel to attend these conferences was supported by a Macquarie University Postgraduate Research Fund grant. The positive environment of AIHI and student support from Macquarie University made this PhD journey remarkable.

Our Higher Degree Researchers are undoubtedly *the future of healthcare* with their innovative ideas and dedicated approach.

Organisational structure

FACULTY OF MEDICINE, HEALTH AND HUMAN SCIENCES
Executive Dean
Deputy Vice-Chancellor (Medicine and Health)
Managing Director MQ Health
Professor Patrick McNeil

ADMINISTRATION ← → **AUSTRALIAN INSTITUTE OF HEALTH INNOVATION (AIHI)** → **AIHI BOARD**

Founding Director
Professor Jeffrey Braithwaite

CENTRE FOR HEALTHCARE RESILIENCE AND IMPLEMENTATION SCIENCE (CHRIS)

CENTRE FOR HEALTH SYSTEMS AND SAFETY RESEARCH (CHSSR)

CENTRE FOR HEALTH INFORMATICS (CHI)

Director	**Director**	**Director**
Professor Jeffrey Braithwaite	Professor Johanna Westbrook	Professor Enrico Coiera
• Appropriateness of Care and Patient Safety • Complex Systems • Health Outcomes • Human Factors and Resilience • Implementation Science • International Healthcare Reform • Learning Health Systems	• Aged Care Evaluation and Research • Diagnostic Informatics • Health Analytics • Medication Safety and Electronic Decision Support • Work Innovation, Communication and e-Health	• Australian Alliance for Artificial Intelligence in Healthcare (AAAiH) • Consumer Informatics • Patient Safety Informatics • Precision Health • Digital Epidemiology • Digital Scribes

NHMRC PARTNERSHIP CENTRE FOR HEALTH SYSTEM SUSTAINABILITY
NHMRC CENTRE OF RESEARCH EXCELLENCE IN DIGITAL HEALTH
NHMRC CENTRE OF RESEARCH EXCELLENCE IN IMPLEMENTATION SCIENCE IN ONCOLOGY

Global themes: Patient Safety; Improvement Studies; Multidisciplinary Teamwork; Behaviour Change; International Health Reform; Digital Health; Aged Care

Introducing our Centres

The Australian Institute of Health Innovation is dedicated to improving the services and systems that deliver healthcare to individuals and communities. Central to this mission are the three highly productive and complementary Research Centres at the core of the Institute:

- Centre for Healthcare Resilience and Implementation Science
- Centre for Health Informatics
- Centre for Health Systems and Safety Research

These Centres are specialist powerhouses of expert research endeavour, as can be seen in the reports that follow. They also collaborate extensively. The success of this model is witnessed by the three additional centres funded by the National Health and Medical Research Council (NHMRC) and led by AIHI, shown in the organisational structure.

AIHI also contributes to higher degree research student supervision (PhD and Master of Research candidates) and to the Faculty of Medicine, Health and Human Science's teaching programs. As part of MQ Health, Macquarie's academic health sciences centre, including Macquarie University Hospital, AIHI is at the heart of education and research, making a real-world impact.

Centre for Healthcare Resilience and Implementation Science

Even before the COVID-19 pandemic, health systems around the world were under pressure. Ageing populations, chronic ill-health, technological breakthroughs, limited resources and consumer expectations have all contributed to stress on the system and those who work within it. The Centre for Healthcare Resilience and Implementation Science (CHRIS) is reconceptualising healthcare research to build more resilient systems to meet this ongoing and complex challenge.

CHRIS are leaders in the study of complexity science, human factors, resilience in healthcare setting, implementation science and patient safety. We address complex problems, adopting evidence and translating this into practice to improve delivery systems and design new models of care. CHRIS pursues highly collaborative, multidisciplinary research to ensure research findings are translated into better and more cost-effective, sustainable care.

CHRIS is integral to the NHMRC Partnership Centre for Health System Sustainability and the NHMRC Centre of Research Excellence in Implementation Science in Oncology. We also work with international bodies including the WHO, OECD, the International Society for Quality in Health Care and the Society for Organisational Behaviour in Health Care to support global healthcare reform.

" We are proud to support clinicians and healthcare workers in Australia and overseas who have steadfastly stood by their health systems and cared for all patients during the COVID-19 pandemic."

PROFESSOR JEFFREY BRAITHWAITE

FINANCIAL REVIEW

'Fragile situation': Can Australia keep COVID-19 at bay?

Jill Margo
Health editor

TRACKING THE QUALITY OF CARE FOR CHILDREN

When results from the CareTrack Kids project were published in one of the world's prestigious medical journals, the Journal of the American Medical Association (JAMA), the Editor-in-Chief of JAMA Network described it as "one of the most important papers in child health in the last 5 years".

18 months to find tools left inside patients

SUE DUNLEVY

SURGICAL instruments have been accidentally left inside patients, undetected for up to 18 months, new research has found.

About 30 patients a year are victims of medical mishaps in which equipment used during surgery is not removed from their body, and more than 400 people have suffered from other medical errors in the last five years.

Macquarie University researcher Associate Professor Peter Hibbert, who specialises in adverse medical events, studied 31 investigations into "retained" surgical items in Victorian hospitals between 2010 and 2015. About two thirds of the foreign objects left inside patients were sponges, drain tubes and a vascular device, he found.

There was also a surgical instrument – a curette used to scrape human tissue – as well as a cochlear implant stainless steel template and guide-wires left inside patients.

Across Australia, there are about 30 such incidents every year, Prof Hibbert, pictured, said.

"It can be a distressing event for patients," he said. "These foreign bodies can cause pain, loss of function and infections." The adverse events can also be expensive because all bar one of the victims needed another operation to remove the instrument left inside them, the study found.

The study, published in the *International Journal for Quality in Health Care*, found one in four of the surgical items was discovered on the day of the procedure but one in six took longer than six months to detect.

In one case, a central venous catheter guide wire left inside a patient went undetected for 18 months.

Patients generally noticed something was wrong when they felt pain caused by the retained device pressing on a nerve, causing a bowel obstruction, sepsis or serious infections, the study said.

"The majority of incidents don't occur because clinicians are doing the wrong thing but because of the complex system in which they work," said Prof Hibbert, who trains doctors how to avoid these sorts of complications.

The types of surgery in which equipment was left inside patients included hip replacements, knee procedures, removal of part of the large intestine, removal of a larynx (voice box) and an emergency caesarean section.

X-rays detected some of the retained devices but did not pick up others.

The researchers said the best way of preventing these medical mishaps included managing the fatigue of medical staff, improved communication among members of the operating team and reducing noise and interruptions during surgery.

InSight+
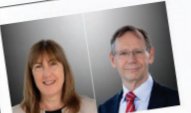
Authored by
ROBYN CLAY-WILLIAMS
JEFFREY BRAITHWAITE

16 March 2020
COVID-19: we need health services researchers in hospitals now

THE CONVERSATION

Shutterstock

What is a rare disease? It's not as simple as it sounds

February 26, 2020 2.10pm AEDT

If you have a rare disease, you may be the only person in Australia with that condition.

You may not know, however, that being diagnosed with a rare disease means you are part of a community of up to two million Australians with one of these conditions. And more than 300 million people globally.

Author

Yvonne Zurynski
Associate Professor of Health System Sustainability, Australian Institute of Health Innovation, Macquarie University

insight

Broken bones and hospital visits: new study reveals the danger of kids' sport

Research published in the *International Journal for Quality in Health Care* identifies broad-based testing as one of the key factors for managing COVID-19 in health systems across the world following a large study of 40 health jurisdictions.

A survey of more than 1000 healthcare workers on the management strategies of different countries during the COVID-19 outbreak and published in the *International Journal for Quality in Health Care* provides unique insights.

Advocating for the development of deep learning systems in healthcare, "The three numbers you need to know about healthcare: the 60-30-10 Challenge" in *BMC Medicine* continues to attract global interest.

Extensive media attention highlights the importance of research into retained surgical items and improving the way adverse events in hospitals are investigated.

With the International Society for Quality in Health Care, Professor Jeffrey Braithwaite presents in a seminar series on the value, techniques and process of critical crisis thinking and future health system crisis preparedness.

Collaborations grow around the genomics implementation program of work, and expertise in large-scale system change, organisational culture and rare diseases.

CareTrack Kids research into the appropriate delivery of healthcare features in peer-reviewed journal articles and industry publications.

International peer-reviewed journals publish a large scoping review on strategies to measure and improve emergency department performance and Cognitive Work Analysis findings, both arising from Associate Professor Robyn Clay-Williams' NSW Health Early-Mid Career Research Fellowship.

WHO's Patient Safety Framework is operationalised to classify medical or surgical patient deaths using the WHO International Classification for Patient Safety Framework to identify incident characteristics and contributing factors for medical or surgical complication deaths.

'A Human Factors Resource for Health Professionals and Health Services Staff' is launched.

A collaboration with the Melanoma Institute Australia receives extension funding.

The first rapid review to be conducted in Australia of key components of health and social delivery in epilepsy is released.

The International Society for Quality in Health Care appoints Professor Jeffrey Braithwaite as President.

Associate Professor Rebecca Mitchell

Research Streams CHRIS

COMPLEX SYSTEMS

Professor Jeffrey Braithwaite
jeffrey.braithwaite@mq.edu.au

Dr Janet Long
janet.long@mq.edu.au

Complex Systems explores ways to capture, leverage and embrace the intricacies and multifaceted nature of our health system. In a Complex Adaptive System, with multiple staff members, a social network of multidisciplinary teams and patients, complicated technologies and processes, and multifarious interdependencies of resources, a holistic approach is required.

We focus on aspects of organisational culture and how to measure it, implementation of genomic medicine, and implementation evaluation of mental health initiatives. Projects include the Medical Research Futures Fund Keeping Australians out of Hospital; genomic work on Mackenzie's Mission: the Australian Reproductive Genetic Carrier Screening Project and Acute Care Genomics (both funded by the Genomics Health Futures Mission); and active implementation of consensus guidelines for management of patients with mitochondrial disorders (The Mito Foundation); and empirical work on the application of Broken Windows Theory to the hospital setting.

LEARNING HEALTH SYSTEMS

Professor Jeffrey Braithwaite
jeffrey.braithwaite@mq.edu.au

Learning Health Systems seeks to promote the development of a learning health system to support the rapid integration of new knowledge and best practice evidence into the front lines of care.

The report, 'Mapping the Learning Health System: a scoping review of current evidence – a white paper' was released during 2020, along with the *BMC Medicine* article 'The three numbers you need to know about healthcare: the 60-30-10 challenge.'

APPROPRIATENESS OF CARE AND PATIENT SAFETY

Associate Professor Peter Hibbert
peter.hibbert@mq.edu.au

Professor Jeffrey Braithwaite
jeffrey.braithwaite@mq.edu.au

Appropriateness of Care and Patient Safety conducts research on whether Australians receive healthcare that is in line with the recommendations in clinical guidelines. This is important because if evidence-based care is not delivered to patients reliably they can be subject to misdiagnoses, or delayed treatments, or suffer harm from reactions to medications they do not need.

The NHMRC funded CareTrack Aged project is focused on the delivery of evidence-based care in aged care facilities, where it is crucial residents receive care that is best practice.

In consultation with clinical experts, we completed the development of the first comprehensive set of quality indicators that outline care that should be delivered in aged care across 15 conditions. The indicators provide the basis for both research and quality improvement.

HUMAN FACTORS AND RESILIENCE

Associate Professor Robyn Clay-Williams
robyn.clay-williams@mq.edu.au

Human Factors and Resilience focuses on creating health systems that function effectively in the presence of complexity and uncertainty. Our research bridges the gap between theory and practice, by developing products and processes that are usable and ready for implementation.

We adapt, test and apply our knowledge and methods to healthcare at macro-, meso- and micro-levels to improve system functioning and increase 'the number of things that go right'. Our team provides a vital contribution, nationally and internationally, to understanding how healthcare systems function, and how to make them safer for patients.

We have started a new risk assessment project for the Medical Council of NSW and completed a large systematic review on the factors and key indicators that identify doctors at risk of impaired performance and malpractice.

HEALTH OUTCOMES
Associate Professor Rebecca Mitchell
r.mitchell@mq.edu.au

Health Outcomes examine the injury and disease burden to determine priorities for preventive efforts, and conducts research in the health system and in the general population aimed at identifying where health outcomes could be enhanced. During 2020, we developed and published in *Injury Prevention* a revised public health model for injury prevention and worked on the WHO Patient Safety Framework.

PhD candidate Kristy Burns was awarded a High Distinction for her MRes on 'Work-related injury hospitalisations in young vs older workers in NSW: a comparison population-based study.'

IMPLEMENTATION SCIENCE
Professor Frances Rapport
frances.rapport@mq.edu.au

Implementation Science develops research design proposals that ensure clear translation of research outcomes into practical and implementable healthcare interventions. We examine how best to translate findings to real-life healthcare settings and ensure that research outcomes are rigorous, and evidence based.

We are working in the fields of childhood cancer, epilepsy, melanoma, hearing health, environmental impact on practice and breast cancer. Our ongoing program of research in refractory epilepsy produced three publications in 2020 and attracted new funding.

INTERNATIONAL HEALTHCARE REFORM
Professor Jeffrey Braithwaite
jeffrey.braithwaite@mq.edu.au

International Healthcare Reform focuses on comparative health reform efforts in low-, middle- and high-income countries and their efforts to make systems improvement. Two book series have been produced in this field: one on international efforts to understand resilient healthcare, and another on 152 different countries' reform activities.

L-R: Professor Jeffrey Braithwaite, Dr Janet Long, Associate Professor Peter Hibbert, Associate Professor Robyn Clay-Williams, Associate Professor Rebecca Mitchell and Professor Frances Rapport
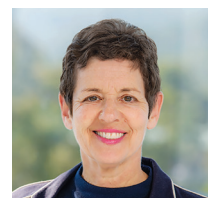
Centre for Health Informatics

The Centre for Health Informatics (CHI) researches the design and use of AI and digital technologies to drive fundamental changes in healthcare and ensure we have a sustainable and patient-centred healthcare system.

CHI is a multidisciplinary team of research scientists with backgrounds in medicine, biomedical engineering, computer science, pharmacology, electrical engineering, data science, information technology, clinical science, philosophy, bioinformatics, and nursing. Working with national and international collaborators, our research focus is on patient safety, precision health and consumer informatics. With our industry and clinical partners, we use machine learning to create predictive models for a range of diseases and clinical challenges.

To ensure technology use is effective, safe and ethical, we identify methods for identification and surveillance of digital health failures. Working closely with consumers, we use novel research methods to understand their needs and journey, and translate these into new digital tools to help them navigate their lives.

Our students study the impact of AI and digital tools on the management of events such as massive transfusions, chronic disease states, consumers' health literacy and decision-making, shared-electronic health records, and the use of mobile technologies and apps.

"**Ensuring our healthcare system is fit for purpose, safe, effective and resilient has always been amongst the greatest of research challenges. In 2020 these system challenges became even harder. COVID-19 has shown us just how fragile healthcare systems can be, and how sometimes even heroic actions are not enough. Finding a way through that and making sure we are better prepared for the next disruption – that is what gets me out of bed every morning.**"

PROFESSOR ENRICO COIERA

A world-first scoping review capturing the work required for people with chronic conditions to manage their own care, influences development of the national policy blueprint 'Self-Care for Health'. Launched by the Minister for Health and Aged Care, Hon Greg Hunt MP.

Research contributes to Australia's first National Safety and Quality Digital Mental Health Standards aimed at ensuring a safe and effective digital mental health system.

Associate Professor Farah Magrabi is elected Fellow of the American College of Medical Informatics, in recognition of significant and sustained contributions to the field of medical informatics.

A review of safety concerns with consumer health apps was ranked among the Top 10 articles published by the leading international journal for medical informatics, the *Journal of the American Medical Informatics Association*.

Global online survey results published in the *Journal of Medical Internet Research* show impact of the use of augmented reality games on physical activity and mental well-being during the COVID-19 pandemic.

Professor Enrico Coiera presents the AI pillar of the National Oncology Alliance Vison 20-30 Report launched by the Hon Greg Hunt MP.

Associate Professor Farah Magrabi is named Australian field leader for medical informatics by *The Australian* newspaper for the second time.

Our systematic review in *JAMIA* on conversational agents in healthcare is among the Top Cited *JAMIA* Articles of the year.

In 'The cognitive health system' published in *The Lancet*, Professor Enrico Coiera presents a major new framework for understanding how AI will transform the health system.

Our Opinion piece 'Can AI help in the fight against COVID-19?' features in the *Medical Journal of Australia*.
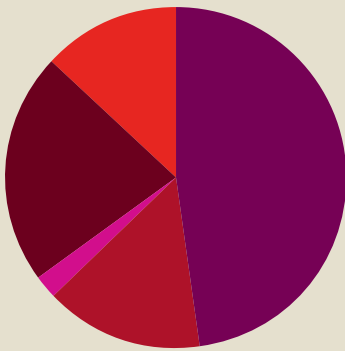
CHI is invited to join the ITU/WHO Focus Group on Artificial Intelligence for Health.

CHI and AAAiH ran webinars titled 'Artificial intelligence, health and human rights' and 'AI Healthcare: Hype, Hope or Humdrum' attracting wide interest.

Australian Alliance for Artificial Intelligence in Healthcare

- 48% Academia
- 15% Government
- 2% Health Service Provider
- 22% Industry
- 13% Other

270+
Individual Members

95
Member Organisations

The Australian Alliance for Artificial Intelligence in Healthcare (AAAiH) is led by Professor Enrico Coiera. Formed in 2018, it has grown to 95 organisations with 270 individual members from Australia, the UK, US, New Zealand and Canada. AAAiH seeks to become the national body responsible for driving the critical research, technological advances and policy directions needed to harness AI and meet the many systemic challenges healthcare faces in quality, safety, sustainability, equity and effectiveness.

In 2020 we commenced the National COVID-19 Research Platform project and have been developing an algorithm registry and evaluation framework for the assessment of the utility of COVID-19 AI models which assess the technical, functional and utility aspects of the models. An international team of medical researchers and data scientists has been brought together to develop the registry and framework. The evaluation framework includes specific indicators for safety, quality and ethics.

The Safety, Quality and Ethics Program continued mapping the nature and extent of safety and ethics guidance on AI in healthcare and the ethical values that underpin this advice.

They completed an inventory of relevant Australian guidelines and are now investigating key international guidance documents. The Program also evaluated algorithms used for the clinical management of COVID-19 as part of the AAAiH National COVID-19 Research Platform project, enabling the evaluation framework to include specific indicators for safety, quality and ethics.

AAAiH co-managed the first AI Healthcare Workforce Survey to inform the development of a curriculum framework for the use of AI. The intention is that this work will contribute to the wider workforce development and analysis that the Australian Digital Health Agency and other agencies have started.

A key priority for AAAiH in 2021 is to develop a national AI Roadmap for Healthcare.

Our goal is to ensure AI-enabled healthcare is developed and implemented in Australia in a way that is scalable, sustainable, and has clear positive impacts on clinical and economic outcomes for the nation.

AAAiH
Australian Alliance
for Artificial Intelligence in Healthcare

Research Streams CHI

PRECISION HEALTH
Associate Professor Shlomo Berkovsky

shlomo.berkovsky@mq.edu.au

Precision Health focuses on the use of machine learning methods to develop patient models and personalised predictions of diagnosis and care. In addition, we study how sensors and physiological responses can predict medical conditions, and how clinicians and patients interact with health technologies.

We undertake collaborative projects with healthcare organisations, leading national research groups and government bodies, such as the Kolling Institute, Optus Macquarie University Cyber Security Hub, Melanoma Institute Australia, and the Agency for Clinical Innovation.

Five papers were accepted to the 42nd International Conference of the Engineering in Medicine and Biology Society and a further six papers were published including 'Envisioning an Artificial Intelligence Documentation Assistant for Future Primary Care Consultations: A Co-design Study with General Practitioners' in the *Journal of the American Medical Informatics Association*.

PATIENT SAFETY INFORMATICS
Associate Professor Farah Magrabi

farah.magrabi@mq.edu.au

Ensuring that when we care for patients, we do not harm them is one of the greatest challenges of health service delivery. Our research is examining how healthcare can be made safer through the effective use of digital health. We are also investigating the clinical safety and effectiveness of AI technologies in healthcare. Our work is used nationally and internationally by healthcare organisations, government departments, patient safety agencies and industry.

In 2020, Associate Professor Farah Magrabi was named Australian field leader for medical informatics by *The Australian* newspaper. The field leader is the Australian researcher with the highest number of citations from papers published in the last five years in the 20 top journals in their field.

CONSUMER INFORMATICS
Dr Annie Lau

annie.lau@mq.edu.au

Consumer Informatics investigates the science, design and impact of digital health for patients and consumers. We are passionate about understanding and improving the health of individuals through the use of digital technology.

We work closely with patients, consumers, clinicians and multidisciplinary colleagues to identify important gaps, and together develop innovative ideas and apply rigorous methods to test the boundaries of how digital technologies can improve health.

During 2020, we welcomed three new Master of Research students to investigate how digital health and health services for patients and consumers have transformed during the COVID-19 pandemic.

DIGITAL EPIDEMIOLOGY
Associate Professor Adam Dunn

The Digital Epidemiology team applies machine learning and network science to solve problems in the production, reporting, and use of evidence in clinical medicine and public health. The team finished their work on an NHMRC-funded project with a paper in the *American Journal of Public Health* showing that vaccine misinformation makes up a tiny proportion of the information Twitter users see about vaccines. Samia Amin submitted her thesis on social factors affecting e-cigarette use; Markye Steffens submitted her thesis on promoting vaccines in online environments; and Eliza Harrison received the Executive Dean's Commendation for her Masters thesis on identifying health questions and recommendations on Reddit.

DIGITAL SCRIBES
Professor Enrico Coiera
enrico.coiera@mq.edu.au

Modern electronic health record systems are often unwieldy and can lead to clinician burnout because of the additional workload such systems can impose. Our researchers are working on creating a Digital Scribe which would use speech recognition and AI to transcribe and summarise spoken consultations between doctors and patients and automate record creation. Our research is showing many technical challenges remain before such systems come into routine practice and perform to their full potential. With five papers published in 2020 the team is internationally pioneering in this new informatics challenge.

L-R: Professor Enrico Coiera, Associate Professor Shlomo Berkovsky, Associate Professor Farah Magrabi, Dr Annie Lau and Associate Professor Adam Dunn

Centre for Health Systems and Safety Research

From hospitals to aged care services, health information technologies are designed to make things better – from greater efficiency to improved patient safety. However, the implementation of these technologies is complex and often disrupts healthcare delivery. The Centre for Health Systems and Safety Research (CHSSR) continues to tackle important research questions about how health information technologies can be designed and utilised to deliver improved outcomes for Australians.

Effective information exchange, communication and teamwork are essential elements of the patient safety puzzle. Through our design and application of complex multi-method evaluation models our research is delivering high-quality evidence to inform decision making and drive changes in healthcare policy and practice.

"**During a very challenging year our researchers have responded in a range of areas, delivering important evidence about how COVID-19 impacted the use of GP services, and how older Australians fared during lockdown.**"

PROFESSOR JOHANNA WESTBROOK

Professor Johanna Westbrook is recognised with the NHMRC Elizabeth Blackburn Investigator Grant Award for Leadership in Health Services Research.

MACQUARIE University | The Lighthouse
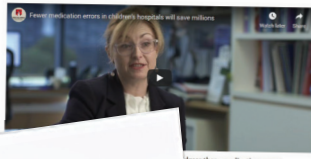
OUR STORIES

Fewer medication mistakes in children's hospitals will save millions

RESEARCHER
Professor Joanna Westbrook

WRITER
Fran Molloy

DATE
10 March 2020

FACULTY
Faculty of Medicine and Health Sciences

TOPIC
Our Stories
Health and Medicine

SHARE

New research shows that electronic medication support technology can reduce drug errors in children's hospitals by as much as 40 per cent.

Medication errors cost an estimated $1.3 billion each year in Australia alone, causing potential harm and longer hospital stays - and they pose a major safety challenge in hospitals around the world.

Fewer medication errors in children's hospitals will save millions

...dress these medication errors.

RESEARCH IMPROVES THE EARLY DETECTION OF SEPSIS

The Sydney Morning Herald

NATIONAL   AGED CARE

Far from happy bowels: The most common condition afflicting aged care residents

By Julie Power
October 20, 2020 — 12.00am

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Happiness is a healthy bowel, some experts say. Yet new research shows 70 per cent of residents in aged care facilities suffer chronic constipation, making the condition more common than dementia, hypertension, arthritis and depression.

Over 30 months, the average time in care of each resident, the median number of laxatives taken by residents was 684 – about one a day. The results were uncovered in a review of 9436 residents' electronic health records at 68 aged care facilities in NSW and the ACT by researchers from Macquarie University.

The paper's authors, Dr Kimberly Lind and Dr Magda Raban, from Macquarie's Australian Institute of Health Innovation, were surprised by the size of the problem, particularly as constipation has a major impact on a resident's quality of life and can lead to serious complications.

Pressure is growing on the aged care sector.   GETTY

croakey

At Taronga TV, watch a pygmy marmoset and an echidna puggle, as well as many other animals (stills from video footage)

Some timely suggestions for social care for older people

InSight+

10 February 2020

Nudging: can letters to GPs reduce antipsychotics in aged care?

Authored by

JUST before Christmas 2019, GPs received a letter from the Department of Health that caused concern.

The Interim Report of the Royal Commission into Aged Care Quality and Safety, titled Neglect, identified the overuse of chemical restraint as requiring urgent action. In December 2019, the Department of Health announced that GPs who are high prescribers of antipsychotics and benzodiazepines in residential aged care facilities (RACFs) would receive a letter containing data on the individual GPs prescribing patterns in comparison to their peers.

THE MANDARIN

HOME   EDITORS' PICKS

Amid the rush to telehealth, let's ensure we address these cautions and questions

Brain Bootcamp, a pioneering initiative targeting better brain health for older adults, is launched.

An innovative macro is developed that can be applied to data in residential aged care electronic health records, including free text, to measure the prevalence of 60 health conditions.

The first nine pathology professionals complete the new Evidence-based Laboratory Medicine program, producing a systematic review of the literature for nine different pathology tests. This has provided evidence for critical alert thresholds, which the Royal College of Pathologists of Australasia and Australasian Association for Clinical Biochemistry and Laboratory Medicine (RCPA-AACB) High Risk Results Working Party are now harmonising.

A Digital Health Cooperative Research Centre grant is received to identify and report on emerging trends related to COVID-19, its diagnosis, treatment and medications prescribed, and its impact on patients and general practice.

The results of the 'Enhancing patient outcomes through evaluation of the appropriateness and quality use of pathology in general practice' project for the Department of Health Quality Use of Pathology Program are published and promoted nationwide.

The findings of the Epidemiology of Sepsis in Australian Public Hospitals: A Mixed Methods, National Longitudinal Study (2013–2018) are used by the Australian Commission on Safety and Quality in Health Care to inform the national program to improve sepsis outcomes.

Results from the collaborative NHMRC Partnership Project with the Sydney Children's Hospital Network and eHealth NSW are applied to inform the review and clarification of aspects of medication policy and enhancements to design elements of the electronic medication system.

Analysis published in *BMJ Quality and Safety* of more than 5000 observed medication administrations in hospital points to further investigation required into the effectiveness of nurse double-checking.

First research in Australia showing that programs to strengthen the ability of hospital staff to speak up about unprofessional behaviour could help mitigate the negative impact of bullying and incivility in the workplace, is published in *MJA*.

Volunteers pack more than 1000 Brain Bootcamp packs to go to older Australians.

Research Streams CHSSR

DIAGNOSTIC INFORMATICS
Professor Andrew Georgiou
andrew.georgiou@mq.edu.au

Diagnostic Informatics encompasses major areas of research across the diagnostic analytical process. This ranges from the clinical choice of diagnostic request, the quality and efficiency of the analytical process, right through to the interpretation and follow-up of test results and their impact on patient care outcomes.

Diagnostic Informatics involves laboratory medicine, anatomic pathology and medical imaging. Whilst diagnostic testing may account for a small (less than 5%) proportion of most hospital budgets, it is considered to have a huge influence on medical decision-making. It underpins much of our healthcare system, generating information that is crucial to the prevention, diagnosis, prognosis, stratification of risk and treatment of disease.

AGED CARE EVALUATION AND RESEARCH
Dr Mikaela Jorgensen

Aged Care Evaluation and Research seeks to improve the health and wellbeing of older Australians through enhancing the delivery of aged care services. As use of new information technologies increases in aged care, we are focused on:

- incorporating digital health, such as use of clinical information systems, client-focused health devices, and health and aged care data to support care coordination across an older person's healthcare journey
- developing new approaches to support care providers to improve meaningful outcomes such as quality use of medications and quality of life
- co-designing research with relevant stakeholders including aged care clients and workforce, to align with their needs and preferences

HEALTH ANALYTICS
Associate Professor Ling Li
ling.li@mq.edu.au

Health Analytics delves beneath the surface of complex, rich health data to reveal hidden issues and possibilities. The ongoing rollout of electronic health records across modern healthcare systems presents unprecedented opportunities to harness large volumes of data. Our foci are:

- to develop and apply rigorous, cutting-edge data analytic methods to evaluate the impact of digital health interventions on patient safety and outcomes
- to utilise rich dynamic electronic health record data to improve patient care delivery
- to provide real-time information that can support decisions and deliver actionable insights.

Sepsis detection and care pathways continue to be a major focus, with two papers published and the receipt of an international student higher degree research scholarship.

MEDICATION SAFETY AND ELECTRONIC DECISION SUPPORT
Dr Magda Raban

magda.raban@mq.edu.au

Medication Safety and Electronic Decision Support focuses on evaluating and optimising electronic systems to improve the delivery of care and health outcomes. Our research spans multiple health settings, including hospitals and residential aged care.

Research has highlighted the limitations of electronic medication systems in aged care with respect to medication workflow within facilities and externally with GP systems.

WORK INNOVATION, COMMUNICATION AND E-HEALTH
Dr Neroli Sunderland

Work Innovation, Communication and e-Health examines the ways in which clinical care is delivered. Our team applies a broad range of methods (e.g., direct observation methods, social network analysis, qualitative techniques) to learn more about clinician work patterns as well as identify factors that can influence workflow, task errors, and staff and patient wellbeing and safety.

From 2021, this research stream will broaden its focus to Healthcare Engagement and Workplace Behaviour.

L-R: Professor Andrew Georgiou, Dr Mikaela Jorgensen, Associate Professor Ling Li, Dr Magda Raban and Dr Neroli Sunderland

Health System Sustainability
NHMRC Partnership Centre

NHMRC Partnership Centre for Health System Sustainability

PCHSS LEAD INVESTIGATORS AND PARTNER ORGANISATIONS

WESTERN AUSTRALIA
Dr Delia Hendrie [RL]
Prof Elizabeth Geelhoed [RL]
Dr Darren Gibson [RL]
WA Dept of Health*

NORTHERN TERRITORY
Department of Health, NT*

SOUTH AUSTRALIA
Prof Jon Karnon [RL]
PHN Country SA*
PHN Adelaide*

VICTORIA
Prof Tony Scott [RL]
Prof Rachelle Buchbinder AO [RL]
Prof Helena Teede [RL]
Circle Health*
Monash Partners*
Dept of HHS Victoria*
PHN South Eastern
Melbourne*
Cabrini Health*

TASMANIA
University of Tasmania*
Dept of HHS Tasmania*
PHN Primary Health Tasmania*

QUEENSLAND
Prof Paul Glasziou [RL]
Prof Leonard Gray [RL]
Prof Robyn Ward AM [RL]
Metro South Health*
Queensland Health*
PHN Brisbane South*
James Cook University*

NEW SOUTH WALES
Prof Jeffrey Braithwaite [CIA]
Prof Enrico Coiera [RL]
Prof Johanna Westbrook [RL]
Dr Teresa Anderson [RL]
Dr Jean-Frédéric Levesque [RL]
Mr George Leipnik [RL]
Mr James Downie [RL]
Prof Christine Bennett AO [RL]
Ms Annette Schmiede [RL]
Sydney LHD and Sydney
Health Partners*
Macquarie University Hospital*
PHN Sydney North
Health Network*

ACT
Ms Leanne Wells [RL]
ACT Health*

CIA – Chief investigator first listed
RL – Research lead investigator
* System-based implementation partner organisation

NATIONAL COLLABORATORS
Consumers Health Forum of Australia
Aged Care Guild
Independent Hospital Pricing Association
HammondCare

FUNDING PARTNERS

Australian Government
National Health and Medical Research Council

Bupa

THE UNIVERSITY OF NOTRE DAME AUSTRALIA

NSW

Government of **Western Australia**
Department of **Health**

The Governance Authority for the PCHSS comprises representatives of the NHMRC and its Funding Partners: Bupa Health Foundation, NSW Health, University of Notre Dame and Western Australia Department of Health. It is currently co-chaired by Associate Professor Annette Schmiede, former Executive Leader of Bupa Health Foundation, and Mr George Leipnik from the NSW Ministry of Health.

Health System Sustainability
NHMRC Partnership Centre

OUR VISION

To produce research that contributes to the development of a resilient health system – one that is affordable, cost-effective, and delivers improved health outcomes for all Australians.

The NHMRC Partnership Centre for Health System Sustainability (PCHSS) is a $10.75 million, five-year collaboration involving 17 lead investigators, 20 expert advisers, and over 40 system implementation partners from around Australia. The Centre is led by Professor Jeffrey Braithwaite. In 2020, the Centre continued its internationally recognised research into improving health services and systems.

ADDRESSING THE CHALLENGES

We are committed to generating and disseminating ideas and evidence to improve the performance of the health system so that it delivers care efficiently and effectively over the long-term. Our Centre seeks to maximise health system improvement in the real-world by bringing together people who provide, plan, and need healthcare.

ACHIEVEMENTS IN 2020

PCHSS was associated with over 230 published papers relating to the sustainability of national and international health systems in 2020. Our research also contributed substantially to the understanding of the effect of the COVID-19 pandemic on health systems through the publication of 19 papers and reports. For example, Professor Len Gray's team documented the meteoric rise in telehealth usage in Australia since the change in financial incentives at the start of the pandemic. Professor Tony Scott's work revealed the extent of the financial and emotional stress that the pandemic has caused health professionals.

THE THREE BROAD THEMES OF OUR RESEARCH

Using analytics, technology and shared data

Reducing waste and low-value care

Promoting better value for the health dollar

Research by Professor Paul Glasziou showed that COVID-19 has exacerbated the problem of research waste due to fragmented funding, poorly designed research, and duplication of effort. From a systems perspective, Professor Braithwaite's work assessed how governments' capacity to respond, stringency of response, and scope of testing affected death rates in 40 countries. This research demonstrated that broad-based testing was key to managing COVID-19.

PCHSS research generated over 360 radio, television, news articles, and commentaries in the popular press, which attests to its currency and relevance. We expanded our public engagement through a six-part webinar series on topics ranging from the impact of COVID-19 on the health workforce to the role of consumers in creating

sustainable health systems. We also worked closely with partners and collaborators, including over 60 health system researchers, 32 non-academic institutions, and health consumer researchers.

PCHSS investigators, since inception, have generated over $62 million in new grant funding, including during 2020 grants for research on improving health communication through engagement with the early childhood sector, implementing new clinical decision support tools in emergency departments, and researching innovative models of care delivery for a new hospital facility.

Visit our website:
healthsystemsustainability.com.au

USING ANALYTICS, TECHNOLOGY AND SHARED DATA

Professors Johanna Westbrook, Enrico Coiera and Len Gray

This research theme tackles important questions in informatics and healthcare, including using big data to improve care, diagnostic testing, and medication management, as well as designing analytics to guide better healthcare decisions. Researchers are also examining the role of telehealth.

HIGHLIGHTS

ELECTRONIC MEDICATION ADMINISTRATION

The importance of electronic health records has been demonstrated for medication management, improving patient safety, and for their potential to reduce costs to the health system. During 2020, research showed that electronic medication systems significantly reduce the number of prescribing errors in hospitals, and data from electronic health records enables monitoring of antibiotic use and overuse in residential aged care facilities.

RISK TRIGGER MONITORS

Risk trigger monitors are automated tools that can support prospective near real-time detection of adverse events by monitoring electronic health record data for flags that suggest potential medical harm. An assessment has been completed of the implementation of one of these tools in two NSW hospitals.

TELEHEALTH

COVID-19 resulted in the wide adoption of telehealth for healthcare delivery when new Medicare Benefits Schedule items were fast-tracked to incentivise greater access to telehealth. In response, telehealth user guides were rapidly devised that included best practice for health professionals and consumers to make the most of telehealth consultations. The team also documented the enormous rise in telehealth usage – seven million telehealth appointments were billed in just six weeks – and its impact on health professionals and consumers.

Health System Sustainability
NHMRC Partnership Centre

REDUCING WASTE AND LOW-VALUE CARE

Professors Paul Glasziou and Rachelle Buchbinder

Approximately 30% of delivered healthcare is wasteful or of low-value. Researchers from this stream are finding ways to reduce wasteful expenditure and to deliver needed care more cost-effectively.

41%
prostate cancers likely over-diagnosed

HIGHLIGHTS

CANCER OVER-DIAGNOSIS
Patients and general practitioners are being brought together to co-design interventions to ensure prostate-specific antigen (PSA) testing is timed in line with current recommendations. This will feed into co-design of a suite of interventions to reduce waste from unnecessary tests that can lead to overtreatment, with 41% of prostate cancers likely over-diagnosed, that is identification of cancer that does not require treatment.

HOSPITAL IN THE HOME
Cost-effective and high-quality care are corner stones of a sustainable health system. Alternative service models of care are being explored to determine their effect on patients and the health system. An analysis has been completed on the uptake of and trends over time in the usage of Hospital in the Home as a care delivery mode by Australian private hospitals.

We congratulate Professor Rachelle Buchbinder. Who received the Order of Australia for distinguished service to medical education in the fields of epidemiology and rheumatology, and to professional associations.

PROMOTING BETTER VALUE FOR THE HEALTH DOLLAR

Professors Tony Scott and Jon Karnon and Dr Delia Hendrie

This research group is developing new frameworks and metrics to improve health system sustainability and to promote value-based healthcare.

15%
private health insurance users downgrading or dropping their insurance

HIGHLIGHTS

PRIVATE HEALTH INSURANCE

The number of people reducing or cancelling their private health insurance cover in Australia has been increasing since 2015. New research revealed the trend continued during the pandemic with 15% of private health insurance users downgrading or dropping their insurance during 2020. The research suggests that many Australians view private health insurance as poor value for money.

EMBEDDED ECONOMIST

The 'Embedded Economist' project, which links economists with healthcare managers to co-design health services for Primary Health Networks and Local Health Networks, began in 2020.

RESEARCH TRANSLATION PROGRAM

The impact of the Western Australian Department of Health Research Translation Projects program is being evaluated using a realist evaluation and program theory development to examine the mechanisms by which the program contributes to health system sustainability.

Health System Sustainability
NHMRC Partnership Centre

OBSERVATORY ON HEALTH SYSTEM SUSTAINABILITY

Professor Jeffrey Braithwaite and Associate Professor Yvonne Zurynski

The Observatory is led by Professor Jeffrey Braithwaite and Associate Professor Yvonne Zurynski, Australia's first associate professor for health system sustainability. The Observatory oversees partnership-wide activities, coordinates engagement with investigators, stakeholders, and funders and conducts research.

60%
of care is delivered in line with evidence or consensus-based guidelines

30%
of care has little or no value for the patient

10%
of care is harmful

Harnessing Digital Technologies to Enhance Patient Safety

PCHSS Webinar
25 November 2020

HIGHLIGHTS

COVID-19
Professor Braithwaite and colleagues contributed several substantial pieces of work towards our understanding of the impact of the COVID-19 pandemic on health systems in Australia and internationally. Examples include an international survey of COVID-19 management strategies in 97 countries and across all World Health Organization regions, and a paper that accessed data from 40 health systems to identify factors associated with COVID-19 death rates.

LEARNING HEALTH SYSTEMS
Professors Braithwaite, Glasziou, and Westbrook's article in *BMC Medicine* described one of the Gordian knots of healthcare. In this article, the authors explain that 60% of care is delivered in line with evidence or consensus-based guidelines. 30% has little or no value for the patient, and 10% is harmful. These numbers have not changed in three decades. The authors

proposed that the adoption of a deep learning health system may address this recalcitrant problem.

HEALTH CONSUMERS
Leveraging the close collaboration between the PCHSS and the Consumers Health Forum of Australia, Associate Professor Zurynski led a survey of consumer sentiment about the Australian health system. Results showed that, even before the pandemic, Australians were concerned about healthcare affordability, adequate access to medicines, health workforce capacity, and the quality of aged care facilities.

ENGAGEMENT
Editorials were published in a number of outlets such as *Croakey.org*, *MJA Insight+*, and *The Conversation*. These included articles on telehealth, the economic and social impact of COVID-19 restrictions, and AI in healthcare. Webinars and videos are available on the PCHSS YouTube channel.

PCHSS Investigators

Digital Health
NHMRC Centre of Research Excellence in Digital Health

NHMRC Centre of Research Excellence in Digital Health

The NHMRC Centre of Research Excellence in Digital Health (CREiDH) is a national research group bringing together the major Australian centres of health informatics research. The CREiDH delivers an integrated research program to address critical evidence gaps that limit our national capacity to exploit digital technologies in healthcare. Our translation program delivers evidence-based recommendations to government, health services, consumers, clinicians and industry; and through our Australasian Fellowship by Training Program we train the health informatics workforce of the future.

CREiDH is led by Professor Enrico Coiera and administered by AIHI, with full details on our website: **digitalhealth.edu.au**

HIGHLIGHTS

ACCELERATED SYSTEMATIC REVIEWS

The Accelerated Systematic Review program (known as 2-week systematic reviews) continues to be expanded and enhanced with nine systematic reviews produced, ranging from a remarkable five to 18 days for completion of each.

AI-BASED MEDICAL DEVICES

A review of AI-based medical devices approved by the US Food and Drug Administration over the last two years has been completed. Findings included that the AI systems had limited autonomy, requiring clinicians to confirm information provided by devices and to be responsible for decisions. Going forward, the relationship between clinician and AI systems needs to be more carefully designed, focusing on clinical tasks and workflows.

SELF-MANAGEMENT

Self-management is a critical component of chronic disease management. To better study the lives of patients in their homes, a new methodology was developed that utilises deep learning to classify images of daily living collected from body cameras on patients who have multimorbid type 2 diabetes. Results uncovered the challenges people experience as well as the strategies they adopt in their daily routines. This new methodology allows a more tailored approach to improve self-care capability on an individual level.

FELLOWSHIP BY TRAINING PROGRAM

The Australasian Fellowship by Training Program continues to develop leadership capability in the health informatics workforce with two candidates completing the program in 2020 and joining the community of Fellows, Australasian Institute of Digital Health. The Program delivers strong learning outcomes through journal clubs, master classes and arranging candidates' participation in conferences and colloquiums as well as securing work placements.

RESEARCH PARTNERS

Professor Enrico Coiera
AIHI, Macquarie University

Professor Paul Glasziou
Bond University

Dr David Hansen
CSIRO Australian e-Health
Research Centre

Dr Anna Scott
Bond University

Professor Teng Liaw
University of New South Wales

**Associate Professor
Farah Magrabi**
AIHI, Macquarie University

Professor Vitali Sintchenko
University of Sydney

Professor Karin Verspoor
University of Melbourne

**Associate Professor
Shlomo Berkovsky**
AIHI, Macquarie University

Dr Annie Lau
AIHI, Macquarie University

Dr Anthony Nguyen
CSIRO

Dr Hamed Hassanzadeh
CSIRO

Mr Justin Clark
Bond University

Implementation Science
in Oncology
NHMRC CENTRE OF RESEARCH EXCELLENCE

NHMRC Centre of Research Excellence

IN IMPLEMENTATION SCIENCE IN ONCOLOGY

The NHMRC Centre of Research Excellence in Implementation Science in Oncology seeks to characterise oncology service provision as a basis for understanding the barriers and facilitators to the prompt uptake of evidence-based care in oncology. The Centre, led by Professor Jeffrey Braithwaite and Dr Gaston Arnolda, responded to changes driven by the COVID-19 pandemic and adapted the research program with highly productive outcomes. In addition, the following new research has commenced:

· a study of the personal accounts of younger people with colorectal cancer, in Australia, New Zealand and the United Kingdom, and contrasting the patient reported outcome measures (PROMs) of younger and older colorectal cancer patients in the USA
· a study of the speed of uptake of immunotherapies for cancer in Australia
· systematic reviews of telemedicine for oncology consultation and recommendations for staffing of oncology outpatient services

Visit our website:
creiso.edu.au

HIGHLIGHTS

PUBLISHING A SYSTEMATIC REVIEW IN *BMC HEALTH SERVICES RESEARCH*
On clinicians' attitudes to patient reported outcome measures (PROMs) in oncology practice.

PUBLISHING A SYSTEMATIC REVIEW IN *IMPLEMENTATION SCIENCE*
On clinicians' attitudes to clinical practice guidelines in oncology.

PUBLISHING A SYSTEMATIC REVIEW IN *JOURNAL OF EVALUATION IN CLINICAL PRACTICE*
Of nudges to alter clinician behaviour; 'nudges' are modifications of choice architecture that encourage, but do not mandate, specific choices.

CHIEF INVESTIGATORS

Professor Jeffrey Braithwaite
AIHI, Macquarie University

Professor Robyn Ward AM
University of Sydney

Professor David Currow
Flinders University

Professor Geoff Delaney
South-Western Sydney Local Health District

Professor Richard Kefford AM
Macquarie University

Professor Ian Olver AM
University of Adelaide

Professor Jonathan Karnon
Flinders University

Professor Phil Crowe
University of New South Wales

Associate Professor Winston Liauw
South-Eastern Sydney Local Health District

Professor Johanna Westbrook
AIHI, Macquarie University

Higher degree research program

2020 HIGHLIGHTS

PhD

22 Candidates
5 Thesis Submissions

MRes

9 Candidates
5 Thesis Submissions

Study with AIHI provides unique access to the expertise and experience of an internationally recognised pool of researchers who support and supervise students across a broad range of disciplines. Our postgraduate program places a strong emphasis on academic and professional development. Past doctoral candidates have progressed to senior roles in academia, health services and industry.

All AIHI postgraduate candidates are provided with opportunities to stay up-to-date with leading trends in health services research. They work with two or more experienced supervisors and are encouraged to interact with colleagues across AIHI, Macquarie University and MQ Health.

Read about our programs and be inspired with profiles of our PhD and Masters graduates:
goto.mq.edu.au/aihistudy

E: aihi.hdr@mq.edu.au

Access to the expertise and experience of an internationally recognised pool of researchers

REAL-WORLD LEARNING WITH PACE

The multi-award-winning PACE (Professional and Community Engagement) program at Macquarie University supports undergraduate students with authentic workplace experiences. In 2020, AIHI hosted 44 PACE students, placing them alongside academics and professional staff to participate in projects ranging from medical informatics to aged care.

ANYONE FOR LUNCH?

Recognising the specific challenges faced by early-career academics, AIHI supports the early-career researcher and higher degree researcher Lunch Club. The club provides monthly professional development and networking opportunities designed to enhance the experience and career prospects of our rising researchers. While COVID-19 put a stop to the pizza lunches, the sharing and support continued with the use of technology (pictured above).

NEW INTERNATIONAL HEALTH IT PHD PROGRAM

AIHI and Neu-Ulm University of Applied Sciences, Germany, commenced a joint international PhD program.

The program includes an 18-month placement of outstanding PhD candidates with the respective other research institution and undertaking highly innovative research on the use of information and communication technology in healthcare. The first student in the program, Tanja Schroeder, has commenced her PhD in Germany titled: Employing technology acceptance models to evaluate the utilisation of information technologies among older adults.

Tanja Schroeder

Doctor of Medicine research program

The Macquarie University Doctor of Medicine (Macquarie MD) program has a culture of transformative learning. Doctors of the future need to be well versed not only in observing and acting on the signs and symptoms of ill-health, but also in understanding the importance of keeping abreast of the latest research evidence in the field, and understanding where and how to access the sources of that evidence. To facilitate this, the Macquarie University MD Program, led by the Faculty of Medicine, Health and Human Sciences, prides itself in offering a rigorous and structured research program, where evidenced-based and patient-focused medical skills are taught, and students manage their own research projects in such a way that skills acquired can be applied throughout their medical career. AIHI's Professor Frances Rapport oversees the MD students' 18-month research projects.

Our staff

AIHI academic and professional staff deserve the highest regard for their resilience during the challenging year of 2020. With their dedication and professionalism, we were able to adapt to COVID-safe work practices and maintain or adjust our programs of research. We formed new collaborations and benefited from the support of long-term working relationships.

AIHI is thriving with more than 180 academic and professional staff and honorary appointments.

We attract highly skilled clinicians, pharmacists, scientists, engineers, epidemiologists, statisticians, psychologists and analysts who develop expert communities of practice, multi-disciplinary research teams and synergistic networking and co-authorship. A full list of staff is available on our website: **aihi.mq.edu.au**

Award highlights

MS SABA AKBAR
Recognised by the *Journal of the American Medical Informatics Association* for an article in Top 10 Articles by Full-Text Views in the Last 12 Months.

DR ANDREA SMITH
Awarded Best of the Best Oral Presentation in Implementation Science at the Clinical Oncology Society of Australia Conference; and Top 10 Posters at the Cancer Survivorship Conference.

DR KAREN HUTCHINSON, PROFESSOR JEFFREY BRAITHWAITE AND PROFESSOR FRANCES RAPPORT
Awarded Special Commendation Poster Award at Epilepsy Society of Australia Virtual Annual Scientific Meeting.

DR KATHLEEN YIN
Awarded Early Career Researcher Showcase Faculty prize, Faculty of Medicine, Health and Human Sciences, Macquarie University.

DR KIM LIND
Received the Macquarie University Faculty of Medicine, Health and Human Science's EnCourage Early Career Researcher Publication Award.

DR LILIANA LARANJO
Recognised by the *Journal of the American Medical Informatics Association* for review on conversational agents in healthcare as among the Top Cited Articles 2019 Impact Factor and also the top article from issues published in 2018 or later which have received the most citations so far.

DR MITCHELL SARKIES
Received the David Sackett Award for the Best Paper by a Young Investigator as First Author, from the *Journal of Clinical Epidemiology*.

DR MITCHELL SARKIES
Received the Macquarie University Faculty of Medicine, Health and Human Science's EnCourage Best Early Career Researcher Poster Award.

DR MOHAMED KHALIFA
Awarded Best Paper in the clinical decision support section of the *International Medical Informatics Association Yearbook 2020*.

ASSOCIATE PROFESSOR FARAH MAGRABI
Named Research Field Leader for Medical Informatics by *The Australian* newspaper.

ASSOCIATE PROFESSOR FARAH MAGRABI
Appointed Fellow of the American College of Medical Informatics.

PROFESSOR JOHANNA WESTBROOK
Recognised by *BMJ Quality and Safety* for the Top 10 2020 article Associations between double-checking and medication administration errors: a direct observational study of paediatric inpatients.

PROFESSOR JOHANNA WESTBROOK
Awarded the NHMRC Elizabeth Blackburn Investigator Grant Award (Leadership in Health Services Research).

Institute engagement

AIHI is dedicated to providing a public forum for the sharing of ideas, new research and calls to action that invigorate debate and contribute to improving the health system in Australia and internationally. Following are two of the most popular sessions held during 2020.

THE ARC GLOBAL ECOSYSTEM: ACCELERATING TRANSFORMATIVE INNOVATIONS IN HEALTHCARE

By collaborating with major hospitals and startups around the world, Israel's Sheba Medical Centre launched ARC, a global ecosystem that aims to develop, pilot and roll-out more consumer-based solutions for sustainable healthcare. Dr Eyal Zimlichman, Chief Medical Officer and Chief Innovation Officer at Sheba Medical Centre, described how ARC prioritises innovations in digital health as the main change vehicle for transformation.

TRANSFORMING THE AUSTRALIAN HEALTHCARE SYSTEM THROUGH INTEGRATED CARE: THE NEED FOR TRANSLATIONAL RESEARCH

For many years in Australia there has been a growing realisation that it's health and care systems require significant change to promote higher value care. During this presentation, Professor Nick Goodwin, Director, Central Coast Research Institute, Faculty of Health and Medicine, University of Newcastle, and Director of Research, Central Coast Local Health District, unpacked the meaning, logic and importance of integrated care for the Australian context. He argued that integrated care is primarily an implementation and change strategy and, as such, research and evaluation must adapt to understand how integrated care operates.

Professor Andrew Georgiou

Our publications

1 JANUARY TO 31 DECEMBER 2020

1	**14**	**242**	**9**	**14**
Edited book	Book chapters	Peer reviewed journal articles	Letters to the editor and editorials	Conference proceedings

EDITED BOOK

1. Rapport, F & Braithwaite, J 2020, *Transforming healthcare with qualitative research*. Routledge Studies in Health and Social Welfare, vol. 18, Routledge, New York.

BOOK CHAPTERS

1. Augustsson, H, Churruca, K & Braithwaite, J 2020, Much more than old wine in new bottles: Soft Systems Methodology (SSM) for healthcare improvement. in F Rapport & J Braithwaite (eds), *Transforming healthcare with qualitative research*. Routledge Studies in Health and Social Welfare, vol. 18, Routledge, New York, pp. 179-189.

2. Best, S, Long, JC, McPherson, E, Taylor, N & Braithwaite, J 2020, Deep inside the genomics revolution: on the frontlines of care. in F Rapport & J Braithwaite (eds), *Transforming healthcare with qualitative research*. Routledge Studies in Health and Social Welfare, vol. 18, Routledge, New York, pp. 167-178.

3. Braithwaite, J & Rapport, F 2020, Conclusion: On progress, directions and signposts to a transformed healthcare system. in F Rapport & J Braithwaite (eds), *Transforming healthcare with qualitative research*. Routledge Studies in Health and Social Welfare, vol. 18, Routledge, New York, pp. 190-219.

4. Churruca, K, Ellis, LA, Long, JC & Braithwaite, J 2020, "What on earth is going on and what should I do now?": sensemaking as a qualitative process. in F Rapport & J Braithwaite (eds), *Transforming healthcare with qualitative research*. Routledge Studies in Health and Social Welfare, vol. 18, Routledge, New York, pp. 157-166.

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LETTERS TO THE EDITOR

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CONFERENCE PROCEEDINGS

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Computing and 2020 ACM International Symposium on Wearable Computers, UbiComp/ISWC 2020, Virtual, Online, Mexico, 12/09/20.

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9175454, Institute of Electrical and Electronics Engineers (IEEE), pp. 2155-2158, 42nd Annual International Conferences of the IEEE Engineering in Medicine and Biology Society, EMBC 2020, Montreal, Canada, 20/07/20.

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AIHI grants awarded or under management in 2020

Title	Funding source	Investigators	Total awarded
NHMRC			
NHMRC Partnership Centre for Health System Sustainability (Includes partner funds: BUPA, NSW Health, and WA Health)	NHMRC	Braithwaite J Coiera E Westbrook J Glasziou P Karnon J Scott A Buchbinder R	$8,750,000
NHMRC Investigator Grant: Delivering safe and effective medication management technology now and for the future	NHMRC	Westbrook J	$2,500,000
NHMRC Centre of Research Excellence in Digital Health	NHMRC	Coiera E Glasziou P Runciman W Hansen D Liaw S Magrabi F Sintchenko V Verspoor K Gallego Luxan B Lau A	$2,498,649
NHMRC Centre of Research Excellence in Implementation Science in Oncology (CRE-ISO)	NHMRC	Braithwaite J Ward R Currow D Delaney G Kefford R Olver I Karnon J Liauw W Westbrook J	$2,495,783

Title	Funding source	Investigators	Total awarded
NHMRC Partnership Project: A dashboard of predictive analytics and decision support to drive care quality and person-centred outcomes in aged care (Includes partner funds: Anglicare and Sydney North PHN)	NHMRC	Westbrook J Georgiou A Lord S Gray L Day R Ratcliffe J Baysari M Braithwaite J	$1,836,150
Medical Research Future Fund (MRFF) Keeping Australians Out of Hospital	NHMRC	Braithwaite J Westbrook J Day R Levesque J Mitchell R Rapport F Cutler H Tran Y Clay-Williams R	$1,505,612
NHMRC Investigator Grant: Designing and implementing a real-world learning healthcare system: operational knowledge, data and practice for clinical microsystems of the 21st Century	NHMRC	Braithwaite J	$1,350,000
NHMRC Partnership Project: Creating a culture of safety and respect: a controlled, mixed methods study of the effectiveness of a behavioural accountability intervention to reduce unprofessional behaviours (Includes partner funds: St Vincent's Health Australia)	NHMRC	Westbrook J Braithwaite J Day R Middleton S Scott D Rapport F Mitchell R Baysari M Li L Taylor N	$1,225,978
NHMRC Project Grant: CareTrack Aged: Appropriate care delivered to Australian living in residential aged care	NHMRC	Braithwaite J Cameron I Kitson A Reed R Georgiou A Gray L	$1,157,722

Title	Funding source	Investigators	Total awarded
NHMRC Partnership Project: Delivering safe and effective test result communication, management and follow-up (Includes partner funds: South Eastern Area Laboratory Service, Australian Commission on Safety and Quality in Health Care)	NHMRC	Georgiou A Westbrook J Greenfield D Horvath A Wakefield D Li L Hillman K	$1,133,359
NHMRC Partnership Project: Delivering safe and effective care for children in hospital with eHealth systems (Includes partner funds: Sydney Children's Hospitals Network, eHealth NSW, and NSW Office of Kids and Families)	NHMRC	Westbrook J Georgiou A Day R O'Brien T Karnon J Dalla-Pozza L Cowell C Li L Baysari M Ambler G	$1,082,805
NHMRC Project Grant: New methods for tracking the influence and geospatial clustering of vaccine misinformation	NHMRC	Dunn A Leask J	$476,648
NHMRC Early Career Fellowship: Optimising eHealth systems to improve medication safety and patient outcomes	NHMRC	Raban M	$347,952
NHMRC Partnership Project: Delivering precision diagnosis to patients with mitochondrial disease: Using digital technologies to enhance the delivery pathway to provide an accurate genetic diagnosis for patients with mitochondrial disease	NHMRC	Sue C Kummerfeld S Barlow-Stewart K Schofield D Coiera E Berkovsky S Davis R	$155,900
NHMRC Centre of Research Excellence in Interactive Digital Technology to Transform Australia's Chronic Disease Outcomes	NHMRC	Oldenburg B Maddison R Kostakos V Boyle D Borland R Lau A Furler J Scuffham P Abraham C Taylor C	$115,000

Title	Funding source	Investigators	Total awarded
NHMRC Centre of Research Excellence: Protecting the public from emerging infectious diseases	NHMRC	Sorrell T Sintchenko V Cheng A Gilbert G Holmes E Howden B Smith D Coiera E Iredell J Jones C	$87,004
NHMRC Project Grant: Preventing chronic disease in patients with low health literacy using e-health and teamwork in primary health care	NHMRC	Harris M Stocks N Nutbeam D Zwar N Karnon J Denney-Wilson E Noakes M Liaw S Lau A	$79,564

OTHER

Title	Funding source	Investigators	Total awarded
COVID-19 – utilising near real-time electronic General Practice data to establish effective care and best-practice policy	Digital Health CRC	Georgiou A Wabe N Hardie R Imai C McLeod A Pearce C	$1,010,000
Person, tumor and system-focused knowledge to drive better outcomes in melanoma	University of Sydney	Braithwaite J Rapport F	$589,707
Murdoch Children's Research Institute Placement Agreement	Murdoch Children's Research Institute	Braithwaite J	$525,000
Towards an innovative, far-reaching research-based solution for the local community	NSW Health Infrastructure	Clay-Williams R Hibbert P Arnolda G Rapport F Mitchell R Zurynski Y Long J Braithwaite J	$394,000

Title	Funding source	Investigators	Total awarded
Paediatric Precision Oncology Implementation Science	Children's Cancer Institute Australia	Rapport F Braithwaite J Long J O'Brien T Tyrrell V	$390,640
Using a life course approach to examine the influence of individual and psychosocial characteristics on individual trajectories though the health and aged care systems	NSW Health	Mitchell R	$360,939
Productive safety in the Emergency Department (ED): Developing ED safety capacity when responding to high patient demand and unexpected events	NSW Health	Clay-Williams R	$360,929
Redesigning patient experience in health service navigation using digital technology	NSW Health	Lau A	$360,541
PSRACS participation in the CareTrack Aged research, a NHMRC-funded Project Grant	Victoria Department of Health and Human Services	Braithwaite J Hibbert P Wiles L	$357,603
Risk assessment project proposal	Medical Council of NSW	Clay-Williams R Arnolda G Tran Y Lystad R Mitchell R Hibbert P Braithwaite J	$353,280
Evaluation of the Delirium Clinical Care Standard	NSW Health	Mumford V	$293,506
Mackenzie's Mission	Australian Genomics Health Alliance	Braithwaite J Long J Best S	$250,000
Health System Sustainability	Independent Hospital Pricing Authority	Braithwaite J	$240,103

Title	Funding source	Investigators	Total awarded
Active Implementation of Australian Consensus Guidelines for the effective delivery of ethical services to patients with Mitochondrial Disorders	Mitochondrial Foundation Board	Christodoulou J Braithwaite J Long J Best S	$238,685
LifeSpan: an implementation evaluation	The Black Dog Institute	Zurynski Y Ellis L Long J	$227,966
NHMRC Investigator Grant DVC(R) Co-funding	Macquarie University	Westbrook J	$200,000
Independent file review to monitor the minor injury definition and threshold in the new CTP scheme	State Insurance Regulatory Authority	Mitchell R Braithwaite J Hibbert P	$173,997
Use it or Lose it? Maximising your brain health (Brain Bootcamp)	NSW Department of Planning, Industry and Environment	Siette J	$172,280
Computerised decision support to improve efficiency and outcomes of massive blood transfusion	Australian and New Zealand College of Anaesthetists	Sanderson B	$160,000
The impact of electronic clinical systems on medication safety and workload in oncology	Cancer Institute NSW	Westbrook J Baysari M Mumford V Li L	$160,000
Evaluation of My Health Record and Healthdirect Australia after hours GP helpline	Healthdirect	Westbrook J Baysari M Koyama A Nguyen A Van Dort B	$149,181
Data analysis and evaluation of the clinical outcomes of the electronic National Residential Medication Chart trial	Commonwealth Department of Health	Westbrook J Lind KE Nguyen A Gates P Raban M	$116,015

Title	Funding source	Investigators	Total awarded
Complex analysis of resident de-identified data	Commonwealth Department of Health	Westbrook J Lind KE Raban M Seaman K	$111,350
WOMBAT iOS development	Macquarie University	Westbrook J	$100,000
Variation in care for pancreaticoduodenectomy in NSW – an outcome and cost analysis	Cancer Institute NSW	Li L	$96,817
NHMRC Investigator Grant DVC(R) Co-funding	Macquaire University	Braithwaite J	$90,000
Sydney North Health Network Digital Test Beds Evaluation	Sydney North Health Network	Georgiou A Jorgensen M Siette J Nguyen A	$89,991
Impact of chronic illness and injury on school performance	Macquarie University	Mitchell R	$77,639
Comparison of outcomes with hearing aids and cochlear implants in adults with moderately severe to profound bilateral sensorineural hearing loss (COACH study): qualitative arm	Cochlear Ltd	Rapport F Hogden A Boisvert I	$72,480
Perceived improvement in quality of care	University of Wollongong	Mitchell R Wadolowski M Goodenough B Watts J	$69,614
Epidemiology of sepsis in Australian hospitals	Australian Commission on Safety and Quality in Health Care	Li L Rathnayake K Sunderland N Westbrook J	$69,353

Title	Funding source	Investigators	Total awarded
Private machine learning with omics data	Optus Macquarie University Cyber Security Hub	Berkovsky S	$64,759
Sepsis Analysis and Epidemiological Interpretation	Australian Commission on Safety and Quality in Health Care	Li L	$63,049
Review of the Southern Adelaide Local Health Network Continuous Improvement Program	Southern Adelaide Local Health Network	Hibbert P Braithwaite J Gardner C Wiles L Clay-Williams R	$62,256
Incident Management Systems – a national approach to enhance patient safety	Australian Commission on Safety and Quality in Health Care	Hibbert P Braithwaite J Clay-Williams R Blakely B	$56,036
Research on approaches for clinical governance of consumer digital health	Healthdirect	Magrabi F Coiera E	$54,657
Living Stroke Guidelines Evaluation	Stroke Foundation	Wiles L Hibbert P Zurynski Y Smith KL Arnolda G	$54,511
MindSEIS: Resilience, Mindfulness and Medication Safety with Electronic Systems	European Commission H2020 MSCA International Fellowship	Lichtner V Westbrook J	$53,346
Macquarie MINDS: Monitoring of injury and psychosocial health outcomes, career trajectories and continuing educatioN, LiveD experiences and Social connectedness	Macquarie University	Lystad R Peters L Johnstone M Ellis L	$49,994
Mitochondrial Disease Triage Tool	Kolling Institute	Berkovsky S	$49,409
Electronic medication management systems in residential aged care facilities – a literature scan	Australian Commission on Safety and Quality in Health Care	Raban M	$44,545

Title	Funding source	Investigators	Total awarded
iConnect: Capturing social interactions using wearable technology in residential aged care	Macquarie University	Siette J	$43,875
LMP: Evidence Check: Lifestyle modication programs	Sax Institute	Zurynski Y Smith K Siette J Nic Giolla Easpaig B	$40,000
Townsville Hospital and Health Services SPUR Project	Townsville Hospital and Health Service	Clay-Williams R Lane P Johnson A	$40,000
IT Safety at Telstra Health	Telstra Health	Magrabi F	$37,188
List of validated patient reported outcome measures	Australian Commission on Safety and Quality in Health Care	Ellis L Churruca K Pomare C	$36,243
Supporting materials for patient safety culture measurement: Parts A and B	Australian Commission on Safety and Quality in Health Care	Ellis L Tran Y Pomare C	$35,800
Evaluation Plan: MQ Health HeartConnect Service	MQ Health	Zurynski Y Wilcock S Naliliah C Lopez F Kmet W	$35,000
Evaluation of Community Connections Program	Enrich Living Services	Siette J	$34,595
Coupling results data from ClinicalTrials.gov and bibliographic databases to accelerate evidence synthesis	National Library of Medicine	Bourgeois F Dunn A Mandl K	$32,340

Title	Funding source	Investigators	Total awarded
Determining the role and responsibilities of the Australian Epilepsy Nurses in the management of epilepsy across primary and community care	University of Sydney	Rapport F Hutchinson K Herkes G Bleasel A Nikpour A Wong C Ireland C Bartley M Braithwaite J	$30,000
Computerised decision support to improve efficiency and outcomes of massive blood transfusion	National Blood Authority	Sanderson B	$30,000
Exploring the impact of child and placement characteristics, carer resources and perceptions, and life stressors on caregiving	Department of Communities and Justice	Mitchell R Ryder T Zurynski Y	$30,000
Evaluation of a peer support program at the Townsville Hospital	Townsville Hospital and Health Service	Clay-Williams R Austin E Ellis L Blakely B Lane P	$26,343
Effectiveness of mental health EMRs on usability, uptake and clinician and patient safety and quality outcomes	Sax Institute	Zurynski Y Clay-Williams R Ellis L	$26,000
Scoping barriers and finding solutions to research knowledge translation and implementation into the Australian health care system	Research Australia	Zurynski Y Braithwaite J Holt J	$25,272
Hospital Funding Models	Western Sydney Local Health District	Clay-Williams R Zurynski Y Long J Braithwaite J	$25,000

Title	Funding source	Investigators	Total awarded
Evaluating the value, role and responsibilities of the metastatic breast care nurse	Macquarie University and McGrath Foundation	Smith A Rapport F Braithwaite J Lewis S Mahony J Townsend J	$20,850
Safety audit of Communicare	Telstra Health	Magrabi F	$20,250
Monitoring the safety and quality of artificial intelligence (AI) systems in healthcare	Macquarie University	Magrabi F	$20,000
Bringing artificial intelligence into the real world of healthcare – the implementation challenge	Macquarie University	Coiera E	$20,000
Improving outcomes from high risk surgery: patient-centred advanced care planning	Townsville Hospital and Health Service	Clay-Williams R Senthuran S Lane P	$20,000
Improving long-term health outcomes for Australians with traumatic brain injury	Macquarie University	Lystad R	$19,916
MQSN Mind the gap - a computational model to understand bed block in public hospitals	Macquarie University	Clay-Williams R	$19,800
Special Donation Gastrointestinal Research	Macquarie University	Auton E	$19,571
Case studies on patient reported outcome measures	Australian Commission on Safety and Quality in Health Care	Ellis L Churruca K Mahmoud Z	$17,352
IT safety workshops	Telstra Health	Magrabi F	$16,938
Social Network Analysis of TCRN 2020	TCRN	Long J Pomare C	$14,230

Title	Funding source	Investigators	Total awarded
National injury prevention strategy – Literature Review	NSW Families and Child Services	Hunter K Ivers R Clapham K Curtis K Keay L Vallmuur K Brown M Mitchell R Scott D Cullent P	$6,000
Translating genomics into routine care using implementation science	Macquarie University Postgraduate Research Fund (PGRF)	Gul H	$5,500
Automation in nursing decision support systems: Evaluating effects on risk identification and decision making	Macquarie University	Akbar S	$5,000
Absent voices: Feasibility study exploring whole family experience in living with parental refractory epilepsy to inform service development	University of Technology Sydney	Hutchinson K Rapport F Braithwaite J Hofstaetter L Todd L Herkes G Bleasel A Wong C Nikpour A	$5,000
MQ Postgraduate Research Fund	Macquarie University	Pomare C	$4,915
MQ Postgraduate Research Research Funding	Macquarie University	Ludlow K	$3,747
Grand total funding			**$35,979,029**
Grants awarded			**91**

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