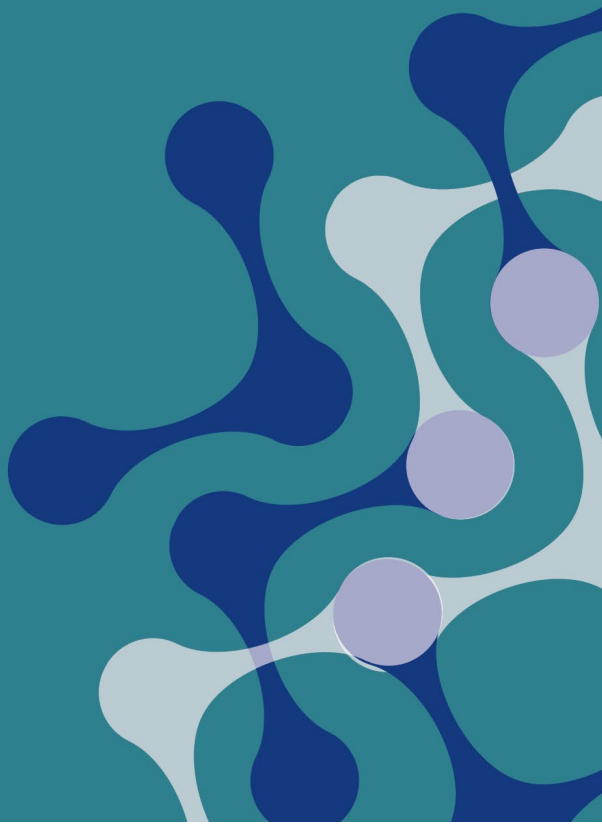
Office for Health and Medical Research

Impact and process evaluation of the NSW Health Early-Mid Career Grant Program

2024



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Foreword

The NSW Health Office for Health and Medical Research developed the Early-Mid Career Grant Program (the Program) as part of a package of measures within the Health Services Research Support Program, a comprehensive strategy designed to support frontline health and medical research and early-mid career researchers. The inaugural round of grants (titled NSW Health Early-Mid Career Fellowships) was launched in 2016.

The Program now offers grants of up to $500,000 over three years that may be used for salaries, professional development, and research costs, including consumables and equipment.

The Program focuses on five key aims:

1. attract and retain skilled early-mid career researchers within the health and medical research sector in NSW
2. support early-mid career projects that build capacity and capability in areas of identified need
3. support researchers to gain additional grants and fellowships from national competitive grant schemes, philanthropic sources and industry
4. encourage collaboration and leadership with the NSW health system, research and/or commercial environment to address areas of identified need
5. embed translation and planning through all stages of early-mid career grant projects.

An independent evaluation of rounds one and two of the Program was undertaken by Hunter Medical Research Institute (HMRI) during 2023-24. These rounds were designed to build a strong, vibrant, and highly skilled research workforce, to attract new researchers to the health and medical research sector in NSW, to retain existing talented early-mid career researchers, and to bridge the gap between research and policy and practice. The grants provided funding for the salary of the early-mid career fellow for up to three years and support for their professional development with a modest additional payment.

The evaluation used a mixed methods approach combining an impact assessment framework (FAIT) with a process evaluation providing a comprehensive picture of the Program's impacts, returns on investment, as well as challenges and improvements for the future. The evaluation used data collected annually from each grant project, as well as secondary data collected through a survey of chief investigators. Having an independent organisation manage the survey allowed recipients to be candid about their experiences, particularly in relation to process evaluation aspects.

The evaluation report documents significant positive impacts on knowledge, policy, practice, community, and the economy. The findings support that the grants provided outstanding value to NSW, when compared to other Australian research grant programs.

Key findings of the evaluation include:

- 30 research grants were awarded in the first two rounds of the Program, totalling $11.1 million
- the cost to administer two rounds of the program (including establishing and operating an expert panel to review applications) was $329,320 over almost five years
- the Program was responsible for attracting more than $105 million in additional grant and fellowship funding; $95 million of which was leveraged from outside NSW
- adjusted for inflation, the return on investment for the first two rounds of the Program was 6.99, or almost seven dollars returned for every dollar of NSW funding
- grant recipients produced 313 publications, with almost 70% in tier one peer reviewed publications. Publications were collectively cited 8,072 times by the end of 2023. This is a 44% greater publication yield compared to similar stage researchers

- grant recipients gave 335 presentations, were the focus of 10 national television news stories, established a biobank, and have created several datasets, which have been made available for use by other researchers
- grant recipients forged 196 new collaborations, of which 52 were international collaborations, supervised 35 PhD students, and mentored a further 61 researchers
- eight projects (30%) have already directly contributed to policy change. Twelve projects (46%) have enabled changes to research or health practices in NSW
- almost all grant recipients (97%) were still working in the NSW health and medical research sector 5-6 years after being awarded an NSW Health Early-Mid Career Grant. The evaluation also found that grant recipients secured 31 promotions, averaging two years sooner than similar career researchers
- many grant recipients credited the Program with keeping them in research and progressing their careers. Researcher comments also provided information and ideas to continue to improve the Program.

The evaluation made 14 recommendations on how to improve the Program. Many of the recommendations have already been addressed by the Office for Health and Medical Research in subsequent grant rounds; some are initiatives currently being implemented; and some are outside of the Office's remit. Several evaluation limitations were also identified. The Office will reflect on how to address these for future evaluations of research grant programs.

The Office for Health and Medical Research's (OHMR) responses to the recommendations in the report are outlined in the table below.

Recommendations from the Report

Theme	HMRI recommendation	OHMR response
Grant management system	**Recommendation 1**: Migrating the application to an online system. **Recommendation 2**: Exploring the inclusion of data from previous NSW Health applications and the NHMRC Sapphire platform for the track record sections to minimise burden on applicants. **Recommendation 7**: A less clunky and less burdensome reporting system, such as an online REDCap survey that could be used to add progress year on year. This would help ease the reporting burden for recipients.	OHMR is currently assessing several grant management systems. Once a system is selected and implemented it is expected that recommendations 1 and 7 will be addressed within the online grants management system. Once a preferred solution is implemented, OHMR will investigate opportunities to integrate data from other systems for both application and grant reporting (recommendation 2).
Grant guidelines	**Recommendation 3:** Providing clearer instructions about how to develop the knowledge translation plan.	OHMR will incorporate clearer instructions into the guidelines and application form going forward.
	Recommendation 5: Confusion about who the administering institution would be and who would be paying the recipient's salary when they were jointly employed by an MRI/University and health service.	This issue has been addressed as the Program has evolved over subsequent rounds. EMC Grants now cover salary and other research costs and NSW Health employees can now use the grant funds to backfill their position when conducting research.

Theme	HMRI recommendation	OHMR response
	Recommendation 6: Confusion around the payment rules when the recipient had an existing University grant such as a fellowship.	This issue was resolved by expanding the categories of expenditure of the Program grants after round one. Since round two, applicants with an existing fellowship could retain the fellowship and use the grant for the salaries of other team members and/or research costs.
	Recommendation 10: Increase the value of the grants so the recipient does not run out of money at the completion date.	EMC Grants now fund both the salary of the fellow and research costs. Managing a project within a research grant budget is an essential skill for all researchers.
	Recommendation 11: Factor in parental leave - i.e. parental leave payment and bridging as people often become "out of grant cycle" by taking time off.	Employment conditions, such as parental leave, are the responsibility of the host and/or administering organisations (dependent on the researcher's individual workplace employment agreement). OHMR works with grant recipients and host/administering institutions to minimise barriers to conducting research.
Application review process	**Recommendation 4**: Having three reviewers instead of two OR to develop a process to have applications re-assessed if the two reviewers' marks were conflicting or differed greatly.	OHMR now has a minimum of three reviewers per application in the EMC Grants Program. In round one, to which this recommendation pertains, where there was a significant discrepancy between reviewer scores, the application was re-assessed by a third reviewer.
Grant administration	**Recommendation 8**: Have a single OHMR contact (per project) for all variation negotiations	OHMR implemented a single designated grant program email address for all grant variations and other queries in 2018.
	Recommendation 9: Have some flexibility with the allocation for budget items such as career development support that are sometimes difficult to cost ahead of time and to allow the administering institution authority to approve minor reallocations	The funding agreement now includes a clause that allows recipients some flexibility with regards to small changes in costs between line items in the budget. A stream-lined variation procedure also enables more significant changes to be considered as required.
Program funding priorities	**Recommendation 12**: Ensure the EMC grant is not focussed on one area of research (e.g. cardiovascular was the focus for round two). Keep it generic to support the whole EMC cohort. **Recommendation 14**: Weigh up the need to spread the grant opportunity around with being able to re-apply for other OHMR/NSW Health EMC grants (e.g. the microbiome call in 2023).	A key aim of the EMC Grants is to support EMC researchers in areas of identified need. Since round three, the Program has focused on advanced therapeutics and NSW Health will continue to identify research priorities in future years, and continue to reassess this balance.

Theme	HMRI recommendation	OHMR response
Other	**Recommendation 13**: Influence NSW public hospital recruitment to ensure leadership and vision in the clinical departments that lead to appointments that factor in academic and clinical contribution.	Directly affecting public hospital recruitment is out of scope for OHMR, however through the research grant programs OHMR administers, clinicians are encouraged to undertake research by providing funds to backfill clinical roles. In 2022, NSW Health released the Future Health: Strategic Framework which highlights the importance of research and innovation in the health system through Strategic outcome five: Research and innovation, and digital advances to inform service delivery.

Impact and process evaluation of the NSW Health Early-Mid Career Grant Program

Round 1 (Awarded 2017)

Round 2 (Awarded 2018)

Prepared for: Office of Health and Medical Research

March 2024

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Executive summary

The NSW Health Office for Health and Medical Research (OHMR) developed the Early-Mid Career (EMC) Grant Program (formerly titled Early-Mid Career Fellowships in early grant rounds) as part of the Health Services Research Support Program. The inaugural round of grants launched in 2016.

The program aims to (1) Attract and retain skilled EMC researchers within the health and medical research sector in NSW, (2) Support EMC projects that build capacity and capability in areas of identified need; (3) Support researchers to gain additional grants and fellowships from national competitive grants schemes such as the National Health and Medical Research Council (NHMRC), Australian Research Council (ARC) and Medical Research Future Fund (MRFF), philanthropic sources and industry; (4) Encourage collaboration and leadership with the NSW health system, research and/or commercial environment to address areas of identified need; and (5) Embed translation and planning through all stages of EMC grant projects.

In 2023, OHMR commissioned the Health Economics and Impact Team (HEI) of the Hunter Medical Research Institute (HMRI) to undertake an independent evaluation of the EMC Grant Program based on the first two rounds of the Program (2017 and 2018), which funded a total of 30 projects.

Objectives and methods

The following table summarises the objectives of the evaluation, the methods used and where data was sourced or collected.

Objectives	Methodology	Data collection
Quantify the impact of the EMC Grant Program including impact on knowledge, policy, health practice, health outcomes, economic outcomes, and research capacity building and engagement	The Framework to Assess the Impact of Translational Health Research (FAIT) * - modified Payback	Individual project documentation supplemented with an online survey of grant recipients
Monetise, where possible, the returns on the investment in the EMC Grant Program to show accountability for the expenditure of public monies	FAIT – Cost-consequence analysis	Administrative data and financial records supplemented with an online survey of recipients
Describe the difference that the EMC Grant Program has made to the success of relevant research projects and career progression of recipients using case studies	FAIT – Narrative	Project documentation, online survey of recipients and follow up phone or email communication with relevant recipients
Understand the various pathways that recipients' careers have taken since receiving the EMC grant and the difference having the grant made to their future careers	Career progression mapping	Online survey of recipients supplemented with a desktop search for survey non-responders
Evaluate the process of grant administration and management, including recipient experience of the process, and identify areas for improvement	Process evaluation	Online survey of recipients

** FAIT is a methodology that encompasses three existing and validated techniques for research impact assessment: Payback, economic analysis, and narratives. It is underpinned by a Program Logic Model and enabled project and scheme level impacts and returns to be aggregated to show the collective benefits of the entire EMC Grant Program.*

Results

Research impact

Knowledge impact: To date, the 30 projects have published 313 papers, of which almost 70% were in Tier 1 peer reviewed publications and have collectively been cited 8,072 times by the end of 2023. The average field weighted citation index (FWCI) of 1.44 which, for benchmarking purposes relative to peers in the scientific literature, places the EMC outputs collectively at 44% above the world average in their respective fields for frequency of being cited. The research also resulted in 335 presentations, 10 national television news stories, created a biobank and several datasets available for use by other researchers.

Capacity building: The EMC projects initiated 196 new collaborations, of which 52 were international collaborations. Recipients held 84 positions or membership on 41 research networks and committees. They collectively supervised 35 PhD students and mentored a further 61 researchers, building future research capacity in NSW. They also personally developed 80 new skills and enhanced 125 existing research skills during the grant period. Their main skills acquired or enhanced were in research translation, research leadership and management, evaluation methods, health systems research, imaging, and implementation science. As one recipient reported, “the EMC Grant’s emphasis on skill development (and provision of funds specifically for this purpose) was an integral contributor to taking a step up in my career and building my reputation internationally”.

Policy change: Eight EMC funded research projects (30%) had directly contributed to policy change, including:

- the 2017 Atrial Fibrillation SCREEN White Paper, 2017 European Heart Rhythm Association AF Screening Consensus Document, 2018 Australian Heart Foundation/ Cardiac Society of Australia and New Zealand (CSANZ) AF guidelines; and the 2020 European Society of Cardiology AF Management Guidelines.
- one NSW hospital implementing policy changes to reduce bed moves for patients with delirium.
- the Victoria Vision 2030 Blueprint for Mental Health and Suicide Prevention.
- a submission to the Medical Services Advisory Committee (MSAC) for approval for rebate of whole genome sequencing (WGS) for mitochondrial disease diagnosis, which was eventually approved. Findings were also used in mitochondrial donation submissions to Parliament, ultimately leading to a change in legislation to allow donation for mitochondrial disease to occur.

Practice changes: Twelve EMC funded research projects (46%) enabled practice changes including:

- the establishment of a "clinically accredited” and “commercially ready” genome profiling platform enabling two of the largest precision medicine cancer trials for adults and children, providing treatment options for over 1,400 patients and gathering evidence for health system implementation.
- data and advocacy, including support from the Black Dog Institute, to change how the Department of Education (DoE) guides schools in the adoption of evidence-based programs for depression prevention. Black Dog Institute also trained DoE counsellors on the use of digital tools and information conveyed to the Leaders in Psychology group (regional supervisors of school counsellors) has led to the subsequent rollout of a digital depression prevention program to 150 schools in NSW.
- the creation of the Mity tool that has been implemented into clinical practice through Genome One, a sequencing company established by the Garvan Institute which has been acquired by Australian Clinical Laboratories.
- Dimethylguanidino valeric acid (DMGV) to be routinely used as a diagnostic marker in NSW and is now being used in clinical trials by groups in USA, Sweden, and China in exercise, coronary artery disease, and cancer.
- the Rapid Access Chest Pain Clinic at Royal North Shore Hospital (RNSH) being considered standard of care at RNSH and being approved in 2021 as a permanently funded Clinic.

Community benefit: Several of the practice changes translated into community-level benefits such as:

- the use of WGS as a first line genetic diagnosis for mitochondrial disease which is now claimable through the Medicare Benefits Scheme (MBS) and is a quicker diagnosis with less invasive testing and diagnostic journeys.
- a genetic based diagnosis for rare diseases has resulted in better outcomes for the patients involved.
- a genome profiling platform enabling precision cancer medicine to be delivered to patients, improving their recovery from cancer.
- approval for donations for mitochondrial disease to occur in Australia allowing everyday Australians the opportunity to support this work.
- DMVG is being used to detect subclinical non-alcoholic fatty liver disease (NAFLD) better and predict future development of diabetes over a decade in advance. It can also determine who will and will not obtain beneficial metabolic adaptations to exercise training, thus helping target exercise to cardiac and metabolic rehabilitation to those who will benefit the most, with alternative strategies for those who will not.
- the methodology for screening for Sjogren's and Lupus can predict the patient's exacerbation of disease during remission which has enabled pre-emptive treatment and prevented hospitalisation.
- atrial fibrillation was identified in approximately 1.4% of community dwellers aged 65 and older as part of the research. Subsequent consultation and treatment with GPs has resulted in a 66% reduced risk of future stroke.
- showed high patient satisfaction and positive cost-benefit from the Rapid Access Chest Pain Clinic, a benefit to patients and the community.

Economic benefit: The EMC Grant was able to leverage 145 additional grants and fellowships, many from nationally competitive NHMRC and MRFF grant schemes, valued at over $145 million. This figure increased to $173 million when taking inflation in to account and dropped back to $105 million (s.a.[1] $35M to $173M) when the amounts of the leveraged grants attributable to the EMC Grant (as determined by the recipients) were factored in. When only considering grants and fellowships that attracted funds into NSW, this figure dropped to 95 additional grants and fellowships with a total attributable, inflation adjusted value of $95 million (s.a. $31M to $154M). In addition, grant monies were used to employ 29 staff including post-doctoral fellows, research assistants, and clinicians with a combined salary of $4.7 million. As described by one of the recipients: *"I probably would not have been able to remain an academic without the funding support I received as an EMCR from this scheme. I am very grateful as this really put me on a trajectory towards NHMRC and other funding which allowed me to continue with my research."* Two projects also reported evidence for future potential economic and commercialisation benefits from discoveries made during the EMC funded research project but at the time of this assessment, neither had yet eventuated.

Return on investment

The total cost of administering and managing the EMC Grant Program including monies disbursed was valued at $13.58 million (s.a.$13.51 to $13.65 million) over the two rounds (2017 & 2018). The total monetisable consequences (grants and fellowships) were calculated in two separate ways: the total attributable inflation adjusted figure was $145 million (s.a. between $35M to $173M) based on all grants and $95 million (s.a. $31M to $154 M) based on grants that attracted funds to NSW. It is important to note that the estimated monetisable consequences are conservative for two reasons. Data was only available for 26 projects (while data for the costs of the Program covered all 30 projects in Rounds 1 & 2). Despite the unavailability of data and taking a conservative approach, the EMC Grant Program has generated returns that are **6.99 times** (*s.a. 2.26 to 11.43*) the

[1] s.a. is a sensitivity analysis which acts much like a confidence interval and creates a bandwidth within which the true attribution figure lies.

investment if limited to fund leveraged into NSW and 7.75 times *(s.a. 2.54-12.86)* the investment if including all leveraged funding.

Career progression

Almost all recipients (n=28, 97%) were still working in the health and medical research sector 5-6 years after being awarded NSW Health EMC Grant. One recipient had moved into a policy role within the NSW Ministry of Health, closely aligned to their area of research. The same proportion (97%) remained in employment in NSW with only one recipient relocating to Singapore to continue their research career. The table below summarises the opinions of respondents (n=17) to the extent that the EMC Program contributed to various aspects of their career.

Contribution of NSW Health EMC Grant to:		
Staying in the health and medical research sector	Two thirds (76%) thought it had made a significant contribution	29% thought it was *the main reason,* 47% thought it had contributed *a lot,* 11% thought it had contributed *a little and the remaining 11% did not provide a response*
Staying in the health and medical research sector in NSW	Less than half (47%) thought it made a significant contribution	*11 % thought it was the main reason, 35% thought it contributed a lot,* 11% thought it had contributed *a little, 23% thought it had contributed nothing and 17% did not provide a response*
Their capacity and capability as a researcher	Four out of five (82%) thought it had made a significant contribution	29% thought it was the main contributor, 53% thought it had contributed *a lot,* and 12% thought it had contributed *a little, and 6% did not provide a response*

When asked about their next positions immediately following the completion of their EMC Grant, almost all respondents reported holding joint positions either between a University and Medical Research Institute (MRI) or a NSW Health Service. Responses could be grouped into four categories: (1) those who had secured their next grant that included a salaried position; (2) those who stated their position title but did not indicate if it was the same position or a promotion; (3) those who secured an academic promotion; and (4) those who remained employed in the same position as they were in when they commenced their EMC Grant.

The five main impacts on their career, as expressed by survey respondents were the ability to continue a career in research, contribution to academic promotions and senior positions, ability to use the EMC grant to leverage subsequent competitive funding, opportunity to build research skills and research leadership and the opportunity to build vital collaborations.

Administration of the EMC Grant Program

Application process

Half of respondents (n=7) thought the application process was efficient or had no suggestions to add. They described the process variously as "*very clear, straightforward, practical and easier than some others e.g. NHMRC and MRFF schemes*".

Almost 60% of respondents thought the response time for applications for the EMC Program were *the same as* or *shorter than* other schemes. None of the respondents thought it was *longer than other comparable schemes*.

Grant establishment

When asked to comment on the grant establishment process, respondents rated it as *very* to *moderately* efficient, supportive and clearly communicated with *clarity of communication* rated the highest (3.53 out of 5) and *efficiency* the lowest (3.13 out of 5).

Almost all (86%) respondents reported *no delays to the start of their research as a consequence of the grant establishment process*. Two respondents (14%) reported that their *research start had been delayed* due to (1) the recipient's lab moving to a new MRI resulting in delays in receiving the funds and (2) the grant not beginning until Feb 2017 due to delays with the recipient having a concurrent fellowship elsewhere.

Progress reporting, variations and delays

Four out of five (80%) respondents reported they had *no problems meeting the progress reporting requirements,* although three (20%) did report *challenges*. The main challenges reported were:

- other competing grant commitments
- had difficulty completing the reporting templates (Excel) sent out by OHMR, finding them 'clunky to populate'
- COVID impacting recruitment of patients.

When asked how clear they were about what the progress reporting is used for, two thirds (67%) of respondents were *clear* or *somewhat clear* but a third (33%) were *not at all clear*.

Fifty three percent of respondents *did not have to negotiate any variations*, five respondents (33%) had *no problems negotiating a variation* and two respondents (13%) *reported challenges negotiating a variation* to the terms of their grants. These challenges included feeling that it took too long for OHMR to reach decisions and requiring multiple levels of sign-off at OHMR to make changes to agreements.

Almost two thirds of projects (60%) were completed *early, on time or within three months* of the expected completion date. A further third of projects (33%) were completed *more than 3 months after the expected completion date*, and one of the projects *had significantly changed in scope such that the expected completion date was no longer relevant.* The main reason for delays were related to the COVID pandemic which affected four projects. Other reasons included delays in obtaining ethics, changes in staff delivering the research intervention, delays in procurement of data required for the project, expected delays in publishing and presentation of findings and other competing demands on researcher time. When asked if something could have been done by OHMR to minimise delays, 13 respondents (86%) said that there was nothing that OHMR could have done and two (14%) said there were ways OHMR could have helped.

Final reporting

Almost all respondents (86%) reported they had *no problems meeting the final reporting requirements* and two (14%) reported *they had challenges meeting the final reporting requirements*. Two thirds (67%) of respondents were *clear* or *somewhat clear* but a third (33%) were *not at all clear* about what the final reports were used for, mirroring responses on the utility of the progress reporting.

Individual comments from recipients about barriers and challenges, as well as suggested solutions are included in the Results section of the report.

Discussion and recommendations

The comprehensive evaluation of round 1 (2017) and round 2 (2018) of the NSW Health EMC Grant Program indicate that the Program has achieved, with different levels of completeness, four of the five key objectives of the Program, as set out in the current Program Logic Model for the scheme, with the fifth objective not evaluated for this report having only been added in later rounds. The Program has retained skilled EMC researchers within the health and medical research sector and to a lesser extent, retained them within NSW. A key contribution of the Program has been the building of capacity and capability in the EMC grant recipients and the broader health and medical research sector in NSW, much of it in areas of identified need. The Program has also supported researchers to gain additional grants and fellowships from nationally competitive grants schemes and attracted $95 million dollars in income to NSW. Grant recipients were able to confirm that the Program encouraged collaboration and leadership with the NSW health system, research and/or commercial environment and set the recipients up for translation, commercialisation and future success and impact.

> *"I wish to thank the OHMR for this opportunity. My progress notwithstanding, I am sure this scheme has helped many researchers transition to the next steps in their research and academic development. I hope the scheme continues to support the researchers."*
>
> *Grant recipient, 2018*

The only area that was not evaluated was the extent to which the Program embedded translation and planning through all stages of EMC grant projects (being the fifth objective noted above). The multi-method evaluation was able to evidence the various impacts of the Program on knowledge advancement, capacity building, policy and practice change and community benefit, as well as a solid return on the research investment, its contribution to the research careers of recipients and the health and medical research sector more broadly. The evaluation also highlighted suggestions for improvement in grant administration processes from grant recipients, including:

- Migrating the application process to an online platform and exploring pulling in track record data from other OHMR applications or the NHMRC Sapphire portal
- Providing clearer instructions about how to develop the knowledge translation plan
- Clarifying who the administering institution would be and who would be paying the recipient's salary when they were jointly employed by an MRI/University and health service
- Clarifying the payment rules when the recipient had an existing University grant such as a fellowship
- Having a single OHMR contact (per project) for all variation negotiations
- Greater flexibility with the allocation for budget items and to allow the administering institution authority to approve minor reallocations.

Several of these suggestions have been addressed in subsequent rounds (3-6) of the Program. More information is provided in NSW Health's response to the recommendations in the report Foreword.

> *"The grant enabled me to understand the research process and to develop data collection and analytic techniques."*
>
> *Grant recipient, 2017*

List of abbreviations

AF	Atrial fibrillation
AHA	American Heart Association
ANZCMR	Australia and New Zealand Working Group for Cardiovascular Magnetic Resonance Imaging
ARC	Australian Research Council
ATP	Adenosine triphosphate (ATP), energy-carrying molecule found in the cells of all living things.
CCA	Cost consequence analysis
CEE	Centre for Epidemiology and Evidence (NSW Ministry of Health)
CI	Chief Investigator
CMR	Cardiovascular magnetic resonance imaging (MRI)
CRE	Centre of Research Excellence
CSANZ	Cardiac Society of Australia and New Zealand
CSV	Comma Separated Value (file format)
DMGV	Dimethylguanidino valeric acid
DNA	Deoxyribonucleic acid
EMC	Early-Mid Career
FAIT	Framework to Assess the Impact of Translational health research
FWCI	Field weighted citation index
HMRI	Hunter Medical Research Institute
MBS	Medicare Benefits Scheme
MRFF	Medical Research Future Fund
MSAC	Medical Services Advisory Committee
NAFLD	Non-alcoholic fatty liver disease
NHMRC	National Health and Medical Research Council
NSLHD	Northern Sydney Local Health District
OHMR	Office for Health and Medical Research
PI	Principal Investigator
PLM	Program Logic Model
Q1	Quartile 1 (Peer reviewed publication)
QALY	Quality-Adjusted Life Year
RNSH	Royal North Shore Hospital
REDCap	Research Electronic Data Capture
TRGS	Translational Research Grants Scheme
US FDA	United States Federal Drug Administration
WGS	Whole Genome Sequencing

Introduction

This report presents the results of an independent evaluation of Rounds 1 and 2 of the NSW Health EMC Grant Program undertaken by the Health Economics and Impact team of the Hunter Medical Research Institute.

The objectives for the evaluation were to:

- Quantify the impact of the EMC Grant Program including impact on knowledge, policy, health practice, health outcomes, economic outcomes, and research capacity building and engagement
- Monetise, where possible, the returns on the investment in the EMC Grant Program to show accountability for the expenditure of public monies
- Describe the difference that the EMC Grant Program has made to the success of relevant research projects and career progression of recipients using case studies
- Document the various pathways that recipients' careers have taken since receiving the EMC grant and the difference having the grant made to their future careers
- Evaluate the process of grant administration and management to measure recipient satisfaction with the process and identify areas for improvement.

Together these findings will help NSW Health evidence and report on the impact and return on investment in the EMC Grant Program, inform recommendations for the future of the EMC Grant Program and consider ways to refine and improve the Program.

Background

Following the NSW Health and Medical Research Strategic Review in 2012[2], the OHMR was established within NSW Health to implement the NSW Government's strategic plan to build research capability in NSW. Key priorities included facilitating engagement of stakeholders; assisting with the development of statewide strategic research priorities; providing a supportive policy framework; administering funding programs that support research infrastructure and innovation; supporting clinical trials and working with pillar organisations, local health districts, primary care providers and the non-government sector in the translation of research into clinical practice, healthy lifestyles and illness prevention.

EMC fellowships, along with PhD scholarships, were first offered by NSW Health in 2016 as part of a package of measures within the Health Services Research Support Program, a comprehensive strategy designed to support frontline health and medical research and early-mid career researchers.

This strategy committed $40 million over four years to building research capability in local health districts, specialty health networks and NSW Ambulance by reducing barriers to conducting research and clinical trials, providing essential statewide research infrastructure including data linkage, biobanking and funding translational research (which led to the development of the Translational Research Grants Scheme). A further $10 million over four years was provided to support EMC researchers.

OHMR conducted a desktop review of existing early-mid career research grants and schemes in NSW and elsewhere and consulted with stakeholders to inform the development of program guidelines, including eligibility and selection criteria for round one of the EMC Grant Program, and consideration of how to support the professional development of early-mid career researchers. This process saw the creation of an EMC Fellowship that aimed to develop the capacity and capability of early-mid career researchers by supporting their salary through a fellowship, providing coaching on writing grant applications, and additional funding to attend conferences and workshops for skill development.

[2] https://www.medicalresearch.nsw.gov.au/app/uploads/2018/07/strategic-review-report-2012.pdf

Round One

The inaugural round of the EMC Program (titled NSW Health Early-Mid Career Fellowships) was launched in 2016. The grant was designed to cover the salary of the early-mid career fellow and support their professional development by providing between $80,000 – $115,000 per annum (exclusive of GST) for up to three years towards their salary costs (including on-costs of up to 15%), and up to $16,000 as a single payment made in the first year to support their direct research costs, publication costs and professional development.

Round One Guidelines stated that the purpose of the Fellowships was to:

1. Promote the participation of EMC researchers in high-quality research projects across the spectrum, from basic sciences through to health services and population health research.
2. Develop skills in the following priority areas: health services and system design, implementation science, evaluation and improvement, epidemiology, medical and bioinformatics, health economics, and biostatistics.

The objectives of the Program at that time were to:

- build a strong, vibrant and highly skilled research workforce
- attract new researchers to the health and medical research sector in NSW
- retain existing talented early-mid career researchers
- bridge the gap between research and policy and practice.

Round One was open to all early-mid career health and medical researchers in NSW, and no specific research priority areas were identified. Cancer was the only exclusion, as there was an existing fellowship open to cancer researchers, administered by Cancer Institute NSW.

Two Fellowships were designated for researchers who identified as Aboriginal or Torres Strait Islander. With no applications submitted by researchers who identified as Aboriginal or Torres Strait Islander, these were rolled into the general funding pool.

A total of 290 applications were received under Round One with 277 of these assessed as eligible by NSW Health. Eligible applications were reviewed by two Expert Reviewers. Applications where the discrepancy between the two scores was 20 points or more were re-reviewed by both or reviewed by a third reviewer. All applications were then ranked based on the average of the two scores, or for those where there was a discrepancy of 20 or more, the revised scores. The top 40 applications were then referred for discussion at an Expert Reviewer Panel Meeting, and 17 applications were funded at a cost of $5.1 million.

Round Two

Round Two of the Program was launched in 2017. While the overall purpose and aims of Round Two remained much the same, the Program developed in several important ways based on learnings from Round One:

1. Firstly, in Round Two cardiovascular disease (CVD) was identified as the key focus area. The NSW Cardiovascular Research Network (CVRN) collaborated with OHMR to run this grant round.
2. Secondly, an Expression of Interest stage was introduced in Round Two.
3. Thirdly, there was an increased focus in Round Two on project and professional development for potential applicants.

NSW Health allocated $560,000 over four years to the development of a mentoring program, which would link senior researchers and/or clinicians with early-mid career researchers to assist the early-mid career researcher to develop their grant writing skills. With the support of OHMR, the CVRN also ran workshops and telephone information sessions with applicants to develop their research idea. Additionally, a Working Group was established by the CVRN to identify mentors who could work with early-mid career researchers to develop their applications.

Feedback and mentoring ensured that all Round Two applicants, whether they were successful or not in being awarded a grant, had access to mentors who could support them to improve their skills and contribute to their professional development.

Two types of Fellowships were offered in Round Two:

1. Full Fellowship: This included salary funding of between $80,000 – $115,000 per annum (exclusive of GST) for up to three years and up to $250,000 to support the Fellow's direct research costs, publication costs and identified formal training activities as part of the skill development plan over the grant period.
2. Project funds for existing Fellows with at least two years left on their Fellowship: This included funding for up to two applicants who had existing salary support from other sources and had at least two years left in their Fellowship. They could apply for up to $250,000 to support research and professional development costs.

In Round Two, applicants completed a two-page Expression of Interest (EOIs) and attended a workshop or a telephone information session with the CVRN Working Group to develop their research idea. A total of 101 EOIs were received by NSW Health with 95 assessed as eligible. Eligible applications were reviewed by between two and four Expert Reviewers, who recommended that 21 be invited to submit a full application.

At full application stage, an independent review panel assessed 26 full applications. Each application was assessed by four reviewers and discussed at an Expert Reviewer Panel Meeting. A total of nine full fellowships and four projects with research funds only were recommended for funding totalling $6 million.

The EMC Grant Program has continued to evolve over four subsequent rounds. From Round Three, the priority research focus shifted to advanced therapeutics as NSW Health sought to build the pipeline of research leaders in this emerging area. The Program Logic Model now includes five key aims:

1. Attract and retain skilled EMC researchers within the health and medical research sector in NSW.
2. Support EMC projects that build capacity and capability in areas of identified need.
3. Support researchers to gain additional grants and fellowships from national competitive grants schemes (such as grants from National Health and Medical Research Council, Australian Research Council and Medical Research Future Fund), philanthropic sources and industry.
4. Encourage collaboration and leadership with the NSW health system, research and/or commercial environment to address areas of identified need.
5. Embed translation and planning through all stages of EMC grant projects.

OHMR identified the need to undertake a comprehensive evaluation of completed rounds of the EMC Grant Program to report on the impact of the funding on knowledge, capacity building of recipients, policy and practice changes, community, and economic benefits; the return on investment, contribution of the Program to the career development and progression of recipients and identify ways to improve the administration and management of the Program.

Methods

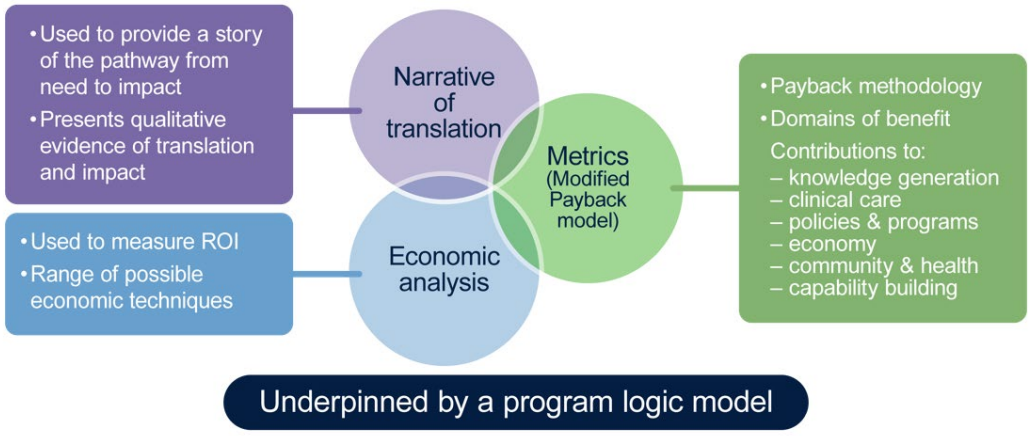
The Health Economics and Impact Team[3] in collaboration with the OHMR project team[4] agreed that the evaluation would consist of three distinct components:

1. Application of the Framework to Assess the Impact of Translational health research (FAIT) to assess the impact of the EMC Grant Program. Although originally designed for application to research projects, FAIT has been applied to other NSW Health funding schemes including the Preventative Research Support Program (PRSP), the COVID-19 Research Program (1) and the Translational Research Grant Scheme (TRGS). Data would be reported quantitatively, qualitatively and economically.
2. Undertake a survey and either phone interviews or email discussions with selected recipients to understand what difference the EMC grants made to their career progression and future success and map their career pathways post receipt of the EMC Grant. This data would be reported on both quantitatively and qualitatively.
3. Undertake a process evaluation to evaluate the grant application, establishment, and management processes from the perspective of the recipients to identify areas for improvement and inform future planning for the Program.

1. FAIT

The Framework to Assess the Impact of Translational Health Research (FAIT) is a framework designed to both measure and encourage research translation and research impact. (2) The FAIT model was developed by the HMRI team by reviewing, combining, and modifying three existing and validated techniques for research impact assessment; Payback, economic analysis, and narratives (see Figure 1 for a brief description of what each method achieves).

Figure 1 Framework to Assess the Impact of Translational health research (FAIT) model



The modification of the Payback methodology creates impact metrics within Domains of Benefit relevant to the research that help to quantify the key impacts of the project; the economic analysis helps to understand the return on the research investment and the narrative sets out the pathway to impact and reports on qualitative impacts that are difficult to quantify or monetise. Together, these three techniques paint a comprehensive

[3] Shanthi Ramanathan, Kurtis Budden, Connor Ballinger

[4] Jason Boyd, Thomas McCorquodale, Catherine Kellick, Claudia Coyle

picture of impact of a research project, program, or in this case, research project results aggregated up into a research grant scheme. A detailed Program Logic Model (PLM) underpins the three techniques. FAIT was identified as an appropriate tool to assess the impact of the EMC Grant Program by aggregating project level impacts to show the collective impact from Rounds 1 and 2 of the Program.

Program Logic Model

Applying FAIT began by revisiting the already developed Program Logic Model for the EMC Grant Program. The PLM was finalised in early 2023, several years after the establishment of the EMC Grant Program. It was developed in consultation with senior managers from the EMC Grant Program and the NSW Centre for Epidemiology and Evidence (CEE). The first draft was developed by the CEE team and went through an iterative process of refinement with input from NSW Health and HMRI staff. A copy of the final PLM is provided as Appendix 1 and provides a pathway from the need for the EMC Grant Program to the aspirational impacts from the investment.

Payback metrics

Once the PLM was established, Payback metrics were selected to reflect the impacts of the EMC Grant Program based on suitability, measurability of the impact, availability of data, timeliness of obtaining data and a measure of pragmatism. The final impact metrics that were agreed upon were grouped under the following domains: Knowledge Advancement, Policy Impacts, Practice Impacts, Health and Healthcare Impacts, Economic Impacts, and Capacity building and engagement. Although the modified Payback metrics normally involve quantified metrics, in this instance, some further detail was also captured.

Economic analysis

The economic analysis was designed to understand a return on the EMC Grant Program investments. A simple cost-consequence analysis (CCA) was selected as the most appropriate and pragmatic economic method based on the availability of data and the limited economic evaluations at the project level. A CCA involved converting benefits into monetary values, wherever possible, but for benefits where this was not feasible, benefits were expressed in their original measurements or values, as per the Payback metrics. The CCA is intended to present a transparent account of costs and consequences across many different dimensions allowing decision-makers to see clearly what types of information are included and omitted, and to make their own decision about the value of a program.(3) Within FAIT, the various Payback tables were used to record all the consequences of the EMC Grant Program using quantified metrics, leaving only the monetisable impacts to be included in the economic analysis. The consequences of value to OHMR such as a change in policy, practice and potential improvements in care and health outcomes were presented in the Payback tables and only consequences that could be easily monetised with available data (e.g., further funding leveraged) were included in the CCA results. A full cost benefit analysis would have required economic analyses to have been undertaken at the project level and was out of scope for this study.

Data for the CCA were captured through the online surveys and final reports, and expert input provided by staff at OHMR and the recipients themselves. Costs are presented in monetary units so that the value of different resources can be aggregated and compared. For program administration activities, the costs of overheads (electricity, water, security, building maintenance etc) and oncosts (superannuation, leave etc.) were added to labour costs at a rate of 25% overall. Wage values and the oncosts and overhead values were obtained directly from the OHMR finance department, as were the values of grants disbursed. The value of the consequences that were monetisable (e.g. grants and fellowships leveraged) were obtained from the grant recipients including their assessment of the level of contribution of the EMC grant that could be attributed to the leveraged funding. Where this researcher attribution was not available, we took the mid-point and allocated 50% of the leveraged funding

to the EMC Grant Program and included a sensitivity analysis to account for the potential variability in this assumption.

For the cost-consequence analysis, two sets of figures were calculated, the value of ALL leveraged funding and the value of leveraged funding that was attracted into NSW. This excluded grants that were NSW or Institutional-based and two grants that went to a recipient who was overseas. All monetary values were converted to 2023 values to account for inflation. No discounting was applied to any of the calculations for the CCA.

Narratives

Narratives were constructed using data obtained from the surveys and final reports. Two deep dives were developed to showcase outstanding exemplars of how the EMC Grant Program investment led to positive outcomes in terms of research translation and impact. Data from the survey and reports were supplemented with data from phone interviews with the two selected recipients. Where interviews were not possible, the information was supplemented with a set of additional questions sent via email. In addition, two researchers were selected as the subject of deep dives to showcase the contribution of the EMC Grant Program to the career progression of recipients. These recipients also participated in phone interviews to supplement the survey data.

2. Career progression mapping

In addition to FAIT, data obtained from the surveys were also used to map the career progression of recipients of the EMC Grants. Two key objectives of the EMC Grant Program are to build research capability and capacity within NSW and to retain talented researchers in the state. To evaluate this aspect of the Program, additional questions were developed by the HMRI team in collaboration with the OHMR team and added to the survey to obtain data on career pathways of recipients. This included questions on recipients' next position, whether they were still undertaking health and medical research and how much the EMC grant contributed to them continuing in the sector. Recipients were also asked where they were currently working, their reasons for leaving the sector or state if they had left and how much the grant contributed to building their capacity and capability as researchers. To supplement the data provided by the 15 survey respondents, the team also undertook desktop research to find out the following details for non-respondents:

(1) Whether they were still employed in health and medical research – identified through their publication track record in 2023 and their current place of employment
(2) Whether they were still employed in NSW – identified through their current position
(3) Whether they work in a metropolitan or regional location, also identified through their current place of employment.

3. Process evaluation

A third method used for the study was a process evaluation to evaluate the grant application, establishment and management processes from the **perspective of the recipients**. A list of additional questions was developed by the HMRI team in collaboration with the OHMR team and added to the FAIT survey. These included questions about the application, grant establishment and the close out and final reporting. Questions focussed on the administrative processes for this Grant Program in comparison to other schemes; what could have made the process more efficient and less burdensome, what the impacts of any inefficiencies were and what challenges were faced at all three stages of the lifecycle of the Program.

4. Data collection

Secondary data availability

To avoid costly primary data collection, the HMRI team first sought to review the availability of existing outcome and impact data from the OHMR grant recipient reporting. The evaluation was confined to the first two rounds of the EMC funding: the first commencing in 2017 and the second in 2018. These were selected strategically given their higher probability of being completed and potentially having some downstream research impacts unlikely to be found for more recently funded projects. A full list of grant recipients (n=30) was obtained from OHMR together with all available final reports (n=25). One further final report was sent through in November 2023 and the data extracted by HMRI staff and included in the analysis. These reports were in two separate formats based on the year of administration. An OHMR staff member entered the data from the final reports into a pre-prepared spreadsheet created specifically for the purpose of collating the report data. Once data entry was completed, the data was reviewed by HMRI staff. The review concluded that there had been too long a period between when the final reports were submitted and the evaluation. This justified a primary data collection process being undertaken directly with the researchers who received funding, to supplement the available information and potentially give further visibility to the downstream benefits not evident at the time of final reporting. This was agreed to by the OHMR team.

Primary data collection

Survey development

A survey was developed with questions aligned to the key metrics within each Payback domain of benefit. In addition, questions pertaining to career progression and a process evaluation were also added to ascertain the researcher experience of receiving the EMC Grant and its impact on his/her career. Survey questions went through several rounds of review with designated OHMR staff to ensure their relevance to the aims of the research.

Survey platform and ethics

The final survey was programmed into REDCap[5]. REDCap is a web application for building and managing online surveys and databases. While REDCap can be used to collect virtually any type of data in any environment, it is specifically designed to support online and offline data capture for research studies and operations and met the purpose of this project. The software and systems used to run REDCap are securely hosted at HMRI on its servers and technical support was available from both REDCap and information technology experts employed at HMRI. As the study involved collection of information for internal OHMR evaluation and quality improvement purposes only, Ethics Committee approval was not required. However, informed consent was captured through the REDCap administration process. The survey itself was individualised for each researcher with data pre-populated from their final reports (where available). This helped to reduce responder burden with recipients only having to update existing data captured through the reports.

Pilot

Several research grant recipients were selected to pilot test the survey. Following feedback, some modifications were made to the survey tool. In particular, the survey was modified to allow researchers to 'save and exit' and

[5] Research Electronic Data Capture (REDCap) is a secure, web-based software platform designed to support data capture for research studies. See https://www.project-REDCap.org/

return later, as it was found that the information required to complete the survey was not always readily accessible. The information collected in the pilot test was later uploaded to the live survey, to ensure the pilot testers did not have to complete the survey again.

Sample

A total of 30 researchers were identified who received an EMC Grant from OHMR in 2017 and 2018. Of these, 17 received funding in 2017 and 13 in 2018. Surveys were sent out to all 30 grant recipients.

Survey deployment

Staff at OHMR who were associated with the EMC Program and familiar to the recipients sent out an introductory email to all 30 recipients. The email informed researchers about the evaluation of the EMC Grant Program, the impending survey including its purposes, the role of the HEI team in analysing the data and keeping their responses confidential in the reporting process. The introductory email also requested updated email contact details from all participants which were provided to the HMRI team for deployment of the survey. Following this the survey was deployed via the email function within the REDCap portal. Each recipient received a personalised unique survey link that opened up a survey with relevant data from their final reports already pre-populated with identifying fields (Researcher Name, Research Project, Year of Funding and Funding Amount) to ensure recipients were clear about which project they were answering for.

The survey was deployed to all eligible participants on 9 October 2023. One invalid email address that was notified by return email to HMRI was forwarded to the OHMR team for investigation and a new email address was obtained. Reminder emails, with a link to the survey, were sent weekly to any participants who had not yet completed the survey, until the last one was sent a week before the original closing data of 31 October 2023. A few grant recipients responded via email to notify the HMRI team that they were busy with grant proposal preparation, so the survey deadline was extended by another 10 days to allow those who had indicated they wanted to complete it, sufficient time to do so. The survey finally closed on 11 November 2023. In some instances, where clarification or further information (e.g., for development of a deep dive) were required, researchers were recontacted by email, only if they had provided permission as part of their survey. Following a response, phone interviews were set up with the relevant recipients.

5. Analysis

Data was downloaded as CSV files directly into Excel and cleaned and prepared for analysis. Wherever possible to ensure anonymity of respondents, any identifying information such as the name of the researcher and the project were removed with a unique recipient identifier used to link data back if required. Data was aggregated up for the whole EMC Grant Program.

For bibliometric data and presentation classification, additional desktop research was undertaken to obtain this information from Scival. To arrive at a value for leveraged funding that could be attributed to the investment and support of the EMC Grant Program, project recipients were invited to make that assessment themselves, based on their understanding of the unique circumstances of their projects. This attribution figure (0-100%) was applied to the total grant value. All costs and consequences were converted to 2023 values, accounting for inflation. Where appropriate, thematic analysis was undertaken to group qualitative responses into meaningful categories and in other instances, comments were grouped but presented in their original verbatim form.

Results

Section 1: Response rates and demographics of respondents

Response rates

A total of 19 responses were received to the online survey (63% response rate) but only 15 of those completed the entire survey (50%). The information from the survey was used to supplement what was available from the 27 final reports. Of the 28 EMC recipient projects (93% coverage) included in the final analysis, 27 (90%) had report data and one had only survey data. The 2 recipients for whom no data was made available were excluded from the analysis. (see Table 1).

Table 1 Response rates and data completeness

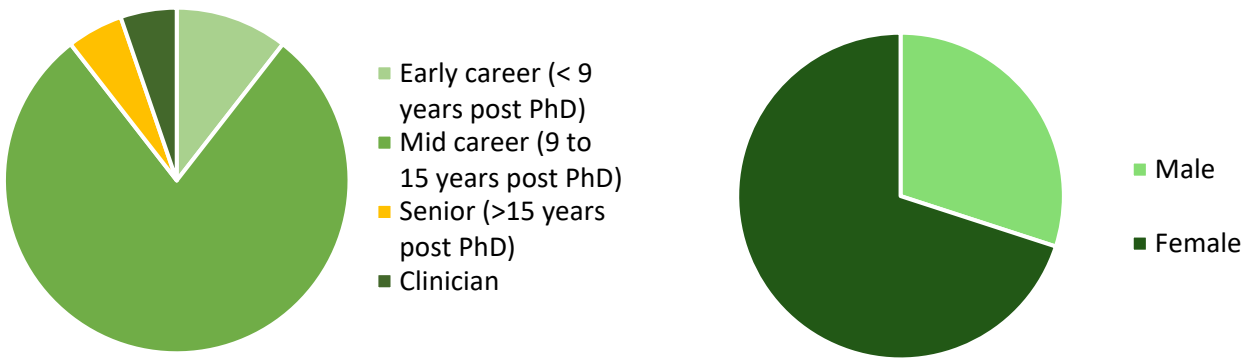
Year	All included grant recipients		2017	2018
	n	%	n	n
Total recipients	30	100	17	13
Recipients with final report	27	90	15	12
Recipients with complete survey	15	50		
Recipients with partial completed survey	4	13		
Recipients with either report, survey or both survey and report data	28	93		
Recipients with no data *	2	6	1	1

**Removed from the evaluation*

Demographics

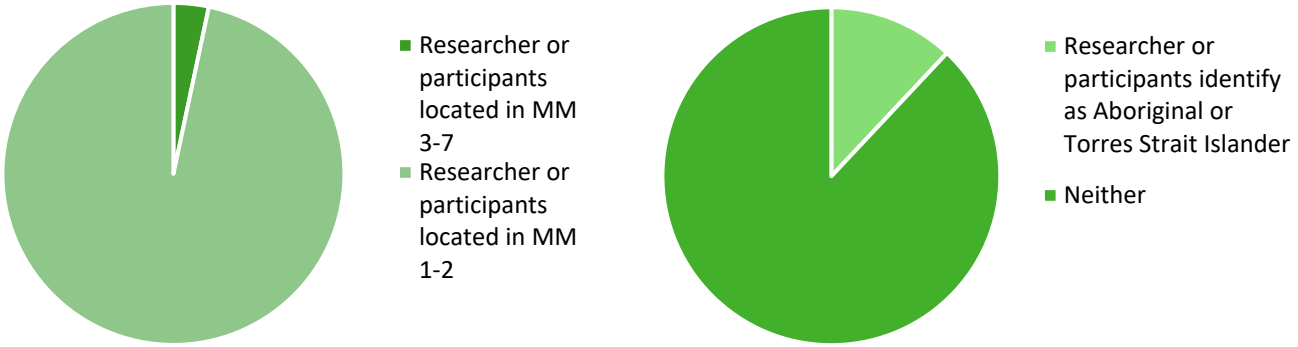
Of the 19 recipients who responded to the survey, 15 (79%) were mid-career researchers, 2 (11%) were early career researchers, and one each a senior researcher and clinician researcher respectively. With data available for the whole cohort via EMC Grant Program administrative data, 70% of recipients were female and 30% were male. (see Figure 2)

Figure 2 Career stage of respondents and gender of whole cohort



Combining survey data for recipients who responded to the survey and desktop data for the non-respondents, all recipients are currently working in a metropolitan area (defined as MMM 1-2 on the Modified Monash Model)[6] and only one project involved participants living in a region classified as MMM 3-7. With reference to Aboriginal and Torres Strait Islander status, one researcher identified as being Aboriginal and two projects included a focus on Aboriginal and Torres Strait Islander population (see Figure 3). A copy of the survey questions for this section are presented in Appendix 2.

Figure 3 Location and Indigenous status of researchers and/or research participants



Section 2: Impact

This section summarises the collective impacts of the EMC Grant Program for the first two funding rounds (2017 and 2018). These are reported by domains of benefit, a key feature of the Payback Framework that forms one of the impact assessment methods used within FAIT.

Knowledge Impacts

Knowledge impact refers to the impact when the findings from research potentially translates to other users such as research, policymakers, clinicians, or the public. It is impact that can occur during the life of the project, soon after its completion or years afterwards.

Outputs: Of the 26 projects for which data was available, there was a total of 313 peer reviewed papers published with an average of 44 publications per year from the program or 12 publications per project/recipient. Fifty five percent (n=172) of these publications were first or senior author publications meaning the EMC recipient was either the first or senior author and 215 or 68.7% of them are in Q1 publications. To be classified as Q1, a journal's impact factor must be in the highest quartile (the top 25%) among all the journals publishing in the same field of science.

Impacts: These 313 publications yielded 8072 citations which is 26 citations per paper, higher than many publications that age. The average field weighted citation index of 1.44 means that the EMC outputs have been cited 44% more times than expected. There were also 26 patent citations meaning the number of times an EMC research paper was cited by a patent applicant, patent examiner, or third party that relates to the content of a patent application (see Table 1). A total of 335 presentations were delivered by the EMC recipients of which 20% were invited presentations, 29 were posters and 37% were at an international conference, symposium or other event. Collectively, the EMC Program has had significant knowledge advancement impacts and informed academics, clinicians and other key knowledge users about the research and discoveries funded by the EMC Grant Program.

[6] https://www.health.gov.au/topics/rural-health-workforce/classifications/mmm

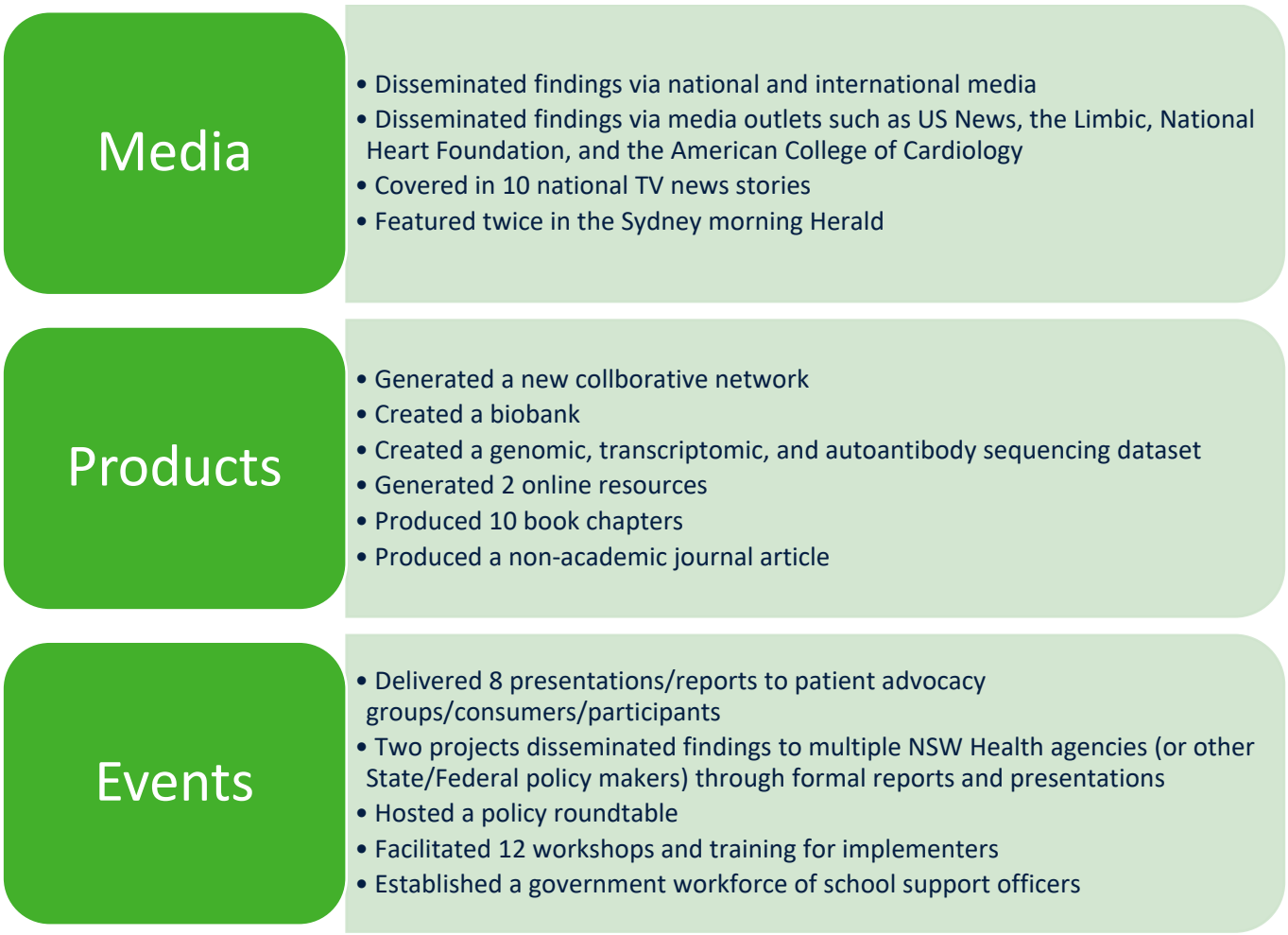
Table 2 Publications and presentation impacts

Metric	Result
Publication	313
1st/senior publication (N)	172
1st/Senior Publication (%)	55
Q1-tier publications (N)	215
Q1-tier publications (%)	68.69
Citations (N)	8072
FWCI (Avg)	1.44
Patent Citations	26
Presentations (N)	335
Invited Presentations	67
Domestic Conference/Symposiums	126
International Conference/symposiums	123
Meetings	13
Education Sessions	14
Posters	29
Unknown	42

In addition to these academic methods for sharing knowledge (research publications and presentations), EMC recipients also utilised less conventional ways to disseminate the knowledge generated by their research. These included outputs such as online resources and book chapters as well as hosting events like a policy roundtable. They also used mainstream options like print and electronic media including the Sydney Morning Herald, to get the knowledge out to the community. Figure 2 captures the key media, products and events that were used by the EMC recipients to disseminate the knowledge generated by their research.

> *"The EMC Grant's emphasis on skill development (and provision of funds specifically for this purpose) was an integral contributor to taking a step up in my career and building my reputation internationally."*
>
> *Grant recipient, 2017*

Figure 4 Other knowledge dissemination activities and products



Capacity building, leadership and engagement

Two key aims of the Program are to encourage collaboration and leadership with the NSW health system, research and/or commercial environment and to build capacity and capability of promising NSW health and medical researchers by supporting EMC projects that build capacity and capability in areas of identified need. The metrics captured in this section (see Table 2) give visibility to the following concepts including collaboration, stakeholder engagement, skills development and training, and leadership. Collectively, the EMC grant recipients built 196 collaborations of which 26% were international collaborations. With regards to representation, EMC recipients were represented on 84 groups including 24 societies, 41 research networks/committees and 25 government panels/groups.

Overall, these EMC researchers supervised 35 PhD and 19 Masters students and mentored 26 undergraduate students and 61 others: training the next generation of health and medical researchers. This also allowed them to build their own research and leadership capacity and capability and to build and grow a team of likeminded individuals to support bids for nationally competitive funding.

Table 3 Metrics for collaborations, representation, and leadership impacts

Collaborations Total	196
Average no. of collaborations per project	7.5
Collaborations (National)	144
Collaborations (International)	52
Representation	84
Membership on societies	24
Membership on Research Networks/Committees	41
Membership on Government Panel/Group	25
PhD Students supervised	35
Masters Students supervised	19
Honours/Undergraduate Students mentored	26
Mentoring (total numbers)	61

With regards to skill development, recipients were asked to nominate at application stage research and leadership skills they wanted to work on during their fellowship. The twenty-three recipients who responded identified 80 research and leadership skills to be learnt or advanced during the period of their fellowship. They were also asked to rate their proficiency for each of their nominated skills on a five-point scale (0-4) with 0 indicating a completely new skill and 4 indicating they were an expert. This measurement was repeated at the end of their fellowship. Their range of score increase was from 0 (no improvement) to 4 (large improvement) and their personal average improvement scores across their selected skills ranged from 0-3. The overall self-reported improvement in proficiency scores across all recipients and all their nominated skills was 1.6 points. Recipients also reported attending 31 training sessions. Table 3 presents the types of skills that EMC recipients developed with the top three being more generic in nature: research translation, leadership and management and evaluation methods. Skills acquired by only one or two recipients tended to be more specialised skills relating to the funded project.

Table 4 Skills development and training impacts

Research and leadership skills identified by 23 recipients as skills they wanted to learn or improve	80 skills
Total increase in self-reported proficiency across the 23 participants and 80 skills	125 points on a 5-point scale
Average self-reported improvement on each of the 80 skills	1.6 points
Training and Development sessions	31

Skills	Number of recipients who acquired or enhanced this skill (self-reported)
Research translation	9
Leadership and management	9
Evaluation Methods (Qualitative, Quantitative)	7
Health Systems Research and Design	6
Imaging	6
Implementation Science	6
Bioinformatics	5
Biostatistics and Econometrics	5
Integration of Technology to Patient Care	3
Clinical Trials	3
Epidemiology	3
Media	2
Medical Research	2
Animal Models	2
Collaborative Research and Commercial Investment Networking	2
Translational Oncology and Genetics	2
Basic Science	1
Biomarker Discovery	1
Cardiology, Epigenetics/Proteomics	1
Cognitive Work Analysis	1
Cytogenetics	1
Diagnosis Of Rare Disease	1
Methods Development	1
Functional Resonance Analysis	1
IP Development	1
Resilience Engineering	1
Writing	1

Policy impacts

Policy impacts refer to instances when research directly informs changes to policy (including guidelines, models of care and protocols) or legislation. Policy impacts are a higher order impact that other forms of knowledge advancement. Eight recipients (31%) reported that findings from their research had influenced policy or legislation. These were in the areas of atrial fibrillation screening, diagnosis of coronary artery disease; bed moves for patients suffering delirium, diagnosis of mitochondrial disease and inclusion on the list of conditions for which donations can be sought, depression prevention in schools, treatment of mental illness and substance use comorbidity, cardiomyopathy and prediction. Details of these policy and legislative impacts are summarised in Table 4.

Table 5 Policy and legislative impacts

Exemplars of policy and legislative impacts
Contribution to 2017 AF-SCREEN White Paper, 2017 European Heart Rhythm Association AF Screening Consensus Document, 2018 Australian Heart Foundation/ Cardiac Society of Australia and New Zealand (CSANZ) AF guidelines; 2020 European Society of Cardiology AF Management Guidelines. Also cited extensively in several international AF Guidelines and Roadmaps such as the 2018 Scottish Parliamentary Report on AF detection and treatment recommendations.
Cited in Australian & New Zealand Working Group for Cardiovascular Magnetic Resonance (ANZCMR) application to Medicare for a new MRI item number for diagnosis of coronary artery disease. After stress testing with cardiovascular magnetic resonance imaging (stress CMR) was declined by the Medical Services Advisory Committee in 2016 due to lack of evidence, this project has provided the necessary additional evidence for re-submission for a Medicare Benefits Schedule listing for stress CMR.
One hospital participating in the Evaluation of the Delirium Clinical Care Standard study implemented policy changes to reduce bed moves for patients with delirium.
The findings were used in the Medical Services Advisory Committee application for approval for rebate of whole genome sequencing (WGS) for mitochondrial disease diagnosis, which was eventually approved. Findings also used in mitochondrial donation submissions to Parliament, ultimately leading to change in legislation to allow donation for mitochondrial disease to occur.
Data from the implementation of an evidence-based depression prevention program in schools was shared with NSW Health Department, Child and Adolescent Mental Health Services teams and included in briefing documents to incoming Labour Government in 2023.
Seminar outlining plans and request for rollout of a multi-modal training package for improving management of comorbid mental health and substance use to NSW Ministry of Health in December 2020; Contribution to Victoria Vision 2030 Blueprint for Mental Health and Suicide Prevention.
Recipient was an author on the 2023 European Society of Cardiology Guidelines for the management of cardiomyopathies
Cited in American Heart Association (AHA) statement on Establishment of a Specialized Clinical Cardiovascular Genetics Programs (2019) and is currently undergoing US FDA diagnostic submission. In Australia, DMGV has been included as a legitimate blood marker for NAFLD (liver disease) into MBS Item #66755 which has used 7098 times 2021-'22 and 7500 times between 2022-'23.

Practice Impacts

Practice change impacts refer to instances when the research informs changes in clinical or healthcare practice, either directly or via a policy change. This is an impact that is highly relevant to the NSW Ministry of Health seeking to accelerate the adoption of innovative practices and models of care into business as usual for the residents of NSW. Evidence-based changes in practice are also well on the pathway to improving health outcomes for the people of NSW. Changes in practice as a consequence of research funded under the EMC Grant Program include using whole genome sequencing for diagnosis of rare genetic disease, primary immunodeficiencies, autoimmune diseases such as Sjogren's syndrome and Lupus, mitochondrial disease, and non-alcoholic fatty liver disease; improved screening for atrial fibrillation; improved treatment of delirium in hospitals; improved safe patient flows in the emergency department; improved referral pathways for children following burn injury; adoption of evidence-based depression prevention programs in schools; improved treatment of comorbidity (mental illness and substance use) using a multi-model training package; and the introduction of a Rapid Access Chest Pain Clinic at usual standard care at the Royal North Shore Hospital in Sydney.

Twelve of the 26 recipients (46%) reported practice changes resulting from their research (see Table 5). Changes varied from those at the local level to changes across NSW jurisdictions, nationally or even internationally.

Table 6 Practice changes as a result of research supported by the EMC Grant Program

Exemplars of practice change impacts
Methods of analysing whole genome sequencing data for rare genetic diseases has been clinically accredited and commercialised; the research enabled two of the largest precision medicine cancer trials for adults and children providing treatment options for over 1,400 patients and gathering evidence for health system implementation. The research enabled the establishment of a "clinically accredited" and "commercially ready" genome profiling platform to enable precision cancer medicine to be delivered to patients.
Genetic diagnosis was made in 42% of 130 patients in a clinical trial environment, directly informing their treatment. The research identified a new gene implicated in immunodeficiency. This form of genetic testing to identify primary immunodeficiencies is being adopted more widely within NSW. Future research is looking at identifying remaining genetic contributors in patients who did not benefit from the initial study. This will require the development of new bioinformatic tools.
Findings/data from screening and diagnosis of autoimmune diseases focusing on Sjogren's syndrome and Lupus were provided to treating physicians and helped inform treatment strategy. Patients were also being followed up to assess role of prediction in remission.
Screening protocols have been implemented into clinical AF screening and education programs offered in UK pharmacy chains and during Heart Week in Australia. Validated eHealth technologies for atrial fibrillation screening provided data needed for health departments to design and establish local screening
At least 3 hospitals have implemented strategies to improve testing, diagnosis, treatment, and prevention of delirium in elderly patients in acute care including 4AT testing and education, policy changes, behavioural training and establishment of volunteer and medical emergency teams to help manage patients with delirium.
After reporting outcomes from the health service and systems redesign project to improve safe patient flow through the Emergency Department, there has been significant interest in using the findings to improve the ED journey, especially for mental health patients. This is being trialled in several hospitals in Sydney.
At the 2018 Australian and New Zealand Burn Association Conference in Brisbane, a leading surgeon highlighted that publication from the "*Improving models of care and referral pathways following burn injury for children in New South Wales:*" project was one of the most influential factors in his care delivery decisions. This suggests an impact on health practice and treatment for Aboriginal and Torres Strait Islander children with burn injuries even prior to adoption into clinical guidelines.
Data and advocacy including support from the Black Dog Institute changed how the Department of Education (DoE) guides schools in the adoption of evidence-based programs for depression prevention. Black Dog Institute trained DoE counsellors on the use of digital tools. Information conveyed to the Leaders in Psychology group (regional supervisors of school counsellors) has led to the subsequent rollout to 150 schools in NSW.
The project, conducted in Sydney Local Health District between 2019-2020 resulted in the implementation of a multi-modal training package for file audit of electronic clinical note taking and file review for comorbidity to enhance comorbidity competency and improve management of comorbidity.
MSAC application preferences WGS as first-line genetic diagnosis approach for mitochondrial disease and has now been adopted. The Mity tool has been implemented into clinical practice through Genome One, a sequencing company established by the Garvan Institute for genetic diagnosis of rare conditions which has since been acquired by Australian Clinical Laboratories.
Dimethylguanidino valeric acid (DMGV) can now routinely be used in patients in NSW as a diagnostic marker. It can: (1) detect subclinical non-alcoholic fatty liver disease (NAFLD) better than currently available blood markers; (2) predict future development of diabetes over a decade in advance; (3) determine who will and will not obtain beneficial metabolic adaptations to exercise training, thus helping target exercise to cardiac and metabolic rehabilitation to those who will benefit the most, with alternative strategies for those who will not. DMGV has been

used in clinical trials by groups in USA[7], Sweden[8], and China[9] in exercise, coronary artery disease, and cancer.
The Rapid Access Chest Pain Clinic at Royal North Shore Hospital Sydney was a pilot program supported by the Northern Sydney Local Health District (NSLHD). The Clinic is now considered standard of care at Royal North Shore Hospital and has been approved in 2021 as a permanently funded Clinic by NSLHD.
Serum biomarker testing has been adopted by NSW health.

Community Benefit

Community benefits encompass improvements in access to care and the quality of care provided to patients, improvements in health outcomes including health states and overall wellbeing. Health and healthcare outcomes are the highest order impacts, the sought-after benefits that all research ultimately hopes to achieve and is the objective of all research schemes including the EMC Grant Program. However, evidencing these improvements in care and /or health outcomes can be very challenging, hence the dip in reportable impacts compared with the practice change impacts (see Table 6). Ten projects (33%) were able to report on community/patient benefits.

Table 7 Community and health care benefits

Exemplars of community benefit
For patients, the use of WGS as a first line genetic diagnosis for mitochondrial disease is claimable through the Medicare Benefits Scheme and is a quicker diagnosis with less invasive testing and diagnostic odysseys. There has also been approval for donations for mitochondrial disease to occur in Australia allowing everyday Australians the opportunity to support this work.
The genome profiling platform is enabling precision cancer medicine to be delivered to patients, improving their recovery from cancer.
This genetic based diagnosis included diagnosis of an otherwise undiagnosable patient with DOCK8 deficiency who had undergone somatic reversion, treatment of a patient with CTLA4 haploinsufficiency using everolimus, treatment of a cohort with DOCK8 deficiency using haematopoietic stem cell transplants, treatment of boys with XEMN disease using magnesium supplements followed by hSC transplant, and treatment of a CVD patient with rapamycin to suppress lymphoproliferation; all of which resulted in better outcomes for the patients involved.
In one patient the methodology developed during the fellowship for screening for Sjogren's and Lupus was implemented to predict the patient's exacerbation of disease during remission which enabled pre-emptive treatment that prevented hospitalisation.
Atrial fibrillation was identified in approximately 1.4% of community dwellers aged 65 and older as part of the research. Subsequent consultation and treatment with GPs has resulted in a 66% reduced risk of future stroke.
The implementation of the multi-modal training program increased compliance of comorbidity compliant files from 10% to 95%.

[7] Robbins JM, Herzig M, Morningstar J, Sarzynski MA, Cruz DE, Wang TJ, Gao Y, Wilson JG, Bouchard C, Rankinen T, Gerszten RE. Association of Dimethylguanidino Valeric Acid With Partial Resistance to Metabolic Health Benefits of Regular Exercise. JAMA Cardiol. 2019 Jul 1;4(7):636-643. doi: 10.1001/jamacardio.2019.1573. https://pubmed.ncbi.nlm.nih.gov/31166569/

[8] Ottosson F, Ericson U, Almgren P, Smith E, Brunkwall L, Hellstrand S, Nilsson PM, Orho-Melander M, Fernandez C, Melander O. Dimethylguanidino Valerate: A Lifestyle-Related Metabolite Associated With Future Coronary Artery Disease and Cardiovascular Mortality. J Am Heart Assoc. 2019 Oct;8(19):e012846. doi: 10.1161/JAHA.119.012846. https://pubmed.ncbi.nlm.nih.gov/31533499/

[9]Yang FM, Shen L, Fan DD, Chen KH, Lee J. DMGV Is a Rheostat of T Cell Survival and a Potential Therapeutic for Inflammatory Diseases and Cancers. Front Immunol. 2022 Aug 5;13:918241. doi: 10.3389/fimmu.2022.918241. https://pubmed.ncbi.nlm.nih.gov/35990633/

The research has added to the body of evidence suggesting that varenicline (a more efficacious quit smoking medication) is no more harmful than nicotine patches and can be prescribed without concerns for increasing patient's risk of cardiovascular events. This will result in greater use of varenicline which is a more efficacious option compared to nicotine patches.
Provided genetic diagnosis to 42% of patients in the study (n=1,400) allowing their condition to be treated and managed.
Generation of novel rat models which reduced animal welfare concerns and will permit world-first studies of chronic infection.
Outcomes from the research showed high patient satisfaction and positive cost-benefit from the Rapid Access Chest Pain Clinic, a benefit to patients and the community.

Economic impacts

Economic impact refers to the benefits that research can have on the economy. Typically, these benefits include increases in skilled positions created by the research, leveraged funding and other sources of economic benefit as a consequence of research being adopted into practice. A key aim of the EMC Grant Program is to support researchers to gain additional grants and fellowships from national competitive grant schemes such as the Medical Research Future Fund (MRFF), the Australian National Health and Medical Research Council (NHMRC), the Australian Research Council (ARC), as well as other philanthropic sources and industry.

For this impact assessment, the economic benefit we were able to capture and evidence were grants and fellowships leveraged through the EMC Grant Program and the value of positions created and funded using the EMC Grants (see Table 5). In total, 26 recipients of an EMC Grant managed to secure 145 leveraged grants and fellowships valued at almost $146 million in raw terms. This did not include any leveraged funding from 4 recipients for whom this data was not available. When taking inflation into account and converting the monetary values to 2023 values, that figure increases to almost $174 million. Considering researcher attribution and assuming 50% attribution when researcher attribution was unavailable, the figure is $105 million. A sensitivity analysis puts the upper limit at $173,786 and the lower limit (allowing 20% attribution) at $34,757,247.

Table 8 Leveraged funding and increased staffing as a consequence of the EMC Program

Grants and fellowships leveraged (N)	145
Raw value	$145,708,234
Leveraged value in 2023 adjusted dollars (100%)	$173,786,235
Funds Attributed to Grant (Assumed 50% for unknowns)	$105,237,058
Funds Attributed (lower limit – 20%)	$34,757,247
Funds Attributed (upper limit – 100%)	$173,786,235
Staff employed (total)	29
Post doctoral fellows employed	12
Research assistants /Clinicians employed	17
Total Staff Salaries	$4,758,967
Commercial company launched	1

With regards to positions created, Program funds created 29 additional research positions previously unavailable of which 12 were postdoctoral positions and the remaining 17 were research assistant or clinical positions. These positions were valued at $4.76 million dollars and were created in NSW, retaining the skills, knowledge, and talent in the state.

One project also resulted in the launch of a commercial company Genome One. Unfortunately, the business model for the company failed to take off so further economic benefits were unable to be included in this assessment.

With reference to the types of grants that were leveraged, Table 8 provides a summary of the notable grants/fellowships leveraged by recipients in descending frequency with the largest number from the MRFF through various funding calls and the (NHMRC funding schemes namely Ideas Grants and the (now defunct) Project Grant schemes. One recipient has also been awarded an Australian Research Council Future Fellowship.

Table 9 Notable grants/fellowships secured by EMC grant recipients

Notable Grants	
MRFF (International clinical trials, Cardiovascular)	19
NHMRC Ideas/Project Grants	13
NSW Health Project Grants or Fellowships	4
NHMRC Investigator Grant	4
NHMRC CREs/Program Grants	4
National Heart Foundation Fellowship	3
NHMRC Clinical Trials and Cohort Study	2
NHMRC Partnership Grants	2
Cancer Australia Project Grants	2
Australian Research Council Future Fellowship	1
Goodman Foundation	1
Kinghorn Foundation	1
National Heart Foundation Research Grant	1
National Stem Cell Foundation	1
NHMRC Translation Fellowship	1
NSW Health Translation Fellowship	1
Parkinsons Collaborative Research Network	1

Two projects also reported evidence for future potential economic and commercialisation benefits from discoveries made during the EMC funded research project but at the time of the assessment, neither had yet eventuated. These are summarised in Box A below.

Further to this, there were also improvements in the delivery of healthcare and health outcome improvements from EMC funded research that have potential economic benefits at a personal, health system or societal level. Examples include:

- The genome profiling platform developed through an EMC project is enabling precision cancer medicine to be delivered to patients, improving their recovery from cancer and reducing downstream healthcare costs and personal costs associated with prolonged cancer treatment.
- Atrial fibrillation was identified in approximately 1.4% of community dwellers aged 65 and older as part of

the research. Subsequent consultation and treatment with GPs has resulted in a 66% reduced risk of future stroke. Increasing the proportion screened from 34% to 75% would prevent an additional 177 strokes per year potentially avoiding significant downstream healthcare costs and loss of productivity and income for patients.

- DMGV is now routinely used as a diagnostic marker in NSW. It can predict future development of diabetes over a decade in advance allowing targeted prevention strategies and it can also determine who will and will not obtain beneficial metabolic adaptations to exercise training, thus helping target exercise for cardiac and metabolic rehabilitation to those who will benefit the most, with alternative strategies for those who will not. This has large potential personal and health care savings through avoidance of diabetes and improved outcomes for those at risk.
- Outcomes from the research showed positive cost-benefit from the Rapid Access Chest Pain Clinic. The research identified the most cost-effective approach for diagnosing significant coronary disease in chest pain (electrocardiogram stress testing followed by stress CMR if inconclusive; based on threshold $45,000 to $75,000 per QALY gained).

Unfortunately, this study was not funded to model and monetise the cost and consequences of these project level outcomes listed above, but collectively; their economic benefits have the potential to show significant further returns on NSW Health's research investment in the EMC Grant Program.

Box A: Future potential economic and commercialisation benefits from discoveries

Case A

The project was aimed at finding novel treatments for pulmonary hypertension (PH) a rare and devastating new disease affecting a young cohort with a median survival from diagnosis of 2.8 yrs. There is a high associated healthcare cost to patients and the health system. From a commercial standpoint, PH has a lucrative market and is predicted to significantly grow as some PH drugs are coming off patent and pipeline for new drugs is poor. The class of medications being explored (β3AR agonists) has several potential advantages over existing drugs and could create competitive interest for repurposed, IP-protected, new-agent/group-of-agents, with β3AR agonists as a novel treatment class. The team have filed a patent application (PCT/AU2021/051134) covering their IP. They aim to test Mirabegron (Astellas Pharma), a highly selective agonist for beta 3 ARs in humans that is FDA and TGA approved for overactive bladder syndrome, in patients with PH. Astellas is approaching a "patent cliff" with their compound patent, and the crystal form patent for Mirabegron is likely to expire by the time the team have undertaken relevant clinical trials. They could be interested in expanding the current clinical indications for Mirabegron to include PH and right ventricular cardiomyopathy. The commercialisation committee at the recipient's workplace is supportive of their commercialisation plan and providing technical and financial support.

Case B

This project aims to develop recombinant human platelet-derived growth factor-AB as a novel cardiac regenerative therapy. Next steps are to develop more investor friendly and commercially viable products from their rhPDGF-AB discovery. The nanoparticles investigated within the EMC grant remain an option but the team are also investigating peptide mimetics that will give them stronger IP protection (and therefore likely improved investor interest). Peptides will also have a more attractive lower cost of manufacture. The recipient has also discussed these results with investors and industry in the hope that they will fund early-stage clinical trials.

Section 3: Cost consequence analysis

The costs and monetisable consequences (from available data provided as part of the report and survey – See Appendix 4) for the EMC Grant Program are presented in aggregated form in Table 9.

Program Costs

The total cost of Rounds 1 and 2 of the EMC Grant Program are grouped into three categories, all converted into 2023 values:

1) The value of the monies disbursed to recipients which was valued at **$13,250,055** over the two cycles of the scheme included in the analysis
2) The cost of administering the Program including staff salaries and other incidental costs normally associated with the administration of such a Grant Program valued at **$99,253** over the two cycles
3) All grant reviewer costs costed at full market value which totalled **$230,067** *(s.a.$160,921 to $299,214)* over the two cycles.

Monetisable consequences

The main consequence that could be monetised were the grants and fellowships that were leveraged. For the economic analysis we included two values:

(1) the value of ALL funding leveraged
(2) only the value of grants that were attracted into NSW that could have gone elsewhere.

From this second figure, we also excluded two grants that were obtained by a recipient who was overseas at the time they secured the funding, and these funds are assumed to remain overseas. This reduced the number of eligible grants from 145 to 95 and the total value in 2023 dollars from **$105,237,058** (*s.a. $34,757,247 to $173,786,235*) to **$94,973,088** (*s.a. $30,891,546 to $154,457,728).* It is important to note that both these estimated monetisable consequences are conservative for two reasons:

- data was only available for 26 of the 30 projects (while data for the costs of the Program covered all 30 projects)
- this study was not funded to undertake an economic analysis of the implementation costs and downstream savings from individual research projects that had achieved changes in healthcare delivery and corresponding improvements in care and health outcomes that could have been monetised.

Table 10 Costs and monetisable consequences for the EMC Grant Program

COSTS	Round 1 2017	Round 2 2018	Total Two rounds	Sensitivity analysis
Grant administration and management (OHMR)	$49,626	$49,626	$99,253	
Grant review	$109,135	$120,932	$230,067	*$160,921 - $299,214*
Grants monies disbursed (converted to 2023 value)	$6,161,365	$7,088,690	$13,250,055	
Total estimated cost over 2 Rounds			**$13,579,375**	*$13,510,228 - $13,648,522*

CONSEQUENCES	Raw value	20%	Researcher attribution	100%
Grants and fellowships leveraged (145)	$145,708,234	$34,757,247	**$105,237,058**	$173,786,235
Grants and funding leveraged into NSW (95)	$131,928,504	$30,891,546	**$94,973,088**	$154,457,728

What is evident is that even when using a conservative estimate, the EMC Grant Program has generated returns that are significantly higher than NSW Health's original investment in the scheme in those two rounds. When only including the figures from funding leveraged into NSW, the returns are 6.99 times higher than the investment (*s.a. 2.2 to 11.4*). When including ALL leveraged, the returns are 7.75-fold the investment (*s.a. 2.5 to 12.9)*

Inclusion of data for all projects and the ability to undertake an economic analysis of all projects that have had downstream practice and health impacts would increase the value of monetisable consequences beyond this conservative estimate.

> *"Thank you for the support. I probably would not have been able to remain an academic without the funding support I received as an ECR from this scheme. I am very grateful as this really put me on a trajectory towards NHMRC and other funding which allowed me to continue with my research."*
>
> *Grant recipient, 2017*

Section 4: Narratives

Research Impact

The full extent and depth of the impact of research can often be best captured using a case study approach. The following are the two case studies (deep dives) selected to showcase the impact of research funded by the EMC Grant Program. With permission from the relevant recipients, who are identified, the narratives provide crucial details about the selected projects and the translation of the research to policy, practice and potential health outcomes so the reader can follow the pathway from the research to the final impacts.

Project Narrative 1: Dr Ryan Davis

Improving Mitochondrial Disease diagnosis, awarded an NSW Health EMC Grant for $361,000 in 2017.

Problem and Need

Mitochondria are the power houses of the cell providing the body with over 90% of the energy it needs to sustain life. Mitochondria absorb sugars and proteins from the food we eat and produce energy (ATP) that our bodies use to function properly. Mitochondrial disease is a debilitating and potentially fatal disease that reduces the ability of the mitochondria to produce ATP but also impacts on other cellular and metabolic functions. When mitochondria are not working properly, cells begin to die until eventually whole organ systems fail and the patient's life is compromised. Amongst genetic diseases, mitochondrial diseases are unique as they are not only caused by mutations in the nuclear genome, but also in mitochondrial DNA. As a result, diagnosis is exceedingly challenging, typically taking 3-6 years and involving 5-7 clinicians, with most patients previously receiving a non-mitochondrial diagnosis. (4) This long and complicated process places additional burdens on patients, healthcare systems, and pathology services. Whole genome sequencing (WGS) captures both mitochondrial and nuclear DNA, presenting an opportunity for rapid and efficient diagnosis from a single test. However, the lack of adequate analytical methods has prevented its use in diagnosis of mitochondrial diseases. New tools are needed to implement this technology into clinical practice.

Response

This fellowship addressed this gap in knowledge by facilitating a visiting scientist appointment to the Garvan Institute of Medical Research where the researcher worked closely with geneticists and bioinformaticians to develop one of the first tools for high resolution analysis of mitochondrial DNA in WGS (*mity*^{TM}). To assess the utility of this tool in clinical practice, WGS of blood DNA was implemented in a cohort of 242 adult patients presenting to a specialist mitochondrial disease clinic in Sydney with definite (62), probable (108) or possible (72) mitochondrial disease diagnoses based upon clinical presentation. This work was funded by a NSW Health Collaborative Genomics Grant. Using WGS as a first-line diagnostic blood test, precise diagnoses for rare mitochondrial diseases were obtained at a diagnostic rate of 53.7%, which was a favourable rate compared to genetic disease cohorts sequenced using other next-generation sequencing methods. In addition to favourable diagnostic rates, this approach was simplified to a single test, used less invasive sampling (blood vs. muscle biopsy), and was more comprehensive when compared to conventional targeted mitochondrial sequencing panels for diagnosis.

Outcomes

Diagnosis by WGS led directly to changes in clinical care, including implementation of disease-specific care or avoidance of contraindicated care, and clarification of reproductive options for patients. Patients with differential diagnoses of non-mitochondrial diseases also benefited from changes in clinical care or subsequent diagnostics tests based upon the WGS results. Subsequent analysis revealed that implementation of WGS as a first-line diagnostics was cost-effective. In summary, WGS was found to be accurate, minimally invasive, cost effective, and able to lead to rapid implementation of appropriate clinical management, including avoidance of inappropriate therapies and reproductive advice.

Impacts

Knowledge – This fellowship including the tools and skills it enabled the researcher to develop, have contributed to 23 peer-reviewed publications (7 first/senior author; 16 in Q1 journals) with at least 943 citations (FWCI = 3.8) and 21 conference and other presentations (9 of which were invited). Findings from the research and knowledge generated have also been disseminated through the Mito Foundation via regular reports in their newsletter.

Policy and practice – Data from this fellowship was directly relevant in establishing the use of whole genome sequencing for diagnosis of mitochondrial disease at the Royal North Shore Hospital in Sydney and was instrumental in obtaining Medical Services Advisory Committee approval of a rebate for this testing. As a result, WGS is now the preferred first-line genetic diagnosis approach for mitochondrial disease in Australia, effective from November 2023, permitting patients to achieve quicker diagnoses through less invasive testing.

Further healthcare impacts: With NSW Pathology, serum biomarkers of mitochondrial disease have been translated into clinical service to triage patients from clinics into the WGS pipeline to further refine the utility of this technique. This work was largely driven by Dr Davis who led publications to support the translation. Findings from Dr Davis' fellowship were also used in the mitochondrial donation submissions to parliament, resulting in changes to legislation which have enabled mitochondrial donation to occur in Australia. Evidence for this is on the Mito Foundation website (https://www.mito.org.au/fundraise/).

Capacity building – The novel bioinformatics tool generated during this fellowship (*mity™*) builds global research capacity, as does a second tool (Introme) developed during the fellowship but not directly relevant to its outcomes. These tools and the clinical/bioinformatics collaborations established during this fellowship are now being applied to a diverse range of diseases including Parkinson's disease and chronic pain. As part of the fellowship, the researcher was involved in establishing the Australian Mitochondrial Disease Medical Network (MitoNet) which is facilitating greater collaborations between Australian clinicians and researchers investigating mitochondrial diseases. Funding secured as a result of this fellowship enabled supervision of 3 PhD and 2 masters/honours students, as well as employment of additional research staff.

Economic impacts – Dr Davis has been instrumental to securing $18.75M (inflation adjusted) in research funding from 10 grants, including two NHMRC partnership grants and two MRFF grants to continue this work. This funding was directly attributable to the skills, knowledge, collaborations and track record developed during Dr Davis's EMC fellowship. Research from this project, being led out of Macquarie University has also identified the additional cost per QALY (Quality Adjusted Life Year) gained by implementing WGS for diagnosis and informing disease management of mitochondrial disease but this work has yet to be published.

Reflections

This fellowship was instrumental to the researcher's promotion to Senior Research Fellow and establishment as head of an independent research team. The researcher appreciated how, at a pivotal moment of their career, the fellowship was able to provide them with an opportunity to learn new skills and develop cutting-edge techniques that built their own career and research capacity more generally. The greatest benefit from this fellowship, for them, has been the ability to develop the close collaborations necessary for translational science that impacts clinical practice to benefit patients and the healthcare sector.

> *"I'm kind of that conduit between them understanding the genomics, understanding the basic science, having the links with the clinicians and the bioinformaticians and externally with things like the health economists to really pull it all together…. I wouldn't have had that opportunity otherwise...You can see that the power of genomics is not just cross-sectional. It doesn't just happen at that one point. You can look at it down the track and gain further insight or gain some more aspects to it. So what I really did was "here's a technique that can offer us something that we can't get from anywhere else, for mitochondrial diseases. But now I can apply that to a whole bunch of different disease sets, through my collaboration with clinicians."*

Project Narrative 2: A/Prof Aliza Werner-Seidler

The implementation of an evidence-based depression prevention program in the school system, awarded an NSW Health EMC Grant for $358,260 in 2017.

Problem and Need

Mental health problems, particularly depression, are a major health concern for young people. A 19% lifetime prevalence of a major depressive disorder in adolescence can lead to detrimental effects on social, educational, and health outcomes for sufferers compounded by underdiagnosis and high relapse rates. Preventative measures are necessary and digital technologies provide the potential for large scale, cost-effective interventions in a format readily embraced by adolescents. School teachers and counsellors consider supporting their student's mental health as an important component of their work. The combination of digital depression prevention tools and their implementation in schools represents a scalable intervention to alleviate the mental health burden of depression in Australian adolescents. However, despite early promise, the enthusiasm to deliver digital mental health programs as a solution to mental ill-health has not been met by commensurate implementation in the field. Many factors can affect the uptake and efficacy of these programs, and there is a lack of evidence concerning the barriers and facilitators to their widespread implementation in Australia.

Response

This work supported by the EMC Grant addressed this gap in knowledge by conducting a series of quantitative and qualitative investigations into the implementation of digital depression prevention programs in schools. Systematic reviews and meta-analyses of mental health programs targeting both teachers and students were conducted to characterise current knowledge in the field. A qualitative assessment of NSW school teachers (N=91) and counsellors (N=83) assessed their perception of the school's role in student mental health and explored their views about how support is currently provided in schools. Finally, a cross-sectional survey of teachers (N=97), counsellors (N=93) and principals (N=11) assessed the barriers and facilitators to the implementation of a digital depression prevention program in schools.

Outcomes

The research identified cost and resourcing issues as the greatest challenge to implementing digital depression prevention programs, particularly staff training in delivery, support from school counsellors and wellbeing leaders, flexibility in program delivery and the importance of co-design. These results suggest that the refinement of school-based prevention programs have the potential to reduce mental health burden and advance public health outcomes and have subsequently led to the delivery of a hybrid implementation/effectiveness pilot trial across twelve secondary schools in NSW. The range of implementation strategies which were employed and evaluated have been reported to key stakeholder and potential implementers (e.g. development of educational resources and teacher training, engagement with school leaders and the Department of Education) and has informed a follow-up scaled study involving approximately 150 schools and up to 10,000 high school students.

Impacts

Knowledge – The research funded by the EMC Grant contributed to eight peer-reviewed publications (5 first/senior author; 66% in Q1 journals) with at least 169 citations (FWCI = 2.4) and eight conference and other presentations (6 of which were invited). Findings from the research and the knowledge generated have also been disseminated in summaries and recommendations provided to participating schools, training of counsellors, and delivery of workshops to school administration stakeholders. Online information packs have been developed to support sustained rollout.

Policy and practice – Data from the EMC grant was included in a briefing document to the incoming State NSW Labour government in 2023, and research findings have been shared with numerous educational and counselling groups for training and to inform practice. These groups include the NSW Health Child and Adolescent Mental Health Services, Department of Education, Independent School bodies, and the Leaders in Psychology group (regional supervisors of school counsellors). Fortnightly meetings have been held with contacts from the Department of Education, and the Black Dog Institute has trained every single Department of Education school counsellor in NSW schools in how to use digital tools to support student mental health. The study has also changed how the NSW Department of Education guides schools to evidence-based programs, with a "menu" developed in 2022.[10] A/Prof Werner-Seidler has also contributed to more than 5 government inquiries into mental health including appearing before the legislative council as an expert witness for the ACT Inquiry into Youth Mental Health. An outcome included the adoption of every recommendation from the 40 citations of her work, including material completed as part of the EMC Grant.

Capacity building – The EMC Grant aided A/Prof Werner-Seidler to develop her skills in media engagement and Implementation of findings, as well as facilitated her participation in the University of NSW's Women in Science Leadership Training. This equipped her for her foundational role in establishing two global networks to improve internet-based interventions and implementation of research, including the Future Proofing Study - the largest mental health digital prevention trial undertaken in Australia. Skills learned have also led to the establishment of a special interest group within the Black Dog Institute for professional development, skill training and knowledge exchange in relation to depression prevention in schools.

[10] (https://education.nsw.gov.au/schooling/school-community/mental-health-programs-and-partnerships/evidence-based-mental-health-wellbeing-programs-for-schools

Economic impacts – A/Prof Werner-Seidler has gone on to secure $13.87M (inflation adjusted) in research funding from 8 grants, including an NHMRC Centre for Research Excellence grant, an Investigator grant, and several project grants; an MRFF grant, and a major philanthropic grant from the Goodman Foundation. An estimated $7.73M ($3.24M lower limit; $13.33M upper limit) of this funding was directly attributable to the skills, knowledge, collaborations and track record developed by Associate Professor Werner-Seidler's during her EMC fellowship. Much of this funding has supported the rollout of mental health interventions into 150 schools and development of a supported online therapy program for young people.

Reflections

This fellowship facilitated research directly targeted towards implementation of evidence-based preventative measures for mental health. The findings have led to large-scale clinical trials, as well as significant development in mental health and education policies, and has provided a suite of training with utility for both counsellors and teachers. By providing the funding to facilitate Associate Professor Werner-Seidler's focus on implementation science, and not merely knowledge generation, the EMC Grant has already provided wide-ranging impact on the mental health of thousands of school children, with significant potential for further scale-up as the ongoing trials reach their conclusion and lead to further engagement with educators, counsellors and policymakers. The collaboration and connections established during this fellowship have been crucial to Associate Professor Werner-Seidler's success.

> *"The training focus of this Fellowship has allowed me the time and funding to develop skills from global and local leaders in the area, as well as the opportunity to then apply these skills and learning to the Fellowship project. Moreover, not only have I had the opportunity to develop my own skills in implementation science, but I have been able to share them with my team and build their skills in the area. Finally, developing skills in this area has led to the formation of a special interest group at my organisation bringing together professional development, skill training and opportunities for knowledge exchange in this increasingly important area."*

Career impact

The following narratives contain two case studies focussed on the impact of the EMC Grant on career progression and trajectories for selected recipients. Unlike the previous narrative that focused on research impact, these narratives showcase the impact of the EMC Grant Program on the research careers of recipients.

Project Narrative 3: Prof Robyn Clay-Williams

Health service and systems design to improve safe patient flow through the Emergency Department, awarded a NSW Health EMCR Fellowship for $360,929 in 2017.

Synopsis of project and impacts

Emergency departments have an ongoing problem coping with demand, exacerbated since the COVID-19 pandemic. There is significant scope to improve emergency departments (ED) efficiency and capacity but the complex and dynamic nature of the system and busyness of staff makes it challenging to assess interventions in real-world settings. Cognitive work analysis is a complex technique aimed at modelling intricate systems and assessing the effect of interventions, allowing detailed experiments to be completed without disrupting the system's functioning in real life. Prof Clay-Williams led a team to develop cognitive work analysis models of the emergency departments at Blacktown and Mt. Druitt Hospitals. The models were validated and are now available for investigation of EDs across NSW. The research funded by the EMC Grant contributed to 26 peer-reviewed publications (14 first/senior author; 12 in Q1 journals) with at least 323 citations (FWCI = 0.97), 7 book chapters, and 49 conference and other presentations (3 of which were invited). The models are currently being used to test interventions aimed at improving patient experience, outcomes and emergency department performance, and there are ongoing discussions with the Blacktown Hospital ED to use the current findings to improve outcomes for mental health patients. The EMC Grant drove the application of cognitive work analysis in healthcare design, developing a novel tool that can be utilised in global healthcare systems and assisted Prof Clay-Williams to secure $20.3M (inflation adjusted) in additional funding, of which $12.5M is attributed to this fellowship ($6.3M lower limit; $20.3 upper limit)

Reflections – Career Impact

Prof Clay-Williams began this fellowship in 2017 as a Level B academic. This was a pivotal moment in her career, as funding for health services research had an exceptionally low success rate from the NHMRC and her future prospects in research were uncertain. She was ineligible for further promotions and career progression as she had not received a Category 1 competitive grant as Lead Investigator (CIA), and teaching roles were not available for health services researchers. Her own assessment of her situation was that she would likely have spent a small period employed as a post-doctoral researcher before leaving academia.

Instead of this position, Prof Clay-Williams' career in research has continued with rapid progression, including her recent appointment to Professor (Level E) in January 2024. As her first Category 1 grant as CIA, the EMC Grant facilitated her promotion to senior research fellow (Level C Academic) and ensured that her research career was able to continue. The stability of funding for three years and emphasis on skills development were essential, as learning the cognitive work analysis technique and applying it to health system design required significant investment due to the complexity of the models.

> *"One key benefit of the fellowship was that it encouraged you to pick a research method that you were not familiar with and to learn a new research method which in early career research is really valuable because usually, when you finish your PhD, you don't have that opportunity. You just have to start researching using your existing skills. By this sort of gave me space to learn a brand-new research method."*

The EMC Grant placed Professor Clay-Williams and her research team at the leading edge of the field, gaining them international recognition. She has since received international recognition for her work and remains a key part of the research team with ongoing funding.

Establishing collaborations in this fellowship has also been a major contributor to the success of Professor Clay-Williams. Through the EMC Grant, Prof Clay-Williams established connections with members of the Western Sydney Local Health District, Emergency Care Institute and local ED management. When a major MRFF grant opportunity was made available with only three weeks' notice to final submission, the prior establishment of these connections made it feasible to develop an application which successfully secured $2.8M in funding over 5 years, with $700k in in-kind support. Without the connections established through the EMC Grant, such funding and interactions would not have been possible.

> *"It's certainly put you in a position where you were in high-powered meetings where you could actually meet the right people."*

Overall, this fellowship was instrumental in turning the uncertain future of a Level B academic into a professor with an expanding research team, international recognition, and unique expertise capable of driving systemic change to improve healthcare systems in NSW.

Project Narrative 4: Associate Professor Joanne Reed

Screening and diagnosis of autoimmune diseases focusing on Sjogren's syndrome and Lupus, awarded a NSW Health EMCR Fellowship for $328,217 in 2017.

Synopsis of project and impacts

Autoimmune diseases such as Sjogren's syndrome and Lupus occur when a person's antibodies mistakenly attack their own body. These diseases are poorly understood, and it is unclear why patients will experience the sudden onset of clinical disease despite no obvious change in the autoantibodies which have been present for years. Due to this gap in understanding, current serology-based diagnostic tests have little predictive ability, limiting opportunities for early interventions or preventative strategies for people at risk of these autoimmune diseases. Single cell sequencing techniques have significant potential to characterise disease processes and develop molecular tests with better predictive power. Associate Professor Reed employed single cell genomic and transcriptomic analysis of blood cells and antibody peptide sequencing from patients with autoimmune diseases. She identified that severe disease was associated with a cascading series of genetic events producing many B cell clones with mutations in immunoglobulin genes and lymphoma/leukemia driver genes, identifying novel markers that can be used in predictive diagnoses. The research funded by the EMC Grant contributed to 11 peer-reviewed publications (7 first/senior author; 9 in Q1 journals) with at least 313 academic citations (FWCI = 1.28), 1 patent citation, and 35 conference and other presentations (1 of which were invited). Data from the project informed treatment strategies for patients, including prediction of disease exacerbation which were able to direct early interventions that prevented hospitalisation. Findings are currently being assessed for their utility in remission and in directing targeted therapeutics. Work from the EMC Grant assisted Associate Professor Reed to secure $2.9M (inflation adjusted) in additional funding, of which $1.6M is attributed to this fellowship ($580K lower limit; $2.9M upper limit).

Reflections – Career Impact

Associate Professor Reed began this fellowship in 2017 as a post-doctoral researcher. This was a challenging period for her career, as she was no longer eligible for early career NHMRC grants and fellowships but was not competitive for the next level of independent research grants. To be competitive for further funding and advance her career, Associate Professor Reed needed to establish her own research program, which aligned with her

personal goals of pursuing her own research interests rather than those of a supervisor. While her employment was secure, her assessment of her situation was that she would likely have spent much more time employed as a post-doctoral researcher in a supporting role and would have found it extremely challenging to make the transition to an independent researcher pursuing her own personal area of research.

> *"With a lot of the other funding bodies, the jump between post-doc and group leader is very stark, and there seems to be a real lack of anything that actually allows you to develop as a researcher."*

Instead, the OHMR EMC Grant allowed Associate Professor Reed's to begin leading her own research team at the Garvan, and subsequently the Westmead Institute for Medical Research where she was recently appointed as the director for the Centre for Immunology and Allergy Research.

Associate Professor Reed appreciated the focus of the fellowship on personal development, which allowed her to hire a post-doctoral researcher from the United States to provide bioinformatics expertise. Associate Professor Reed continues to use the analysis pathways developed as part of her EMC Grant research, and credits the skills learnt from this researcher with improving her ability to design experiments to maximise the benefits of large, complex datasets and facilitating her collaborations with other bioinformaticians.

> *"What was really good about these grants, when I think about it, was that they were about actually developing the fellows as opposed to just generating data. Obviously, you're generating data at the same time by developing those skills, but it seemed to be more about building a knowledgeable workforce as opposed to just straight up outcomes."*

The EMC Grant led directly to Associate Professor Reed's appointment as an independent lab head and provided the skills and preliminary data for a Rebecca Cooper Foundation grant which required supplementary salary support and an NHMRC Project Grant that led her to expand her team. The EMC Grant developed collaborations with clinicians from Westmead, creating career opportunities for her to move to that institution and subsequent promotion and a recently awarded NHMRC Investigator Grant. Her work has also led to increased involvement with the Lupus Research Alliance and, through them, she has established international collaborations with New York University and John Hopkins University. It also provided the freedom to become more engaged with the Australian Society for Immunology, including delivering teaching as part of the advanced immunology school.

Overall, the EMC Grant established Associate Professor Reed as an independent researcher and facilitated the development of a unique set of skills and techniques which she describes as the 'brand which her entire lab is based around'. It has improved her skills in experimental design and data management, facilitated ongoing collaborations and career advancement, and provided tangible improvements in patient care with significant scope for further implementation.

> *"This grant 100% facilitated my research because I needed to get paid a salary and my NSW Institute wasn't going to do that."*
>
> *Grant recipient, 2018*

Section 5: Impact of EMC Grant on Career Progression

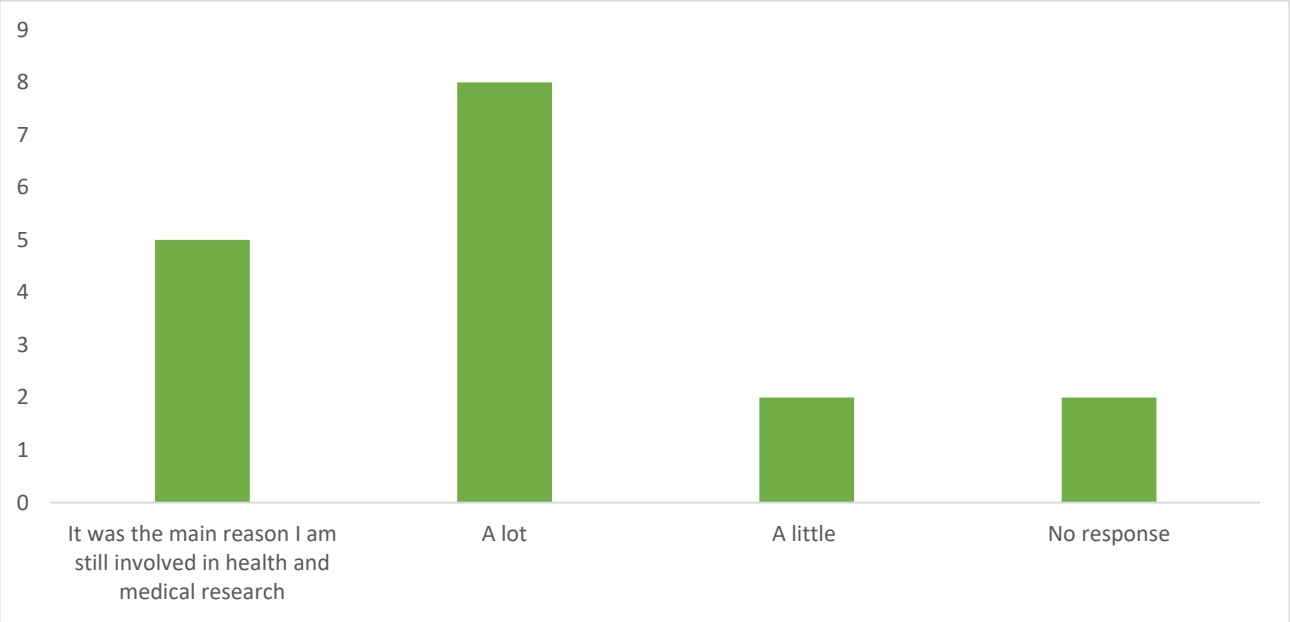
A key aim of the EMC Grant Program is to attract and retain skilled EMC researchers within the health and medical research sector in NSW.

Retention in the health and medical research sector

Of the 17 survey respondents who completed the survey, 14 (82%) confirmed that they were currently undertaking health and medical research as an academic, clinician or any other type of researcher and the remaining three respondents did not provide an answer. None of the survey respondents had left the health and medical research sector at the time of the survey. Of the remaining 13 non-respondents, desktop analysis revealed that 12 were still in the health and medical research sector and one had moved into a policy role at the NSW Ministry of Health. This means that overall, 97% of recipients (n=29) were still in the health and medical research sector 5-6 years after securing an OHMR EMC Grant.

When asked how much the OHMR EMC Grant contributed to their continued involvement in health and medical research, 47% of respondents selected *a lot* and a further 29% said it was *the main reason they were still involved in health and medical research* (see Figure 5).

Figure 5 Extent to which EMC Grant contributed to recipients' continued involvement in health and medical research

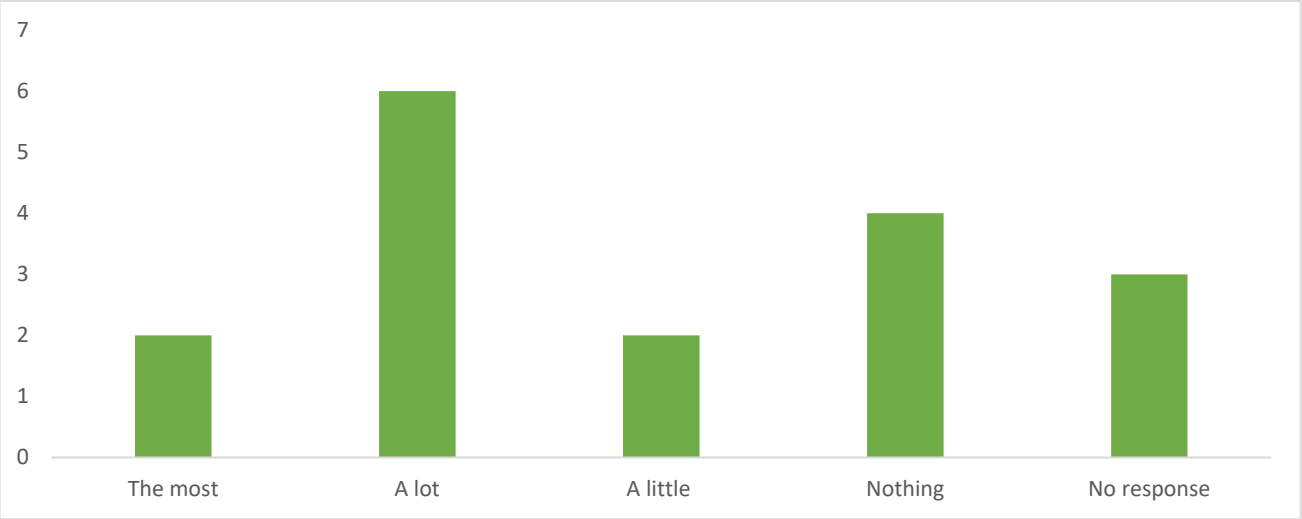


Retention in NSW

Fourteen respondents (82%) remained working in NSW whilst one had left the state to take up a research position overseas. Two respondents did not provide a response. The main reason the one respondent moved overseas was to avail themselves of perceived better funding opportunities there. Desktop research revealed that all non-responders had remained in NSW bringing the overall tally to 97% remaining in NSW, 5-6 years after they secured the OHMR EMC Grant.

When asked the extent to which the OHMR EMC Grant had contributed to keeping them in NSW, responses were somewhat polarised. Whilst 47% of respondents thought it had contributed *the most* or *a lot* to their retention in NSW, 36% thought it had contributed *a little* or *nothing* to them staying in NSW (see Figure 6).

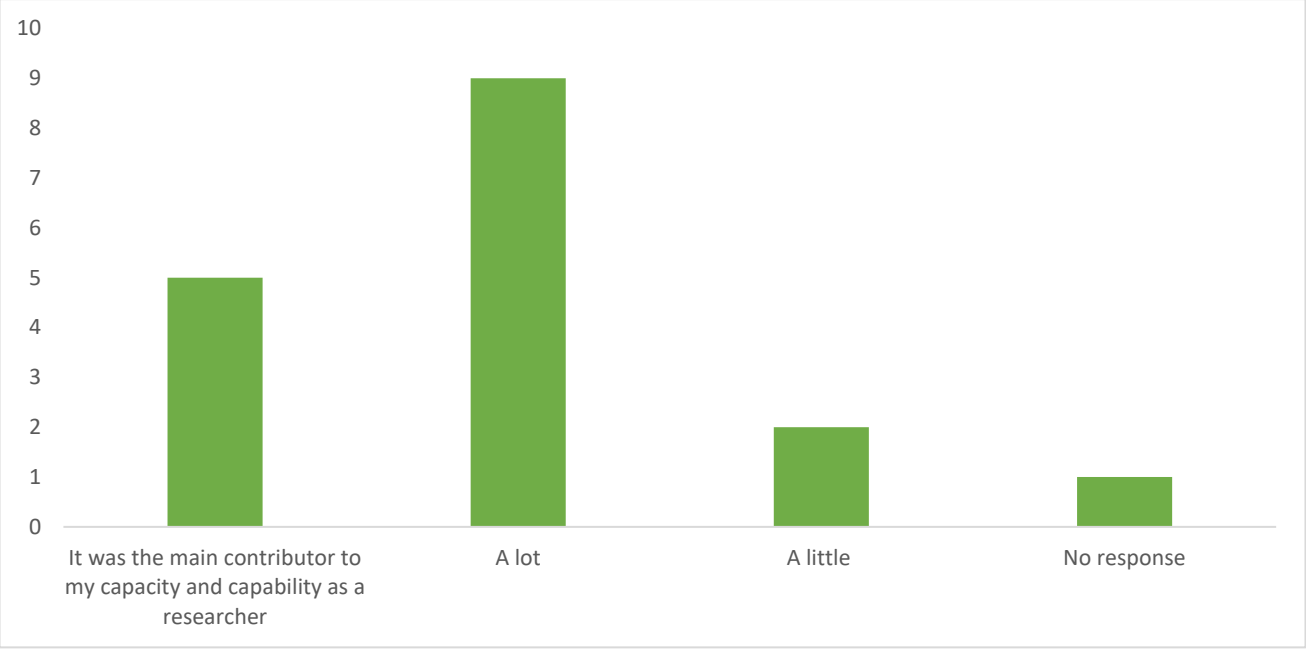
Figure 6 Extent to which OHMR EMC Grant contributed to recipient staying in NSW



Contribution to building their capability and capacity as a researcher

When asked how much the grant contributed to building your capacity and capability as a researcher, from the time they received the OHMR EMC grant until the time of the survey, an overwhelming majority (82%) said it contributed *a lot* (53%) or it was *the main contributor to their capacity and capability as a researcher* (29%). Only two respondents said the grant had "little" contribution to their development as a researcher (see Figure).

Figure 7 Contribution of OHMR EMC Grant to capacity and capability as a researcher



Immediate positions following completion of EMC Grant

Survey respondents reported their next positions immediately following the completion of their EMC Grant. Many held joint positions: either between a University and Medical Research Institute (MRI), or a University and NSW Health Service. Responses could be grouped into four categories: (1) those who secured their next grant that included a salaried position; (2) those who stated their position title but did not indicate if it was the same

position or a promotion; (3) those who secured an academic promotion; and (4) those who remained employed in the same position as they were in when they commenced their EMC Grant (see Table 10).

Table 11 Positions immediately following the EMC Grant

Responses
• *I had my salary paid by my Institute for 6 months but was then awarded an NHMRC investigator grant - bridging would have been nice.* • *I was a 0.6FTE Chief Investigator of a MRFF Grant whilst remaining 0.4FTE in a clinical position with a local health district*
• *Associate Professor and a University and Lab Head at an MRI* • *Senior Hospital Scientist within NSW Health* • *Head of a Clinical Genomics Lab* • *Senior Research Fellow. Joint position at a research institute and University*
• *Promoted to Senior Research Fellow at the same Institute/University* • *Promoted* • *Promoted to Associate Professor*
• *I remained employed in the same position at the same Institute/University* • *Part time Project Investigator at the same Institute* • *I remained a Research Fellow but have since had a promotion* • *Continued in same position*

Impact on career trajectory

Recipients were also asked about the impact the EMC Program had on their individual career trajectories and success. Table 11 contains their verbatim responses. The five main impacts on career as expressed by respondents to the survey have been:

- The ability to continue a career in the health and medical research sector
- Contribution to academic promotions and senior positions
- Ability to use EMC Grant to leverage subsequent competitive funding
- Opportunity to build research skills and research leadership
- Opportunity to build collaborations vital for their research.

Table 12 Career progression outcomes attributed to the EMC Grant Program

Exemplars of career progression as a result of the EMC Grant Program
*"The NSW Health Early-Mid Career Fellowship allowed me to rapidly transition my career through various roles based at UNSW School of Women's and Children's Health, the Children's Cancer Institute, Kinghorn Centre for Clinical Genomics, and the Garvan Institute. This career development growth allowed me to **accelerate my collaborative networks**, establishing the collaborations vital for my work. Evidence of this can be seen in my **increased research leadership through membership on various committees."***
*"Since receiving the EMC fellowship my **contract was renewed for 5 years and I have been promoted** to the next academic level starting 2024."*
*"In addition to the research findings, another important outcome of this funding mechanism was my **development as a research leader**. When I was awarded this funding, I was a senior research scientist wanting to take the next step to lead my own research group but was unable to obtain the next level of NHMRC fellowship funding. Since being awarded a NSW Health EMC fellowship I have taken steps to **increase my research and leadership skills through training and development of a new research area**, this **has led to two successful NHMRC grants** and **promotion to a Group Leader position**, where I am now responsible for a team of 5 staff and students. I was **promoted to Associate Professor** in 2021 and **took up a new research leadership position as Lab Head** and Principal Research Fellow at the Westmead Institute of Medical Research. I was recently **awarded a Leadership Investigator Grant from NHMRC**."*
*"I **secured a Medical Research Future Funds Clinical Researcher Grant in 2022** which has allowed me to continue the work I began with the EMC fellowship."*
*"The EMC Fellowship has allowed me **to further enhance my program of research** that is focused on examining health outcomes, particularly following traumatic injury, across the lifespan using record linkage and mixed method research techniques. This research has **allowed me to explore using novel data analysis techniques, such as trajectory analysis**, to determine the impact of different types of injuries on an older adult's health outcome and their movement between the home, hospital, and residential aged care facilities in NSW. I have **applied for a promotion to Professor** and will find out at the end of October 2023 if the application has been successful. I have applied for other grants examining health outcomes of Australians and have been successful, e.g. I am **leading both a NSW and a national cohort study** to examine health service use and health and social outcomes after a Cochlear implant."*
*"This study has been **critical in building my confidence in both clinical and health economic aspects of research**. Many health economists deal only with secondary research material, but my clinical skills were fundamental in being able to design a medical record review audit that integrated both disciplines and will provide robust primary data. I used the Fellowship funds to **develop my health economic skills in discrete choice experiments** as this research project has illustrated the importance of assessing consumer preferences for care. The Fellowship has allowed me to **develop, lead, and drive a significant research project within a healthcare setting**. It has been a challenging process, but I have benefited significantly in terms of **demonstrating my ability** to undertake such projects, and in **gaining a deep insight into acute care pathways within NSW Health."***
*"Professionally, the EMC Fellowship has **enabled me to continue to develop as a research-intensive academic with an international reputation** in the field of resilient health care. This award **facilitated my promotion to senior research fellow and assisted me in obtaining Category 1 research funding**. It has **enabled me to connect with fellow researchers in my field both in Australia and internationally**, and to significantly contribute to the knowledge base on complexity and dealing with the unexpected in health care. The EMC Fellowship has offered me the **opportunity to work directly with clinicians at the frontline of care**, to learn about providing health services from*

their point of view and to begin to understand how work is done when caring for patients. This knowledge and understanding ***will assist me in translating research findings into practical tools and approaches that can help make our hospitals safe****r. I was also* ***promoted to Associate Professor*** *in 2021."*

"The fellowship has ***improved my research capacity*** *to a great extent."*

"The training focus of this Fellowship has allowed me the time and funding to ***develop skills from global (e.g., Fixsen, Barwick) and local leaders in the area*** *(e.g., Lingam, Wolfenden), as well as the* ***opportunity to then apply these skills and learning*** *to the Fellowship project. Moreover, not only have I had the opportunity to* ***develop my own skills in implementation science****, but I have been able to* ***share them with my team and build their skills in the area*** *(particularly one of my junior post-doctoral fellows who has been working in this area for the last 18 months). Finally, developing skills in this area has led to* ***the formation of a special interest group at my organisation bringing together professional development, skill training and opportunities for knowledge exchange*** *in this increasingly important area. I have been* ***successful in gaining funding*** *to continue this area of work, including funding as a CI from the NHMRC (Project Grant) to take to scale a hybrid/implementation trial where approximately 5,000 young people are expected to receive the digital depression prevention program that was the focus of this Fellowship by the end of 2021. Finally, this Fellowship has* ***put me on a trajectory towards continued funding****, as I have* ***secured a competitive NHMRC Emerging Leader Investigator Grant*** *(2022-2026) to continue my work translating and delivering evidence based digital mental health interventions into schools as a way to prevent the onset of mental illness in young people. I have been* ***promoted to Associate Professor*** *and* ***received a tenure track position*** *at the Black Dog Institute, UNSW."*

"As a result of the research activities funded by the fellowship, I was ***promoted to Senior Research Fellow*** *at UNSW, Honorary Senior Research Fellow at the University of Wollongong and* ***appointed Program Lead*** *in Trauma and Crime Research at the Matilda Centre. I also applied for and was* ***successful in obtaining an NHMRC Investigator Grant*** *to continue forging this program of work from 2021-2025."*

"The NSW Health EMC Fellowship has ***improved my research capability*** *immensely. I now have the skills to answer the questions I was previously unable to do. It has* ***added another key component to my area of work and opened up a whole new world of research*** *for me and a new way to improve the lives of the people I care about."*

"Aside from ***opening up diverse opportunities to collaborate*** *in areas of research interest other than my own, I am now also branching out from the research interests I had before starting this fellowship.* ***Collaborations have emerged*** *in areas including, cancer, movement disorders, and pain, while* ***diversification of my own research interests*** *now includes non-coding causes of disease and impacts of the microbiome in Parkinson's and mitochondrial disease. I* ***took over as the head of the Neurogenetics lab*** *at the Kolling with the recent departure of Professor Sue to NeuRA. I was also recently* ***promoted to Senior Research Fellow****."*

"My research capacity has been greatly aided by this grant; as mentioned, it ***provided a direct route for multiple grant successes****."*

"I ***moved from a hospital scientist position to a senior hospital scientist position*** *and am currently in charge of the intravital and spinning disk confocal microscopy section with the research lab/institute."*

"I left Australia and ***have a stable research-only position*** *at a five STAR Institute with around 5 times more funding than I could have received by staying and rolling the dice for an NHMRC fellowship."*

"Honestly, I had a really outstanding experience with this grant and your office supporting me. There was flexibility and understanding when I went on maternity leave and ***the grant absolutely set up my career."***
"I accepted Faculty position at Garvan April 2021. Then in 2022 I was ***appointed Program Director****, Genomics and Inherited Disease,* ***leading scientific vision and line management of Faculty labs****."*
"I have been ***promoted to Associate Professor*** *and I have* ***secured a leadership position in my organisation*** *(Deputy Director at the National Drug and Alcohol Research Centre)."*
"I have been ***promoted to Professor*** *at University of Sydney - the* ***First "Professor of Cardiometabolic Medicine"*** *in the history of The University of Sydney!"*

Section 6: Recipient feedback for improving the administration of the scheme

To assist with improving the EMC Grant Program in the future, recipients were also asked to reflect on their experience of the Program and to identify ways that the administration of the scheme could be improved in the future. This covered several different aspects of the administration of the grant from the application phase to the close out. Half of the recipients (n=15) responded to this section of the survey, which is a 50% response rate.

Grant application and notification

Just over half of respondents (n=7) thought the application process was efficient and/or said they did not have any suggestions to add. Two respondents said they were unable to recall the process and were unable to comment. Of those that thought the process was efficient, below are some of their comments:

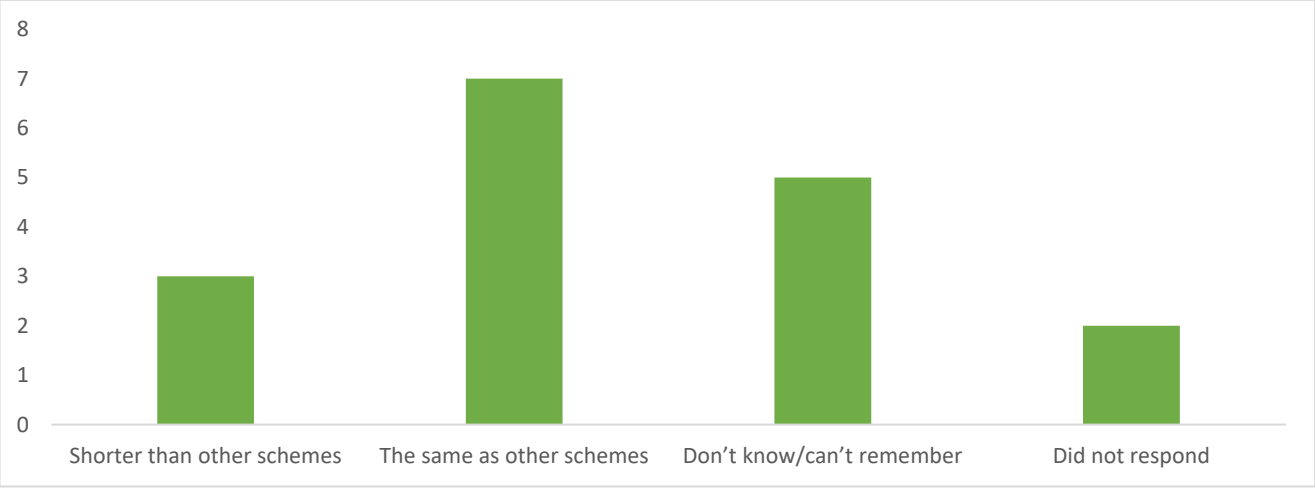
- *"The application process was very clear. I liked that it was a single form."*
- *"I thought the process was straightforward and probably easier than some others (e.g. NHMRC/MRFF)."*
- *"The application process was quite efficient at the time."*
- *"I think the application process was quite straightforward and practical."*

Several respondents made some suggestions for improving the efficiency of the application process: use of existing career track record information available on the NHMRC Sapphire portal, having an online application form, having clearer instructions in relation to the knowledge translation plan, and suggestions for how to better manage reviewer assessments.

- *"Clearer instructions in particular about the knowledge translation plan."*
- *"Having three rather than two reviewers or a way to have applications re-assessed if the two reviewers' marks were conflicting or differed greatly would also be useful."*
- *"Utilise information from previous grant reports submitted for this scheme and use information from Sapphire to minimise duplication of effort."*
- *"Would have been even more efficient to be able to fill in the application form online if at all possible."*

Almost 60% of respondents thought the response time for applications for the EMC Program were *the same as* or *shorter than other schemes*. (e.g. NHMRC, MRFF, ARC, TRGS etc). None of the respondents thought it was *longer* than other comparable schemes. Figure 8 summarises responses.

Figure 8 Notification time for EMC Program compared with other schemes



Grant establishment process

When asked to comment on the grant establishment process the highest number of respondents said the grant establishment process was *very* efficient, supportive and clearly communicated with 4 being the mode for all three questions. (see Table 12) However, on balance, the mean scores were 3.13, 3.46 and 3.53 respectively out of a possible 5 indicating that the process was *moderately* efficient, supportive and clear and *clarity of communication* was rated the highest and *efficiency* the lowest.

Table 13 Feedback on aspects of the grant establishment process

Was the grant establishment process	Efficient?		Supportive?		Clearly communicated?	
	n	score	n	score	n	score
Not at all (1)	2	2	1	1		
Somewhat (2)	2	4	3	6	3	6
Moderately (3)	4	12	1	3	3	9
Very (4)	6	24	8	32	7	28
Extremely (5)	1	5	2	10	2	10
Total	15	47	15	52	15	53
Mean	**3.13**		**3.46**		**3.53**	

Two respondents identified that they had experienced problems during the grant establishment phase, including some initial confusion on who the administering institution would be and a second issue related to interaction between the grant and their employment arrangements.

Thirteen of the 15 respondents (86%) reported no delays to the start of their research as a consequence of the grant establishment process and two respondents (14%) reported that their research start had been delayed due to grant establishment. Details of the delays are presented below:

"I moved my lab to a new Institute in April 2021 so there were delays to receiving funds whilst they were moved between Institutes."

"The grant was budgeted to commence on 1 Jan 2017 but did not begin until Feb 2017. The impact of this is that I had to relinquish the last month of funding because of an NHMRC rule that I was not allowed to hold any government funding throughout the year 2020 to be eligible to apply for an NHMRC Fellowship in 2019 (for funding to commence in 2020)."

Reporting requirements – Progress Reporting

When asked about their experience with meeting the progress reporting requirements, 12 respondents (80%) reported they had *no problems meeting the progress reporting requirements* and three (20%) reported they *had challenges meeting the progress reporting requirements.*

The individual challenges reported were:

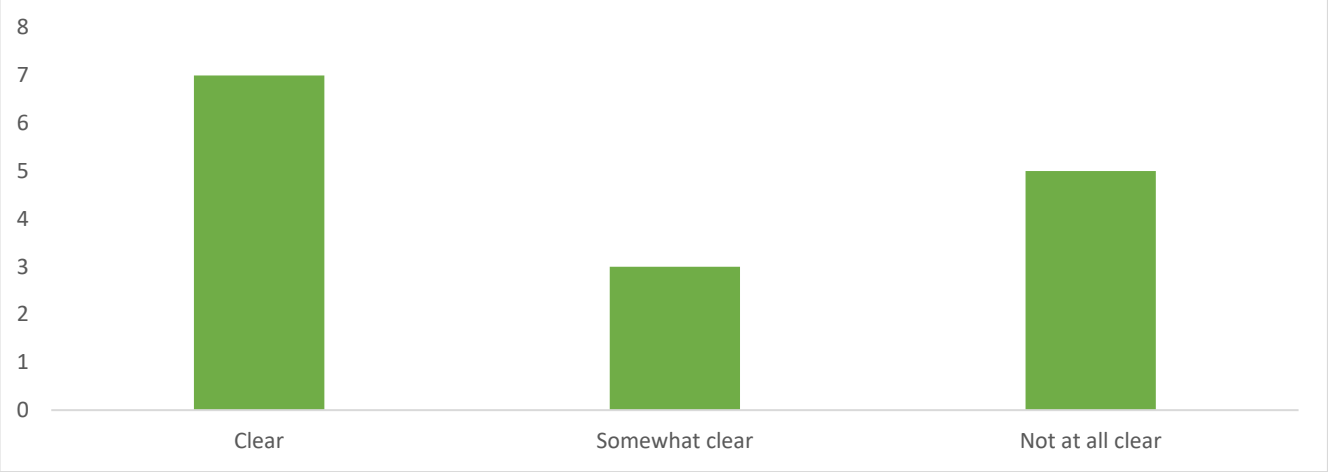
- the reporting templates (Excel) sent out by OHMR were very clunky to populate
- other competing grant commitments
- COVID- I met the timeline for the basic science component of the project but the clinical component that required recruitment and admission of patients was hampered by the COVID pandemic.

Suggestions that could have made the process more efficient and less burdensome included:

- an online database (e.g. REDCap) that you could add your progress to each year
- I had no issue with the process from the OHMR but the interface between the Research Institute and the University generated some inefficiencies.

When asked how clear they were about what the progress reporting is used for, two thirds (67%) of respondents were *clear* or *somewhat clear* but a third (33%) were *not at all clear* about what the progress reports were used for (see Figure 9 for details).

Figure 9 Clarity about what progress reporting is used for



Negotiating grant variations and completion of projects

Eight respondents (53%) *did not have to negotiate any variations*, five respondents (33%) had *no problems negotiating a variation* and two respondents (13%) *had challenges negotiating a variation* to the terms of their grants.

The two respondents who had challenges describe them briefly below (see Table 13) and provide suggestions for making the process more efficient and less burdensome for them.

Table 14 Challenges and suggested solutions for improving grant variation negotiations

Responses
Challenge *"It was not a straightforward process, and it was not clear who to email. It took way too long to reach a decision and I had to deal with multiple people at OHMR."* **Solution:** *"Dealing with one person would be more efficient. Hopefully the process has improved now that more people have received the award – I believe I was one of the awardees from the first round so they were probably still working things out."*
Challenge *"Requesting changes to the career development support allocation of $16,000 required a request to the University, who then had to request the change to NSW Health, who then responded to the University, who then responded to me."* **Solution** *"It was a $16,000 allocation; the Uni could have made approvals on changes. At the time of applying, I had no idea what to budget for as most conferences during the fellowship were not announced and I had no idea what opportunities would arise. The fact we were held to the budget we submitted made it very difficult and inefficient."*

Recipients were also asked about completion of their projects. Table 14 shows that almost two thirds of projects (60%) were completed early, on time or within three months of the expected completion date. A further third of projects (33%) were *completed more than 3 months after the expected completion date*, and one of the projects had *significantly changed in scope so that the expected completion date was no longer relevant*.

> *"Honestly, I had a really outstanding experience with this grant and your office supporting me. There was flexibility and understanding when I went on maternity leave and the grant absolutely set up my career."*
>
> Grant recipient, 2018

Table 15 Completion status for respondents

Response	n	%
Completed on or before expected completion date	6	40
Completed up to and including three months after expected completion date	3	20
Completed more than three months after expected completion date	5	33
Significantly changed in scope that the expected completion date was no longer relevant	1	7
Discontinued	0	0
Total	15	100

The reasons for these delays, not related to the grant establishment process are detailed in Table 15. The main reason for delays were related to the COVID pandemic which affected four projects. Other reasons included delays in obtaining ethics, changes in staff delivering the research intervention, delays in procurement of data required for the project, expected delays in publishing and presentation of findings and other competing demands on researcher time.

Table 16 Reasons for delays not related to the grant establishment process

Responses
• *Difficulty in obtaining ethics.*
• *Change in staffing of the health service delivering the intervention under evaluation.*
• *Delays in delivery of the data required for the project.*
• *COVID x 2.* • *I met the timeline for the basic science component of the project, nevertheless the clinical component that required recruitment and admission of patients was hampered by the COVID pandemic.* • *Due to overseas travel restrictions during COVID, I was unable to attend the external super-resolution microscopy workshop and conferences I have proposed in my application as part of my skills development plan.* • *Due to COVID restrictions throughout 2020 and 2021, it was difficult for me to perform some of the super-resolution microscopy experiments as proposed in my application, and to perform some of the proposed animal experiments collaboratively.* • *We were unable to recruit healthy individuals and coronary artery disease patients during COVID lockdown periods, hence resulting in a delay with experiments that required fresh human blood samples.*

- *The main data analysis and program of work had been completed but the publishing of peer-review articles can take a bit longer e.g. up to 3 months after submission.*
- *Also, presenting the research at conferences is reliant upon specified conference dates. For example, I am presenting one of the study findings at a conference in 2023.*

- *Just a lot of work that was ongoing – competing demands on my time. I achieved enough during the grant period, but the work continued on after.*

When asked if something could have been done by OHMR to prevent the delays, 13 respondents (86%) said that there was nothing that OHMR could have done to prevent the delays and two (14%) said OHMR could have helped in the following ways:

- *"They could have paid me more then I wouldn't have run out of money at the completion date."*
- *"They could decrease the duplication and burden of the reporting process."*

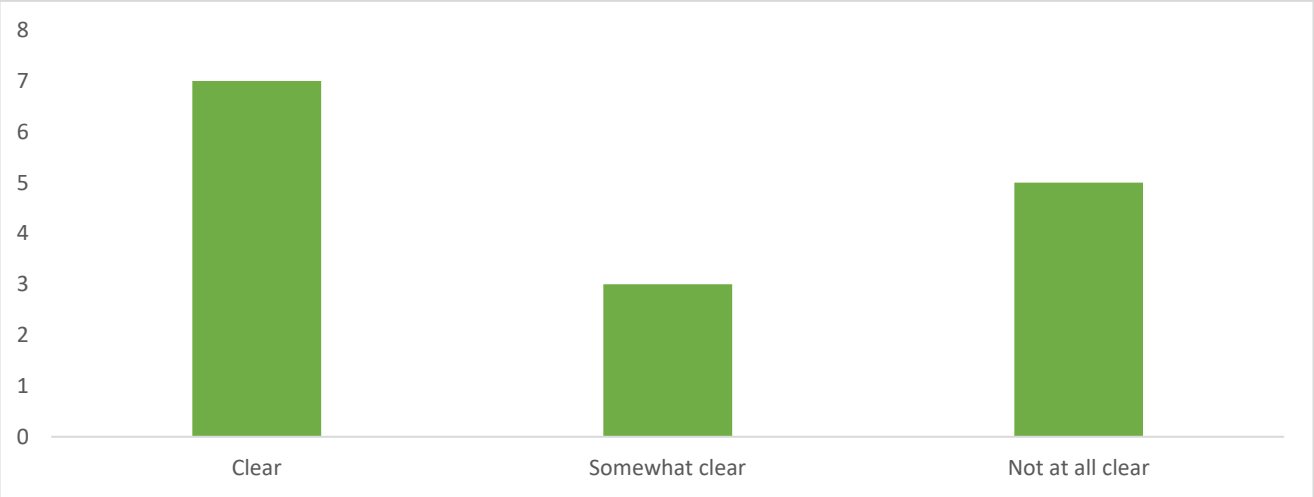
Reporting requirements – final reporting

When asked about their experience with meeting the final reporting requirements, 13 respondents (86%) reported they had *no problems meeting the final reporting requirements* and two (14%) reported they *had challenges meeting the final reporting requirements.* Suggestions for addressing the challenges included:

- *"Repopulating the same information in a clunky template where copy and paste (from previous years reports) is very inefficient. A more efficient system is required."*
- *"Decrease burden and simplify the process."*

When asked how clear they were about what the final reporting is used for, two thirds (67%) of respondents were *clear* or *somewhat clear* but a third (33%) were *not at all clear* about what the final reports were used for (see Figure 10 for details). These responses mirrored those for the utility of the progress reporting.

Figure 10 Knowledge about utility of the final reports



"Reporting is fairly intense, and simplification of this process could be helpful."

Grant recipient, 2018

Final comments

Below are some final comments made by recipients who responded to the survey. They relate to parental leave payments and bridging, lack of leadership and vision for research and clinical improvement amongst NSW public hospital clinical leaders, the inability to apply for a second EMC Grant, and confinement of an EMC Grant round to cardiovascular research.

- *"It would be nice if parental leave was factored in - i.e. parental leave payment and bridging as people often become out of grant cycle by taking time off."*
- *"My position as a clinician-scientist required an academic appointment at the hospital as a staff specialist to be able to pursue my career in both academia and clinical fields. Unfortunately, there was no support from the hospital I was conducting the research at to secure such a position, thus I had to leave the academic hospital environment and work as a private clinician."*
- *"The fact that we are ineligible to apply for further [OHMR EMC grants] is a bit disappointing. I understand trying to spread the opportunity around, but equally I was highly productive from this fellowship and could have been with other projects that stemmed from my fellowship that fit funding calls (e.g. the microbiome call earlier this year). I also think it was better in the first round when broad areas were eligible to apply, not just cardiovascular, who already have a considerable funding pool and diversity of funders to apply to."*

> *"The final results were delayed due to some time off to deal with post-fire stress and also lack of access to the hospitals to review medical records, but the hospitals were incredibly supportive*."
>
> Grant recipient, 2018

Discussion and conclusion

The comprehensive evaluation of the NSW Health EMC Grant Program set out to (1) evidence the impact of the Program across key domains of benefits; (2) quantify, where possible, the returns on investment in the Program to show accountability for the expenditure of public monies; (3) develop several case studies on selected projects and recipients to provide qualitative accounts of impact at both the research project and recipient career levels ; (4) understand the difference the Program is making to the career trajectory of its recipients; and (5) identify areas of grant administration and management that could be improved, from the recipient perspective.

Research impact

The application of the FAIT methodology was able to evidence the impact of the Program within the six domains of benefit used in the Payback Framework, one of the three impact assessment methods that make up FAIT. Of particular relevance was the capacity building domain, given a key objective of the EMC Grant is to support EMC projects that build capacity and capability in areas of identified need. It was pleasing to note that, grant recipients developed 80 new research and leadership skills and advanced 125 skills during the period of their funding with the top three being research translation, leadership and management and evaluation methods, all areas of identified need in research. They also acquired more specialised skills relating to their funded project such as biomarker discovery, cytogenetics and econometrics. EMC recipients also supervised 35 PhD and 19 Masters students and mentored 26 undergraduate students and 61 others: training the next generation of health and medical researchers in NSW. One in three survey respondents (29%) thought the EMC grant had contributed the most to building their capacity and capability as a researcher, 53% thought it had contributed a lot, and 13% thought it had contributed a little.

Collectively, the impacts metrics also describe a Program that has had far-reaching knowledge impacts through publications, presentations and emerging knowledge dissemination strategies. Some projects also created research collateral such as biobanks and datasets that can be used by other researchers in the future. Some of the research findings have also been translated into policy (31% of projects) and changes to health practice (46% of projects) which have also had community and health system benefits (33% of projects).

The CCA within FAIT was able to monetise the costs and conservatively estimate the consequences of the first two rounds of the Program to date which showed that the monetisable consequences (returns) were 6.99 times (s.a. 2.26 to 11.43) the NSW Health EMC Grant investment and likely to be significantly higher if all project data was available and the study was able to monetise community impacts. All of the consequences that were monetisable related to leveraged grant funding, most of which came from nationally competitive grant schemes fulfilling another key objective of the EMC Program - to support researchers to gain additional grants and fellowships from national competitive grants schemes such as the NHMRC, ARC and MRFF, philanthropic sources and industry.

Two of the narratives produced were able to describe the pathway from need through to the impact for two discrete projects, one in depression prevention in schools and the other in mitochondrial disease. A further two narratives describe the career pathway for two selected recipients to showcase the impact that the NSW Health EMC Grant had on their career. Another key objective of the EMC Program is to encourage collaboration and leadership with the NSW health system, research and/or commercial environment. These career narratives confirmed that the EMC grant helped recipients by creating opportunities for collaboration and leadership:

> "The *fellowship certainly put you in a position where you were in high-powered meetings where you could actually meet the right people.*"
>
> "*It enabled me to connect with fellow researchers in my field both in Australia and internationally."*
>
> "*EMC Fellowship has offered me the opportunity to work directly with clinicians at the frontline of care, to*

learn about providing health services from their point of view and to begin to understand how work is done when caring for patients. This knowledge and understanding will assist me in translating research findings into practical tools and approaches that can help make our hospitals safer."

Career impacts and progression

Data from the survey was also able to evidence the impact the EMC Grant had on recipients' careers including their retention in the sector, their retention in NSW, their research capability and capacity, and their promotion and career success. The volatility of the health and medical research workforce has been a growing issue in Australia with the lack of career opportunities and job security being the primary areas of concern. An Australian Society for Medical Research (ASMR) 2006 survey found that 6% of respondents had left active research in the previous 5 years and 73% had considered leaving the sector. Factors influencing this decision included shortage of funding (91%), lack of career development opportunities (78%) and poor financial rewards (72%). (5) A similar ASMR survey conducted in 2015 found that 83% of the 942 respondents had considered leaving active research for another career, and the majority of these were mid-career researchers (6-15 years post-doctoral). (6)

All but one of the 30 EMC Grant recipients were still in the health and medical research sector 5-6 years after securing a NSW Health EMC Grant and 76% thought the Grant was the *main reason* or had *contributed a lot* to them staying in the health and medical research sector. This confirms that the EMC Grant has contributed to retaining early to mid-career health and medical researchers employed in the sector, one of its key objectives. This is reflected in the following comment made by a recipient:

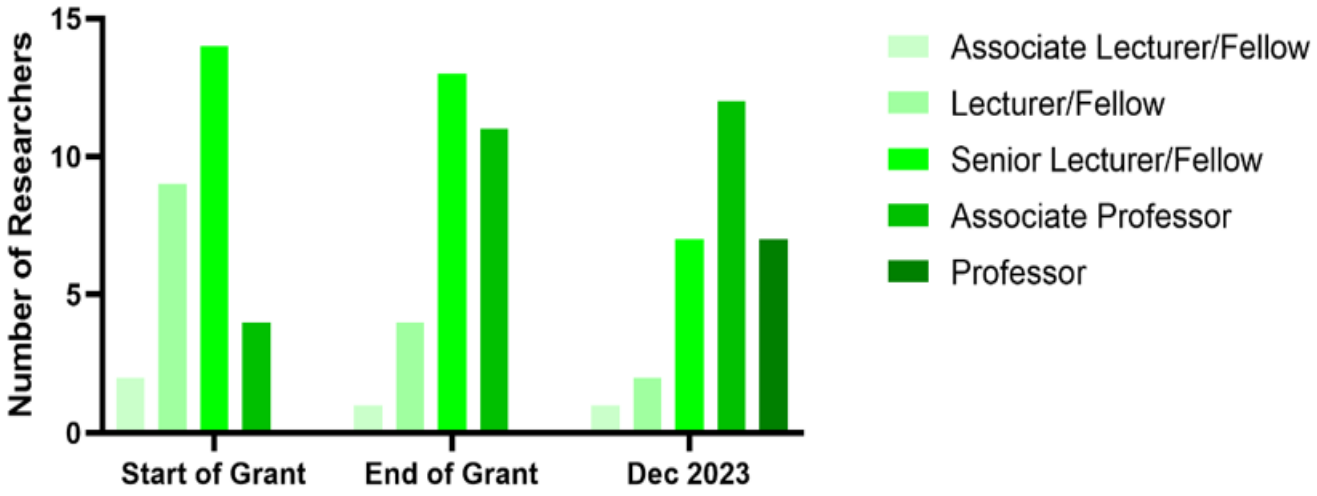
"This grant 100% facilitated my research career because I needed to get paid a salary and my NSW Institute wasn't going to do that."

It is also notable that the career benefits of the EMC Grant, as expressed by recipients who responded to the survey, align well with the requirements for keeping health and medical researchers in the sector. This includes the ability to continue a career in the sector, contribution to academic promotions and senior positions, ability to leverage subsequent competitive funding, opportunity to build research skills and research leadership, and the opportunity to build collaborations vital for their research, all of which they claimed the EMC Grant provided.

A second benefit of the Program was to keep early to mid-researchers in NSW but the perceived contribution of the EMC Grant to this aspect of recipients' careers is far less obvious compared to retention in the sector. Less than half thought the EMC Grant had contributed *a lot* or *the most* to keeping them in NSW and 36% thought the contribution *was little* or *nothing*. Despite this, only one recipient (3%) had moved overseas to take advantage of better funding and career opportunities, which resonates with the findings from the ASMR survey where 3.1% of the 942 respondents were currently living/working overseas. Sixty three percent of the ASMR researchers indicating that *better funding for research* strongly influenced this decision and more than 80% reported that *job insecurity* and *fewer career opportunities* were reasons why they wouldn't return to Australia, sentiments echoed by the one recipient who has located overseas *"I now have a stable research-only position …with five times more funding than I could have received by staying and rolling the dice for an NHMRC fellowship."* This finding suggests that while the EMC Grant can provide employment security for selected NSW EMC researchers and enhance their chances of obtaining other sources of funding including nationally competitive funding; ultimately, the issue of retention in NSW is also dependent on retention in Australia which requires a whole of health and medical research ecosystem response.

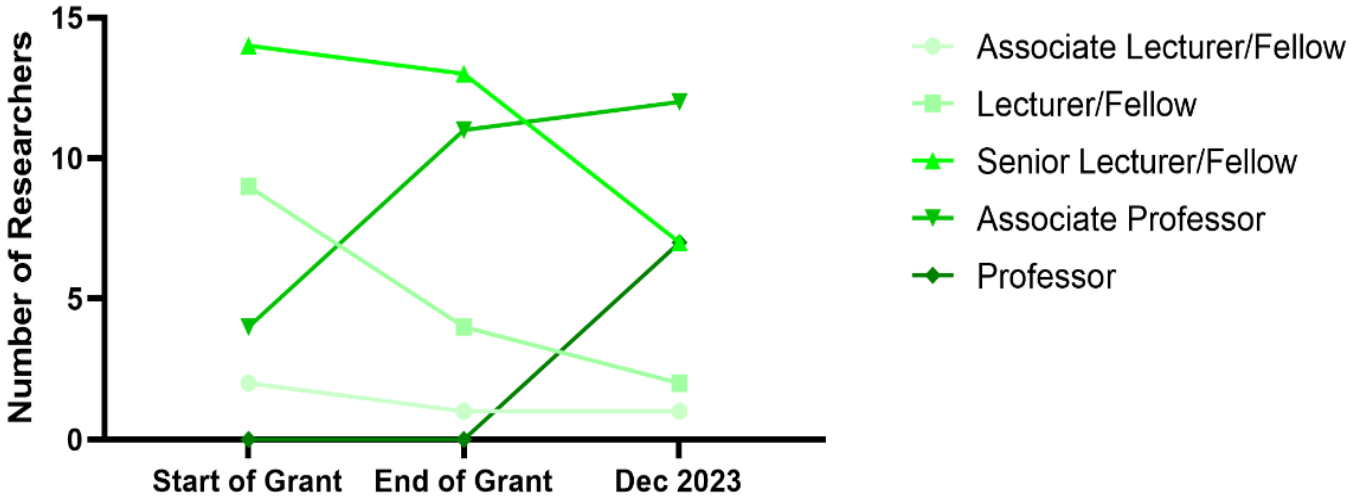
With regards to career progression and trajectory, the EMC grant clearly contributed to fast-tracking recipients' academic careers. In the 5-6 years from the time of receiving the grant, the cohort has gone from having 26 lower-level academics (Associate to Senior Lecturers) and only 4 Associate Professors to having 20 professorial alumni (13 Associate Professors and 7 Professors) and only 10 alumni remaining in the lower academic levels by December 2023 (see Figure 11).

Figure 11 Academic level of EMC Grant Program recipients from Rounds 1 and 2 at start and end of grant and in December 2023



Using University of New South Wales data which covers all fields of academia, the median length of promotion from Lecturer to Senior Lecturer is 6.75 years and the median length from Senior Lecturer to Associate Professor is 8.5 years. (7) Within the 5-6 years period from 2017/2018 to 2023, the EMC recipient cohort secured 31 promotions. Figure 12 presents the same data in a different format. What is clear from that graph is the significant change in numbers of recipients by career stage over the 5-6 years. The number of Senior Lecturers halved from 14 to 7 and the number of Lecturers fell by 7 recipients from 9 to 2. In the same period the number of Associate Professors tripled from 4 to 12 and the number of Professors went from none to seven, all within the period between the end of the grant and the end of 2023. While the UNSW data is not the strongest counterfactual, and any contribution is mediated by the selection of the best and brightest EMC researchers at the time, who can be presumed to have above average promotion prospects, the data suggests that the EMC Program makes a significant contribution to recipient's promotion prospects.

Figure 12 Number of recipients at each level between 2017/2018 and 2023



Evaluation timing

With regards to timing for an evaluation of the EMC Program in the future, this study suggests that an evaluation of the capacity building impacts of such a grant could be completed as part of the final reporting process. Allowing a 1–2-year lag would be best for evidencing knowledge impacts such as scientific publications and presentations and a 2–3-year lag would more adequately allow an assessment of policy and practice change impacts. To fully capture community and economic benefits, 5-6 years after completion of the grant would be ideal in order to be able to report these longer-term impacts such as commercialisation outcomes. This evaluation was able to evidence some community benefits but unable to quantify the full extent of these benefits in order to value them. With regards to evaluating the grant administration process, the sooner the better appears to be the best approach. There were several respondents who were unable to recall their experience of the administration and management of the EMC Grant when surveyed in 2023.

Strengths

The main strength of the study was its mixed methods approach combining a comprehensive impact assessment framework (FAIT) with a process evaluation. The use of a range of methodologies to evaluate the EMC Grant Program provided a comprehensive picture of not just the Program's impacts and returns on investment but areas of challenge and improvement in the future. A second key strength was the comprehensive final reports available for a majority of the projects. This provided an enormous amount of secondary data that only needed to be updated and supplemented with primary data collection via an online survey. A third key strength was the independence of the evaluation which allowed recipients to be candid about their experiences, particularly in the process evaluation.

Limitations

There were also key limitations that need to be considered in future evaluations of the NSW Health EMC Grant Program. The first was the 50% response rate to the survey (those who completed the entire survey) which has implications for the findings, particularly those that relate to career progression and the administration and management of the grant and potential areas of improvement. To address this limitation, the OHMR team were able to undertake some desktop research to supplement the career information available from the final reports. Future evaluations might benefit from considering a longer timeframe for response and exploring the possibility of including some incentives.

A second limitation is that the reporting format has changed between grant rounds which required the data to be manually entered into a consolidated database. This task was undertaken by OHMR but was labour intensive and caused delays to the entire evaluation process. It is hoped that the migration of grants administration to an online portal will resolve this issue in the future.

A third limitation was a failure to include any questions in the survey about the "inclusion of translation and impact planning throughout each project", the fifth objective of the EMC Grant Program that was added to the Grant after round 2. Future evaluations should evaluate this objective of the Program.

EMC Grant administration, management and reporting.

Overall, most researchers found the application process efficient, straightforward and better than other NHMRC and MRFF schemes. Most recipients also thought the timing from close of applications to notification of outcomes was *better* or *the same* as most other nationally competitive schemes with no suggestions for improvement. These are pleasing results on both counts. However, there is room for improvements such as:

- Migrating the application to an online system. **(Recommendation 1)**
- Exploring the inclusion of data from previous NSW Health applications and the NHMRC Sapphire platform for the track record sections to minimise burden on applicants. **(Recommendation 2)**
- Providing clearer instructions about how to develop the knowledge translation plan. **(Recommendation 3)**
- Having three reviewers instead of two OR to develop a process to have applications re-assessed if the two reviewers' marks were conflicting or differed greatly. **(Recommendation 4)**

A majority of respondents found the grant establishment process efficient, supportive, and clearly communicated (mode of 4 out of 5 for all three) but there was opportunity to address:

- Confusion about who the administering institution would be and who would be paying the recipient's salary when they were jointly employed by an MRI/University and health service. **(Recommendation 5)**
- Confusion around the payment rules when the recipient had an existing University grant such as a fellowship. **(Recommendation 6)**

Only two out of 15 projects (13%) reported delays caused by grant establishment. The first related to a delay in receiving grant funds caused by a movement of the recipient's lab in April 2021. On closer inspection, this incident would have occurred long after the grant had been established and can be viewed as irrelevant to its establishment. Similarly, it was not clear what aspect of the grant establishment caused a minor one-month delay in commencement for a second grant. Given this was during the shutdown period for OHMR, universities and research institutes; it is likely that the delay was unavoidable. However, the impact of this delay was that the recipient had to relinquish the last month of OHMR funding in order to be eligible to apply for an NHMRC Investigator grant in 2020. In the big scheme of things, this was an unfortunate but potentially common scenario that highlights the potential to improve coordination between funding bodies to ensure researchers applying for funding are not having to forego already secured funding to make themselves eligible for a subsequent career-defining grant. A potential solution would be to repurpose the funds for translation activity and training. Such coordination would help OHMR deliver on its objective of supporting EMC researchers secure nationally competitive grants.

With regards to both progress and final reporting, at least four respondents recommended:

- a less clunky and less burdensome reporting system, such as an online REDCap survey that could be used to add progress year on year. This would help ease the reporting burden for recipients. **(Recommendation 7)**

Of the 46% of recipients who had to negotiate a variation to their projects, less than 15% had challenges. For one recipient the process was not straightforward, and it took longer than potentially required to reach a decision and necessitated dealing with multiple people at OHMR. A suggestion was to:

- have a single OHMR contact (per project) for all variation negotiations. **(Recommendation 8)**

A second recipient had issues with requesting a variation to their career development support allocation to accommodate the cost of conference attendance that was different to the amount in the original budget. A recommended solution was to:

- Have some flexibility with the allocation for budget items such as career development support that are sometimes difficult to cost ahead of time and to allow the administering institution authority to approve minor reallocations. **(Recommendation 9)**

Overall, project completion was reasonable considering many of the 2018 cohort projects were conducted during the COVID period. Two thirds of projects were completed within three months of the expected finish date, including some that were early and on time. A third of projects (33%) were completed more than 3 months after the expected completion date and one had to be re-negotiated due to a significant change in scope that made the expected completion date irrelevant. Four projects were affected by the COVID pandemic. Other reasons included delays in obtaining ethics, changes in staff delivering the research intervention, delays in procurement of data required for the project, expected delays in publishing and presentation of findings and other competing demands on researcher time. There was one suggestion for consideration about what OHMR could do to minimise delays:

- increase the value of the grants so the recipient does not run out of money at the completion date. **(Recommendation 10)**

A few additional recommendations were made in the final comments section of the survey:

- Factor in parental leave - i.e. parental leave payment and bridging as people often become “out of grant cycle” by taking time off. **(Recommendation 11)**
- Ensure the EMC grant is not focussed on one area of research (e.g. cardiovascular was the focus of Round 2). Keep it generic to support the whole EMC cohort. **(Recommendation 12)**
- Influence NSW public hospital recruitment to ensure leadership and vision in the clinical departments that lead to appointments that factor in academic and clinical contribution. **(Recommendation 13)**
- Weigh up the need to spread the grant opportunity around with being able to re-apply for other OHMR/NSW Health EMC grants (e.g. the microbiome call in 2023). **(Recommendation 14)**

Conclusion

The evaluation of the NSW Health EMC Grant Program has been able to evidence the outstanding impacts from the Program in terms of its impact on knowledge, policy, practice, community and the economy. It was also able to evidence the impact on the capacity, capability of recipients and the NSW health and medical research sector more broadly and its impact on the career trajectory and success of recipients.

The administration and management of the Program itself was, in the main, efficient, straight forward, supportive and clearly communicated with a majority of recipients having no issues. However, this was not the experience of all recipients, and some 14 recommendations were made by recipients to improve the administration and management of the Program. The most mentioned improvement was the move to an online grant application and reporting system that would minimise duplication by linking to other data sources thereby decreasing recipient burden.

NSW Health responses to the recommendations can be found at the front of this HMRI report in the Foreword.

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Appendices

Appendix 1: Program Logic Model for the EMC Research Grant Scheme

NEEDS Develop and retain early and mid-career researchers to be future research leaders within NSW and nationally and to lead and translate research that improves the health and wellbeing of the NSW population				
AIMS/OBJECTIVES	**ACTIVITIES**	**OUTPUTS**	**INTERIM IMPACTS**	**FINAL IMPACTS**
1. Attract and retain skilled EMC researchers within the health and medical research sector in NSW	**OHMR** ◦ Develop clear guidelines for selection and advertise the program ◦ Deliver grant reviewer briefing to improve potential for selection of high quality candidates, and convene review panel ◦ Deliver grants to attract international and interstate researchers to NSW ◦ *Monitor annual reports from recipients against key performance metrics* **Grant recipients** ◦ Complete high quality research according to their submitted plan ◦ Apply their skills to a range of NSW health and medical research projects and build their track record to increase competitiveness for future funding ◦ *Complete monitoring reports for OHMR*	**OHMR** ◦ Funding provided to selected recipients and funding agreements in place ◦ Risks to research progress identified and communicated **Grant recipient** ◦ Research completed and track records built ◦ Published research, conference papers and posters produced	**Advancing knowledge** ◦ Recipients publish and disseminate high quality research methods and results ◦ Increased publication quality metrics (e.g. number of citations, high impact journals etc.) ◦ Datasets, research methodologies and products are available for further research where appropriate **Capacity and capability building** ◦ Increased number of skilled and experienced EMC researchers working in areas of identified need in NSW ◦ EMC researchers with skills in areas of identified need remain in NSW following completion of their funding ◦ EMC researchers take on	**Advancing knowledge** ◦ Ongoing research in NSW is increased **Capacity and capability building** ◦ More high-quality, NSW-led competitive grants are successful in obtaining federal funding ◦ Increased number of NSW researchers in Australia's top performing EMC researchers ◦ NSW has a pipeline of strong and highly skilled researchers ◦ Grant recipients remain in NSW following the completion of their funding ◦ Increased workforce capacity in the health and medical research sector or health and medical sector
2. Support EMC projects that build capacity and capability in areas of identified need	**OHMR** ◦ Identify areas of need within the NSW health and medical sector and fund EMC researchers in these areas ◦ *Monitor annual reports from recipients against key performance metrics* **Grant recipients** ◦ Ensure research aligns with and builds capacity and capability in areas of identified need ◦ Undertake research and development activities in areas of identified need in accordance with research and	**OHMR** ◦ Research funding provided in areas of identified need ◦ Risks to research progress in areas of identified need (including lack of capacity and capability) are identified and communicated **Grant recipients**		

	development plan and grant guidelines ◦ *Complete monitoring reports for OHMR*	◦ Completion of research project and development activities in areas of identified need ◦ Publications, presentations, research methods and data sets created which address areas of need	leadership positions in NSW following completion of their funding ◦ EMC researchers partner with various sectors (academic, health services, not-for-profit and industry) following completion of their funding ◦ EMC researchers apply their improved understanding of the commercialisation pipeline and translation to their ongoing research in areas of identified need ◦ EMC researchers are listed on grant proposals and successfully secure additional grants and fellowships from national competitive grants schemes, philanthropic sources and industry ◦ High quality researchers who have relocated to NSW for the purpose of the grant are retained in NSW **Policy and practice** ◦ Implementation and/or scaling of best practice processes identified through EMC Projects ◦ Reduced time between the generation of research findings and translation to next user or policy, practice or commercial	**Policy and practice** ◦ Research findings translated to next stage of the research continuum including to next users, clinical practice, health policy and or models of care ◦ New, effective and cost-effective models of care, treatments, devices and medications are adopted into the NSW health system ◦ Ineffective and/or wasteful treatments, models of care, devices and medications are discontinued ◦ Improved efficiencies in the delivery of population health, health services and clinical care in NSW **Health and community** ◦ Translation of research leads to improvements in health care treatments and health care outcomes for the NSW population, including priority population groups ◦ Improved prevention practices lead to improvements to the health and wellbeing of the NSW population, decreased disease burden and increased productivity
3. Support researchers to gain additional grants and fellowships from national competitive grants schemes, philanthropic sources and industry	**OHMR** ◦ Include requirements for the application for Federal, philanthropic and industry funding by EMC recipients during the grant period ◦ Grant supports NSW researchers to develop research skills and build their track record to maximise likelihood of leveraging additional competitive grants ◦ *Track funding leveraged from EMC funded projects* **Grant recipients** ◦ Apply for Federal, philanthropic or industry funding during the grant period ◦ Leverage OHMR grant funding to improve the strength of research applications for additional competitive grants ◦ *Complete monitoring reports for OHMR*	**OHMR** ◦ Progress towards leveraged funding is monitored **Grant recipients** ◦ Applications to federal funding organisations including NHMRC, ARC and MRFF submitted and secured ◦ Grant recipients receive additional funding for their research or career development funds through other schemes		
4. Encourage collaboration and leadership with the NSW health system, research and/or commercial environment to address areas of identified need	**OHMR** ◦ Develop guidelines and selection criteria that encourage recipients to engage relevant partners who will provide a meaningful contribution to delivery of research projects and implementation of outcomes in areas of identified need ◦ Develop guidelines and selection criteria that encourage leadership activities, e.g. membership on relevant research committees ◦ Select and fund applications which include collaboration with the NSW health system, research and/or commercial environment ◦ Facilitate NSW Health Commercialisation Training to all recipients to build capability in areas of identified need	**OHMR** ◦Grant recipients have completed NSW Health Commercialisation Training ◦ Funding provided to selected applicants and funding agreements in place ◦ Risks to research and collaboration/partnerships and skill development planning are identified and managed		

	◦ Monitor annual reports from recipients against key performance metrics **<u>Grant recipients</u>** ◦ Engage relevant partners who will provide a meaningful contribution to delivery of the research project and implementation of outcomes in areas of identified need ◦ Identify key priority areas for skill development throughout their grant, and work towards building capacity in these areas ◦ Undertake training in translation and commercialisation to build capacity and understanding of the translation and commercialisation pipeline ◦ Complete monitoring reports for OHMR	**<u>Grant recipients</u>** ◦ Project is undertaken in partnership with the NSW Health system, research and/or commercial environment ◦ Complete NSW Health Commercialisation Training	outcomes ◦ Established agreements for collaborations and partnerships between the research sector and either NSW Health or commercial sector **Economic** ◦ EMC researchers leverage funding to secure career development grants from national and international bodies ◦ EMC researchers secure continued employment in the	**Economic** ◦ Increased economic returns from leveraged research investment into NSW ◦ Increased proportion of research funds nationally come to NSW ◦ Increased future wages of trained researchers ◦ Decreased hospital-based care, treatment episodes and corresponding treatment costs in NSW ◦ Savings from removal of wasteful practices and ineffective care ◦ Income generated from commercialisation of research discoveries including new therapeutic devices and medications ◦ Increase patients and commercialisation of therapies
5. Embed translation and planning through all stages of EMC grant projects	**<u>OHMR</u>** ◦ Develop guidelines that encourage recipients to engage with relevant partners to enhance research translation and commercialisation ◦ Include research translation, impact planning and reporting requirements at the application and commencement stages ◦ Support high-quality, translational projects across the research continuum ◦Facilitate partnerships and collaboration amongst EMC researchers and existing networks to encourage translation and commercialisation ◦ Fund practicing clinicians to conduct research that optimises translation to practice ◦ *Monitor annual reports from recipients against key performance metrics including participation of key users, translation to next users, policy, practice and commercialisation* **<u>Grant recipients</u>** ◦ Collaborate with next users to facilitate translation and potential commercialisation of new discoveries ◦ Submit plan for translation and commercialisation of	**<u>OHMR</u>** ◦ Risks to translation and commercialisation activities or progress are identified and managed **<u>Grant recipients</u>** ◦ Recipients have established translation and impact plans with pathways for translation clearly identified ◦ Collaboration of key stakeholders in the governance and implementation of research projects ◦ Research is published and translated ◦ Ongoing monitoring reports submitted which identify any potential risk to ongoing research		

	research (new activity) ◦ Submit a research program logic that identifies key users and translation activities ◦ *Complete monitoring reports for OHMR*	translation activities or progress		

Appendix 2 Demographic survey questions

Q1 What is your preferred title?

- Dr
- Associate Professor
- Professor
- Other

Q2 First name?

_____ (open ended)

Q3 Last name?

_____ (open ended)

Q4 Gender?

- Man or male
- Woman or female
- Non-binary
- I/they use a different form
- Prefer not to say

Q5 Aboriginal or Torres Strait Islander?

- Aboriginal
- Torres Strait Islander
- Both Aboriginal and Torres Strait Islander
- Neither
- Prefer not to say

Q6 Please select all responses which describe your current position(s).

- Early-career researcher (< 9 years post PhD)
- Mid-career researcher (9 to 15 years post PhD)
- Senior researcher (>15 years post PhD)
- Clinician
- Other

Q7 How would you describe your main geographical work location?

- Metropolitan
- Regional
- Rural / Remote

N.B For guidance on what is considered a rural or remote area, please refer to the Modified Monash Model. Areas classified MMM 3-7 are rural or remote.

Q8 What was the title of your project?

_____ (open ended)

Q9 In which year did the project start?

_____ (open ended)

Q10 In which year was the project completed?

_____ (open ended)

Appendix 3 Research impact (excluding economics) survey questions

The following questions relate to the outcomes of your research supported by the EMC Grant Program. You detailed these outcomes in your final report. We would like to collect information on any additional outcomes (related to the EMC Grant Program), which have subsequently been achieved. For example, you may have submitted a draft manuscript pertaining to work funded by the EMC Grant Program which was published after you lodged your final report.

Q1 Were there any peer-reviewed publications from research funded by the EMC Grant Program in subsequent years?

- Yes
- No (skip to Q3)

Q2 Please only provide peer-reviewed papers which have been published.

Repeating form

- Publication Title
- Year of publication
- DOI
- Full reference

Q3 Have there been any presentations from your EMC grant which occurred in subsequent years?

- Yes
- No (skip to Q5)

Q4 For the purposes of this question, presentations include conferences (oral or poster), webinars, and policy presentations. Please provide the following details:

Repeating form

- Name of event
- Type of presentation (Conference/Forum/Colloquium/Symposium - domestic Conference/Forum/Colloquium/Symposium – international, Meeting Education session Media, Stakeholder meeting)
- Title of presentation
- Year of presentation

In your final report, you detailed the following instances of dissemination of your research:

Q5 Other than peer reviewed publications and presentations, have there been any further dissemination of findings and results from your study funded by the EMC Grant Program (e.g. a report or policy brief or submission to NSW Health) since the final report was submitted?

- Yes
- No

Q6 Please list and provide details for other instances of dissemination of findings, excluding peer-reviewed publications and presentations.

_____ (open ended)

Q7 Has the research informed policy e.g. NSW policy, national or international guidelines?

- Yes
- No (skip to Q9)

Q8 Please provide the policy name(s) and weblink(s) if possible.

_____ (open ended)

In your final report, you detailed the following practice change(s) as a result of your research:

Q9 Since the final report, has the research resulted in any practice change in NSW or elsewhere?

- Yes
- No (skip to Q11)

Q10 Please provide details.

_____ (open ended)

Q11 Has the research resulted in any improvements in quality of care, access to care or health outcomes in NSW?

- Yes
- No

Q12 If yes, please provide details

_____ (open ended)

Appendix 4: Economic impact and analysis survey questions

Grants leveraged

Listed below are the additional grants you received which were disclosed in your final report. For each of the grants, please answer the following question:

Q1 How much of this funding do you attribute to the EMC Grant Program?

- 0%: the EMC Grant Program had no bearing on you receiving the additional funding.
- 25%: small association between the leveraged funds and the EMC grant.
- 50%: you may have received the funding with / without the EMC grant.
- 75%: you were unlikely to receive the additional funding without the EMC grant.
- 100%: you would not have received the additional funding without the EMC grant

Q2 Please add any additional grants not covered in your final report here, one at a time.

- Grant Scheme
- Funding organisation
- Name of project
- Amount ($)
- Year in which funding commenced
- How much of this funding do you attribute to the EMC Grant Program?

  0%: the EMC Grant Program had no bearing on you receiving the additional funding.

  25%: small association between the leveraged funds and the EMC grant.

  50%: you may have received the funding with / without the EMC grant.

  75%: you were unlikely to receive the additional funding without the EMC grant.

  100%: you would not have received the additional funding without the EMC Grant Program.

  0% 50% 100%

  (Place a mark on the scale above)

Research Outcomes: Commercial

Q3 Did the research result in any commercial outcomes e.g. patents, products, pharmaceuticals, devices, models of care, interest from industry?

- Yes
- No

Please provide details.

Appendix 5: Career progression survey questions

Two key objectives of the EMC Grant Program are to build research capability and capacity within NSW and to retain talented researchers in the state.

Q1 Immediately following the completion of your EMC Grant, what was your next position?

_____ (open ended)

Q2 Are you currently undertaking health and medical research as an academic, clinician or any other type of researcher (e.g. industry researcher)?

- Yes
- No (skip to Q4)

Q3 How much did the OHMR EMC grant contribute to your continued involvement in health and medical research?

- Not at all
- A little
- A lot
- It was the main reason I am still involved in health and medical research

Q4 What is the main reason you are no longer working in health and medical research?

_____ (open ended)

Q5 Are you still working in NSW?

- Yes (skip to Q8)
- No

Q6 What State/Territory/ have you moved to?

- ACT
- NT
- Queensland
- South Australia
- Tasmania
- Victoria
- Western Australia
- Overseas

Q7 What was the main reason for your move outside NSW?

_____ (open ended)

Q8 How would you say the OHMR EMC grant contributed to keeping you in NSW?

- Nothing
- A little
- A lot
- The most

Q9 From the time you received the OHMR EMC grant until now, how much did the grant contribute to building your capacity and capability as a researcher?

- Not at all
- A little
- A lot
- It was the main contributor to my capacity and capability as a researcher

Q10 Is there anything else about the grant process, or the outcomes on your career, that you'd like to tell us which hasn't been detailed in the previous responses?

_____ (open ended)

Q11 In the final report, you listed the following career achievements:

Since your submission of the final report for the EMC Grant Program, have there been any big career wins for you (e.g. a promotion, secured a sought-after research position)?

- Yes
- No (section finished)

Q12 Please describe any additional career achievements.

_____ (open

Appendix 6 Research Administration survey questions

The Office for Health and Medical Research's (OHMR's) grant management system and application forms have undergone changes since you applied for your EMC grant. Please answer these questions based on your experience with the process when you received your grant.

Q1 Was there anything that could have been done to make the application process more efficient for you to complete and submit your application?

_____ (open ended)

Q2 In terms of your knowledge of health and medical research grant schemes overall (e.g. NHMRC, MRFF, ARC, TRGS etc), how does the length of time between the closing of the EMC Grant Program and the notification of success compare?

- Shorter than most other schemes
- Longer than most other schemes
- The same as most other schemes
- Don't know/can't remember

Research Administration: Establishment

Q3 Rate the grant establishment process in terms of...

1. Efficiency
2. Supportiveness
3. Clarity of communication

- Not at all
- Somewhat
- Moderately
- Very
- Extremely

Q4 What could have improved the process? Please state the problem and up to three potential solutions.

_____ (open ended)

Q5 Was your research start delayed because of the grant establishment process?

- Yes
- No (skip to Q7)

Q6 What was the impact of the delay?

_____ (open ended)

Q7 What was your experience with meeting the progress (excluding final) reporting requirements?

- I had no problems meeting the progress reporting requirements (skip to Q10)
- I had challenges meeting the progress reporting requirements

Q8 What were the challenges?

_____ (open ended)

Q9 What could have made the process more efficient and less burdensome on you?

_____ (open ended)

Q10 How clear are you about what the progress reporting is used for?

- Not at all clear
- Somewhat clear
- Clear

Q11 What was your experience with negotiating a variation on your grant e.g. an extension?

- I did not have to negotiate any variations (skip to Q14)
- I had no problems negotiating a variation (skip to Q14)
- I had challenges negotiating a variation

Q12 What were the challenges?

_____ (open ended)

Q13 What could have made the process more efficient and less burdensome on you?

_____ (open ended)

Q14 Was your research project

- completed on or before expected completion date (skip to Q18)
- completed up to and including three months after expected completion date
- completed more than three months after expected completion date
- significantly changed in scope that the expected completion date was no longer relevant
- discontinued

Q15 What was the cause of the delay/discontinuation? If the delay/discontinuation was due to the grant establishment process, and you have already detailed this above, please skip this question.

_____ (open ended)

Q16 Could something have been done by OHMR to prevent this from happening?

- Yes
- No (skip to Q18)

Q17 What could have helped?

_____ (open ended)

Research Administration: Closeout

Q18 What was your experience with the final reporting?

- I had no problems meeting the final reporting requirements (skip to Q21)
- I had challenges meeting the final reporting requirements

Q19 What could have made the process more efficient and less burdensome?

_____ (open ended)

Q20 What additional support, if any, could be provided by OHMR to assist with final reporting?

_____ (open ended)

Q21 How clear are you about what OHMR uses the final reports for?

- Not at all clear
- Somewhat clear
- Clear

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In partnership with our community

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Local Health District