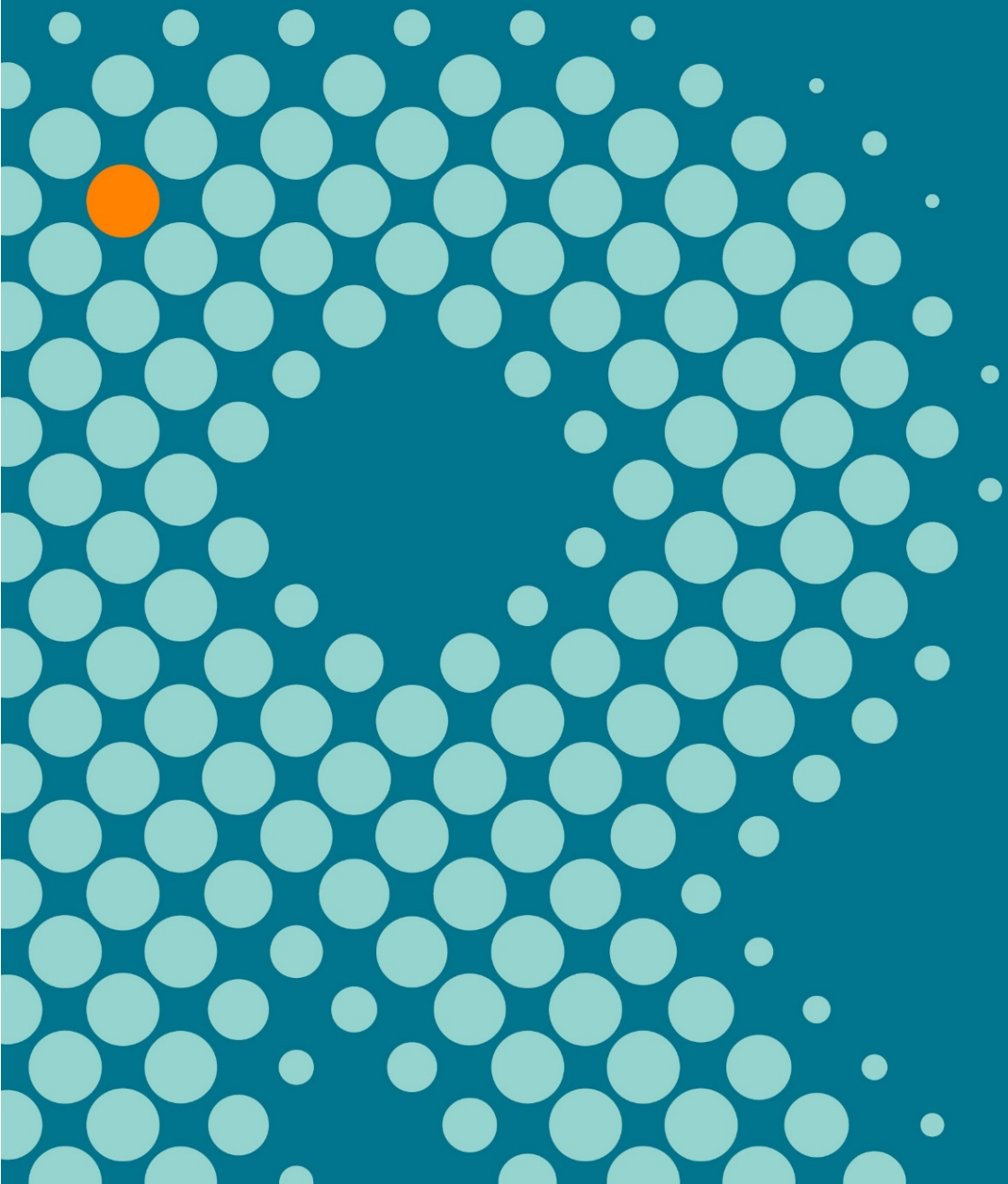
the Raine Study

ANNUAL ACTIVITY REPORT 2018

The Western Australian Pregnancy Cohort (Raine) Study

Professor Peter Eastwood (Director)
Professor Leon Straker (Scientific Director)
The Raine Study Team



the Raine Study

One of us
could change your life

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Executive Summary

The focus for 2018 was to update, revise and modernise the human and technical systems of the Raine Study, to create the basis for sustainable growth into the future.

Highlights for 2018:

- Progressed development of a 5-year strategic plan in collaboration with staff and committees including development of vision, mission and values

- Strengthened the Unincorporated Joint Venture (UJV) by:
  - Encouraging continued high level partner support and good governance of the Raine Study by the members of the UJV Board
  - Providing continuing validation of the value of involvement
  - Encouraged exploration of alternative funding sources including the potential for associated UJV members and the commercial use of the Raine Study data

- Strengthened new staff structure
  - Developed competence of staff in all positions
  - Engaged staff in strategic plan development
  - Appointed a new Data and Biosamples Manager

- Strengthened new committee structure
  - Developed members and activities of Management, Scientific and Participation committees
  - Facilitated meetings of committees (Scientific Management Committee x18, Management Committee x10, Scientific Review Committee x2 face to face meetings and x6 e-meetings, Community Advisory Committee x4)

- Developed Special Interest Group (SIG) leaders
  - Conducted meetings with SIG leaders to define the role, including development of website material and planning discussions (SIG Leaders Committees x 4)

- Developed researchers
  - Introduced new researcher engagement policy and embedded this into the research project management system (Raine Study Online Submission System, ROSS)

- Strengthened consumer engagement
  - Supported development of consumer representatives
  - Gained consumer perspectives on strategic plans and future greater engagement

- Refined new project management system
  - Multiple refinements to ROSS and grant application to Western Australian Health Translation Network (WAHTN) for major upgrade submitted for 2019 funding

- Started multiple processes to establish effective curation and use of Raine Study data
  - Developed relational database and tested with different types/generations of data
  - Developed processes for quality control of the existing data and completed review of the majority of data in two follow-ups
  - Drafted a documented data pipeline for all new data from collection to publication
  - Conducted larger scale WAHTN funded pilot of secure analysis system (SHAPE)
  - Explored opportunities for consolidation of biosamples

- Maintained operational and science leadership
  - Supported data collection from Gen0/1, Gen2_26, Gen2_27, Gen2_econ, Gen_3
  - Supported successful grant applications
  - Developed standard operating procedures for key project components

- Represented the Raine Study at State and National meetings as well as other institutions
  - AHRA/WAHTN Data Committee Workshop (Melbourne, March)
  - Bio banking consultation workshop (Perth, November)
  - Meeting with staff from the office of the new National Data Commissioner for consultation on the new Data Sharing and Release legislation (Perth, November).
  - Attended workshop on 'Ensuring the most effective use of NHMRC funding in the support of cohort studies involving Australians (Canberra, November)

Activities planned for 2019

30 Year Anniversary of the Raine Study

The Raine Study will 'turn 30' in 2019, as will the first of our 'Gen2' participants. This provides an opportunity to create awareness of the Raine Study and what it has achieved in the past 30 years; to highlight its potential for continued contribution to the knowledge of human health and wellbeing; to celebrate with and to recognise our participants; and to promote the collaboration of our UJV partners in positioning the future of the Raine Study.

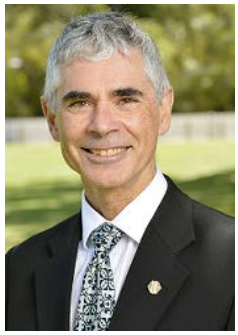
Throughout October 2019 – December 2020 the Raine Study aims to:

- Acknowledge our participants (across all generations) and celebrate their achievements, keeping them engaged in the Raine Study (a large event for participants and key stakeholders is planned for the first half of 2020)
- Promote the opportunities within the Raine Study to researchers
- Position the Raine Study as a valuable resource in the Western Australian community
- Celebrate and communicate the Raine Study findings and what that means for informing health outcomes and guiding health policy
- Raise awareness of the Raine Study and the role of the UJV partners as the leadership group of the Raine Study amongst key audiences
- Position the Raine Study to attract support from potential donors and funding bodies

Future Plans

- Raine Study Generation 2, 30 year follow-up (starting in yr 2020) focusing on mental health and on reproductive health
- Information evenings with other research/health organisations to promote the work of the Raine Study
- Cautious exploration of opportunities for commercial use of the data within ethical and legal standards
- Exploring concept of 'Institutional Associate' category of membership – expand engagement from the wider research and university sectors
- Further development of SIG Leaders
- Identifying opportunities for the Raine Study data to make substantial contributions to global health and wellbeing
- Embedding participants in science development
    - Per project
    - Per SIG
    - In management processes
- Facilitating quick and easy viewing and extraction of data
    - Double checking all historical data
    - Integrating existing data into a relational database
    - Integrating relational database with ROSS
    - Upgrading user-friendliness of ROSS
- Exploring opportunities to establish the Raine Study on a more secure financial basis – in particular exploring availability of State and Federal funding

Professor Peter Eastwood
Raine Study Director



Professor Leon Straker
Raine Study Scientific Director

Message from The Raine Study UJV Board Chair, Jan Stewart

2018 was my first year as Chair of the Raine Study UJV board. It has been an honour to be working with such a unique health study which is already adding to our knowledge of human health and wellbeing and what can be done to make a difference.

The highlights of 2018 for me have included:

- Leading the UJV board and seeing the benefits of collaboration between all of Western Australia's five Universities, the Women and Infants Research Foundation and the Telethon Kids Institute
- Being part of the Raine Study at a time it has expanded to include now four generations of participants and seeing the great potential of this kind of expansion of the study
- Observing the impact of the work of our Directors, staff and Board through their promotion of the research outcomes achieved already and the growth of new opportunities for the use of the rich data locally, nationally and internationally
- The review of our communication and branding through an extensive consultation process with all key stakeholders and the launch of a new contemporary brand and communication approach for this next era of the work of the Raine Study
- Reaching the milestone of 500 papers published utilising Raine Study data

I look forward to continuing to work with our UJV partners and the staff of the Raine Study in the year ahead, particularly as we approach the 30th Anniversary of the study in 2019/2020.

Our staff and colleagues in the research community have done outstanding work in the year just passed. I thank them and the UJV partners for their work and the warm welcome I have been given as the incoming Chair of the Board.

Above all, I thank our participants for their continuing commitment to the Raine Study.

I would also like to take this opportunity to wish those participants who will celebrate their own 30th birthday in 2019, a very Happy Birthday!

Jan Stewart
UJV Board Chair

Summary of The Raine Study

The Raine Study was established 1989-1991 with a cohort of almost 3,000 pregnant women (Generation 1, Gen1) recruited into the study at King Edward Memorial Hospital. It was named 'the Raine Study' to acknowledge the original grant from the Raine Medical Research Foundation and the ongoing support received from the Foundation.

Since the Raine Study was established, the children (Generation 2, Gen2) born during that period have been followed up at regular intervals providing an increasingly rich source of data for local, national and international research.

- Over **30,000 pieces of data** (and >30 million pieces of genetic information) have been collected on each of our Gen2 participants in the last 30 years
- Over **500** peer-reviewed journal articles have been published on the Raine Study resources
- In 2019 it will be **30 years** since the Raine Study began
- >400 babies (Generation 3, Gen3) have been born to the Raine Study cohort participants, (estimated to reach 1,500 babies within 10 years)

The Raine Study's Vision, Mission, and Values

Our Vision

Our Vision

Advancing knowledge,
enhancing lives.

Our Mission

Our Mission

To improve lifelong health and quality of life through ground-breaking, impactful research that examines influences, pathways and outcomes from before birth and throughout life's course.

Our Values

Our Values

Committed - We are committed to innovation, discovery, scientific rigour and high ethical standards. Our staff, researchers and participants do what they do for the greater good.

Collaborative - We provide a scientific environment that is flexible, respectful and collaborative to our participants, researchers and all those we work with.

Curious - We search for new discoveries that can improve human health and quality of life. This is what motivates us.

Changing - We are constantly building knowledge that changes people's lives.

The Raine Study Partners

the Raine Study

Our partners

General Information about The Raine Study

History of The Raine Study

In 1989 Professor John Newnham and his colleagues invited more than 3,000 pregnant women to join a National Health and Medical Research Council funded research study at King Edward Memorial Hospital to examine the possible beneficial effects of repeated fetal ultrasound imaging studies. Women were allocated at random into one of two groups – Regular Care or Intensive Care. Those in the Regular Care group had a single ultrasound imaging study at 18 weeks gestation, with further scans only if clinically indicated. The women in the Intensive Care group had ultrasound scans at 18, 24, 28, 34 and 38 weeks gestation.

Along with Professor Newnham, a group of prominent investigators (Professor Fiona Stanley, Professor Lou Landau and Professor Con Michael) formed a group to establish these families into a cohort study, focusing on the child, to determine how events during pregnancy and childhood influence health in later life. This was initially supported with funding from the Raine Medical Research Foundation.

The original cohort of 2,868 children, the Raine Study cohort, is one of the largest, most successful prospective cohorts of pregnancy, childhood, adolescence and now adulthood, to be carried out anywhere in the world.

The Raine Study has grown to be a multi-generational study. A group of young adults (Gen2) have been followed from before they were born and throughout their life. Their families are also part of the study, with their parents (Gen1), grandparents (Gen0) and children (Gen3) now also involved.

The participants have been followed closely over the last 29 years by a collaborative team of researchers from The University of Western Australia, Women and Infants Research Foundation, Telethon Kids Institute, Curtin University, Edith Cowan University, the University of Notre Dame, Murdoch University, the Lions Eye Institute, and many other national and international collaborators.

Development of a new brand with Vision, Mission, and Values

Our 30 year milestone presents a huge opportunity to re-position the Raine Study and showcase the achievements of our participants, researchers and staff in making a difference to human health and well-being across the world.

In May 2018 we embarked on a process to review our existing brand – that included our logo, colours and the font we use. It also included how we talk about the Raine Study in our communications and the establishment of a new vision and mission statement for the Raine Study. This process involved interviewing a number of key stakeholders including participants, staff, researchers and our UJV partners.

It became evident, that whilst our existing brand image had served us well and had a wonderful story behind it, we needed to move our brand forward into a format that showed the maturity of the Raine Study and that worked across digital media and could form the foundation of a total communication strategy for the Raine Study.
Part of this process is to ensure the Raine Study is presented in the best possible light through its visual and written brand and that our brand works well in both traditional and digital formats.

The new brand was officially launched at our 2018 Annual Scientific Meeting in November, and was developed ahead of the Raine Study officially beginning the celebration of its 30th anniversary year, which will commence in October 2019.

The brand review demonstrated that a clear brand positioning statement for the Raine Study would enhance our communication strategy – a positioning statement that goes beyond our individual research findings and would be ‘a big picture statement’ that inspired everyone to want to know more about us.

‘One of us could change your life’

Our new tagline honours our participants, our researchers, our partners and everyone involved with the Raine Study. It makes clear that each and every one of us has the ability to change someone’s life through involvement and research.

Organisational Structure

The Raine Study was initially managed through King Edward Memorial Hospital, then in early childhood, management shifted to the then Telethon Institute for Child Health Research. In 2007 a Memorandum of Understanding was signed to establish a clear collaborative governance structure based on an Executive Committee chaired by the Dean of Medicine at the University of Western Australia (initially Professor Ian Puddey) and supported by a Scientific Director (initially A/Professor Craig Pennell).

As the Raine Study participants matured, the offices for the Raine Study were moved to facilities at UWA (becoming the centre agent of the study) in 2014.

In 2017, following a review of the governance structure, it was decided to establish an Unincorporated Joint Venture which would replace the previous Raine Study Executive Committee. The UJV is now a collaborative partnership agreed between the University of Western Australia, Curtin University, Edith Cowan University, Murdoch University, the University of Notre Dame, Telethon Kids Institute and the Women and Infants Research Foundation with community representatives on the board and with an independent Chair.

The parties agreed to facilitate the development of an optimum governance structure for the Raine Study; developing a clear framework for the ownership, custodianship and control of assets of the Raine Study including data, biological samples and intellectual property.

The Raine Study’s host is the School of Population and Global Health headed by Professor Colleen Fisher, at the University of Western Australia.

The Raine Study is also extremely proud that The Honourable Kim Beazley, Governor of Western Australia in 2018 accepted our invitation to become our Patron.

In 2018 a new independent UJV Board Chair, Jan Stewart was welcomed and brought with her a great deal of knowledge and experience to contribute to this new role.

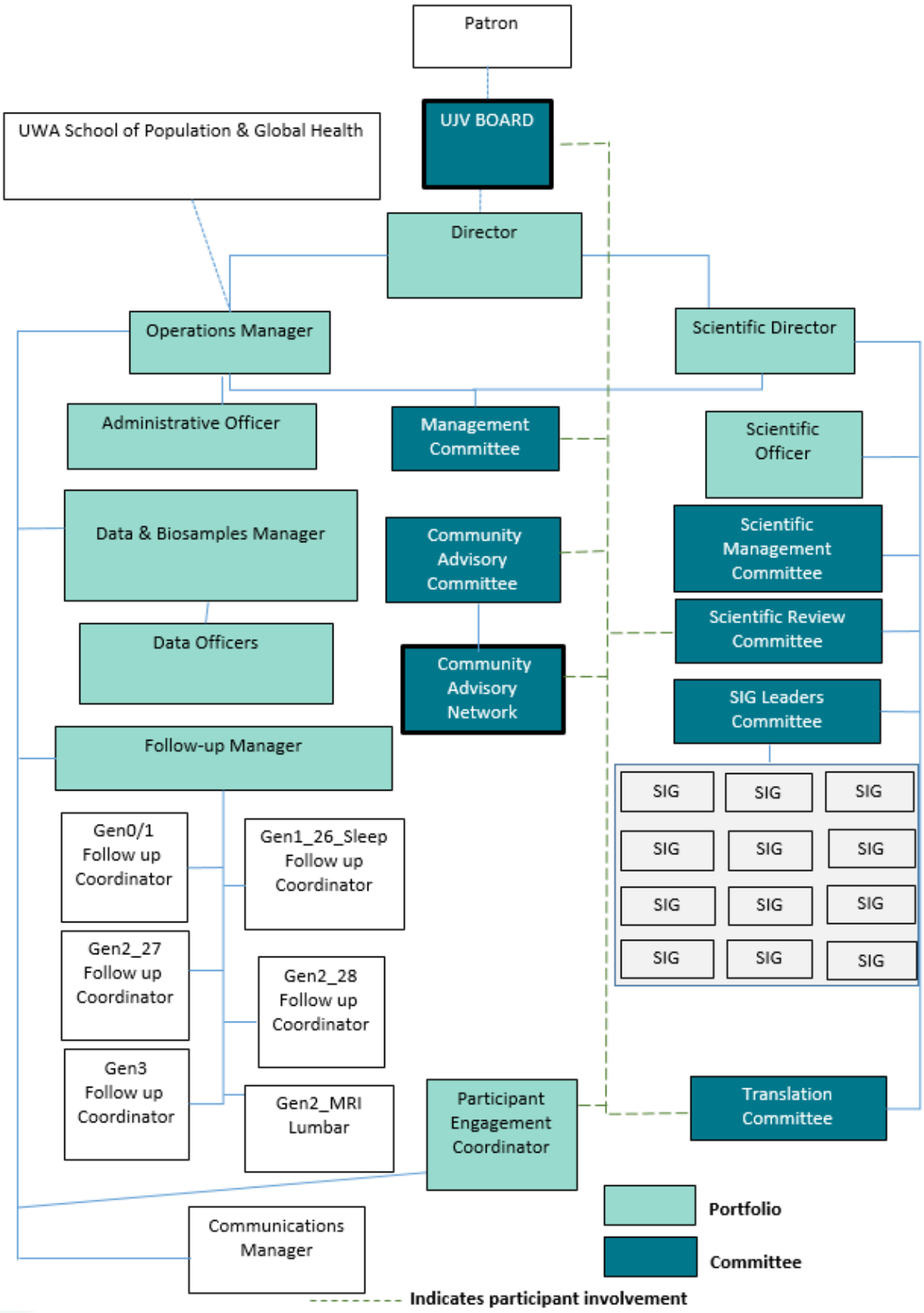


Figure 1: The Raine Study Organisational Structure

Patron

The Raine Study Patron is a distinguished individual who lends their name and support to the organisation and who has strong ties to Western Australia.

UJV Board

The Raine Study UJV Board is comprised of representatives of partners to the Unincorporated Joint Venture Agreement, consumer/community representatives and an independent Chair. The role of the members includes attending regular meetings (four per annum), being engaged in the initiatives and the outcomes being pursued by the Raine Study, being an advocate for the Raine Study and its purpose and being committed to, and actively involved in the Raine Study.

UJV Board Chair

The Raine Study Board is chaired by an individual who is independent of all parties. The Chair is uniquely placed to provide advice to the organisation and its Directors on strategic direction and overall performance. Meetings of the Board are convened by the Chair and supported by the Operations Manager.

Scientific Management Committee

The Scientific Management Committee manages science related activities for the Raine Study. The Scientific Management Committee meeting involves the Scientific Officer, Scientific Director, Director, Data and Biosamples Manager and the Follow-up Co-ordinator.

Scientific Review Committee

The Scientific Review Committee was set up to provide a high quality review of scientific projects and science strategy. The members provide expert advice on science, feasibility and significance of proposed projects, input on processes supporting and monitoring science activity, and input on curation and utilisation of biosamples and data.

Members in 2018 were Prof John Newnham, Prof Lou Landau, Prof Lawrence Beilin, Prof David Mackey, Prof Craig Pennell, Prof Nick de Klerk, Prof Susan Prescott, Prof Trevor Mori, Assoc/Prof Graham Hall, Prof Pat Holt, Assoc/Prof Rae-Chi Huang, Dr Phillip Melton, Prof Peter Eastwood, Prof Leon Straker, Ms Rachael Wilkinson (Participant Representative) and Dr Alison Kerr (Participant Representative).

SIG Leaders Committee

The Special Interest Group leaders are a team of 2-3 people representing a specialist area who have been selected and appointed by the Raine Study Directors. They work with the Raine Study team to maximise the utility and utilisation of data in their area of expertise. They will guide researchers interested in their area to expand activities and look to identify: new expertise/researcher talent to attract to the SIG (local, national and international); opportunities to collaborate with other SIGs; new research projects; new funding opportunities; and student research opportunities. SIG Leaders are also responsible for keeping the brief summary of the SIG's activities up to date.

The Raine Study SIG leaders in 2018 were Dr Phillip Melton, Prof Craig Pennell, Dr Koya Ayonrinde, Prof Trevor Mori, Dr Rachel Foong, Assoc/Prof Graham Hall, Dr Melanie Walls, Prof Roger Hart, Prof Martha Hickey, Dr Darren Beales, Assoc/Prof Peter Kent, Dr Ashleigh Lin, Dr Monique Robinson, Dr Chris Brennan-Jones, Adj/Prof Rob Eikelboom, Prof David Mackey, Prof Peter Eastwood, Prof Leon Straker, Assoc/Prof Joanne McVeigh, Dr Nigel McArdle, Assoc/Prof Therese O'Sullivan, Prof Wendy Oddy, Dr Robert Tait, Prof Rachel Skinner, Prof Megan Galbally, Prof Jeff Keelan, Dr Shin Lee, Dr Gina Trapp, Assoc/Prof Hayley Christian,

Assoc/Prof Michael Dockery, Assoc/Prof Patrick Dunlop, Ms Angela Jacques, Prof Max Bulsara and Prof Anne Smith.

Community Advisory Committee

The Community Advisory Committee is to provide input and a community perspective into the Raine Study activities. They are tasked with contributing to ideas for strategies to enhance participant engagement, identify areas of research that may be important to the Raine Study community and provide feedback on the relevance, understanding and value of the research. The committee was established to provide an important link to researchers from the Raine Study community.

Members in 2018 were Mr Martin Becker, Ms Charlotte Diaz, Ms Rachael Wilkinson, Dr Alison Kerr, Dr Ditza Teng, Mrs Jan Lettenmaier, Ms Claire Adams, Mr Cornel Scheibling, Ms Jessie Appleyard, Ms Alexandra Marsh, Ms Janet Scott, Mr Roland Kerr, Mr Thomas Lettenmaier and one other participant (name not disclosed). Additionally, Mr Martin Becker and Ms Charlotte Diaz represented the Community Advisory Committee on the UJV Board, Mr Cornel Schiebling and Ms Claire Adams on the Management Committee and Dr Alison Kerr and Ms Rachael Wilkinson on the Scientific Review Committee.

Management Committee

The Raine Study Management Committee comprises of the Operations Manager, Director and Scientific Director, a community participant from Generation 1 and Generation 2, two Senior Research Officers, the Scientific Officer and the Communications Manager. The committee assumes overall responsibility to facilitate the effective management and operations of the Raine Study in the key areas of administrative and financial support. The Raine Study Management Committee ensures communication and coordination between operational and scientific components.

Director

The Director provides scientific and operational leadership of the Raine Study. This includes working to maintain the reputation of the Raine Study and a sustainable framework for the protection and continuation of the cohort in the future. The Director also enhances discovery by engaging high quality researchers, supporting the collection of new data and facilitating the utilisation of existing data as well as working to secure and maintain partner funding to cover core management costs. This is notionally a 0.2FTE position.

Scientific Director

The Scientific Director provides leadership and strategic direction for the Raine Study research activities. The Scientific Director's responsibilities include maximising utilisation of the Raine Study resources, maintaining productivity of high quality researchers, establishing and maintaining national and international collaboration and creating research opportunities for the Raine Study. This is notionally a 0.2FTE position.

Scientific Officer

The Scientific Officer works with the Scientific Director and Director to provide support for the scientific aspects of the Raine Study including the Scientific Review Committee, the Special Interest Group Leaders and researchers, and research project management. This position was a shared position at 0.6FTE.

Participant Engagement Coordinator

The Participant Engagement Coordinator coordinates participant engagement activities (formal and informal), is a participant advocate and is responsible for enhancing participant involvement and commitment to the Raine Study. They work with the Communications Manager, Operations Manager and Administrative Officer developing strategies for enhanced engagement, effective communication, as well as ensuring maintenance, confidentiality and security of the cohort details. This is a 0.1FTE position.

Communications Manager

The Communications Manager for the Raine Study is responsible for promoting the Raine Study and providing effective external communications, developing key messages, branding and media releases targeting the community, government, researchers and participants. The Communications Manager consults regularly with the Raine Study Directors and research staff to develop plans and to advise on marketing and promotional strategies to enhance the Raine Study's reputation and improve stakeholder communications, engagement and retention. The Communications Manager role is a 0.2FTE position.

Follow-up Manager

The Follow-up Manager oversees coordination of all follow-up activities and ensures efficient and quality outcomes. They liaise with each follow-up coordinator to ensure consistency in procedures across follow-ups, pilot testing of data collection, provide updates along with study coordinators to lead investigators and work with the Raine Study team to coordinate all follow-up activities. The Follow-up Manager is responsible for ensuring a coordinated approach across all follow-ups to achieve the highest possible quality data and efficiency for the Raine Study. This is a 0.1FTE position.

Senior Research Officers

Two Senior Research Officers coordinate the core Raine Study health assessments on cohort participants and other assessments on behalf of affiliated research projects. The senior research officers also train research staff in the collection of data and ensure the smooth running of the cohort follow-up process. They are responsible for liaising with and recruiting the study participants and for the co-ordination of follow-up assessments including the protection of the study participants' interests, initial quality control of data collection, co-ordination and scheduling of staff. The total FTE of both positions for 2018 is 1FTE.

Phlebotomist

The Raine Study Phlebotomist is responsible for the collection of blood and other biological samples from the Raine Study participants. They are also responsible for assisting with recruitment and research administration for the cohort follow-ups. This was a 0.9FTE position in 2018.

Research Assistants

The Research Assistants are responsible for all aspects of data collection including physical assessment and questionnaire data from Raine Study participants. This includes the collection of anthropometry measurements, accelerometer data, blood pressures, DEXA and breast scans, the collection and processing of some biological specimens and the collection of questionnaire data. Research assistants also have responsibility for the recruitment, booking and co-ordination of the study participants. Their role also includes gaining consent from participants. Across the various studies, 14 Research Assistants and 2 Research Recruitment Officers were employed on a full-time, part-time or casual basis during 2018.

Data and Biosamples Manager

The Raine Study Data and Biosamples Manager position was filled in March, however the incumbent secured a position internationally and resigned in October. The role involves the management and curation of the Raine Study longitudinal data, advising the Raine Study leadership of strategic directions for data and biosample curation, ensuring high quality data and biosample collection, storage, and extraction for researchers, managing datasets, and providing support to researchers in relation to all data requests. The Data and Biosamples Manager is also responsible for the supervision of data support staff. This was a 0.5FTE position filled for 6 months.

Data Officers

Two Data Officers are tasked with verification and accurate entry of scientific data relating to the Raine Study follow-ups, as well as the secure archiving and storage of the data. Their responsibilities include assisting with creating central quality-controlled data sets, data extraction requests, ensuring data quality, answering queries from researchers on data availability and assisting with the provision of feedback in a meaningful way to study participants. The Data Officers also provide support to the Data and Biosamples Manager role. The total FTE of both positions is 0.9FTE.

Operations Manager

The Operations Manager for the Raine Study has senior responsibility for all operational matters including finance, human resources and corporate support and oversight of operational issues related to cohort follow-ups, data and biosamples management, communications and participant engagement. The Raine Study Operations Manager reports to the Head of School of Population and Global Health and the Raine Study Director. This is a 0.8FTE position.

Administrative Officer

The Administrative Officer provides administrative support to operational and scientific activities in the leadership and management of the Raine Study. The Administrative Officer assists with research processes, maintains the online submission system, updates the website, coordinates and takes minutes at meetings, assists with financial and human resource management as well as travel and event coordination and general office administration. This is a 0.8FTE position.

Patron

The Honourable Kim Beazley AC, Governor of Western Australia

UJV Board

Jan Stewart (Chair), Mrs Aggie Bouckley (Secretary), Prof Chris Moran (Curtin University), Prof Greg Blatch (Notre Dame University), Prof Margaret Jones (Edith Cowan University), Prof Robyn Owens (University of WA), Assoc/Prof Graham Hall (Telethon Kids Institute), Prof David Morrison (Murdoch University), Ms Deborah Attard-Portughes (Women & Infants Research Foundation), Prof Peter Eastwood (Raine Study Director), Prof Leon Straker (Raine Study Scientific Director), Mr Martin Becker (Raine Study Participant), Miss Charlotte Diaz (Raine Study Participant)

Directors

Prof Peter Eastwood (Director) and Prof Leon Straker (Scientific Director)

Staff

Operations Manager: Aggie Bouckley

Administration Officer: Heather Campbell

Data & Biosamples Manager: Dr Manon Dontje

Data Officers: Huong Le, Alyce Russell

Communications Manager: Lorelei Campbell

Scientific Officer: Dr Manon Dontje, Dr Juliana Zabatiero

Participant Engagement Coordinator: Diane Wood

Follow-up Manager: Diane Wood

Senior Research Officers: Diane Wood, Alex D'Vauz, Monique Priston

Phlebotomists: Suzanne Green, Lilyana Beer

Recruitment Officer: Michael Trown, Jessica Parrotte

Research Assistants: Monique Priston, Suzanne Green, Erica Hodgson, Natalya Beer, Rose Huxtable, Sean Byrne, Emily Huynh, Kirsten Smith, Tina Barrow, Michael Furfaro, Lauren Reinders, Jacinta Saldaris, Beverley Hodgson, Zoe Baines

Students 2018

In 2018 there were 35 students working with the Raine Study, 20 of whom were enrolled for Doctor of Philosophy (PhD) degree, 5 Honours students, 7 Masters students and 3 Medical students (Figure 2).

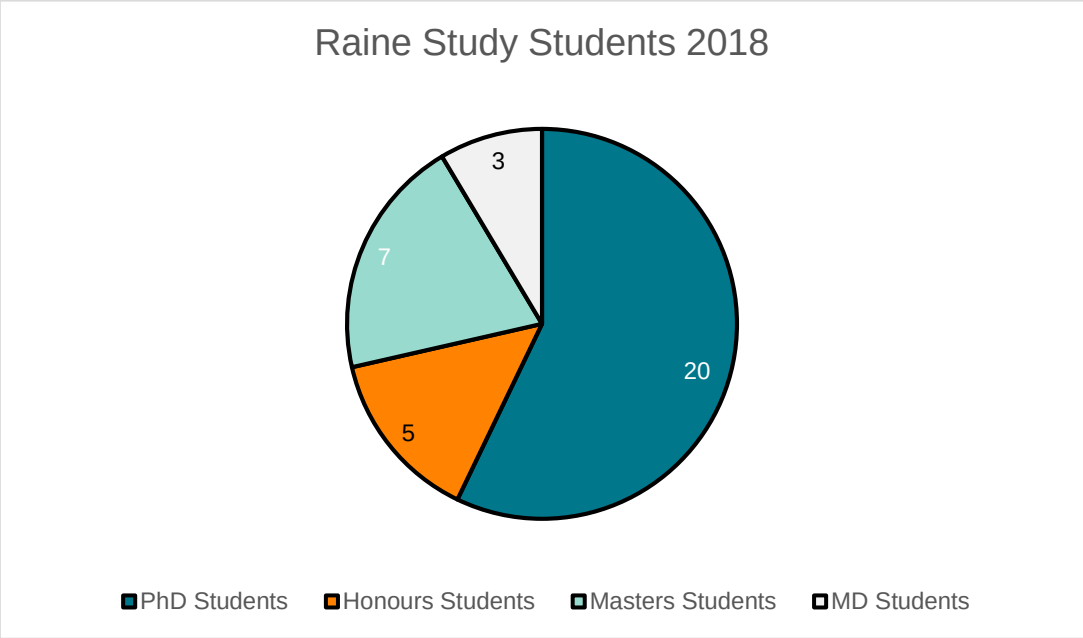


Figure 2. Number of students enrolled in various degrees using Raine Study data

Figure 3 presents the number of Raine Study PhD students enrolled each year since 1990.

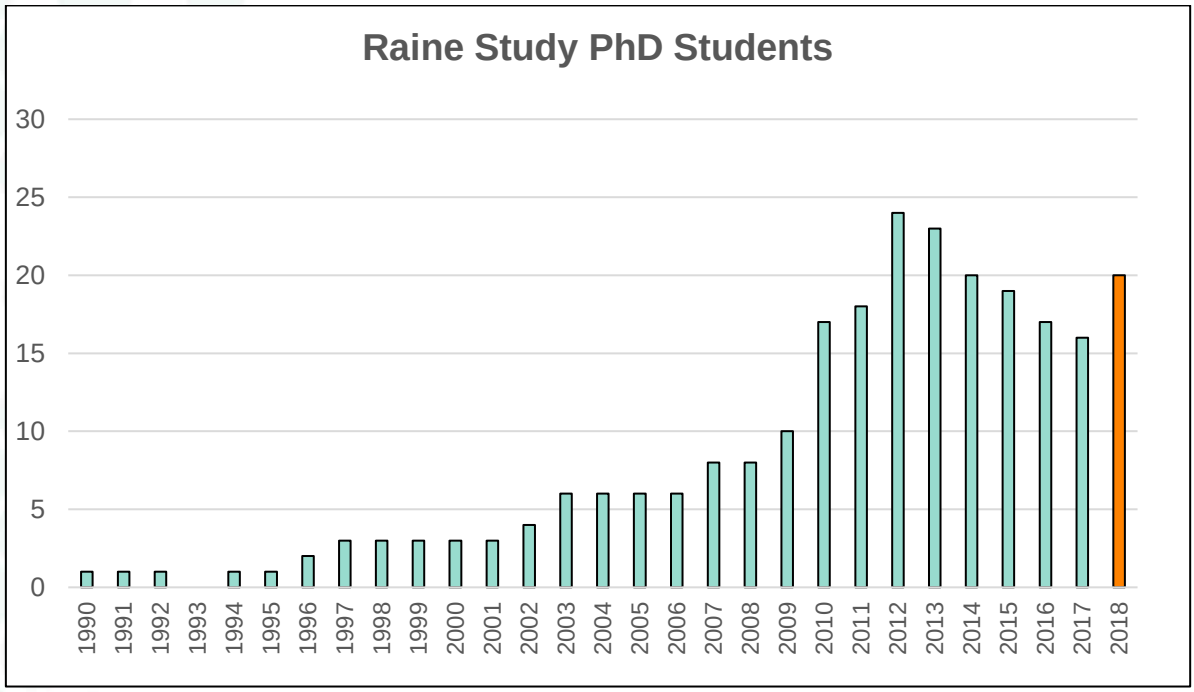


Figure 3. Number of students enrolled in PhD programs using Raine Study data per year

Participants 2018

The original Raine Study babies (Gen2) were (on average), turning 28 years of age in 2018. 2,094 of them remain registered as "active" participants, meaning that they have agreed to remain in the study and be contacted for future assessment. 1,914 Raine Study parents (Gen1) remain as "active" participants, and to date, 428 offspring (Gen3) have been born to Generation 2 and are registered with the Raine Study. In 2018 we also commenced the Gen0/1_28 Breast Density (TiBS) follow-up and had 47 grandmothers (Gen0) participants between July and December 2018.

Funding for the Raine Study

The Raine Study core management costs are covered by contributions from the UJV partners - the University of Western Australia (Faculty of Medicine, Dentistry and Health Sciences), University of Western Australia DVC (Research), Curtin University, Edith Cowan University, Murdoch University, The University of Notre Dame, the Women and Infants Research Foundation, the Telethon Kids Institute and the Raine Medical Research Foundation.

Grant Applications 2017 (for 2018 funding)

Thirteen grant applications totalling $12.4 million were prepared and submitted in 2017 for research projects and Raine Study development projects to commence in 2018, of which five were successful totalling $3.6 million (Appendix 1).

- NHMRC 1134894, 2018-2022. K Steinbeck, R Skinner, L Sanci, D Schofield, F Brooks, A Dawson, R Ivers, L Perry, B Liu, P Collin, M Kang, A Third, J Mooney-Somers, L Straker, S Gibson, P Hazell, L Baur, S Eades, S Sawyer. A Centre of Research Excellence in Adolescent Health: making health services work for adolescents in a digital age. $2,496,294.
- Cancer Australia 1147677, 2018-2020. J Stone, C Saunders, D Sampson, M Hickey, L Lilge, G Cadby, J Shepherd, M Giorgi, M Cook. Measuring breast density in younger women to inform primary prevention and early detection of breast cancer. $592,636.
- NHMRC 1142858, 2017-2021. RC Huang, R Foong, G Hall, A Lin. LIFECYCLE - Early life stressors and lifecycle health. $453,810.
- Department of Health WA, 2018-2019. A Smith, P O'Sullivan, Y Wang, J Karppinen, D Samartzis, L Straker, P Kent, M Hancock, D Beales, S Linton. Lumbar pathology – irrelevant finding or treatment target for low back pain? $75,000.
- WAHTN 2017. L Straker, P Eastwood, D Glance. Secure health data analysis and processing environment (SHAPE) stage 2. $50,000.

Grant Applications 2018 (for 2019 funding)

Nine grant applications totalling $2.3 million were prepared and submitted in 2018 for research projects and the Raine Study development projects to commence in 2019, of which six were successful totalling over $1.4 million (Appendix 2).

- NHMRC 1161445, 2019-2023. R Skinner, J Marino, S Lymer, D Doherty, K Steinbeck, L Straker, M Kang, R Tait. The health, social and economic implications of risk-taking in adolescence over the life-course: a data linkage study of the Raine cohort. $1,061,015.
- National Heart Foundation 102301, 2019. T Mori, L Beilin, M Schlaich, J Yang. Aldosterone, cardio-metabolic profile and early life factors in the Western Australian Pregnancy Cohort (Raine) Study. $74,878.
- National Heart Foundation 102170, 2019. A Haynes, L Taylor, D Green, L Straker, J McVeigh. Developmental origins of adult myocardial structure and function: heart health and the Raine cohort. $75,000.
- Royal Perth Hospital Medical Research Foundation, 2019. C Le-Ha, T Mori, L Beilin, M Hickey. Associations of prenatal androgen exposures and of age at menarche with cardiovascular risk factors in early adulthood: a prospective cohort study. $20,000.
- Lotterywest 420171061, 2018-2019, L Campbell. Website upgrade and re-brand elements. $36,792.00.
- WAHTN-MRFF, 2019. L Straker, P Eastwood, D Glance. Supporting governance, discovery and translation from large health datasets: Development of a research project online management system to support strong governance and translation from health studies. $146,165.

Figure 4 presents the total number of submitted and successful Raine Study grant applications over the last 10 years. The total amount awarded per year to Raine Study grant applications over the last 10 years is shown in Figure 5.

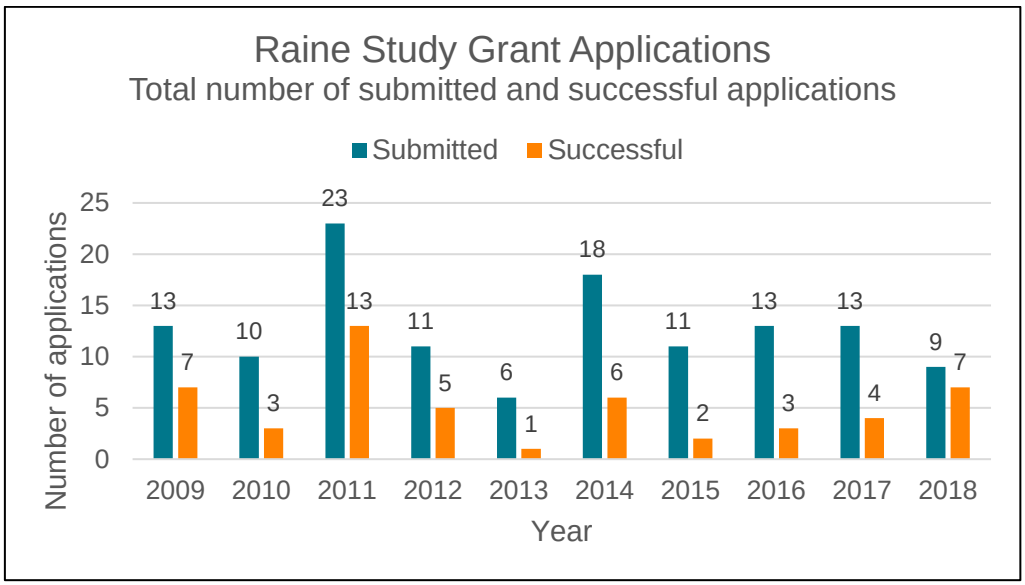


Figure 4. Number of submitted and successful grant applications per year

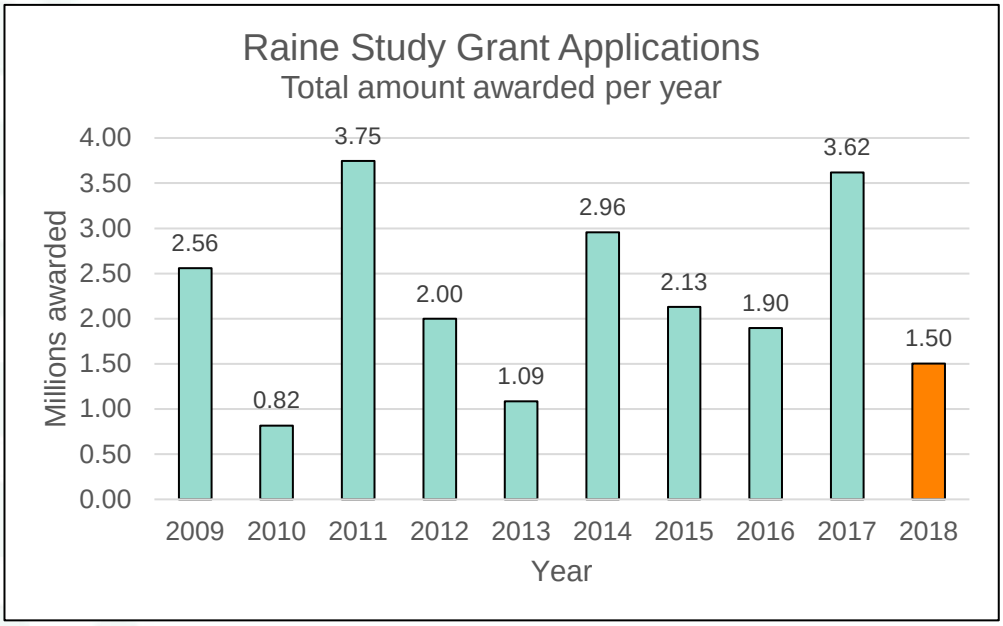


Figure 5. Total amount ($millions) awarded to successful grants per year

Grant Funded Activities Update 2018

ARC 150103312, 2015-2018, S Parker, P Dunlop, L Straker, K Parkes, Work design matters: The dynamic interplay of work and person factors, $334,119.

This project aims to examine the working environment and how this affects an individual's health, work performance and behaviour. The study looks at how personality and demographics, and their interactions, shape or constrain individuals' opportunities to undertake high quality work and vice versa. It also examines how family, education, and workplace factors affect the individual and their workplace. The Raine Study participants' contact details were updated and the questionnaires were sent out in May 2016. All active Raine Study Gen2 participants were contacted and invited to complete an online questionnaire in relation to themselves and their workplace. 472 participants completed their questionnaires. In addition to that, 63 managers and 69 peers completed a questionnaire about the Raine Study participants. In 2018 the follow-up questionnaires were sent to Gen2 participants, with 221 of the original 477 respondents and 114 new Gen2 participants responding. Data analyses and reporting are currently underway.

National Breast Cancer Foundation (NBCF), PS15040, 2015, J Stone, M Hickey, L Lilge, C Saunders, J Hopper, A novel method to measure breast density in young women, $198,931.

Breast density is a strong predictor of breast cancer risk. Evidence of this has been derived from mammography, which is not recommended for younger women. New methods of measuring breast density are therefore needed to bridge large gaps in knowledge regarding breast density in young women. Members of the research team have developed Transillumination Breast Spectroscopy (TiBS) which measures spectral differences in breast composition using visible and near infrared light. It correlates highly with mammographic breast density in women over 40 and is safe and easy to use. This project aims to test the feasibility and acceptability of the TiBS machine to measure breast density. Recruitment is now complete and we have obtained TiBS scans for 542 volunteers (women aged 18-40) and 488 female Raine Study Gen2 participants as part of the Gen2_27 year follow-up. Data analyses are underway and some of the first findings are expected to be published by the end of 2019.

CRC, A Whitehouse, The creation of the Australian Autism Biobank. Autism Cooperative Research Centre (1.002RC). $130,000.

The Cooperative Research Centre for Living with Autism (Autism CRC) is the world's first national cooperative research centre focused on autism. The centre takes a whole-of-life approach to autism focusing on diagnosis, education, and adult life. One project within the Autism CRC was to establish a comprehensive biological and clinical database of children with Autism Spectrum Disorder (ASD) and children without ASD, together called the Australian Autism Biobank (https://www.autismcrc.com.au/biobank). The Raine Study children (Gen3) of the Gen2 participants were identified as a well-established cohort to form a comparison sample of children without ASD. 88 Gen3 children between 2 and 10 years of age participated between 2017 and 2018. Assessments included detailed child development questionnaires, face-to-face testing of developmental abilities, measurements of sleep and physical activity, and collection of blood, stool, urine and hair samples for later genotyping, biochemistry, and other biological sample analyses. Data analyses and reporting are currently underway.

NHMRC 1102106, 2016-2020, T Mori, L Beilin, E Moses, G Watts, L Adams, Genetic and early life predictors of ectopic fat and their association with cardio metabolic health and disease, $1,706,136.

The grant application has helped fund the Gen2_27 year follow-up and aims to examine the genetic, antenatal and childhood antecedents of ectopic fat depots in young adults, and the relative importance of different depots in relation to cardio metabolic health and novel markers of resolution of inflammation. Ectopic fat depots are best quantified using Magnetic Resonance Imaging (MRI). Online questionnaires with the option of paper copies were created, databases to record assessment data developed and contact details of participants updated. Pilot assessments were conducted and the follow-up commenced in May 2016. Eligible participants were invited to participate in a physical assessment and an MRI. The physical assessment tests include the core anthropometric measurements of height, weight, skinfolds and blood pressure, DXA scan as well as a repeat of some of the eye measurements from the year 20 follow-up. Fasting bloods were also obtained on the day of their assessment and for females a new breast density screening test using Transillumination Breast Spectroscopy (TiBS) was also performed. All participants were also requested to provide urine and faecal samples. Data collection was completed in December 2018 with 1082 participants providing some data and 975 completing the abdominal MRI. Analysis and reporting are currently underway.

NHMRC 1109057, 2016-2018, P Eastwood, A Mian, N McArdle, D Hillman, Predicting obstructive sleep apnoea using 3D craniofacial photography, $424,715.

This project commenced in mid-2016. It aims to examine the relationships between the structure of the face, head and neck and the development and severity of obstructive sleep apnoea (OSA), a very common condition associated with snoring and collapse of the upper airway (throat) during sleep. Determining which characteristics of the face and neck are related to the development and severity of OSA could provide important information about the causes of OSA and may allow us to diagnose it using a simple 3-dimensional photograph of the face.

The project leverages off the unique combination of 3D photographs and laboratory-based measurements of OSA that have been obtained in 956 young adults from the Gen2_22 year follow-up and 1,000 of the parents (Gen2) of these young adults. These data sets will be combined with >1,000 data sets from patients attending the Sleep Clinic at Sir Charles Gairdner Hospital (to date 1,365 patients have been studied). Data collection is ongoing.

WAHTN , 2017, Straker, L., Eastwood, P., & Glance, D, Secure Health data Analysis and Processing Environment (SHAPE) stage 1, $15,000 and WAHTN, 2018, Straker, L., Eastwood, P., & Glance, D Secure Health data Analysis and Processing Environment (SHAPE) stage 2, $50,000

This project aims to develop and evaluate a system which would enable: 1) Secure access to analytic data sets by researchers from multiple institutions, states and countries; 2) Provision of appropriate analytic tools to enable collaborative teams to conduct secure analysis; 3) Provision to archive data sets and processes for peer scrutiny subsequent to their publication; 4) Easy usability across multiple researcher groups; and 5) Tracking of user access and clear governance for use. The first stage was successful in drafting governance documentation, developing a research project and team collaborating across the University of Western Australia and Curtin University, developing the hardware and software to establish a secure data space, installing free-to-use statistical analysis software (R studio and R), and conducting the analysis on a cross-institutional project. The second stage successfully involved several Raine Study projects with national and international collaborations to use refinements of hardware and software for the secure data space capacity, including statistical software utilizing multi-user license common commercial software, to conduct analyses and prepare results outputs with national and international researcher groups within the high quality governance environment. Whilst SHAPE demonstrated the proof of concept well, the current cost for the virtual machine environments is too great, but ongoing WA infrastructure development means this barrier may soon be overcome. This would enable the development of SHAPE for the Raine Study and other large studies in Western Australia and beyond.

Projects Update

New applications to utilise The Raine Study data

In 2018 there were 51 new projects approved and 34 manuscripts reviewed. There were 113 data and biosample requests (Figure 6).

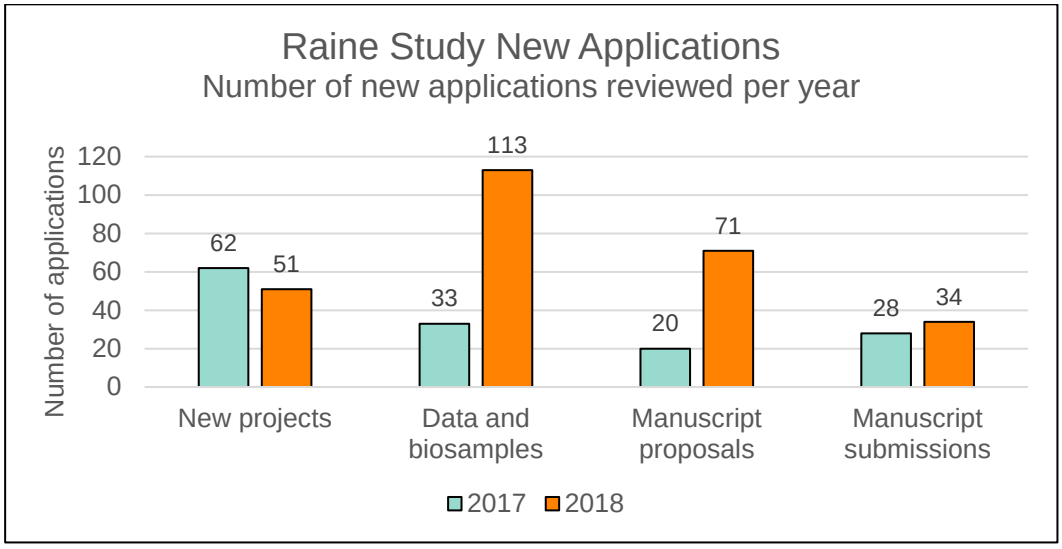


Figure 6. Number of Raine Study new applications in 2017 and 2018

Data collection completed during 2018

Generation 3 Data Collection

- Gen3_27 year follow-up Autism & Related Conditions – 87 participants

Generation 2 Data Collection

- Gen2_27 year follow-up MRI Cardio metabolic – 1082 participants, MRI – 975 participants. Completed data collection in 2018.
- Gen2_27 year follow-up MRI Back Lumbar – 160 participants, 77 pairs. Completed data collection in 2018.
- Gen2_28 year follow-up Vessels & Vision; Vessels – 238 participants, Vision – 324 participants.
- Gen2_28 year follow-up Work & Personality – 319 participants. Completed data collection in 2018.

Generation 1 Data Collection

- Gen1_28 year follow-up Work & Personality – 190 participants.
- Gen1_28 year follow-up Breast Density (TiBS) – 189 participants.

Generation 0 Data Collection

- Gen0_28 year follow-up Breast Density (TiBS) – 41 participants.

Translation, Dissemination & Impact

Publications

In 2018, 39 peer-reviewed papers were published bringing the total to 506 (Figure 7), with 90% of these in journals with impact factors of 2 or greater (Figure 8). High Impact publications included those listed in Appendix 3.

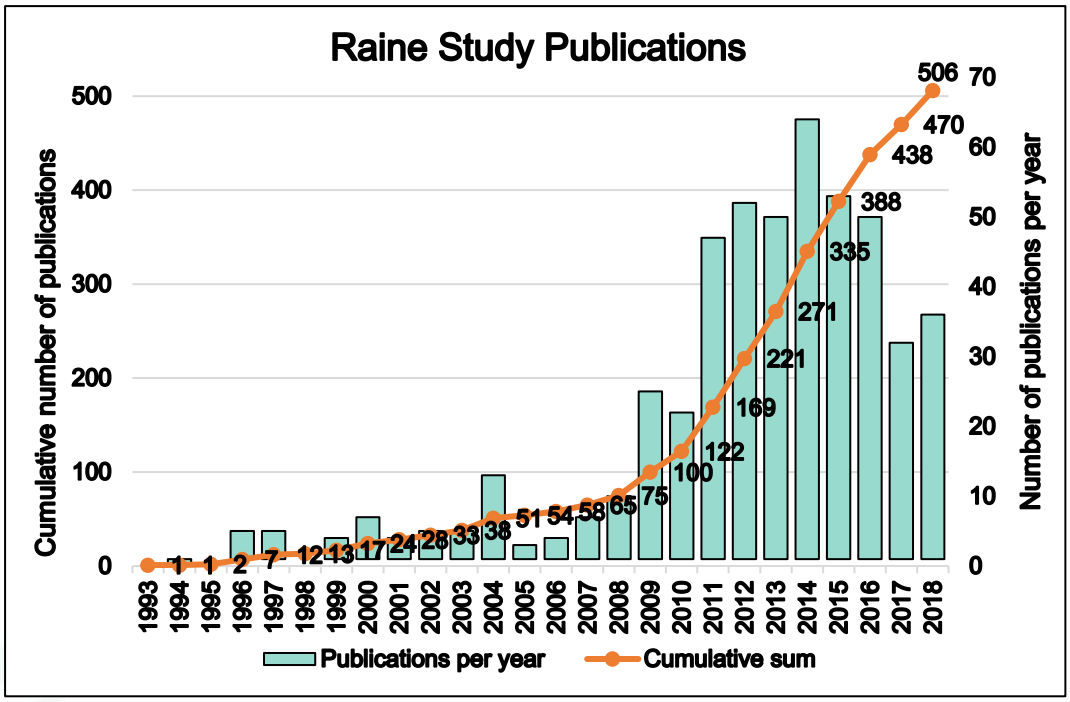


Figure 7. Number of Raine Study publications by year

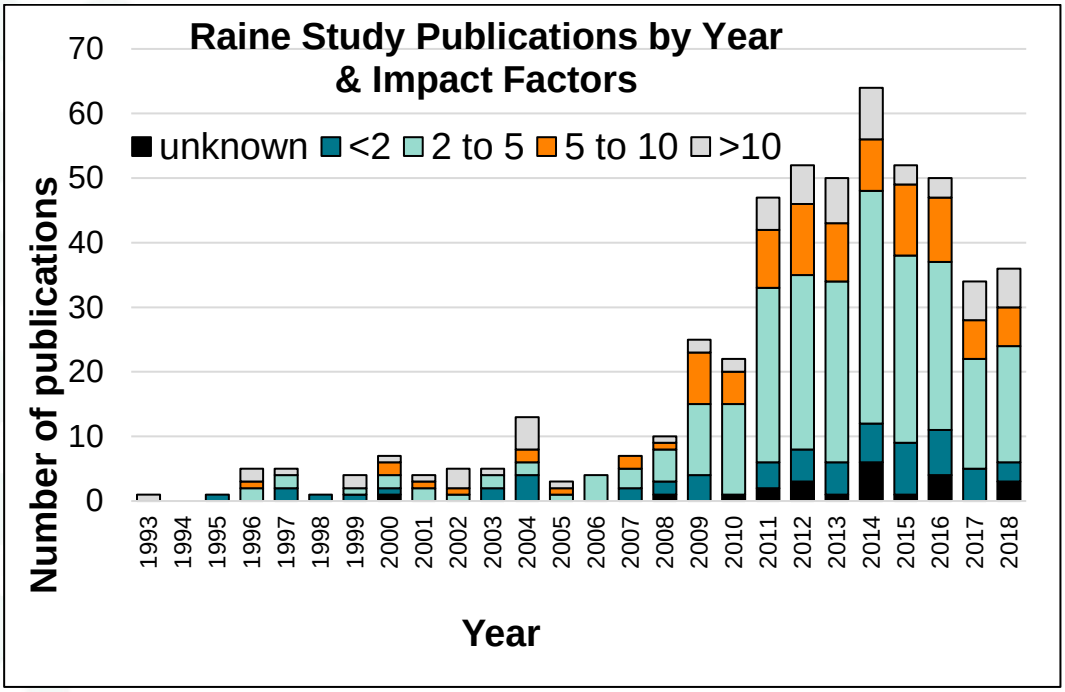


Figure 8. Number of Raine Study publications by year and impact factors

Milestones and Events in 2018

Built Environment, GIS and Health Seminar

Presenters (Left to Right): Ms Bridget Beesley, Dr Hayley Christian, Dr Gina Trapp, Dr Amanda Wheeler

Presenter Dr Hayley Christian giving an overview of Built Environment and Health Research

On Wednesday 19th of September the Raine Study Built and Social Environment SIG held a seminar on the 'Built Environment, GIS and Health'. Organiser and presenter Dr Hayley Christian provided an overview of the evidence of the impact of the built environment on health, Ms Bridget Beesley presented information on GIS and other types of measures used to capture the built environment. Dr Gina Trapp presented examples from her current research including her paper on the link between proximity to alcohol outlets and adolescent alcohol intake. Dr Amanda Wheeler gave an overview of exposure models and explained the details of the ASPREE project. The seminar provided a good opportunity for those interested in this area of research to find out more about the current research being done and to meet the researchers themselves. A big thank you to the organisers and presenters. The Raine Study hopes to have more seminars like this one from our SIG Leaders in the future.

Work and Personality Workshops

Presenter Assoc/Prof Patrick Dunlop

During September the participants who completed the work and personality questionnaire were offered an opportunity to attend an interactive workshop. Assoc/Prof Patrick Dunlop shared information about how people choose different types of work and how their work can affect wellbeing and adult psychological development.

Annual Scientific Meeting 2018

On Friday 30th of November, over 175 researchers from Western Australia and beyond attended our 11th Annual Scientific Meeting (ASM). There were three researchers invited to present their latest findings as well as fourteen Early Career Researcher presentations. As in previous years, the ASM provided an opportunity to showcase research activities undertaken over the previous 12 months and an opportunity for researchers to network and share ideas.

We would like to congratulate all of the presenters on a job well done and in particular, the winners of the Early Career Researcher Presentations for 2018. Mr Will McIntosh and Dr Samantha Lee were both outstanding in their presentations and were awarded their prizes by Dr Amanda Cleaver, Director of the Raine Medical Research Foundation. The two $750 prizes were donated by the Raine Medical Research Foundation.

Raine Study Presentations

- Dr Manon Dontje represented the Raine Study at the *Developmental Origins of Economic Preferences Workshop* at The Institute for Advanced Study in Toulouse, France.
  Thursday 21June & Friday 22 June, 2018
- Professor Peter Eastwood presented 'The Study of a Lifetime – The Raine Study' at the *UWA Open Day*. Sunday 12 August, 2018
- Professor Peter Eastwood presented 'The Raine Cohort' to the *Sleep Apnea Global Interdisciplinary Consortium Scientific Meeting* held in Reykjavik, Iceland.
  Friday 21 – Sunday 23 September, 2018
- Professor Peter Eastwood represented the Raine Study. 'Ensuring the most effective use of NHMRC funding in the support of cohort studies involving Australians: A round table discussion' at the *NHMRC Symposium 2018 in* Canberra, ACT. Thursday 8 October, 2018
- Professor Peter Eastwood presented 'Needs and requirements from population cohorts – the Raine Study' at the *WA Biobank Workshop.* Harry Perkins Institute, QEII Medical Centre.
  Monday 29 October, 2018.
- Professor Leon Straker and Professor Peter Eastwood represented the Raine Study in a presentation to Notre Dame University Leadership Group. Thursday 29 November, 2018.

Raine Study Media

Social Media

In 2018, the Raine Study grew its social media following across its various platforms.

- Facebook – grew from 529 to over 700 people following the page. Engagement and reach continued to grow organically.
- Instagram – The Raine Study has 483 followers on its Instagram account, with exceptionally strong engagement statistics (over 40 per post). This is up from 414 at the start of 2018.
- Twitter – The Raine Study now has 274 people following its twitter account, up from 54 at the start of 2018.
- The Raine Study also has a presence on Google My Business and in 2018 was successfully published as a Wikipedia entry.

Media

Whilst the Raine Study does not have any formal media monitoring process in place (budget prohibitive), the media continues to be interested in research coming out of the Raine Study and some positive media coverage was received in 2018.

Some media highlights:

Marisa Tucker and Aaron Affleck with their daughter Araelia Raine who will be a part of generation three of the Raine study. Photograph – Richard Polden.

Baby Araelia helps future generations

By Chloe Vellinga

For the past 27 years Marisa Tucker has been poked, prodded and scanned in the name of research to help improve human health and wellbeing.

The Gosnells mother was entered into the Raine Study soon after she was born when researchers approached her parents at King Edward Memorial Hospital and asked them to be involved.

The Raine Study was one of the largest prospective cohorts of pregnancy, childhood, adolescence and early adulthood to be carried out anywhere in the world and has been a valuable resource for West Australian researchers.

More than 500 research findings have been published using data from the Raine Study to assess the safety of ultrasounds, lung function, birth weight, diet, development, asthma, mental health and better physical health in adolescents and adults.

Ms Tucker was one of 2868 babies to enter the study between 1989 and 1991 and said her three-month-old daughter Araelia Raine named after her lifelong association with the study will soon follow in her footsteps and become a part of the Generation 3 cohort.

"Having Araelia involved in the study will give me the chance to go through some of the same tests again with a new and completely different point of view," she said.

"I really feel like as participants in a study like this we are making a difference in the world and I am proud to be a part of it."

Participants in the study have provided environmental, developmental and health information from many tests conducted at birth and continued intermittently from age one to 22.

A 27-year follow up which Ms Tucker will complete this year includes a range of questionnaires, blood tests, urine and faecal samples, MRI scans, full body DXA scans and cardiovascular health tests.

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and has held roles with Marsh and BMW Financial Services.

The Raine Study has appointed Jan Stewart chair. Ms Stewart served as chief executive of Lotterywest for 22 years, retiring in 2014. Since then, she has served on a number of boards which currently includes the WA Opera, Harry Perkins Institute, St Bartholomew's House, and MercyCare. Prior to joining Lotterywest, she served as chief social worker of Princess Margaret Hospital. Started in 1989, The Raine Study is a long-term medical research project following the health and wellbeing of almost 2900 children born between 1989-91 and of their families.

St John Ambulance WA has appointed Michelle Fyfe as its next chief

Study

Regina TiteliusPerthNow
November 11, 2018 12:00AM

TOPICS

ParentingWA News

THE children of poorer mothers who smoked during pregnancy have an increased risk of the "double whammy" of obesity and depression from early childhood, a new study shows.

The strong link between low-income mothers who smoked while pregnant and the co-existence of obesity and depression in their children was discovered by a team at the University of Western Australia as part of the long-running Raine Study.

PhD student Sunil Bhat, with the support of UWA Emeritus Professor of Medicine Lawrence Beilin and other researchers, made the discovery after researching 20-year-olds who were the second generation of participants in the Raine Study.

Professor Beilin said the children were identified as obese as early as five years old and showed symptoms of depression as early as eight years old.

"We found those mothers who smoked in pregnancy were the ones whose offspring were most likely to be both overweight and more likely to be depressed or have symptoms of depression. So it's a two-way street," he said.

"But the offspring of mothers who didn't smoke didn't show this relationship.

"They could be overweight but they were not particularly prone to depression.

"Then we looked at this a bit further. While there is this very specific effect of smoking during pregnancy, was smoking doing something to the foetus in the womb? Or was it more related to the general socio-economic background, family behaviours and environmental factors.

"So we looked at income. If you picked out the lowest income when the mums were pregnant, it was those in the lowest income categories who showed this co-association with obesity and depression."

BN COMMUNITY AND ARTS SECTOR

STEWART targets Raine cheques

New chair Jan Stewart will be looking to grow awareness and financial support for the intergenerational Raine health study.

Tori Wilson

STRATEGY: Jan Stewart says all Western Australian universities are involved in the Raine Study. Photo: Attila Csaszar

> One of the things that attracted me to The Raine Study is that this board is a collaboration of every university – Jan Stewart

Early-onset menstruation may signal future CVD, metabolic syndrome

January 10, 2019 | Anicka Slachta | Lipids & Metabolic

Early-onset menstruation in women could be a red flag for an increased risk of cardiovascular disease and metabolic difficulties later in life, according to a report published in *PLOS One*.

Appendices

Appendix 1. Grant applications submitted in 2017 for funding in 2018

1. NHMRC 1134894. K Steinbeck, R Skinner, L Sanci, D Schofield, F Brooks, A Dawson, R Ivers, L Perry, B Liu, P Collin, M Kang, A Third, J Mooney-Somers, L Straker, S Gibson, P Hazell, L Baur, S Eades, S Sawyer. A Centre of Research Excellence in Adolescent Health: making health services work for adolescents in a digital age. $2,496,294. ***Funded.***
2. Cancer Australia 1147677. J Stone, C Saunders, D Sampson, M Hickey, L Lilge, G Cadby, J Shepherd, M Giorgi, M Cook. Measuring breast density in younger women to inform primary prevention and early detection of breast cancer. $592,636. ***Funded.***
3. NHMRC 1142858. RC Huang, R Foong, G Hall, A Lin. LIFECYCLE - Early life stressors and lifecycle health. $453,810. ***Funded.***
4. Department of Health WA. A Smith, P O'sullivan, Y Wang, J Karppinen, D Samartzis, L Straker, P Kent, M Hancock, D Beales, S Linton. Lumbar pathology – irrelevant finding or treatment target for low back pain? $75,000. ***Funded.***
5. WAHTN 2018. L Straker, P Eastwood, D Glance. Secure health data analysis and processing environment (SHAPE) stage 2. $50,000. ***Funded.***
6. Endeavour Foundation. J McVeigh, L Straker, M Ciccarelli, C Harris. A detailed examination of physical activity and sedentary behaviour in children with autistic spectrum disorder. $43,727.
7. UWA 2017 Faculty Small Research Grants Scheme for Early Career Researchers. M Dontje, L Straker, P Eastwood, J McVeigh. Does inactivity run in the family? A feasibility study. $19,451.
8. NHMRC 1147564. A Smith, P O'Sullivan, Y Wang, J Karppinen, D Samartzis, L Straker, P Kent, M Hancock, D Beales, S Linton. Lumbar pathology – irrelevant finding or target for treatment for low back pain? $1,266,600.
9. NHMRC 1193162. J Olynyk, L Adams, D Trinder, R Newton, A Chua, E McKinnon, J Gummer. Impaired iron bioavailability and haemoglobin production in young adults with nonalcoholic fatty liver disease: determining the mechanism and impact on physical activity. $950,346.
10. NHMRC 1139830. G Ambrosini, G Trapp, J Scott, M Allman-Farinelli, B Boruff, W Oddy, E Malacova, J Kay, S Jebb. Identifying opportunities for supporting healthier eating to reduce obesity and chronic disease risk in young adults. $881,868.
11. NHMRC 1144892. R Skinner, J Marino, B Liu, D Doherty, S Lymer, R Tait, L Straker, M Hickey, L Sanci, K Steinbeck, C Olsson, M O'Connor, R Ivers, S Goldfeld. Understanding life course pathways to and economic implications of health and social harms in adolescence and young adulthood: a data linkage study of the Raine cohort. $1,353,047.
12. NHMRC 1147581. P Cistuli, D Hillman, P Eastwood, A Pack, K Sutherland, N McArdle, B Singh, B Keenan. Phenotypic characterisation of obstructive sleep apnoea. $894,733.
13. NIH. T Mori, G Ambrosini, L Beilin, W Oddy, S Sutcliffe. Expansion and validation of measures of distant adolescent dietary patterns. $3,112,357.
14. NHRMC 1144545. B Erbas, R Hyndman, C Svanes, A Huete, J Davies, C Lodge, F Garden, M Abramson. Pollen and lung function development: a multi-cohort study at birth and over the young adult life span. $261,797.

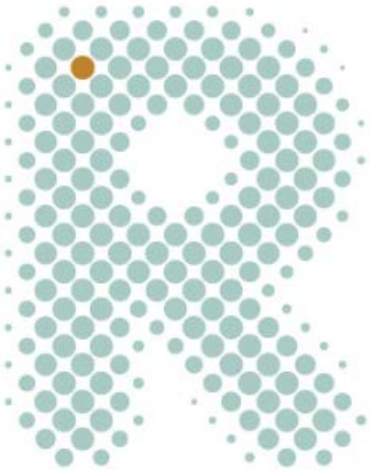
Appendix 2. Grant applications submitted in 2018 for funding in 2019

1. NHMRC 1161445. R Skinner, J Marino, S Lymer, D Doherty, K Steinbeck, L Straker, M Kang, R Tait. The health, social and economic implications of risk-taking in adolescence over the life-course: a data linkage study of the Raine cohort. $1,061,015. ***Funded.***
2. National Heart Foundation 102301. T Mori, L Beilin, M Schlaich, J Yang. Aldosterone, cardio-metabolic profile and early life factors in the Western Australian Pregnancy Cohort (Raine) Study. $74,878. ***Funded.***
3. National Heart Foundation 102170. A Haynes, L Taylor, D Green, L Straker, J McVeigh. Developmental origins of adult myocardial structure and function: heart health and the Raine Cohort. $75,000. ***Funded.***
4. Royal Perth Hospital Medical Research Foundation. C Le-Ha, T Mori, L Beilin, M Hickey. Associations of prenatal androgen exposures and of age at menarche with cardiovascular risk factors in early adulthood: a prospective cohort study. $20,000. ***Funded.***
5. Lotterywest 420171061. L Campbell. Raine Study New website and re-branding roll-out. $36,792.00. ***Funded.***
6. WAHTN-MRFF. L Straker, P Eastwood, D Glance. Supporting governance, discovery and translation from large health datasets: development of a research project online management system to support strong governance and translation from health studies. $146,165. ***Funded.***
7. NHMRC 1165956. P Cistulli, D Hillman, P Eastwood, A Pack, K Sutherland, N McArdle, B Singh, B Keenan, P de Chazal, A Pack. Precision medicine in Obstructive Sleep Apnoea (OSA) – the interaction between risk factors, physiology, clinical expression and treatment outcomes. $491,482.
8. NHMRC 1163437. L Adams, C Chistophersen, W Oddy, T O'Sullivan. Defining and understanding the gut microbiome in nonalcoholic fatty liver disease. $350,839.

Appendix 3. Publications list 2018

1. Appannah, G., et al. (2018). "Determinants of a dietary pattern linked with greater metabolic risk and its tracking during adolescence." J Hum Nutr Diet 31(2): 218-227.
2. Armstrong, R., et al. (2018). "Predicting language difficulties in middle childhood from early developmental milestones: A comparison of traditional regression and machine learning techniques." J Speech Lang Hear Res 61(8): 1926-1944.
3. Ayonrinde, O. T., et al. (2018). "Sex differences between parental pregnancy characteristics and nonalcoholic fatty liver disease in adolescents." Hepatol 67(1): 108-122.
4. Beaumont, R. N. W., et al. (2018). "Genome-wide association study of offspring birth weight in 86 577 women identifies five novel loci and highlights maternal genetic effects that are independent of fetal genetics." Hum Mol Genet 27(4): 742-756.
5. Bhat, S. K., et al. (2018). "Maternal smoking and low family income during pregnancy as predictors of the relationship between depression and adiposity in young adults." J Dev Orig Health Dis 9 (5): 552-560.
6. Blanken, L. M., et al. T.; Whitehouse, A. (2018). "A prospective study of fetal head growth, autistic traits and autism spectrum disorder Autism Res; 11 (4): 602-612.
7. Coenen, P., et al. (2018). "The association of adolescent spinal-pain-related absenteeism with early adulthood work absenteeism: A six-year follow-up data from a population-based cohort." Scand J Work Environ Health 44(5): 521-529.
8. Da Costa, C. E., R. H.; Jacques, A.; Swanepoel, W.; Whitehouse, A. J. O.; Jamieson, S. E.; Brennan-Jones, C. G. (2018). "Does otitis media in early childhood affect later behavioural development? Results from the Western Australian Pregnancy Cohort (Raine) Study." Clin Otolaryngol 43 (4) 1036-1042.
9. Demenais, F., et al. (2018). "Multiancestry association study identifies new asthma risk loci that colocalize with immune-cell enhancer marks." Nat Genet 50(1): 42-53.
10. Dunican, I. C., et al. (2018). "Laboratory and home comparison of wrist-activity monitors and polysomnography in middle-aged adults." Sleep Biol Rhythms 16(1): 85-97.
11. Guastella, A. J., et al. (2018). "Does perinatal exposure to exogenous oxytocin influence child behavioural problems and autistic-like behaviours to 20 years of age?" J Child Psychol Psychiatry 59(12): 1323-1332.
12. Hart, R. J., et al. (2018). "The impact of antenatal Bisphenol A exposure on male reproductive function at 20-22 years of age." Reprod Biomed Online 36(3): 340-347.
13. Hart, R. J., et al. (2018). "The possible impact of antenatal exposure to ubiquitous phthalates upon male reproductive function at 20 years of age." Front. Endocrinol 9: 1-11.
14. Haworth, S., et al. (2018). "Consortium-based genome-wide meta-analysis for childhood dental caries traits." Human Mol Genet 27(17): 3113-3127.
15. Hickey, M., et al. (2018). "Relationship between umbilical cord sex hormone binding globulin, sex steroids, and age at menarche: a prospective cohort study." Fertil. Steril. 110(5): 965-973.
16. Howie, E. K., et al. (2018). "Correlates of physical activity and sedentary time in young adults: the Western Australian Pregnancy Cohort (Raine) Study." BMC Pub Health 18 (1): 10.
17. Howie, E. K., et al. (2018). "Accelerometer-derived activity phenotypes in young adults: a latent class analysis." Int J Behav Med 25 (5): 558-568
18. Hysi, P. G., et al. (2018). "Genome-wide association meta-analysis of individuals of European ancestry identifies new loci explaining a substantial fraction of hair color variation and heritability." Nat Genet 50(5): 652-656.
19. Jones, A. C., et al. (2018). "Persistent activation of interlinked type 2 airway epithelial gene networks in sputum-derived cells from aeroallergen-sensitized symptomatic asthmatics." Sci Rep 8(1): 1511.

20. Lammers, N., et al. (2018). "Are serum ferritin and transferrin saturation risk markers for restless legs syndrome in young adults? Longitudinal and cross-sectional data from the Western Australian Pregnancy Cohort (Raine) Study." J Sleep Res: e12741.
21. McKeown, N. M., et al. (2018). "Sugar-sweetened beverage intake associations with fasting glucose and insulin concentrations are not modified by selected genetic variants in a ChREBP-FGF21 pathway: a meta-analysis." Diabetologia 61(2): 317-330.
22. McVeigh, J. A., et al. (2018). "Organized sport participation from childhood to adolescence is associated with bone mass in young adults from the Raine Study." J Bone and Mineral Res 34 (1): 67-74.
23. Oddy, W.H., et al (2018) Dietary patterns, body mass index and inflammation: pathways to depression and mental health problems in adolescent. Brain Behav Immun 69: 428-439
24. Pena, A. S., et al. (2018). "The majority of irregular menstrual cycles in adolescence are ovulatory: results of a prospective study." Arch Dis Child 103(3): 235-239.
25. Reynolds, A. C. B., et al. (2018). "Working (longer than) 9 to 5: are there cardiometabolic health risks for young Australian workers who report longer than 38-h working weeks?" Int Arch Occup Environ Health 91 (4): 403-412.
26. Shah, R. L,. et al (2018). "A genome-wide association study of corneal astigmatism: The CREAM Consortium." Mol Vis 24: 127-142.
27. Smith, C. E., et al. (2018). "Genome-wide interactions with dairy intake for body mass Index in adults of european descent." Mol Nutr Food Res 62 (3): Article number 1700347
28. Stockil, L., et al. (2018). "Urogenital symptoms: prevalence, bother, associations and impact in 22 year-old women of the Raine Study." Int Urogynecol J 29 (12): 1807-1815.
29. Symen Ligthart, A. V., et al (2018). "Genome Analyses of >200,000 Individuals Identify 58 Loci for Chronic Inflammation and Highlight Pathways that Link Inflammation and Complex Disorders." Am. J. Hum. Genet. 103(5): 691-706.
30. Trapp, G. S. A., et al. (2018). "Proximity to liquor stores and adolescent alcohol intake: A prospective study." Am J Prev Med 54(6): 825-830.
31. Trevenen, M. L., et al. (2018). "Development and validation of an algorithm to temporally align polysomnography and actigraphy data." BPEX 4(2): Article number 025014.
32. Turcot, V. L., Y., et al (2018). "Protein-altering variants associated with body mass index implicate pathways that control energy intake and expenditure in obesity." Nat Genet 50(1): 26-41.
33. Varcin, K. J., et al. (2018). "Maternal pre-pregnancy weight and autistic-like traits among offspring in the general population." Autism Res 12 (1): 80-88.
34. Waage, J., et al. (2018). "Genome-wide association and HLA fine-mapping studies identify risk loci and genetic pathways underlying allergic rhinitis." Nat Genet 50(8): 1072-1080.
35. Warrington, N. M., et al. (2018). "Maternal and fetal genetic contribution to gestational weight gain." Int J Obes (Lond) 42(4): 775-784.
36. Warrington, N. M., et al. (2018). "Genome-wide association study identifies nine novel loci for 2D:4D finger ratio, a putative retrospective biomarker of testosterone exposure in utero." Human Mol Gen 27(11): 2025-2038.



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