

# The ORIGINS Project

## Annual Performance Report 2022-2023



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THE  
ORIGINS  
PROJECT



TELETHON  
KIDS  
INSTITUTE  
Discover. Prevent. Care.

Joondalup  
Health Campus  
Part of Ramsay Health Care

[originsproject.telethonkids.org.au](https://originsproject.telethonkids.org.au)

The ORIGINS Project acknowledges the Aboriginal and Torres Strait Islander people as the Traditional Custodians of the land and waters of Australia. We also acknowledge the Nyoongar Wadjuk, Yawuru, Kariyarra and Kurna Elders, their people and their land upon which we are located and seek their wisdom in our work to improve the health and development of all children.

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## The ORIGINS Project

The ORIGINS Project (“ORIGINS”) goal is to discover how a child’s early environment influences the dramatically rising risk of chronic health conditions such as allergies, obesity, gut health, respiratory and mental health issues and neuro-developmental challenges. ORIGINS is a collaboration between **Telethon Kids** and **Joondalup Health Campus (JHC)**, and generously funded by the **Commonwealth Government through the Telethon Channel 7 Trust** and the **Paul Ramsay Foundation**.

ORIGINS information is being used by researchers around the world to identify and implement ways to reduce risks for children. The samples and information being collected, from complete family units, are creating a rich resource in the ORIGINS Biobank which (at the time of reporting) contains more than **375,000 biological samples linked to 24M+ data points**. We are already learning so much from our families.

### The Aim of ORIGINS

ORIGINS aims is to improve the health of the next generation through a better understanding of how to optimise the early environment. Over a decade we aim to recruit 10,000 children, along with their families, when their mother is early in pregnancy at Joondalup Health Campus and collect biological samples, routine data and web-based questionnaires on physical and mental health, diet, physical activity patterns and a range of environmental factors, creating an extensive Biobank and Databank.

ORIGINS includes:

- **‘Active’ families** - undertaking multiple data and sample collections at specific time points.
- **‘Non-active’ families** - access to all routinely collected hospital data, opportunistic samples and linkage to government and non-government databases.

The data from the ORIGINS research platform - **Biobank and Databank** - will assess how early life exposures influence a child's growth, development and health. ORIGINS’ significant Biobank (DNA, breast milk, urine, plasma and mononuclear cells) will build substantial additional future capacity to address critical questions (including genetic, epigenetic, metagenomic and metabolomic studies) as technologies and new avenues of investigation evolve.



## Annual Performance Report 2022-2023

This Annual Performance Report outlines the progress made and deliverables achieved during the reporting period 1<sup>st</sup> July 2022 to 30<sup>th</sup> June 2023.

### The ORIGINS Project Current Status

Since commencement in July 2017 (as at end of June 2023):

- The ORIGINS Project has welcomed **8,855 families**
- These families include:
  - **8,855** women (4,007 active and 4,848 non-active)
  - **8,337** babies (3,450 active and 4,887 non-active)
  - **2,520** partners (1,094 active and 1,426 non-active)
- That equates to 19,712 individuals
- We have completed many valuable assessments with our families, including
  - **2,184** assessments on one-year infants (85% of all eligible 1-year olds)
  - **953** appointments with our three-year children (71% of all eligible 3-year-olds)
  - **179** 'Kids Checks' appointments with our five-year-olds (57% of all eligible 5-year-olds).
- The ORIGINS recruitment team has enrolled **1,325** mothers for two or more pregnancies
- Our **8,337** ORIGINS children are made up of **8,070** Singletons, **132** sets of Twins, **1** set of Triplets
- We have collected more than **375,000** biological samples
- The ORIGINS Biobank is one of the largest Australian biological cohort collections.
- We have collected more than **24 million** data points in the ORIGINS Databank
- **48** sub-projects have been integrated within ORIGINS, looking at multiple aspects of child and family health and development
- ORIGINS has supported **17** PhD students, **9** postdoc and **29** undergraduate students
- Connected with over **700** national and international researchers who are actively engaged in ORIGINS.

#### *Return on Investment*

The ORIGINS Project infrastructure has been a catalyst for investment in nested sub-projects. The set-up of ORIGINS enables researchers to implement their research projects, leveraging a fully developed platform providing cost savings and economies of scale. ORIGINS recoups costs back into the Project, to sustain and increase the capacity of ORIGINS' resources. A degree of cost recovery is required from those requesting and granted use and/or access to the cohort.

To date the ORIGINS Project infrastructure has attracted independent grant funding in excess of \$18.5 million **which represents an outstanding return on original investment in the ORIGINS**

## Highlights for the Year (30 June 2022 - 1 July 2023)

- **1,311 new families** were recruited into ORIGINS
  - **416** active families recruited and **895** non-active families
- **1,165 new children** joined ORIGINS in 2022-2023. The difference in number of pregnancies and children is due to mother being pregnant at the time of reporting, loss of pregnancy or withdrawal before birth.
- Completion of recruitment for Active families (a total 4,007 women recruited). We will continue tracking these ORIGINS children until they turn five years of age.
- Women birthing at Joondalup Health Campus can still participate in ORIGINS, but only as Non-active participants. The ORIGINS team continue to recruit ORIGINS Non-active participant families; they can also sign up for some sub-studies.
- A major highlight for ORIGINS in 2022-23 was the development and implementation of a comprehensive **Data Platform**. Participant data, including information about biological specimens, has been centralised into one central repository. This enables fast transfer of data to approved researchers, thus accelerating the rate of research outputs.
- **The ORIGINS Smart App** was finalised and has been rolled out to participant families. It will assist with participant engagement and communication.
- ORIGINS worked closely with the Raine and Busselton cohort studies, as part of the **WA Cohorts Network**. The Network is seeking to develop the data structure to harmonise datasets across the cohort studies.
- The ORIGINS team moved into a new **Telethon Kids site in Edgewater**. All 1, 3, and 5-year ORIGINS Kids Checks are now held at this new centre.
- **28** research papers were published on ORIGINS and its sub-projects.

## Key challenges over the last 12 months and how these were addressed

- **Compliance and retention** of participants is an ongoing challenge for research studies. Family situations often change after the first few years, with parents returning to the workforce, as well as other pregnancies or older children. Time restrictions impact on parents' ability to complete ORIGINS questionnaires. Regular reminders are sent to families. Additionally, we are planning to split the questionnaires into smaller components, issued at more frequent timepoints.
- Unfortunately, **non-attendance at clinic assessment** appointments is due to family members being too unwell to attend. Whenever possible, they are recalled back at a future date.
- There has been a gradual **decline** in the number of **new sub-projects** integrated within ORIGINS, in part due to the ability to service so many projects plus the closing of some key timepoints, such as pregnancy and birth. There are plans to reinvigorate access to the cohort in the next few years.
- There is the ongoing challenge of **resourcing a complex, multi-site project**. General costs have escalated, and we are reforecasting our expenditure but will have to adjust and refine our project plans in line with the remaining funds. We are also seeking additional funding opportunities.

## Project Opportunities for the next 12 months

- The WA Cohort Network has been advocating for increased support from WA Health department to ensure the long-term sustainability of cohorts in WA. There is strong indication that some funding from the Future Health Research & Innovation Fund will be made available for WA cohort studies to support **ongoing operations and research**.
- ORIGINS continues to build strong relationships with international collaborators. We have been invited to present as part of an Australian showcase at the international Society for Longitudinal & Lifecourse Studies (SLLS) in Munich in October 2023.
- In order to utilise ORIGINS data, researchers need to understand the collection. Leveraging from the new Data Platform, we are building a researcher **Data Visualisation Catalogue** so researchers can self-select domains of interest, prior to completing a project proposal application.
- A plan is in development to encourage and support an increased number of higher degrees by research students, including PhD, Masters and Medical Degree students. An **ORIGINS Award** will be made available each year as a top-up discretionary fund.
- We will continue to improve the **management and planning of current and future nested sub-projects** to ensure the highest standards of governance and collaboration.
- Recruitment of Non-active participants will continue throughout 2024.
- We are seeking opportunities for additional funding to ensure we **follow up as many three- and five-year-olds** as possible and expand the cohort to include grandparents and siblings. The vision is to continue following the cohort into the **primary school years**. We are also planning cross-cohort **analyses of samples** to generate a wealth of novel, rich data on families in the early years.

## Participant Recruitment & Retention

ORIGINS' active participants are pregnant women (and the non-birthing partner, where possible) who are recruited with informed consent early in their pregnancy to collect detailed environmental and psychosocial data through questionnaires, medical records, diagnostic tools, and collection of biological samples.

When the child is born, they are also consented as an individual. ORIGINS families are contacted at multiple touchpoints throughout their ORIGINS journey by the ORIGINS team.

Non-active participants are recruited when the child is born, and their pregnancy data is collected retrospectively. Non-active pregnant women may also be recruited during pregnancy but may choose to provide the project only with routine data, rather than become a full active participant who is contacted at regular intervals. (See [page 2](#) for a more detailed explanation of active vs non-active ORIGINS participants)



Participant Consent Recruitment 2022-2023

Participant Recruitment (No. signed consents)	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Total in reporting period	Project Cumulative Total
Active pregnancies consented	66	47	47	64	87	60	38	7	0	0	0	0	416	4007
Non-active pregnancies consented	56	56	40	114	91	17	11	116	116	89	93	96	895	4848
Total pregnancies consented:													1311	8855
Active partners consented	4	7	13	15	22	7	11	0	0	0	0	0	79	1094
Non-active partners consented	11	11	9	13	10	3	0	24	6	0	3	5	95	1426
Total partners consented:													174	2520
Active babies consented	38	44	49	53	67	70	56	44	38	22	14	6	501	3450
Non-active babies consented	47	39	32	64	57	35	40	50	48	78	79	95	664	4887
Total babies consented													1165	8337

ORIGINS Child Appointments: Active Participant Families Only (June 2022-July 2023)

ORIGINS One-Year Appointments	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Total 2022-2023 FY
One-year appointment: expected based on birth date	53	59	65	49	44	64	55	75	59	56	61	51	691
One-year appointment: actuals at one-year	39	44	53	32	35	55	46	62	44	45	45	40	540
Percentage Completion	74%	75%	82%	65%	80%	86%	84%	83%	75%	80%	74%	78%	78%
ORIGINS Three-Year Appointments	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Total 2022-2023 FY
Three-year appointment: expected based on birth date	46	28	45	37	44	36	32	47	62	45	56	45	523
Three-year follow up: actuals at three-year	34	20	27	18	24	15	17	31	44	24	32	25	311
Percentage Completion	74%	71%	60%	49%	55%	42%	53%	66%	71%	53%	57%	56%	60%
ORIGINS Five-Year Appointments	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Total 2022-2023 FY
Five-year appointment: expected based on birth date	12	7	19	15	21	27	21	23	33	41	39	42	300
Five-year follow up: actuals at five-year	8	5	12	13	15	17	11	12	23	22	17	21	176
Percentage Completion	67%	71%	63%	87%	71%	63%	52%	52%	70%	54%	44%	50%	59%

Due to participant and appointment availability, participant families often do not attend clinic the corresponding month of their birthday. Therefore - attendance and compliance is measured 6 months of the appointment due date.

## ORIGINS Biobank

The ORIGINS Biobank is collecting biological samples from participant families at 10 timepoints across five years. The Biobank currently contains over 375,000 samples and this will continue to grow to an estimated 700,000 individual samples by 2027.

### Key Activities in Reporting Period

- Sample collections, including a comprehensive set of blood, buccal, saliva, urine, stool, hair and dust, are steadily growing. Antenatal and birth collections are now completed for active participants, and accumulative figures for collections are as follows;
  - **1,529, 1,952 and 3,230** collections at the 20-week, 28-week and 36-week gestation timepoints respectively.
  - **1,105** collections from non-birthing partners.
  - **2,455** cord blood collections from at the time of birth,
  - **1,891** placental sample collections at the time of birth,
  - **2,103** meconium collections after birth,
  - **805** colostrum collections after birth,
  - **3,016** collections of opportunistic routine blood samples from both active and non-active children after birth with cord blood gases, dried blood spots (research Guthrie cards).
  - **1,989** collections at two or four months of age, and **1,645** collections at six months of age, including urine, stool and breast milk.
  - **428** children and **391** mothers participating in certain sub-projects have also provided bloods when the child reached four and/or six months of age.
  - We have conducted **2,195** biological collections from our one-year-olds, **924** from our three-year-olds, and **255** from our five-year-old cohort – this includes cheek swabs, saliva, stool and urine, and bloods from some.
- The ORIGINS Biobank comprises one of the largest Australian cohort collections and we are pleased to report this is now translating to successful funding applications, analysis and publications
- **5,120** specimens were released between July 2022 and June 2023 to **nine sub-projects**. Over the project's duration, a total of **8,974** specimens have been released to **thirteen sub-projects**.
- The **first publication detailing the ORIGINS Biobank** was published in the *International Journal of Environmental Public Health* in June 2023.





## ORIGINS Databank

ORIGINS is collecting a wealth of administrative, biological, physiological, clinical and assessment data from the ORIGINS families. The data is collected over thirteen timepoints beginning from 20 weeks' gestation through to five years of age to enable tracking of the child's development. ORIGINS is in a unique position to **link and integrate data from multiple sources** to enable development and maintenance of a comprehensive longitudinal databank. Data provided to researchers is de-identified and encrypted.



Data derived from samples ('omics data such as metabolomics, transcriptomics, proteomics) and microbiome analyses will need external supercomputing storage capabilities. All data are linked through unique identifiers in order to track individual participants as well as family units.

In 2022-2023 a total of 5,959 online questionnaires were completed by ORIGINS participants.

### Key Activities in Reporting Period

- The **ORIGINS Smart App was launched** in June 2023 to assist participants with keeping up to date with ORIGINS news, allowing them to book in their own paediatric and health check appointments and to access questionnaire links.
- **The ORACLE**, a purposely built administrative system was rolled out to the ORIGINS team in February 2023, to assist with ongoing communication and engagement with ORIGINS' families.
- An **integrated data platform**, which extracts, links, ingests, integrates and stores ORIGINS' complex data on the TKI Amazon Web Services (AWS) cloud-based data warehouse was developed.
- The data platform merges other applications, such as **Microsoft's Power BI**, to permit ad-hoc requests for static and dynamic data and analytics, provide a 360° view of a participant; and full extraction of specific variables.
- A total **14 data extracts** were cleaned and provided to ORIGINS sub-projects for their research.
- The ORIGINS data platform received data back from **five ORIGINS sub-projects**.

## ORIGINS Research Translation and Collaboration

Collaboration and engagement are fundamental elements of ORIGINS at every level. We have **strong links with other birth cohorts** locally, nationally and internationally and are working towards developing a global cohort network to harmonise and enhance research capacity.

ORIGINS information is being used by **researchers all around the world** to identify and implement ways to reduce risks for children and to answer many questions about the development of these chronic health conditions.

Find out more about how we collaborate with our partners on the new [ORIGINS Project website – collaborators tab](#).

For it to be valuable, our research needs to contribute to the global understanding of disease, influence policy and practice, build capacity and collaboration, and must have a direct effect on the lives of children, and we are already seeing this happen through ORIGINS. We are **ensuring our research is translated into real-life outcomes** that make a tangible difference to communities, now and in the future.

As well as enabling strategic long-term research capacity, **ORIGINS is a ‘responsive’ system with ‘real-time’ feedback** to parents and their children, and translation to clinical and diagnostic services. This opportunity to intervene early could potentially change the long-term health trajectory of these children.

When it is needed, ORIGINS provides **referral to appropriate services** for participants – mother, partners and infants. Examples of early identification and referral that we have assisted our families include developmental delay, allergic disease, unhealthy growth trajectory, sleep problems, as well as psychosocial and mental health issues.

### Key Activities in Reporting Period

- We have continued to build and support the **research capacity** of The ORIGINS Project Team, and have continued to disseminate ORIGINS research activities, through publications and presentations.
- Number of publications / grants
- Of the **47 current or completed** nested sub-projects, **23** have direct contact with ORIGINS participants.
- Sub-projects that **completed all participant recruitment** during this reporting period include AERIAL, CUBS, PLANET.
- Realtime, responsive feedback has enabled early identification of the following:
  - Positive skin prick test results: 59 positive skin prick tests at either the 1, 3 or 5 year clinic appointments (i.e. approximately 7% of the cohort)
  - Referrals by ORIGINS Paediatric team: 69 (i.e. approximately 12% of the cohort) paediatric referrals on identification of infant abnormalities such as developmental delays, including hearing, vision and speech.

## Nested Studies – ORIGINS Sub-Projects

As well as ORIGINS long-term core research, there are a number of **clinical trials, early interventions and shorter-term research studies** that sit within ORIGINS. Known as sub-projects, these studies look at multiple aspects of child and family health and development. See recruitment numbers in tables below.

**Sub-Project Recruitment Numbers Total**

Study	Recruited
SYMBA - ORIGINS	471
TALK	501
CARE-Dads	503
CARE-Dads (1YR Check)	101
BENEFIT	108
CASHEW	193
PrEggNut	186
SunPreg	48
Nose	138
ENGAGE Pilot	13
Early Moves (Mothers Consents)	2076
ADAPTS	60
TUMS	192
COCOON	99
AERIAL	485
CUBS	57
Kindy Readiness Project	159
Timeout for Wellbeing	164
Mums Minds Matter	76
ACE	81
Dental Screening	43
Positive Family Foundations	0
Nature Play and Grow	24
PLANET	50

**Sub-Project Recruited 2022-2023 FY**

Study	Recruited
SYMBA - ORIGINS	Completed
PrEggNut	37
Early Moves (Mothers Consents)	539
COCOON	Completed
AERIAL	106
CUBS	17
Kindy Readiness Project	72
Timeout for Wellbeing	Completed
Mums Minds Matter	Completed
ACE	25
Dental Screening	Completed
Nature Play and Grow	Completed
PLANET	11

## Stakeholder & Community Engagement

ORIGINS is a community project with global implications; therefore, community collaboration is essential for the project. We have created extensive relationships with a range of stakeholders and community groups and continue to work in **collaboration for mutual long-term benefit**.

We work closely within existing and newly established partnerships that allow us to spread our reach further, to achieve more and to learn from each other.

Key Activities during the reporting period

- ORIGINS Facebook group grew to **352 members**
- The ORIGINS **Twitter page featured over 50 tweets** and various sharing of content.
- ORIGINS **celebrated International Women’s Day** with cupcakes and a park play session with ORIGINS participants
- In April 2023, the annual **ORIGINS Family Fun Event** was held in the City of Joondalup. Over 250 families attend to help celebrate and acknowledge their contribute to the project.
- In July 2022 a milestone report **“5000 Families”** was released. This publication includes personal stories and experience from ORIGINS families and collaborators, as well as a comprehensive cohort profile of the first 5000 families to joining the project.
- A video promoting ORIGINS to stakeholders was developed and shared with
- The ORIGINS Participant Reference Group reviewed and provided feedback and input on x new sub-projects
- ORIGINS hosted the **Wanneroo & Surrounds Early Year Network meeting** at TKI in November 2022 to showcase those ORIGINS sub-project with a translational focus
- **Media:** ORIGINS featured in The West Australian, Joondalup, Wanneroo and Stirling Times, Perth Now, CH10 news, CH7 News, CH7 Sunrise, CH7 Regional news, Telethon CH7 coverage, ABC Radio, Medical Forum magazine, The Daily Mail (UK), The Sector, as well as the social media channels of Telethon Kids, JHC, HBF, Ch 9, City of Wanneroo, WAHTN, along with posts shared by many other collaborators. Visit the ORIGINS website for a comprehensive outline of the news throughout the year <https://originsproject.telethonkids.org.au/news/>



## ORIGINS Staff, Volunteers & Students

Crucial to ORIGINS are the staff, volunteers, and students. They are the drivers of the Project, led by the Project Directors and senior project management team. The ORIGINS Project team members demonstrate passion and commitment generated from a strong belief in The ORIGINS Project's vision and aims.

### Staff

- There are approximately **30** staff working within The ORIGINS Project, many of whom work in a part-time capacity. This includes clinical, administrative, management, technical and research staff. Staff are employed through either Telethon Kids Institute or Joondalup Health Campus via Ramsay Health Care. Meet the Management team on [The ORIGINS Project website](#)
- We actively work to **build ORIGINS Project Team members capacity**, offering mentoring programs and professional development opportunities. Staff undertook a range of internal and external training opportunities during the year.

### Students & Volunteers

- **5** students are **progressing manuscripts** for publication.
- **10** volunteers assisted with sample pack making, data collation and cleaning.
- ORIGINS has supported **7** placement and/or internship students from Curtin University and UWA.
- **8** students have **presented their research project and/or results at conferences** and other events and forums to report and share knowledge



## APPENDICES

### Appendix One: ORIGINS Sub-Projects

Current & Completed ORIGINS Sub-Projects

Sub-Project	Type	Impact/Focus	Status 30 June 2023 (N)	Grant Value
<b>A family's journey at JHC: Analyses of routinely collected data</b>	Observational	JHC mother and father profiling	Ongoing	In-kind (JHC and TKI)
<b>A Five-Year Developmental Follow-up</b>	Observational	Growth & development and Mental-health and wellbeing	Ongoing	In-kind (JHC and TKI)
<b>ACE Infant Feeding: Helping new mums to be better breast feeders</b>	Randomised Controlled Trial	Breastfeeding	Recruitment ongoing (57/100)	\$75,000 (WA Department of Health)
<b>ADAPTS: Antibiotic Dysbiosis and Probiotics Trial in infants</b>	Randomised Controlled Trial	Gut health	Recruitment completed (60)	\$111,700 (2019-2020)
<b>AERIAL: Airway Epithelium Respiratory Illnesses and Allergy</b>	Observational	Asthma	Recruitment ongoing (345/400)	\$1,942,731 (NHMRC) \$827 235 (NHMRC) \$95,000 (Dept of Health WA Merit Award for NHMRC near-misses) \$74,000 (WA Near-Miss Award (WANMA)) \$50,000 (Millennium Science and 10x Genomics)
<b>BEACHES: Built Environments and Child Health in Wales and Australia</b>	Observational	Built environment, physical activity and childhood obesity	Commencing data extraction	\$797 256 (NHMRC)
<b>BENEFIT: Breastfeeding and Eating Nuts and Eggs for Infant Tolerance</b>	Randomised Controlled Trial	Reducing infant egg and peanut allergies	Recruitment Completed (108)	\$68,616 (2017-2019) (The Financial Markets Foundation for Children) \$110,290 (2018-2019) (Telethon Perth Children's Hospital Research Fund)
<b>The BioMood study: A PILOT study assessing the association between Mediterranean diet, microbiome, metabolome,</b>	Observational	Diet, microbiome, inflammation and mental health	Commencing sample analysis	\$38,000 (Science Sceptics of WA)

Sub-Project	Type	Impact/Focus	Status 30 June 2023 (N)	Grant Value
<b>inflammation and mental health during pregnancy</b>				
<b>CARE-Dads: <u>C</u>ardiovascular <u>R</u>isk <u>E</u>valuation in Expectant Fathers</b>	Observational	Cardiovascular and mental health of fathers	Completed (503)	In-kind (JHC and TKI) \$10,000 (CI contribution)
<b>The Cashew Study: Introducing cashew nuts during infancy</b>	Randomised Controlled Trial	Reducing infant cashew allergies	Recruitment completed (196)	\$50,000 (2018-2019) (Australian Food Allergy Foundation)
<b>COCOON: The COVID Community compassion study: Assessing virus transmission, immunity development and wellbeing of families during COVID-19</b>	Observational	COVID-19	Recruitment ongoing (99/250 families)	\$38,000 (RACGP) \$113,594 (Wal-yan Respiratory Centre Funding Scheme)
<b>ORIGINS Community Wellbeing during the COVID-19 Pandemic</b>	Observational	Mental health during COVID-19	Ongoing	In kind (JHC and TKI)
<b>CUB/Baby AICES - A randomised-controlled trial of a parent-mediated intervention for optimising social and communication development of newborns at increased familial risk of autism spectrum disorders</b>	Randomised Controlled Trial	Parenting education and child development	Recruitment ongoing (37150)	\$1.1million (NHMRC Investigator Grant)
<b>Deciphering Bifidobacterium</b>	Observational	Allergy, immunity, inflammation, nutrition, metabolism, environment, lifestyle, infections, vaccines and growth and development	Commencing sample extraction	\$3,097,106 (Wellcome Trust)
<b>Dental screening: Tele-screening for early childhood caries detection during COVID-19 pandemic</b>	Observational	Oral health	Recruitment completed (42)	\$50,000 (FHRI Focus Grant)

Sub-Project	Type	Impact/Focus	Status 30 June 2023 (N)	Grant Value
<b>Diabetes during pregnancy and subsequent child development: A 3-year follow-up study</b>	Observational	Diabetes	Commencing data extraction	\$69,033 (ECU strategic fund/ The SNM researcher support scheme)
<b>Early Moves</b>	Observational	Neurodevelopmental assessment of general movements in babies	Recruitment ongoing (1558/2000)	\$2,256,750.20 (2019-2024) \$446,773 (2019-2020) (Perth Children's Hospital Foundation) \$242,919 (WA Child Research Fund 2018) \$250,000 (CP Alliance) \$1,000,000 (Mineral Resources)
<b>The Engage Study: Discovering and delighting in your baby (pilot)</b>	Single arm intervention trial	Parenting education	Completed (13)	\$615,000 (2019-2022)
<b>Fertility: Examining subfertility in a prospective birth cohort</b>	Observational		Ongoing	In kind (JHC and TKI)
<b>The Flourishing Child</b>	Observational	Mental health and wellbeing, growth and development, and environment & lifestyle	Ongoing	In kind (JHC and TKI)
<b>Gateway to Allergy Prevention</b>	Observational	Food allergies, probiotics	Commencing sample analysis and data extraction	\$247,597 (WA Child Research Fund 2018)
<b>Global Scale of Early Development</b>	Observational	Mental health and wellbeing and brain and behaviour	Ongoing	\$249,989 WACRF
<b>Importance of Early Breastfeeding</b>	Observational	Allergies, nutrition, growth and development	Commencing data extraction	\$369,000 (NHMRC Idea Grant 2021) \$161,290 (Channel 7 Telethon Trust)
<b>Iron Child</b>	Intervention	Allergy, immunity and inflammation, nutrition and metabolism	Awaiting funding	\$20,000 Researcher discretionary funds
<b>Kindy Readiness: Preschool readiness in the ORIGINS cohort</b>	Observational		Recruitment ongoing (66/5000)	In kind (JHC and TKI)



Sub-Project	Type	Impact/Focus	Status 30 June 2023 (N)	Grant Value
<b>Machine Learning: Personalised, machine learning based prediction of asthma and allergies in Western Australia</b>	Observational	Asthma and allergy	Ongoing	\$134,192 (WA Child Health Research Fund)
<b>Mast Cell: Contribution of a novel mast cell subset to development of atopic disease</b>	Observational	Allergies	Recruitment ongoing (18/60)	\$100,000 (Telethon Kids BHP BlueSky)
<b>Maternal Diet Quality</b>	Observational	Nutrition and metabolism	Approved, but not yet signed Letter of Agreement	\$12,500
<b>Mediterranean Diet: The impact of a Mediterranean diet and physical activity in pregnancy on gestational weight gain and neonatal body composition at birth and weight at 1 year of age</b>	Observational	Diet and body composition	Completed	\$10,000 (2019-2021) (Sceptics WA)
<b>Mums Minds Matter: A three-arm pilot study of mindfulness vs self-compassion vs relaxation training for reducing stress and promoting wellbeing among pregnant women</b>	Interventional	Maternal mental health	Recruitment completed (76)	\$23,510 (Telethon Kids Institute Think Big)
<b>Nature Play &amp; Grow: A pilot study of a family-based intervention to improve child health and well-being</b>	Interventional	Nature relatedness	Recruitment completed (25)	In kind (JHC and TKI)
<b>NDD: ORIGINS of Neurodevelopmental Risk and Resilience Project Amendments</b>	Observational	Neurodevelopment	Commencing data extraction	\$230,842 (WA Child Research Fund)
<b>Newborn Nasal Sampling Evaluation (NOSE) Study (Pilot study of AERIAL)</b>	Observational	Asthma risk	Recruitment completed (141)	Under AERIAL funding
<b>ORIGINS Ideal</b>	Observational	Allergy, immunity and inflammation	Approved, but not yet signed	Awaiting funding and seeking ethics approval

Sub-Project	Type	Impact/Focus	Status 30 June 2023 (N)	Grant Value
			Letter of Agreement	
<b>PEAPOD: Maternal and neonatal factors affecting neonatal body fat percentage</b>	Observational	Overweight & obesity	Commencing data analysis	In kind (JHC and TKI)
<b>Paediatric Burns: Understanding the long-term immune and metabolic impacts of paediatric burn trauma</b>	Observational	Burns, infection & immunity	Commencing data extraction	\$117,450 (Fiona Wood Foundation)
<b>The PLAN Project (pilot study): Pregnancy Lifestyle Activity and Nutrition</b>	Randomised Controlled Trial	Overweight & obesity (mother and child)	Completed (57)	\$24,821 (TKI Research Focus Area Seed Grant 2014) \$250,000 (WAHTN MRFF)
<b>PLANET Project: Plastics in Pregnancy</b>	Observational	Plastic	Recruitment ongoing (25/50)	\$379,000 (Minderoo Foundation)
<b>Positive Family Foundations: Developing and assessing the efficacy of an intervention to enhance psychological wellbeing in families from pregnancy to infancy</b>	Interventional	Parenting education	On hold	\$2,000 (student project; Curtin University internal funds)
<b>The PrEggNut Study: A Maternal diet rich in eggs and peanuts to reduce food allergies</b>	Randomised Controlled Trial	Reducing infant egg and peanut allergies	Recruitment ongoing (141/200-300)	\$100,000 (2019-2023) (part of a larger multi-site NHMRC Project Grant)
<b>Refraction and Axial Length</b>	Observational	Epidemiology, equity and social justice, P4 omics and systems biology, environment and lifestyle, nature relatedness, growth and development, brain and behaviour	Approved, but not yet signed Letter of Agreement	Awaiting funding and seeking ethics approval
<b>Screen ORIGINS: Longitudinal study of the multidimensional influences and impacts of contemporary screen technology use over the first 5 years of life (quantitative &amp; qualitative)</b>	Observational	Technology use (family)	Quantitative study completed (as many as possible) Qualitative recruitment completed (57)	\$6,100 (Curtin School of Physiotherapy and Exercise Science Early research Grant; Curtin PhD Candidate Research Support Fund)

Sub-Project	Type	Impact/Focus	Status 30 June 2023 (N)	Grant Value
<b>STORK: A pilot retrospective observational study to assess biomarkers of stress and serotonin pathways in pregnant women in The ORIGINS Project</b>	Observational	Maternal mental health	Commencing sample extraction	Part funded by Science Sceptics of WA
<b>The SunPreg Study: Measuring sun exposure in pregnancy and its association with the development of early childhood allergies</b>	Observational	Benefits of sunlight exposure in pregnancy on maternal skin	Recruitment completed (48)	Student project
<b>The SYMBA Study: Improving gut health (symbiosis) for allergy prevention</b>	Randomised Controlled Trial	Reducing infant allergies	Recruitment completed (652)	\$1,681,512.40 for 2016-2020 (NHMRC Project grant 2015) \$200,000 (Telethon Perth Children's Hospital Research Fund 2014)
<b>Testosterone and Language in Kids (TALK) Study</b>	Observational	Cerebral lateralisation and early language development	Recruitment completed (501)	\$415,000 (ARC 2015)
<b>Time Out for Wellbeing: an experimental study linked to the Mums Minds Matter Project</b>	Observational	Maternal mental health	Recruitment completed (164)	\$1,500 (UWA Faculty of Health & Medicine; TKI student support)
<b>TUMS: Water quality and the microbiome study</b>	Randomised Controlled Trial	Microbiome	Recruitment completed (197)	\$100,000 (BHP Blue Sky Awards)
<b>Ultrasound Image Measurement</b>	Observational	Growth and development, brain and behaviour	Commencing data extraction	\$10,000
<b>Urinary Ferritin</b>	Observational	Growth and development, and nutrition and metabolism	Commencing sample extraction	\$13,000
<b>Philanthropic donation towards ORIGINS research</b>				\$50,000 (Gavin Argyle - philanthropist)
<b>TOTAL FUNDING</b>				<b>\$18,188,306.20</b>



Additional indirect funding is incorporated within The ORIGINS Project from PhD and other students. In total there are 37 students, including **15 PhD students** currently working on projects in ORIGINS.

A further **nine new sub-projects** have been approved by the ORIGINS Scientific Committee and Project Management Group to be nested within ORIGINS. Nine of these sub-projects have commenced, and two are awaiting funding, ethics and/or governance approval. A further **three sub-projects are under review** and awaiting final approval from the Scientific Committee and Project Management Group.

For a detailed description of each of the current ORIGINS sub-projects visit our website:

<https://originsproject.telethonkids.org.au/sub-projects/>

## Appendix Two: ORIGINS Research Dissemination: Publications, Papers and Presentations

### Publications

1. Azimi, S., Estai, M., Patel, J., & Silva, D. (2023). The feasibility of digital health approach to facilitate remote dental screening among preschool children during COVID-19 and social restrictions. *International Journal of Paediatric Dentistry*, 00, 1-12. <https://doi.org/10.1111/ipd.13054>
2. Azimi, S., Fernando, C., Estai, M., Patel, J., Silva, D., Tennant, M., Azimi, S., Fernando, C., Estai, M., Patel, J., Silva, D., & Tennant, M. (2023). Experience of Primary Caregivers in Utilising an mHealth Application for Remote Dental Screening in Preschool Children. *Australian Health Review*.
3. Cleary, D.B., Bunney, A., Henry, L. et al. A Parent-Mediated Intervention for Newborns at Familial Likelihood of Autism: Initial Feasibility Study in the General Population. *Adv Neurodev Disord* 6, 494–505 (2022). <https://doi.org/10.1007/s41252-022-00262-w>
4. D’Vaz, N., Kidd, C., Miller, S., Amin, M., Davis, J. A., Talati, Z., Silva, D. T., & Prescott, S. L. (2023). The ORIGINS Project Biobank: A Collaborative Bio Resource for Investigating the Developmental Origins of Health and Disease. *International Journal of Environmental Research and Public Health*, 20(13),. <https://doi.org/10.3390/ijerph20136297>
5. Davis, J. A., Ohan, J. L., Gibson, L. Y, Prescott, S. L., & Finlay-Jones, A. L. (2022). Understanding engagement in digital mental health and programs for women in the perinatal period: Systematic review without meta-analysis. *Journal of Medical Internet Research*, 24(8), e36620. DOI: 10.2196/36620
6. Davis, J. A., Finlay-Jones, A. L., Bear, N., Prescott, S. L., Silva, D. T., & Ohan, J. L. (2023). Time-out for well-being: A mixed methods evaluation of attitudes and likelihood to engage in different types of online emotional well-being programmes in the perinatal period. *Women’s Health*, 19, 17455057231184508. <https://doi.org/10.1177/17455057231184507>
7. Hadlow NC, Brown SJ, Lim EM, Prentice D, Pettigrew S, Cronin SL, Prescott SL, Silva D, Yeap BB. Anti-Müllerian hormone concentration is associated with central adiposity and reproductive hormones in expectant fathers. *Clinical Endocrinology*. 2022 Nov;97(5):634-42.
8. Hood R, Zabatiero J, Silva D, R. Zubrick S, Straker L. ‘There’s good and bad’: parent perspectives on the influence of mobile touch screen device use on prenatal attachment. *Ergonomics*. 2022 Dec 2;65(12):1593-608.
9. Imran S, Neeland MR, Martino DJ, Peng S, Koplin J, Dharmage SC, Tang ML, Sawyer S, Dang T, McWilliam V, Peters RL. Epigenomic variability is associated with age-specific naïve CD4 T cell response to activation in infants and adolescents. *Immunology and Cell Biology*. 2023 May 1.
10. Logan AC, Berman BM, Prescott SL. Vitality Revisited: The Evolving Concept of Flourishing and Its Relevance to Personal and Public Health. *International Journal of Environmental Research and Public Health*. 2023 Mar 13;20(6):5065.
11. Logan AC, D’Adamo CR, Prescott SL. The Founder: Dispositional Greed, Showbiz, and the Commercial Determinants of Health. *International Journal of Environmental Research and Public Health*. 2023 Apr 23;20(9):5616.
12. Mancini VO, Brook J, Hernandez C, Strickland D, Christophersen CT, D’Vaz N, Silva D, Prescott S, Callaghan B, Downs J, Finlay-Jones A. Associations between the human immune system and gut microbiome with neurodevelopment in the first 5 years of life: A systematic scoping review. *Developmental Psychobiology*. 2023 Mar;65(2):e22360.
13. Mancini, V. O., Brook, J., Hernandez, C., Strickland, D., Christophersen, C. T., D’Vaz, N., Silva, D., Prescott, S., Callaghan, B., Downs, J., & Finlay-Jones, A. (2023). Associations between the human immune system and gut microbiome with neurodevelopment in the first 5 years of life: A systematic scoping review. *Developmental Psychobiology*, 65, e22360. <https://doi.org/10.1002/dev.22360>
14. Palmer, D. J., Keelan, J., Garssen, J., Simmer, K., Jenmalm, M. C., Srinivasjois, R., Silva, D., & Prescott, S. L. (2022). Study Protocol for a Randomised Controlled Trial Investigating the Effects of Maternal Prebiotic Fibre Dietary Supplementation from Mid-Pregnancy to Six Months’ Post-Partum on Child Allergic Disease Outcomes. *Nutrients*, 14(13), 2753. <https://doi.org/10.3390/nu14132753>

15. Palmer, D. J., Silva, D. T., & Prescott, S. L. (2022). Maternal peanut and egg consumption during breastfeeding randomized pilot trial. *Pediatric allergy and immunology : official publication of the European Society of Pediatric Allergy and Immunology*, 33(9), e13845. <https://doi.org/10.1111/pai.13845>
16. Palmer, D. J., Silva, D. T., & Prescott, S. L. (2023). Feasibility and safety of introducing cashew nut spread in infant diets—A randomized trial. *Pediatric Allergy and Immunology*, 34(6), e13969.
17. Palmer, D. J., Sullivan, T. R., Campbell, D. E., Nanan, R., Gold, M. S., Hsu, P. S., Netting, M. J., McWilliam, V., Koplin, J. J., Perrett, K. P., Quinn, P., O'Sullivan, M., Prescott, S. L., Grivell, R., & Makrides, M. (2022). PrEggNut Study: protocol for a randomised controlled trial investigating the effect of a maternal diet rich in eggs and peanuts from <23 weeks' gestation during pregnancy to 4 months' lactation on infant IgE-mediated egg and peanut allergy outcomes. *BMJ open*, 12(6), e056925. <https://doi.org/10.1136/bmjopen-2021-056925>
18. Perveen K, Quach A, Stark MJ, Prescott S, Barry SC, Hii CS, Ferrante A. PKC $\zeta$  activation promotes maturation of cord blood T cells towards a Th1 IFN- $\gamma$  propensity. *Immunology*. 2023 Jun 20.
19. Prescott, S.L. Greeson, J.M. El-Sherbini, M.S. The Planetary Health Community Convened by the Nova Institute for Health. No Health without Mental Health: Taking Action to Heal a World in Distress—With People, Places, and Planet 'in Mind'. *Challenges* 2022, 13, 37. <https://doi.org/10.3390/challe13020037>
20. Prescott SL, Logan AC, Bristow J, Rozzi R, Moodie R, Redvers N, Haahtela T, Warber S, Poland, B, Hancock T, Berman B. Exiting the Anthropocene: Achieving personal and planetary health in the 21st century. *Allergy*. 2022 Dec;77(12):3498-512.
21. Prescott SL. Planetary Health Requires Tapestry Thinking—Overcoming Silo Mentality. *Challenges*. 2023 Feb 9;14(1):10.
22. Rueter K, Moseley N, Ta B, Bear N, Borland ML, Prescott SL. Increasing Emergency Department visits for anaphylaxis in very early childhood: A canary in the coal mine. *Acta Paediatrica*. 2023 Jul 24.
23. Rueter K, Siafarikas A, Palmer DJ, Prescott SL. Pre- and Postnatal Vitamin D Status and Allergy Outcomes in Early Childhood. *Biomedicines*. 2022 Apr 19;10(5):933. doi: 10.3390/biomedicines10050933. PMID: 35625670; PMCID: PMC9139153.
24. Sakalidis, V. S., Rea, A., Perrella, S. L., McEachran, J., Collis, G., Mirauda, J., Prosser, S. A., Gibson, L. Y., Silva, D., & Geddes, D. T. (2022). Longitudinal changes in wellbeing amongst breastfeeding women in Australia and New Zealand during the COVID-19 pandemic. *European journal of pediatrics*, 181(10), 3753–3766. <https://doi.org/10.1007/s00431-022-04580-y>
25. Srinivasjois, R., Gebremedhin, A., Silva, D., Rao, S., & Pereira, G. (2023). Probiotic supplementation in neonates and long-term gut colonisation: A systematic review of randomised controlled trials. *Journal of paediatrics and child health*, 59(2), 212–217. <https://doi.org/10.1111/jpc.16318>
26. Van den Akker, M., Dieckelmann, M., Hussain, M. A., Bond-Smith, D., Muth, C., Pati, S., Saxena, S., Silva, D., Skoss, R., Straker, L., Thompson, S. C., & Katzenellenbogen, J. M. (2022). Children and adolescents are not small adults: toward a better understanding of multimorbidity in younger populations. *Journal of clinical epidemiology*, 149, 165–171. <https://doi.org/10.1016/j.jclinepi.2022.07.003>
27. Zelenski J, Warber S, Robinson JM, Logan AC, Prescott SL. Nature Connection: Providing a Pathway from Personal to Planetary Health. *Challenges*. 2023; 14(1):16. <https://doi.org/10.3390/challe14010016>

## Presentations

1. Ashleigh Heng-Chin (2022). Perinatal clinical outcomes of plastic chemical exposure in pregnant mothers [Oral presentation]. Ramsay Research Month
2. Cassandra Cuffee (2022). Helping new mothers to breastfeed - before their babies are even born. TBC. TKI Student Symposium
3. Ceridwen Ellis (2022). Prebiotic Dietary Supplementation to Reduce Chronic Low-Grade Inflammation by Promoting Gut Health in Pregnant Women [Oral presentation]. TKI Student Symposium
4. Charlotte Rowley (2023). Biomood: Dietary Patterns and Maternal Metabolic Profile [Oral presentation]. TKI Student Symposium
5. Desiree Silva (2022). The beginnings of good health - DoHAD and ORIGINS [Oral presentation]. UWA teaching IMED2208 Lecture
6. Desiree Silva (2022). Microplastic Research using the ORIGINS platform [Oral presentation]. Minderoo Foundation
7. Desiree Silva (2022). ORIGINS overview and update: PLANET Project [Oral presentation]. Microplastics Workshop Queensland
8. Desiree Silva (2022). The ORIGINS Project & Exciting Research Opportunities at JHC [Oral presentation]. JMO at JHC
9. Desiree Silva (2022). WA cohorts reunite - Our Future is Together [Oral presentation].RAINE Symposium
10. D'Vaz N, Kidd C, Rynne F, Gibson L, Davis J, Silva D, Prescott S. (2023). The ORIGINS Project BioBank: Sample collections and utilization upon reaching a project recruitment milestone [Poster presentation] Science on the Swan
11. Emma Fuller (2022). ORIGINS Data Ecosystem: A platform for research discovery [Oral presentation]. DOHaD ANZ 2022
12. Gibson L.Y, Davis J, Silva D, Prescott S. (2023). Families from the ORIGINS Project: Community Wellbeing and Experiences During a Pandemic [Poster presentation] Science on the Swan
13. Jackie Davis (2022). In digital mental health and well-being programs for women in the perinatal period: Systematic review without meta-analysis [Oral & Poster presentation]. DOHaD ANZ 2022
14. Jackie Davis (2022). The ORIGINS Project: A local project with a global vision [Oral presentation]. DOHaD ANZ 2022
15. Jackie Davis (2023). The ORIGINS Project: a local project with global vision. Presentation to Commonwealth Funders [Oral presentation].
16. Jackie Davis (2023). The Flourishing ORIGINS Child: Understanding the determinants of flourishing in the early years [Poster presentation]. PSANZ Conference
17. Jackie Davis (2023). Understanding engagement in digital mental health and well-being programs for women in the perinatal period: A systematic review without meta-analysis [Poster presentation]. PSANZ Conference
18. Jackie Davis, Desiree Silva, Lisa Gibson, Nina D'Vaz, Susan Prescott (2023). The Origins Project: Ensuring The Next Generation Have A 'healthy Start to Life [Poster presentation]. Science on the Swan
19. Kim Parkin (2022). Feeding method is the key factor characterising the composition and functional profiles of the 6-month infant gut microbiome. [Oral presentation]. TKI Student Symposium
20. Lisa Gibson (2022). Nature Play & Grow: A pilot study to promote engagement in nature in pre-school children [Oral & Poster presentation]. DOHaD ANZ 2022
21. Lisa Gibson (2022). The ORIGINS Project: Health, wellbeing, attitudes and experiences during the COVID-19 pandemic [Oral presentation].DOHaD ANZ 2022
22. Lisa Gibson, Silva, D. Davis, J. Prescott, S., Whalan S., Segers, E., Yeap, B. (2023). The ORIGINS Project: Capturing information on expectant and new fathers [Oral presentation] Australian Fatherhood Research Symposium
23. Maheshwar Bhasin (2022). Health economic impact of non-exclusive colostrum feeding [Oral presentation]. TKI Student Symposium

24. Maheshwar Bhasin (2023). Non-exclusive Colostrum Feeding, a Widespread Practice in WA with Potentially High Health and Economic Impact
25. Nivedithaa Divakara (2022). Gateway to allergy prevention: Promoting a tolerogenic breastmilk profile with maternal prebiotic supplementation [Oral presentation]. TKI Student Symposium
26. Nivedithaa Divakara (2022). Promoting a tolerogenic breastmilk profile with maternal prebiotic supplementation [Oral presentation]. DOHaD ANZ 2022
27. Nivedithaa Divakara (2022). Promoting an immunomodulatory breastmilk profile with maternal prebiotic supplementation [Poster presentation].
28. Nivedithaa Divakara (2023). Maternal Prebiotic Supplementation Modifies Human Milk Immunological Composition linked to Allergy [Poster presentation]. Mucosal Immunology Seminar
29. Patricia Macchiaverni (2022). House Dust Mite Shedding in Human Milk: a Neglected Cause of Allergy Susceptibility? [Oral presentation]. Pathway to Sustainable Healthcare: Microbiome Summit
30. Pannu P, Whalan S, Gibson, L, Davis, J, Silva D, Prescott, S (2023). The ORIGINS Project: How does our infant feeding profile compare to national rates? [Poster presentation] Science on the Swan
31. Poonam Pannu (2022). The ORIGINS Project: A platform for nutrition research discovery [Oral & Poster presentation]. Nutrition Society of Australia Conference
32. Poonam Pannu (2023). The ORIGINS Project: Fruit and vegetable intake of one-year olds in Western Australia [Poster presentation]. PSANZ Conference
33. Poonam Pannu (2023). The ORIGINS Project: A longitudinal cohort study [Oral presentation]. Wanneroo Secondary College
34. Poonam Pannu, Charlotte Rowley, Jilen Patel, Caroline Alexander, Doug Robb (2022). ORIGINS sub-project showcase: Nested research enabling collaboration
35. Rebecca Hood (2022). Family device use & parent-child attachment [Oral presentation]. Ramsay Research Month
36. Romola Bucks, Director, The Raine Study (2023). Western Australian Population Cohorts [Oral presentation]. Science on the Swan
37. Susan Prescott. Conference Chair, Convener, Speaker. Nova Annual Conference of “Flourishing Futures” (virtual) December 2022
38. Susan Prescott. Guest Speaker. NYU Langone, July 28, 2022, New York (in person)
39. Susan Prescott. Invited Speaker. Africa Community of Partners for Health and Environment (ACOPPHE) – World Environment meeting, June 5, 2022 (virtual)
40. Susan Prescott. Invited Speaker. American Academy of Pediatrics. Seminar on Planetary health, April 13, 2022 (virtual)
41. Susan Prescott. Invited Speaker. Eco Health Annual meeting (virtual) November 2022
42. Susan Prescott. Invited Speaker. Microbes and Social Equity (virtual) July 2022
43. Susan Prescott. Invited Speaker: European Human Exposome Network (EHEN) Annual Scientific Meeting, 24-25 May, 2022 Barcelona, Spain
44. Susan Prescott. Meeting organiser and speaker: No Health without Mental Health - Nova Campfire meeting (virtual) April 2022
45. Susan Prescott. Presenter. Planetary Health Annual Meeting, Harvard, Boston, USA November 2022)
46. Susan Prescott. Speaker. Pathways to planetary house (Garrison Institute, New York) March 2023
47. Valerie Verhasselt (2022). Colostrum: The missing link for happy health children [Oral presentation]. Ramsay Research Month
48. Zenobia Talati (2023). Curtin Nutrition seminar [Oral presentation]. Curtin Staff and Students