

E1 Project Title: Our Children, Our Families, Our Place: Enabling Communities for Child Health and Wellbeing.

This collaboration, led by Murdoch University and the Telethon Institute for Child Health Research, is a unique and innovative partnership involving three tiers (national, state and regional) of policy makers, service providers and community organisations, as well as 4 WA Universities. The Collaborating Partners comprise the Australian Government Departments of Health and Ageing; Family and Community Services and Indigenous Affairs; Transport and Regional Services; the WA Departments of Health; Education and Training; and the Peel Health Foundation. Other financial partners include the Departments of Education, Science and Training, and Community Development, St John of God Health Services and the Peel Development Commission.

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E2 Aims and Background

This innovative collaboration between community, research and government sectors, will use multidisciplinary and multilevel research to identify essential elements of the ‘enabling community’: the psychological, social, cultural, educational, physical and economic conditions that maximise opportunities for children to reach their developmental potential¹ (see Fig.1). Interdependent streams of investigation into the psychosocial, biological and environmental pathways to child health and wellbeing will provide comprehensive understanding of children’s development in the context of family and community life in one regional community. The study will investigate the relationship between health and place² through three streams of interconnected analyses (see Table 1).

The research will measure a child's relevant biological endowments (genetic and intrauterine) and their interactions with environmental and social exposures to produce the 'allostatic load'; a measurable outcome of how the child responds to stress³.

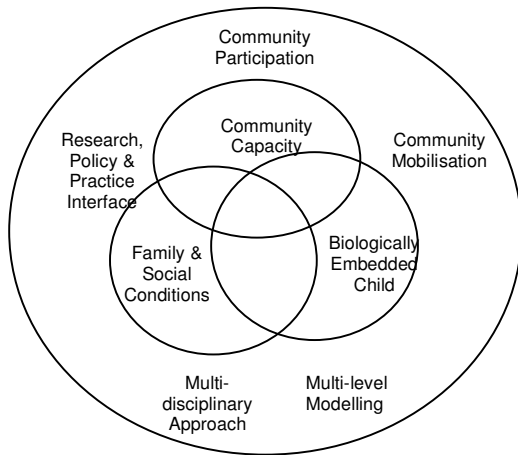


Fig. 1. Research Framework

This breaks new ground by incorporating scientific knowledge of biological embedding, foetal programming and allostatic load in a community study to inform strategies for preventing, addressing or overcoming the effects of early adverse experiences or predispositions⁴. Focusing on services and features of community life with the potential to build resilience addresses National Research Priority 2 and its associated goals: a healthy start to life, and strengthening Australia's social and economic fabric, and regional, state and national initiatives (Early Years Strategy and Communities for Children). In preparation for the study, researchers have established strong links with the community for collaborative establishment of and ongoing input into the research agenda.

Study objective: to identify the most effective aspects of community life that support optimal outcomes for children and families.

Study aims: to

- 1- investigate how community influences help overcome social and other disadvantage at familial and individual levels as manifested in a range of biopsychosocial outcomes (Stream 1+2+3),
- 2- identify the impact of differing physical, social, economic, psychological and cultural environments on children's physiology, including genetic variation and brain, neuroendocrine, cardiovascular and immune function (Stream 2+3)
- 3- use this information to identify best practice and best process indicators for enhancing community capacity to support children and families (Stream 1+2),
- 4- explore how community partnerships can be optimised to yield policy-ready recommendations for child and family support (Stream 1).

Early development from conception to age 5 establishes the foundation for learning, behaviour and health throughout the life cycle⁵. Childhood social and economic circumstances also play an important role in adult morbidity and mortality⁵. This is encapsulated in the hypothesis of 'biological embedding', wherein, from conception, psychosocial and material circumstances embed themselves in the child's biology, which affects certain physiological control systems⁵. To date, no studies have investigated the interplay between these control systems and children's environments and experiences. The proposed study responds to researchers' recommendations that this next step be taken to identify a causal model integrating social and biological factors⁶.

Exposure to undesirable influences in a child's environment can have an impact later in life through two mechanisms: the latency effect, which occurs regardless of intervening experiences, and pathway effects, which represents the accumulation of positive and negative exposures⁷. The magnitude of these effects depends on the duration and intensity of early exposures to adverse conditions, which affect early experiences and subsequent life trajectories. Adverse conditions modify the child's biology through the hypothalamic-pituitary-adrenal (HPA)-axis, the central mediator of the stress response. Both hyper- and hypoactivity of the HPA axis have been associated with such adverse outcomes as cardiovascular disease, behavioural disorders and mental health problems all of which show clear social gradients⁷. To distinguish between *good* (excitement) and *bad* (chronic fatigue, worry, frustration, inability to cope) stress, the concept of allostatic load has been proposed⁸. This represents

the wear and tear on physiological systems (the autonomic nervous system, endocrine and immune systems). Certain physiological mediators of these interlinked systems (adrenalin, cortisol and cytokines) maintain functional stability (homeostasis) through simultaneous actions that mediate short-term adaptive responses to an acute challenge. However, long term elevated or inefficiently managed levels of these mediators contribute to the damaging effect of chronic stress on receptor desensitisation and tissue damage (allostatic load). Perinatal exposure to environmental pollutants can also impact on neurological⁹⁻¹⁰, immunological¹¹ and cardiovascular development¹²; whereas in utero exposures in normal pregnancy are regulated by the placental maternal-foetal barrier, which acts as a biochemical gatekeeper¹³⁻¹⁴. Thus, predisposition by experience before and after birth through biological embedding appears to contribute to individual differences and social gradients in resilience, morbidity and mortality. But genetic predisposition to cortisol sensitivity cannot be excluded either. Perinatal gene-environment interactions are therefore important determinants of health and well-being in the context of genetic *and* early life moderators of stress in the social, family, and the community environment. A deeper understanding of the proximal, psychosocial processes in families and communities that interact with biological processes to affect cognitive and neurological development during childhood may better explain how early life influences and maintains inequalities in health along a socioeconomic gradient⁵. This study will therefore examine the cumulative and interactive effects of psychological, social, genetic, environmental and biological influences to generate new knowledge on developmental trajectories of psychosocial and physiological function and adaptive capacity in early childhood.

Cohort Recruitment

In collaboration with medical practitioners, families with a 1st trimester pregnancy between 2008-2010 will be identified and, following consent, recruited just prior to the 18 wk of pregnancy routine ultrasound. We expect to recruit 600 families in 2008, based on 60% participation rate and an overall 1000 births annually. The arrival of a new child within an already recruited family is estimated 6.8% in 2009 and 18% in 2010; the average Peel family has 2.04 children (DOHWA) This will result in the establishment of a cohort comprised of 1651 families with 1800 newborns and 1288 siblings under the age of 5 (75% of all siblings). Exclusion criteria for family recruitment are (i) no pregnancy, (ii) a pregnancy progressed beyond the 1st trimester and (iii) a pregnancy without a medical referral. The exclusion criterion for siblings within participating families is 5 years of age or older. The majority of deliveries of cohort newborns will be at Peel Health Campus (65%). To prevent the loss of data and sample collection of high risk births, deliveries by recruited pregnant women from the Peel region at King Edward Memorial Hospital (KEMH) will be included. Traditionally high risk births are performed at KEMH accounting for approximately 10% of all births to Peel region mothers. The sample will be expected to comprise 6% low weight births and 2.4% Aboriginal births. All efforts will be made to continue data collection in those families that have moved out of the Peel region.

Table 1: Research Streams and outputs

1. COMMUNITY CAPACITY STREAM	2. FAMILY/SOCIAL STREAM	3. BIOLOGICAL EMBEDDING STREAM
MAJOR RESEARCH FOCI		
<ul style="list-style-type: none"> • Community services, facilities, resources and patterns of access and utilisation • Norms of reciprocity, trust and connectedness • Interagency collaboration and community partnerships • Indigenous participation 	<ul style="list-style-type: none"> • Social gradients in health and development • Families' social and cultural context • Psychosocial, risk and protective factors • Economic, workforce issues 	<ul style="list-style-type: none"> • HPA axis, allostatic load and foetal programming • Genetics underpinning adaptation • Exposures to domestic pollutants
NESTED INTERVENTIONS/EVALUATIONS		
Mapping community assets	Trialing an infant feeding program	Investigating the association between foetal

Investigating child care factors Identifying conditions for school readiness Piloting school based Indigenous child development indicators Trialing the development of a full service school	Investigating the impact of intermittent parenting Evaluating a teen pregnancy intervention Evaluating an Indigenous ante-natal care program Developing an interagency approach to the prevention of child abuse and neglect	growth & in utero HPA development and placenta function Profiling HPA development during early childhood Assessing genetic variation in the capacity to cope with stress Studying allostatic load effects on physiological development after birth Measuring heavy metal and tobacco smoke exposures before and after birth
OUTPUTS		
Online data base of community assets and resources Analysis of service access and use Profile of State and Commonwealth policies Thematic maps of social capital Social atlas of health and well being Index of Indigenous child development indicators Profile of children's responses to childcare Profile of conditions supporting the full service school	Model of the social patterning of biological markers within the community Explanatory analysis of the influence of family psychosocial factors on health and developmental outcomes Locality specific strategies for building family resilience Evidence to assist employers and policy makers for family friendly policies and practices	Analytic, comparative outcomes on: uterine exposure to stressors and foetal dev. impact of biological embedding on child growth, physiology and neurological development effects of MR and GR polymorphisms on stress regulation developmental pathways of physiological function and adaptive capacity in early childhood impact of domestic toxic exposures on health outcomes

E3 Significance and Innovation. This project is innovative in five important ways. First, it is one of the first large scale collections of physiological data on biological embedding, including in-utero foetal programming, and the first time in the world that biological embedding in multiple pathways has been tested as a plausible explanation for social inequality in health. A second significant aspect is the multidisciplinary approach. Combining biological and genetic research will generate new knowledge on developmental pathways of physiological function and adaptive capacity to complement the analysis of behaviour, mental development and cognitive function. Analysis of psychosocial, environmental, biological and genetic data contextualized to family and community life will identify modifiable factors that can prevent adverse child development outcomes, stimulate the growth of physically and mentally healthy children, and reduce family stress associated with employment, child caring, issues related to socioeconomic situation, access to health and social services or exclusion.

A third distinctive feature is the multilevel modeling facilitated by combining qualitative and quantitative research methods. This will provide the breadth and depth of understanding to inform effective, multi-level interventions. Interpretation of qualitative data will enhance the ability to capture insights into social and cultural phenomena and bridge quantitative data with contextualized perspectives of family and community life, including social and cultural perspectives¹⁵. Fourth is the commitment to social inclusion. Voices of the families and community members will help inform the ways communities can use collaborative partnerships and interagency approaches to mobilise resources and processes that facilitate proactive choices and protective mechanisms to achieve healthy, productive and fulfilling lives. Fifth there is an emphasis on and commitment to translation of research findings into action. Research that is collaborative, interdisciplinary and focused on the complexities of individual behaviours in context can influence practical systems and structures, inform policy development, and ultimately, acceptable solutions to differential outcomes of existing policies and practices^{6,16}. The study is timely, given the regional engagement strategies undertaken by Murdoch University to foster a sense that Peel is a learning community, committed to social, cultural and intellectual capital alongside its economic developments. As the fastest growing region in Australia, Peel is ideal as a microcosm of smaller communities, reflecting military, mining and service industries and a wide range of social and economic stratifications in the populations.

E4 Approach and Training

Research stream 1: Community capacity

Objective: To create a sense of how families use structures, resources and intersectoral development strategies to support children's health and development. A community based participatory research (CBPR) case study will collect ethnographic evidence on the Peel Regional community. Peel has a unique model of regional leadership wherein constituent communities are joined with industry and government to establish priorities and directions¹⁷. An initial scoping study has mapped regional health and social services, which will be accessible to families and community members electronically through the Peel Hospital Foundation, with maintenance of the data undertaken by a member of the research team (www.peelhealth.org.au). This asset map will also be used as baseline data for testing and adapting best practices to the community's needs, strengths and problem-solving abilities^{4,18}; including information on (i) horizontal and vertical relationships formed between community support groups (ii) local factors influencing civic engagement, such as economic status (using SEIFA scores), and (iii) solidarity in social relations¹⁹⁻²⁰. The asset map will also gather data from an environmental scan of social, intellectual and public capital. Health, education, transportation and social service provision and use by families will be mapped in relation to demographic distribution. Layers of community life will be mapped to identify social gatherings, organised spaces for interaction, and catalytic organisations that instigate discussion and community resources. Interview data will be gathered from volunteers, groups targeting aspects of community diversity (CALD groups), and recreational, historical and arts organisations that protect and conserve traditions, customs and resources. Snowball sampling will help individual key informant and focus groups with participating families, members of the general community, and community leaders who are already working with members of the research team to help design the scope of the study. Multidisciplinary, multi-level, iterative cycles of data collection and analysis will ground the findings in the community context, thereby increasing face validity and ensuring development of appropriate research questions. Data collection will also be undertaken in formal child care and school settings. This will include correlational analysis of formal and informal child care and the pattern of children's biological responses to these. It will also include analysis of the development, implementation and evaluation of the Full Service School to better understand how schools and communities create shared cultures of interagency collaboration and community partnerships²¹⁻²².

Indigenous researchers will act as advisors to the project. Specifically, they will focus on Indigenous children's transition to and retention at school; a national policy priority for Australian governments to improve the standards of Aboriginal children's literacy and numeracy. The AEDI measures, which have been introduced nationally to provide population level data on children's development to school age, will be tested, including population level indicators of children's readiness to learn at school. The AEDI has been subjected to psychometric analysis and found to be a reliable measure of children's development²³. There are well-documented sensitivities about internationally developed psychometric instruments producing potentially biased or misleading results when applied inappropriately with Indigenous populations²⁴. To determine whether the AEDI is valid and reliable in an Indigenous context, an adapted version of the Index has been developed for use with Aboriginal children, which will be validated in the Peel region to coincide with a planned implementation of the AEDI in schools across the region. The AEDI will be implemented twice during the funding period, providing comparative data on children's developmental outcomes pre-and post- community intervention, the first time this will have occurred in Australia. The second implementation will include the cohort children. Indigenous school retention into secondary school is another significant social and health policy priority for Australian governments, given the low retention rate of Indigenous children into secondary school compared with non-Indigenous children²⁴. Aboriginal identity and self-esteem are integral building blocks for Aboriginal children's development, and maintenance of a healthy social and emotional wellbeing, which, in turn, is critical for the social and academic development of Aboriginal children and contributes significantly to school achievement, including retention into secondary school. To identify children at risk of poor self-esteem, a measure for Indigenous children has been developed and piloted in Perth metropolitan schools in 2006. It is planned to further validate

and refine this instrument in the Peel region. Besides being the first of its kind in Australia, this instrument is the first culturally adapted and relevant self-esteem measure for Australian Aboriginal children aged 8 – 12 years.

The research approach balances research rigour with responsiveness to the community, to enhance conceptual robustness and explanatory utility. The research partnerships will enhance critical awareness and bilateral knowledge development between the research team and community members. This approach reflects the Department of Health (DOHWA) commitment to investing in collaborative partnerships with communities to improve health and wellbeing for young people and families²⁵. Data linkages with the Maternal and Child Health Research Database (MCHRD)²⁶ ABS and state databases will be used across all streams to benchmark how behavioural and social change processes occur at the community level and examine the applicability of this knowledge to other settings.

Research stream 2: Social-Economic-Psychosocial (SEP) Determinants of Health

Objective: To explain how differences in children's early health and developmental outcomes are determined by psychosocial, economic and biological processes in the child's family.

The study will measure family socioeconomic and demographic characteristics, family health and functioning, and children's health and development using validated and reliable instruments currently employed in the Western Australian Pregnancy Cohort (Raine) Study (www.rainestudy.org.au/), the Longitudinal Study of Australian Children (LSAC), and the Household, Income and Labour Market Dynamics in Australia (HILDA) Survey. Home data collection will be undertaken at enrolment (18 wks pregnancy) and when the newborn reaches one and two years of age, in conjunction with the proposed collection of biological samples and measures of environmental pollutants (Research Stream 3 below). Formal observations of the physical and social home environment will be conducted, and basic family anthropometric, health, and developmental assessments completed, including health and developmental data for siblings > age five at the time of enrolment. Supplementary pregnancy, birth, and health data will be obtained for participants through linkage to the MCHRDB housed at the TICHR and the Hospital Morbidity Data System from the DOHWA. Patterns of risk and protective factors and relationships with health and developmental outcomes will be analysed using multivariate and multilevel regression, latent clustering, structural equation, and life-course trajectory modeling.

Research question 1: How do material deprivation (poverty), social exclusion, lack of social support, and labour market experience influence patterns of social-economic-psychosocial stress in families?

Detailed socioeconomic and demographic information will be collected for all family members (DOB, sex, race/ethnicity, language spoken at home), for adults (marital/relationship status and history, education level, income, transfer payments, financial strain, dwelling type, age and tenure, history and likelihood of residential moves, neighbourhood safety and satisfaction) and for children (relationship to carers and other children living in the home, current child care experience and history, current school experience and history). Details of parents' labour market activities will also be sought (occupation, type (e.g. fly-in-fly-out), unemployment, working hours, job security and satisfaction). Social support and/or social exclusion and discrimination will be measured using the Maternal Social Support Scale and Schedule of Racist Events.

Parents will be asked a set of open-ended and fixed response questions about factors they believe contribute to their own health and wellbeing and that of their family and their community, and barriers to family and community health and wellbeing using a survey instrument developed by the Population Research Laboratory at the University of Alberta²⁷. In addition to the information listed above this will gather data on personal health behaviours (exercise, diet, smoking, substance abuse) coping skills, and access to health and social services. Parents will complete an inventory of their physical and mental health including: major illnesses/disabilities (ICD-10); family history of major illnesses/disabilities; general health and well-being (Short Form 36); health service use (Raine); and mental health (Depression-Anxiety-Stress Scale, Perceived Self-Efficacy Index, Edinburgh Postnatal Depression Scale). Height, weight, skinfold measurements, and resting blood pressure will be recorded for both biological parents during the home visit. Interview data will also include welfare supports, social and

community connectedness, participation in community activities, perceived gaps, weaknesses, and suggestions for service improvements, including formal and informal child care.

Research question 2: What are the effects of the social-economic-psychosocial patterning of family stress on children's early health and developmental outcomes?

Data on both objective (allostatic load, Res. Stream 3 below) and subjective experience of stress will be obtained. Instruments measuring subjective stress will be directed to both primary and secondary care givers including: stressful life events, state anxiety, trait anxiety, parental mental health, parental relationships, family functioning, parental consumption of alcohol, drugs and cigarettes, and financial strain (Stressful Life Events Scale, State-Trait Anxiety Inventory). Reproductive history (reproductive problems, ante-natal care, pregnancy, perinatal problems and mode of delivery) will be obtained through a primary care giver questionnaire at enrolment and the MCHRDB via data linkage. Family functioning, attachment and parenting style will be examined through survey questions (Abbreviated Dyadic Adjustment Scale, McMaster Family Assessment Device, Parenting Scale) and formal observation within the home (Home Observation for Measurement of the Environment (HOME) Inventory). An additional funding application for an extension study of alternative child care environments (e.g. grandparent care, centre care) will be submitted. Measures will be gathered on the quality of adult-child relationships, the types of learning opportunities provided, time spent in each alternative care environment, and variation in care environments. Environmental quality in each of the different care environments will be measured and salivary cortisol will be collected from study children for analysis along with samples collected in the child's home.

Perinatal information, birthweight, gestational age, and diagnosis of intrauterine growth restriction (IUGR) in newborns (via Stream 3) and siblings will be obtained from the MCHRDB via linkage. Primary care giver questionnaire assessment of each child's health will include: physical activity; breastfeeding and nutrition; sleeping patterns; major illnesses/disabilities, injuries and hospitalisations (ICD-10); current prescription and pharmacy medications; health service usage (Raine); and immunisation history and current status. Height, weight, skinfold measurements, and blood pressure will be recorded for each child at the time of home visit. Survey measures of child development will include: motor development; early language and communication; behaviour and emotional development; social development; temperament; and school readiness (Strengths and Difficulties Questionnaire, Short Temperament Scale for Toddlers, AEDI). Age appropriate measures of cognitive and neurological development (Academic Rating Scale, Peabody Picture Vocabulary Test) will also be administered to each child at the home visit.

Research stream 3: Biological embedding

Objective: To examine the impact of biological embedding from 1st trimester pregnancy to 3 years of age by investigating child growth and physiological development underpinning adaptation.

Research question 1: Are foetal growth and HPA-development linked to *in utero* exposure to stressors in the social, physical, familial and community environment, as perceived by the mother and regulated by her HPA-axis and the placenta?

Biological sampling for this stream will be undertaken where possible in conjunction with existing medical protocols, expedited by local GP's and midwives, who are also tracking births at Peel in preparation for the study. Maternal baseline HPA function and foetal growth will be assessed at 18 and 34 wks of pregnancy. At birth, body weight and height will define the body mass index (BMI) as an index of physical development and head circumference (HCF) as an index of brain growth. IUGR will be measured using existing diagnostic criteria, ultrasound Doppler scans²⁸, uterine and umbilical blood flow measures, and new measures of IUGR called proportional of optimal foetal weight (POFW) and optimal birthweight (POBW)²⁹. Biochemical analysis of maternal and foetal wellbeing will be assessed, including the links between indices of foetal adrenal and pituitary function at 18 and 34 wks of pregnancy and foetal growth, birth outcomes and physical development in the first three years of life³⁰⁻³¹. Furthermore, placentas of all newborns in the study will be collected upon consent for measures of weight and size and analysis of morphology and transcriptional control. Comparative analyses between

placentas of normal and IUGR births will demonstrate how variations in placental glucocorticoid sensitivity and exposure impact on placental function and foetal growth & well being, and thus postnatal outcomes³².

Research question 2: Is there a gene-environment interaction between genetic variation in stress regulation and measurable effects of early life stress modifiers on child growth and the development of neuroendocrine, immune and cardiovascular function, which interactively regulate maintenance of homeostasis?

To provide evidence of biological embedding after birth, we will study trajectories of body and brain growth and HPA development at annual intervals throughout childhood. Blood and saliva for biological analysis will be collected during the home visits. Monitoring basal cortisol at the peak of daily glucocorticoid release will allow detection of chronically raised or lowered atypical basal HPA activity as a result of allostatic load. We aim to confirm an expected establishment (at 1 year) and maintenance (at 3 years) of circadian rhythm in basal cortisol, characterized by a peak at awakening and a nadir in the early evening. Failure of this circadian rhythm to develop and be maintained will highlight if early life stress in daily routines, such as specific care settings for the child, affect the toddler's capacity to cope with stress.

To analyze genetic variation in coping with stress, we propose to genotype each newborn child for known functional polymorphisms related to stress through cortisol sensitivity and resistance. This will be analysed using techniques provided by our collaborators in The Netherlands who are conducting world class studies on HPA reactivity³³⁻³⁴. To provide insight into the development and functioning of the immune system during early childhood, vaccine antibody responses to the tetanus toxoid (TT) component of the childhood diphtheria-tetanus-pertussis (DTP) vaccine as well as serum cytokine profiles will be measured. We hypothesize that stress modifiers of HPA-axis function, via cortisol release, will impact on immune development by suppressing, delaying or diverting the production of TT-specific antibodies, with corresponding changes in immune modulating cytokine production³⁵⁻³⁶. Blood will be collected at 1 and 2 years of age, (6 and 18 months after the first and third DTP-IPV-HepB-Hib vaccination), in accordance with the DOHWA 2006 vaccination schedule. Annual monitoring of resting blood pressure (BP), heart rate (HR), triceps and subscapular skinfold thickness will be used as indicators of cardiovascular function and metabolic syndrome risk factors during early childhood. To determine the impact of environmental pollutants on child health, house dust will be analysed for analysis of exposure in a foetus at 18 wks, and newborns at 1 and 2 years of age to heavy metals [lead, cadmium, arsenic, cobalt, chromium and mercury; inductively coupled plasma mass spectrometry (ICP-MS)]. Early life exposure to environmental tobacco smoke (ETS) will be analyzed by measuring cotinine in cord-blood and in the child's urine at 1 and 2 years of age. Occupational and domestic exposures of the mother during pregnancy will be determined by questionnaire.

Statistical Analysis Analysis will be undertaken under the supervision of Dr Mike Phillips (Biostatistician), Ms Sally Brinkman (expert on multi-level modelling), A/Prof Kendall, Dr Jianghong Li and Dr. Eugen Mattes (epidemiologists). Analytic strategies will involve both variable-centred and person-centred approaches. Variable-centred analysis will include linear and multilevel regression modelling, and structural equation modelling, where appropriate. This analysis will be based upon standard techniques. Binary outcomes will be related to categorical exposures using contingency tables; tests of statistical significance will be based upon the standard chi-squared test for association or Fisher's exact test. Unconditional logistic regression will be used to investigate the multivariate relationship between a binary response and a series of categorical or continuous explanatory covariates. Multiple regression will be used to investigate the relationship between continuous response and categorical or continuous explanatory covariates. Primary inferences will be based on point estimates of odds ratios, and 95% confidence intervals, t-tests, analysis of variance and simple linear regression, depending whether the exposure was binary, non-binary categorical or continuous. Statistical significance will be defined at the $p=0.05$ level (2-tail).

Person-centred analysis will include: multilevel modelling, latent class analysis, and a semi-parametric group-based approach. Multilevel modelling will be used to take account of the hierarchical nature of the data structure and allow for the characterisation of “within-person” as well as “between-person” parameters. We wish to model changes over time in both exposure (e.g. stressful life events, welfare payments, contact with government services) and outcome variables (e.g. HPA responsiveness in child). For this purpose, a series of individual within-person linear, discontinuous, or non-linear (exponential, quadratic, cubic, etc) trajectories will be calculated, and then aggregated across individuals using between-person models (SAS, HLM, and/or MLwiN software); latent class analysis will be used to model distinct metabolic syndrome clusters given the presence/absence of several biological, psychological, and social characteristics. Parameters will be estimated by maximum likelihood criterion (Latent GOLD software); a semi-parametric group-based approach developed by Nagin⁶³ will be used to identify distinctive clusters of individual trajectories within the study population and for profiling the characteristics of individuals within the clusters (SAS Proc Traj software).

Power calculations Assuming a recruitment rate of 600 individuals per year over 3 years and a moderately sized design effect of 1.5 (this accounts for loss of independence due to clustering within communities) the study will have 80% power to detect a relative risk of 1.2 relating to a binary outcome where both the outcome and risk factor are common (50% prevalence). Where the outcome is rare (10% prevalence) the relative risk detected rises to 1.6 and where the risk factor is also rare this figure rises again to 1.9. For a continuous outcome the study will have 80% power to detect a mean difference relating to a risk factor equivalent to 0.2 standard deviations of the outcome variable.

E5 Partner Organisation Commitment and Collaboration This collaboration, led by Murdoch University and the Telethon Institute for Child Health Research, is a unique and innovative partnership involving three tiers (national, state and regional) of policy makers, service providers and community organisations, as well as 4 WA Universities. The Collaborating Partners comprise the Australian Government Departments of Health and Ageing; Family and Community Services and Indigenous Affairs; Transport and Regional Services; the WA Departments of Health; Education and Training; and the Peel Health Foundation. Other financial partners include the Departments of Education, Science and Training, and Community Development, St John of God Health Services and the Peel Development Commission. The objectives of this project have close synergies with the core work of the collaborating partners (see support letters in Section F). Comprehensive consultations have been ongoing over 18 months to recruit partners operating in the Peel region and to ensure key interest areas of partners are represented in the research program. Partner representatives at senior executive level will participate in the Project Steering Committee. Partner Investigators hold senior management positions and have specific expertise relevant to the project. Partner Investigators will have a direct role in the design of the research and ongoing supervision of students and individual projects. Partners will participate in dissemination and translation processes. Each collaborating organisation has concurred on the usefulness of cross sectoral collaboration to identify and address the complex interactions that contribute to developmental outcomes and to use these findings to inform planning and policy processes. All Collaborating Partners have a strong research culture and dedicated research areas within their organisations.

E6 National Benefit The Peel region is among the highest growth areas in Australia and is experiencing several social patterns and changes that are occurring in other regions across the country – eg high rates of teenage pregnancies, workforce participation changes, diverse socio-economic groups, differential academic achievement, high rates of asthma, and a variety of family structures. There are sufficient sub-populations to enable innovative multi-level statistical modelling methodology which can be used to provide evidence based estimates for key indicators of social patterning for similar populations in other regions in Australia. This study is unique in its focus on the community’s contribution to improving outcomes for children and families, thus emphasizing the use of existing resources in addressing risk factors potentially resulting in significant cost savings. The implementation

of selected nested interventions will provide a suite of trialed and evaluated preventive interventions and strategies to promote resilience which can be replicated in other regions.

E7 Communication of Results Community participation and dissemination of results and research translation are core components of this proposal. Preliminary consultations in a variety of forums with key stakeholders to incorporate their perspectives into the research program have been undertaken. A draft dissemination plan has been circulated to partners and will be finalised at the start of the project. This will include community workshops, information seminars and presentations at key intervals in the research timetable once results have become available. The website developed at the outset of the project will contain current information on project activities, stages, results and other relevant information. Collaborating partners will disseminate findings through organisational processes and publications. A publication plan (including peer reviewed scientific papers, pamphlets, policy papers, etc) will ensure results are communicated at timely intervals to a range of audiences. Commitment has been obtained from the Peel Development Commission and the Mandurah Council to support a biennial International Symposium to showcase the results nationally and internationally.

E8 Description of Personnel Professors A McMurray and F Stanley will oversee the project. Professor McMurray will lead the community stream of the project. Professor B Down will lead the school based research around the Full Service School and community capacity building. A/Professor G Kendall will lead the developmental and psychopathology elements of the project and Dr J Li (senior sociologist and social demographer) will lead the social determinants of health component. Professor B Waddell, Dr P Stumbles, Dr A Van Eekelen (senior neuroscientist) and Dr. E Mattes will lead the various aspects in the biological embedding stream. A/Professor M Sims will investigate childcare arrangements in relation to stress levels in children and families. Dr P Franklin will investigate the impact of in utero exposures to domestic toxins on health developmental outcomes. The Indigenous elements of the project will be overseen by Ms L Nelson, a Noongar woman from the Pinjara community who has been researching access to antenatal care in the Peel region. Ms E Seymour will undertake the role of Partnership Coordinator. All academic partners will supervise postgraduate students working on the project. Partner Investigators will be responsible for ensuring research results are used to inform policy and service delivery and that cross-sectoral synergies are identified and incorporated into research outputs. The research program and outputs will be managed by a team of highly experienced postdocs (including Dr Mattes) and Named Researchers (Dr Van Eekelen, Dr Li and Dr Gallegos) who will provide scientific and practical support to the CIs and undertake mentoring /supervision of students. Dr Gallegos (nutrition specialist) and Dr. Li will manage the Community Capacity and Social Determinants of Health Streams, and Dr Van Eekelen (in present and ongoing collaboration with Profs. R De Kloet at the Univ of Leiden, The Netherlands, and B McEwen at the Rockefeller Univ in New York, US) and Dr Mattes will manage the Biological Embedding Stream. This team will ensure all sub-areas of the research program are integrated into the overarching framework, associative relations are reported with scientific rigour.

E9 References

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ATTACHMENT A: Project Timelines

Year 1: July 2007- June 2008		Year 3: July 2009- June 2010	
1st Quarter	<ul style="list-style-type: none"> Initial Ethics applications lodged Website development Planning and development Communication and dissemination strategy Community consultations APAI recruitment Publication strategy 	1st Quarter	<ul style="list-style-type: none"> Data collection for developmental and social measures Ongoing implementation of nested studies
2nd Quarter	<ul style="list-style-type: none"> 1st year of cohort recruitment Personnel recruitment Biological sampling commences APAI enrolment Methodology for nested studies finalised Ethics applications for nested studies 	2nd Quarter	<ul style="list-style-type: none"> Planning and policy workshops Publication drafts
3rd Quarter	Preliminary consultative processes for <ul style="list-style-type: none"> Child care study Asset mapping Infant nutrition Full service schools Indigenous antenatal care 	3rd Quarter	<ul style="list-style-type: none"> Social atlas 2nd edition of thematic maps of social capital APAI progress reporting Research translation forums 2nd suite of publications submitted
4th Quarter	<ul style="list-style-type: none"> Community dissemination forums Preliminary consultations for Indigenous school based measures and child development indicators 	4th Quarter	<ul style="list-style-type: none"> 2nd round correlation analyses of biological and social/developmental data Dissemination
Year 2: July 2008- June 2009		Year 4: July 2010- June 2011	
1st Quarter	<ul style="list-style-type: none"> Data collection for developmental and social measures commenced AEDI implemented Pilot of Indigenous child development, self esteem and socialisation measures International Symposium on Enabling Communities and Child Development Ongoing implementation of nested studies 	1st Quarter	<ul style="list-style-type: none"> Data collection for developmental and social measures Community consultative forums Publication drafts
2nd Quarter	<ul style="list-style-type: none"> International Symposium on Enabling Communities and Child Development 	2nd Quarter	<ul style="list-style-type: none"> Finalisation of nested studies 3rd suite of publications
3rd Quarter	<ul style="list-style-type: none"> Ongoing development of social atlas Interim thematic maps of social capital APAI annual progress reports 	3rd Quarter	<ul style="list-style-type: none"> 3rd round analyses of biological and social/developmental data APAI theses submitted
4th Quarter	<ul style="list-style-type: none"> 1st round correlation analyses of biological and social/developmental data Community consultative forums Dissemination of results 1st suite of publications submitted 	4th Quarter	<ul style="list-style-type: none"> AEDI implemented 2nd implementation of Indigenous child development, self esteem and socialisation measures Comparative analysis/ validation of Indigenous child development, self esteem and socialisation measures Scientific reports on outcomes of nested projects Scientific reports of 4 year overview of sample and data collection International Symposium on Enabling Communities and Child Development