

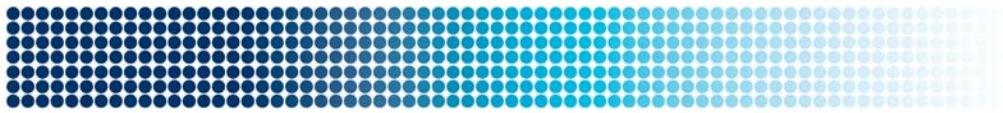
Understanding the nature and significance of early childhood: New evidence and its implications

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Presentation at Centre for Community Child Health seminar
Investing in Early Childhood—the future of early childhood
education and care in Australia

The Royal Children's Hospital, Melbourne, 25 July 2014



INTRODUCTION

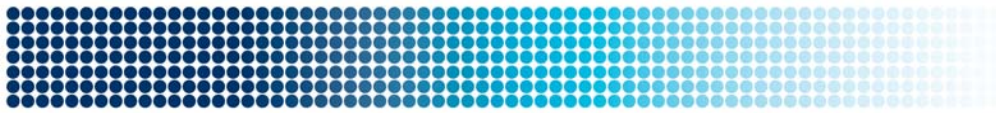
This paper is based on a presentation at a Centre for Community Child Health seminar devoted to a consideration of the Productivity Commission's Draft Report on Child Care and Early Childhood Learning.¹ The aim of the paper was to present a succinct summary of relevant evidence to inform discussions. Rather than reviewing the evidence regarding existing forms of service, the presentation focused more broadly on what we know about child development – how children learn and what children need. The paper is not so much about challenging existing models of early childhood education and care in Australia as challenging our understanding of the nature and significance of the early years.

NEW RESEARCH EVIDENCE AND WHAT IT TELLS US

Over the past few decades, there has been a growing acceptance among scholars, professionals and policy makers of the importance of the early years. However, as we learn more about the way in which experiences in the early years shape health, development and wellbeing, and the extent of these influences over the life-course, the true importance of these years becomes more and more apparent.²

There are nine sources of evidence to be considered*.

- Evidence about the nature and significance of prenatal development and experiences, and their effects over the life course
- Evidence about the nature and significance of postnatal learning and development, and the impact of proximal environments
- Evidence regarding the impact of early childhood experiences on long term development, health and wellbeing
- Evidence regarding neurological development and plasticity
- Evidence regarding the neurobiology of interpersonal relationships
- Evidence regarding 'social climate change' and its effects
- Evidence from economic analyses of child development and the benefits of investments in the early years
- Evidence regarding social inequalities and their effects
- Evidence from repeated measurement of key indicators of child development and functioning.



Prenatal development and experiences

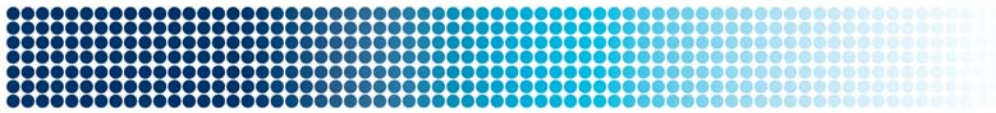
Until recently, there had been a scientific misconception that the placenta provides a barrier for the growing foetus that protects it from the mother's physical and emotional environment. It is now recognised that this is not the case – while the placenta provides some protection against infection, there is free exchange between the embryonic and maternal blood systems, and the placental wall (which is thinnest in the first trimester when the foetus is developing most rapidly) does not protect the foetus against drugs, alcohol, smoking, environmental toxins or maternal stress.

Moreover, instead of being a passive bystander in the womb during the pregnancy journey, the foetus actively responds to changes within the intrauterine environment. The foetus uses the nutritional and hormonal information that crosses the placenta to predict the kind of world it will be born into, and alters its phenotype³ accordingly. While these changes might be adaptive in the immediate environment, they can come with long-term costs, both psychologically and physically.

This process is an example of the broader biological mechanism of developmental *plasticity* by which organisms, in response to cues such as nutrition or hormones, adapt their phenotype to their particular environment. These adaptations involve epigenetic changes⁴ that alter the way that genes are expressed or function. Plasticity is very demanding of energy, and hence in general is limited to an early phase of development because re-engineering the body after the phenotype has been fully developed is costly. The period of maximum developmental plasticity extends from conception to the first 2–3 postnatal years.

Epigenetic changes may also be inherited, so that the experiences of mothers or even grandmothers can be transmitted across generations. While these changes may, in time, be rectified, in the short term they contribute to non-genomic transmission of risk.

This new evidence regarding the impact of neonatal experiences on health and development has led to a significant rethinking of adult health and functioning. Adult conditions such as coronary heart disease, stroke, diabetes, and cancer that were regarded solely as products of adult behaviour and lifestyles are now seen as being linked to processes and experiences occurring in pregnancy or infancy.



Postnatal development and experiences

Just as we have come to rethink the role of the foetus in pregnancy, there has been a rethinking of the capacities of infants. Previously, infants were thought of as needing loving care and protection but not as active learners or social partners. We now know that children come out of the womb primed to engage with their caregivers, and that the parents are primed to engage with them. We also know that learning starts from birth and that learning and development are cumulative, with later development building upon earlier development.

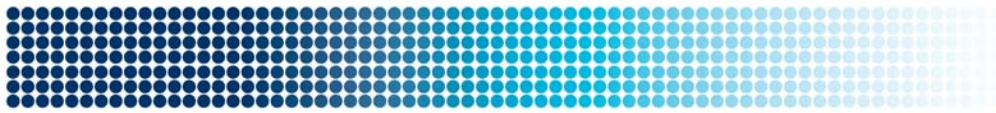
The proximal or immediate environments in which young children spend their time play a fundamental role in shaping their development and wellbeing. These include the home environment, as well as early childhood services, and other community environments. These environments have both physical and relational dimensions, and provide children with opportunities and experiences that shape development for better or worse. Children adapt to these environments – another example of developmental plasticity – in ways that optimise their functioning in the particular environment, but that may have long-term consequences for development, health and wellbeing, again for better or worse.

Children's early social experiences shape their developing neurological and biological systems for good or for ill. The kinds of stressful experiences that are endemic to families living in poverty can alter children's neurobiology in ways that undermine their health, their social competence, and their ability to succeed in school and in life. For children born into a world where resources are scarce and violence is a constant possibility, neurobiological changes may make them wary and vigilant, useful characteristics in such an environment. However, these same changes mean that they are likely to have difficulty controlling their emotions, focusing on tasks, and forming healthy relationships. Unfortunately, these adaptive responses to chronic stress serve them poorly in situations, such as school and work, where they must concentrate and cooperate to do well.

An added complication is the discovery that children are differentially susceptible to environmental experiences: while most children are 'dandelion' children who do well in most environments, a minority are 'orchid' children who flourish in positive environments but react particularly badly to negative environments.

Long term impact of early childhood experiences

Much has been learned about the long-term impact of early childhood experiences from longitudinal studies, such as the Christchurch Health and Development Study, British Cohort Study, Adverse Childhood Experiences Study, and the Longitudinal Study of Australian Children. These studies provide strong evidence of the way in which life-long effects of early experiences impact on the later achievements, social adjustments, mental health, physical health and longevity of individuals.



Three key ways in which early childhood experiences can have long-term effects have been identified: biological embedding, accumulation effects, and developmental escalations of risk over time. Although they are distinguishable from one another, these pathways are not mutually exclusive.

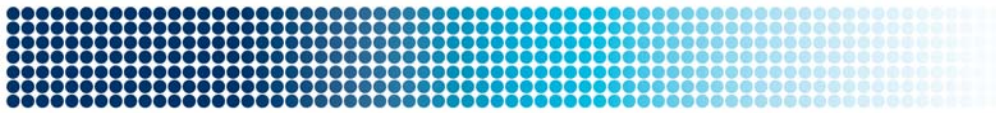
- **Biological embedding.** Biological embedding refers to a developmental process whereby prenatal and early childhood experiences influence physiological and neurological development in ways that have long-term consequences. Through this process, early life social and environmental stressors, such as childhood abuse, neglect, poverty, and poor nutrition, become deeply embedded in the child's neurobiology. These changes have been associated with an increased risk of common metabolic and cardiovascular diseases later in life, the emergence of mental and physical illness (such as anxiety, mood disorders, poor impulse control, psychosis, and drug abuse) and increased risk for psychopathology (from depression and conduct disorders to autism and schizophrenia).

Inadequate diet in early life can permanently change the structure and function of specific organs or homeostatic pathways, thereby 'programming' the individual's health status and longevity.

- **Accumulation effects.** Early experiences also influence later development through accumulation effects. The cumulative effect of adverse experiences during childhood and the toxic stress they cause influences every aspect of health and wellbeing in childhood and beyond. Adverse experiences include abuse (emotional, physical and sexual), neglect (physical and emotional) and household dysfunction (family violence, parental illness or drug abuse, parental separation and divorce).

These effects cascade across all areas of developmental functioning thereby altering the course of development. The greater the number of adverse experiences in childhood, the greater the risks of a range of adult health problems (including heart disease, liver disease and lung cancer) and psychological problems (depression, suicide attempts, alcoholism and drug abuse).

Over time, the cumulative wear and tear caused by exposure to chronic stress results in physiological changes to the body with long term adverse consequences for health and wellbeing. This cumulative wear and tear on the body is known as allostatic load, and is caused by repeated mobilisations of multiple physiological systems over time in response to environmental stressors. The longer the children have been exposed to stressors such as poverty, family violence or child abuse, the higher their allostatic load. These stressors may actually 'reset' the immune system in a manner that increases stress-related impairments in immune function, rates of infectious and chronic diseases, or blood pressure and cardiovascular disease incidence



- **Developmental escalations of risk.** Development is also shaped by developmental escalations in risk over time. An exposure or experience at one stage of the life course influences the probability of others later in the life course, as well as associated health and developmental outcomes. Thus, these experiences form ‘chains’ of risk whereby a sequence of linked exposures that raise disease risk because one bad experience or exposure tends to lead to another and then another.

Neurological development and plasticity

Brains are built over time through an ongoing process that begins before birth and continues into adulthood. Both brain architecture and developing abilities are built from the bottom up, with simple circuits and skills providing the scaffolding for more advanced circuits and skills over time. Neurological development is cumulative, with later development (and learning) building upon earlier development.

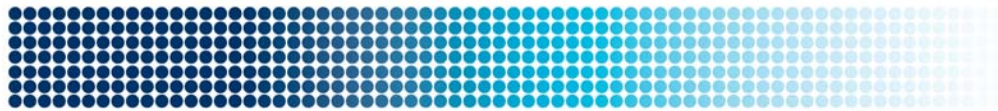
Early environments and experiences have an exceptionally strong influence on brain ‘architecture’. However, the brain is capable of rewiring itself in response to significant changes in environments. This means that our preferred metaphor for describing the early development of the brain is to talk about the ‘architecture’ of the brain – this captures well the importance of building firm foundations, but does not do justice to neurological plasticity, for which there is no equivalent in architecture.

Moreover, framing brain development in terms of building neuronal connections and brain architecture fails to capture the fact that brain functioning is not purely cognitive, that ‘learning’ is not purely conscious, that the brain is not purely skull-based, and that the brain is closely linked with other key bodily systems.

First, the brain is not purely cognitive, but also profoundly emotional. Emotions directly influence the functions of the entire brain and body, from physiological regulation to abstract reasoning. In fact, emotion serves as a central organising process within the brain, and our ability to organise our emotions directly shapes the ability of the mind to integrate experience and to adapt to future stress. The experience of expressing one’s emotional state and having others perceive and respond to those signals appears to be of vital importance to the development of the brain.

Second, learning is not a purely conscious process. Much of our most important emotional and interpersonal learning during our first few years occurs before we have the necessary cortical systems for conscious awareness and memory. Thus, many of the most important aspects of our lives are controlled by reflexes, behaviours, and emotions learned and organised outside our awareness.

Third, properly understood, the brain is not just skull-based but ‘embodied’, being shaped by messages from all over the body via the central and peripheral nervous systems. This embodied brain shapes and is shaped by both its external and internal environments.



Finally, the brain (or autonomic nervous system) is not a stand-alone bodily system, but is intricately connected to other major bodily systems, including the immune, endocrinal, cardiovascular and metabolic systems. These systems shape and are shaped by each other. What all this means is that what is 'learned' in the prenatal and first two to three years of life affects not only the neurological system but also the other bodily systems to which the brain is connected, with potentially profound consequences over the life course.

Neurobiology of interpersonal relationships

Healthy development depends on the quality and reliability of a young child's relationships with the important people in his or her life, both within and outside the family. Relationships are the medium through which young children learn the skills that enable them to become fully participating members of society – in effect, children use the brains of adults to develop their own.

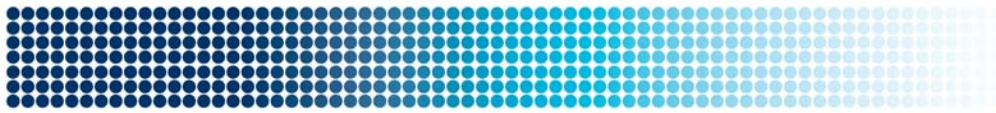
Sensitive and responsive care giving is a requirement for the healthy neurophysiological, physical and psychological development of a child. The key qualities of effective relationships are attunement, responsiveness and respect.

Brains are changed by relationships –this is because our brains constantly communicate with each other through unconscious or subconscious neurobiological pathways of which we are unaware. These subconscious pathways enable our brains to read the body and facial signals of others, and detect their intentions and emotional states. In effect, our (right) brains are able to communicate directly with other people's (right) brains independently of conscious communication processes or awareness.

The right brain limbic areas that enable this to occur grow rapidly in the first two years of life and the nature of their development can have long-term implications. The growth of a baby's brain literally requires brain–brain interaction, and occurs in the context of a positive affective relationship. These interactions constitute a 'social synapse' that resembles the synaptic connections between the neurons in our brains.

'Social climate change'

Over the past few decades, we have experienced a series of linked social, economic, demographic and technological changes that are unprecedented in their rapidity and scale. These changes arise from the same fundamental factors that have contributed to physical climate change and constitute a form of social climate change. One of the consequences is that the nature of the social problems facing society and governments have altered; they are now more likely to be 'wicked' or complex problems that are not able to be resolved through traditional service-driven approaches. Addressing these problems is a challenge for existing service systems and has led to the development of new integrated and place-based approaches to service delivery.



These social changes have also had a significant impact on children, families and communities. For families, the world has become a more challenging and complex place, and the conditions under which parents are raising children have changed dramatically. Families who are relatively well-resourced are better able to meet the challenges posed by altered social conditions, and have benefited accordingly. However, poorly-resourced families can find the heightened demands of contemporary living and parenting overwhelming.

Gaps in family functioning are cumulative: the more advantaged families are initially, the better they are able to capitalise and build on the enhanced opportunities available, so that the gap between them and those unable to do so progressively widens. As a result of this and other factors, there is an increase in the numbers of families with complex needs, and more pockets of intergenerational disadvantage, underachievement and poor health and developmental outcomes.

Economic analyses of investments in the early years

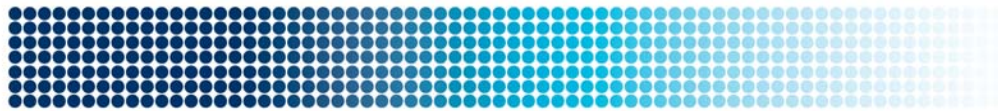
In this changed world, the stakes have risen: in a competitive global market and, national productivity has become even more important, and improving productivity involves people to master more complex skills required by rapid advancing technologies. It is no longer acceptable to have children arriving at school poorly equipped to benefit from the learning and social opportunities schools provide, and therefore at risk of not developing the skills and qualities needed in a modern economy.

Moreover, economic analyses by James Heckman and others show that investments in the early years are more cost effective and beneficial than later investments. On the basis of such analyses, Heckman argues that 'to foster individual success, greater equality of opportunity, a more dynamic economy, and a healthier society, we need a major shift in social policy toward early intervention, with later interventions designed to reinforce those early efforts' (Heckman, 2013). Given the importance of the antenatal period for later development, there are also good grounds for extending the economic argument to include investments in antenatal services.

An additional economic consideration is that the cumulative costs of not intervening early are prohibitive. If nothing is done to address the types of adverse circumstances and events that impact negatively upon children during the early years, the costs of treating the emerging health and developmental issues grows exponentially, with long-term negative effects on the wellbeing of the individuals concerned and their capacity to contribute to national productivity.

Social inequalities and their effects

In every society, regardless of wealth, differences in socioeconomic status translate into inequalities in child development. These social gradient effects are evident across a wide range of developmental, health and wellbeing indicators: inequalities in outcomes are not concentrated exclusively at the bottom of the socioeconomic spectrum in a small group of poor or problematic families, but are distributed across



the entire spectrum in a graded fashion. Outcomes for children and families improve progressively the further up the socioeconomic spectrum they are, and worsen progressively the further down they move.

Discrepancies between children from advantaged and disadvantaged backgrounds emerge early, and progressively widen, with advantages and disadvantages accumulating throughout life. By the time they get to school, there are marked differences between children in regards to the cognitive, non-cognitive and social skills they need to succeed in the school environment. Children who lag behind their peers at school entry tend to be from low-income families. The differences between these children and their more affluent peers at school entry are predictive of later academic and occupational success.

Measurement of key indicators of child development and functioning

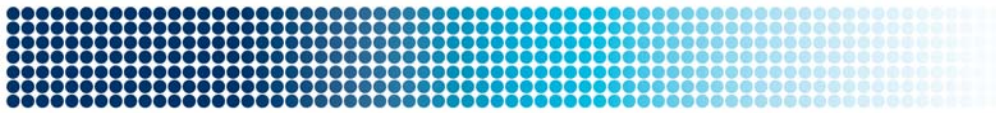
The results of the Australian Early Development Census (formerly Australian Early Development Index) show that significant numbers of children are arriving at school poorly equipped to benefit from the social and learning opportunities that schools offer, and schools struggle to make up the gap between those children and their peers.

IMPLICATIONS

This accumulation of new knowledge about the impact of prenatal and early childhood experiences on health, wellbeing and development in later childhood and over the life-course must change how we view the early years. It is no longer appropriate nor useful to view the first two or three years of life as a period to simply keep children healthy and safe, while allowing development to take its course until they reach school age. Instead, we need to be taking steps to ensure that children are provided with early childhood environments and experiences that build attachments, competencies and skills from birth, and protect them from escalating chains of adverse experiences.

Children learn from every encounter within their physical and social environments – therefore, in every environment, a curriculum of sorts is operating, and we need to ensure that the lessons children learn and how they adapt benefits them over the life course. This does not mean that children need highly enriched or protected early childhood environments: what most children need is ‘good enough’ parenting and caregiving – that is, a threshold level of positive relational and learning experiences.

For families and communities who don’t have the skills and resources to provide these experiences, we need to be able to provide high quality early childhood programs, tailored family support services and parenting programs, and positive community support. We also need a service system that is able to detect and respond to any developmental or health problems in children (which can emerge in children from any background at any time) or any family problems that can compromise parenting and care. In addition, we need to be aware of those children who are differentially susceptible, and therefore more at risk when exposed to inadequate and adverse experiences.



The skills required to perform these tasks are simultaneously simple and sophisticated. They are simple in that the core skills and qualities needed are those that draw upon caregivers' and professionals' own experiences of being parented positively. However, to meet the needs of all children, these need to be supplemented by a more sophisticated and purposeful set of skills that enable caregivers and professionals to know how to provide children with the kinds of environments that will promote their development and wellbeing. Acquiring that additional level of sophistication requires appropriate pre-service training, as well as ongoing training, supervision and support.

As a society, we have long-standing commitments to the public funding of hospitals and schools – but, as yet, no corresponding commitment to some form of early childhood provision, or even an agreement across society as to what that provision should be. The contested issues surrounding child care provision illustrate these dilemmas well: What exactly are its aims? How can we ensure it is of high quality? Should it be publically funded?

We are at a transitional point in our understanding of the nature and significance of the early years – we are becoming much more aware of their importance but are not yet committed to a course of action that will ensure that children's experience of this period is optimal. In moving forward, it is crucial that we base whatever we do on the developmental evidence summarised here.

KEY POINTS

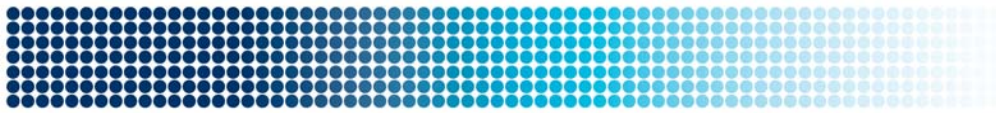
Evidence regarding child development

Prenatal development and experiences

- What happens during the prenatal period can have both immediate and long-term consequences for health and development.
- While the foetus was previously thought to be protected from all external influences in the womb, we now know that it is not protected against drugs, alcohol, smoking, environmental toxins or maternal stress.
- Furthermore, the foetus actively responds to changes within the intrauterine environment to predict the kind of world it will be born into, and makes changes designed to maximise its adaptation to that environment, sometimes with adverse consequences for later health and development.

Postnatal development and experiences

- What happens during the early postnatal years can also have life-long effects on the later achievements, social adjustments, mental health, physical health and longevity of individuals.
- Adult conditions that were previously regarded solely as products of adult behavior and lifestyles are now seen as being linked to processes and experiences occurring in pregnancy or infancy.



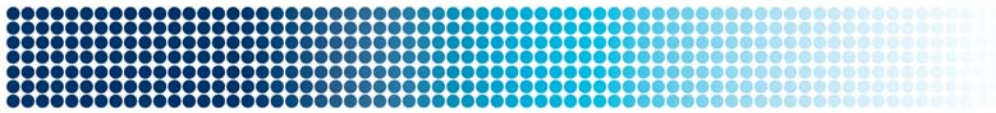
- While infants were previously thought to be passive recipients of care, we now know that they are active partners and learners from birth
- The nature of the environments in which children spend their time – their relational and physical properties, and the learning opportunities they provide – shape children’s development for better or worse.
- Infants and young children adapt physiologically and neurologically to these environments in ways that help them survive and even thrive in the short term, but may have long-term adverse consequences for later development, health and wellbeing.
- The period of maximum developmental plasticity during which these critical adaptations occur extends from conception to the first two or three years postnatally.
- Children are differentially susceptible to environmental experiences, with some children doing well in most environments while a minority flourish in positive environments but react particularly badly to negative environments.

Long term impact of early childhood experiences

- Experiences in the prenatal and immediate post-natal periods can have life-long effects on later achievements, social adjustments, mental health, physical health and longevity of individuals.
- Three key ways in which early childhood experiences can have long-term effects have been identified: biological embedding, accumulation effects, and developmental escalations of risk over time.

Neurological development and plasticity

- These early learnings and adaptations are critical because learning and development are cumulative, with later development and learning building upon earlier development, with the result that the gaps between those doing well and those not doing well progressively widen.
- Much of our most important emotional and interpersonal learning during our first few years occurs before we have the necessary cortical systems for conscious awareness and memory, and therefore many aspects of our lives are controlled by reflexes, behaviours, and emotions learned and organised outside our awareness.
- The brain is not a stand-alone bodily system, but is intricately connected to other major bodily systems, including the immune, endocrinal, cardiovascular and metabolic systems – these systems shape and are shaped by each other.
- Thus, what is ‘learned’ in the prenatal and first two to three years of life affects not only the neurological system but also the other bodily systems to which the brain is connected, with potentially profound consequences over the life course.



Neurobiology of interpersonal relationships

- Healthy development depends on the quality and reliability of a young child's relationships with the important people in his or her life, both within and outside the family – relationships are the medium through which young children learn the skills that enable them to become fully participating members of society.

'Social climate change'

- Rapid social, economic, demographic and technological changes over the last few decades have made the world a more challenging and complex place, and altered the conditions under which they are raising children.
- While most families have benefited from these changes, poorly-resourced families find the heightened demands of contemporary living and parenting overwhelming, and there is an increase in the numbers of families with complex needs, and poor health and developmental outcomes.
- In this changed world, the stakes have risen: a competitive global market and, national productivity has become even more important, and improving productivity involves people to master more complex skills required by rapid advancing technologies.
- It is no longer acceptable to have children arriving at school poorly equipped to benefit from the learning and social opportunities schools provide, and therefore at risk of not developing the skills and qualities needed in a modern economy.

Economic analyses of investments in the early years

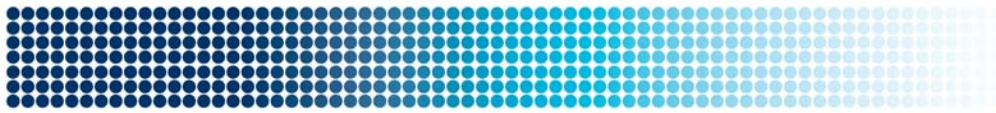
- Economic analyses show that investments in the early years are more cost effective and beneficial than later investments, and that the cumulative costs of not intervening early are prohibitive.

Social inequalities and their effects

- In every society, regardless of wealth, differences in socioeconomic status translate into inequalities in child development across a wide range of developmental, health and well-being indicators.
- Discrepancies between children from advantaged and disadvantaged backgrounds emerge early, and progressively widen, with advantages and disadvantages accumulating throughout life.

Measurement of key indicators of child development and functioning

- Significant numbers of children are arriving at school poorly equipped to benefit from the social and learning opportunities that schools offer, and schools struggle to make up the gap between those children and their peers.



IMPLICATIONS

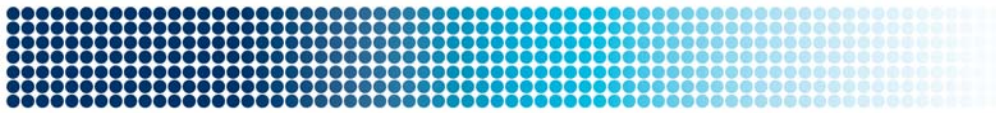
- This accumulation of new knowledge about the impact of prenatal and early childhood experiences on health, wellbeing and development in later childhood and over the life-course must change how we view the early years.
- It is no longer appropriate nor useful to view the first two or three years of life as a period to simply keep children healthy and safe, while allowing development to take its course until they reach school age.
- We need to be taking steps to ensure that children are provided with early childhood environments and experiences that build attachments, competencies and skills from birth, and protect them from escalating chains of adverse experiences.
- Caregivers and professionals need fundamental relational skills and qualities supplemented by more sophisticated and purposeful set of skills that enable them to provide children with the kinds of environments that will promote their development and wellbeing.
- Acquiring an additional level of sophistication requires appropriate pre-service training, as well as ongoing training, supervision and support.
- As a society, we have long-standing commitments to the public funding of hospitals and schools – but, as yet, no corresponding commitment to some form of early childhood provision, or even an agreement across society as to what that provision should be.
- We are at a transitional point in our understanding of the nature and significance of the early years – we are becoming much more aware of their importance but are not yet committed to a course of action that will ensure that children’s experience of this period is optimal.
- In moving forward, it is crucial that we base whatever we do on the developmental evidence summarised here.

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NOTES

1. Productivity Commission (2014). Child Care and Early Childhood Learning: Productivity Commission Draft Report. Melbourne, Victoria: Productivity Commission. <http://pc.gov.au/projects/inquiry/childcare/draft>
2. Some idea of the ways in which our ideas regarding child developed have evolved over the past decade or so can be gauged by comparing the present paper with an earlier summary by the same author:
Moore, T.G. (2002). **Review of the research evidence on early child development.** Paper presented at National Meeting on Early Childhood Systems, Melbourne, 25th November.
http://www.rch.org.au/emplibrary/ecconnections/Child_develop_evidence.pdf
3. The phenotype is the composite of an organism's observable characteristics or traits, and is the result of the interaction between an organism's genes and environmental factors or experiences. These determine whether particular genes will be expressed or not, and therefore whether they will shape development and behaviour.
4. Epigenetics refers to the processes whereby interactions with the environment alter the expression or function of genes without altering their DNA sequence.

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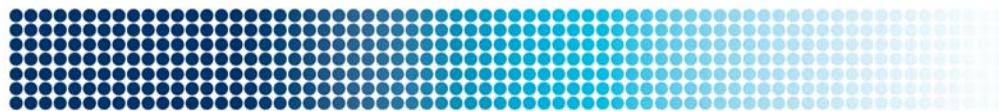
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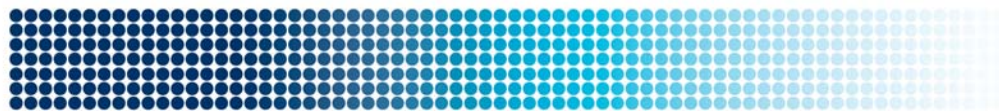
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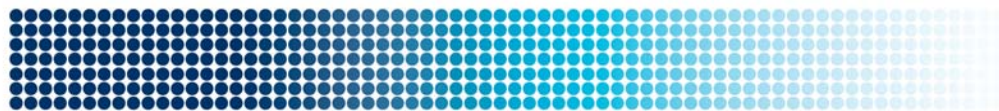
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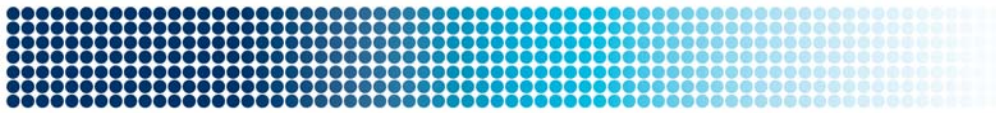
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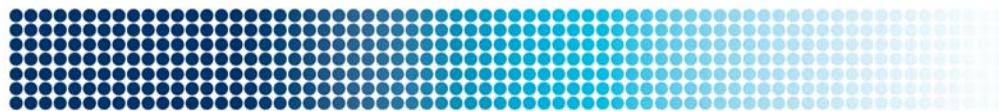
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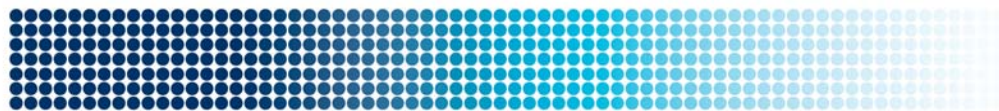
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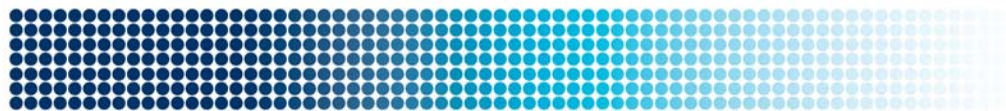
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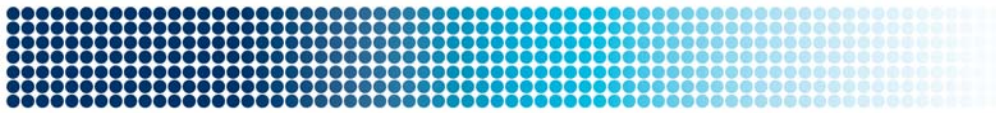
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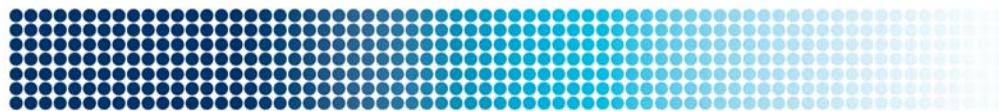
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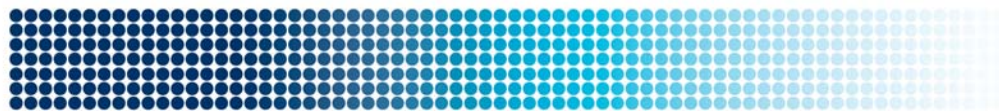
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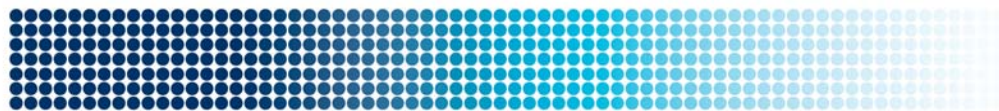
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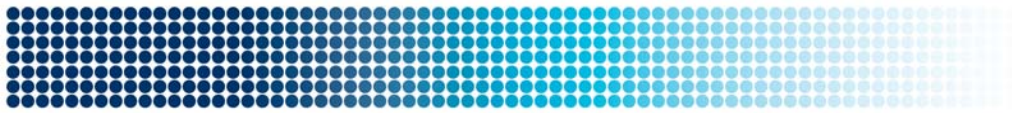
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