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adverse childhood experiences:
understanding their effects

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In the 1990s a large US study found associations between adverse experiences in childhood and poor adult outcomes in physical, emotional and mental health.

This article explores some of the key findings from the seminal Adverse Childhood Experiences (ACE) studies, in conjunction with other research into the potential effects of adversity on tamariki and rangatahi. It is intended for those working with tamariki and rangatahi, or their whānau, to aid understanding about the possible impacts of adversity on those they support.

In this issue...

What is adversity?

Adversity is an umbrella term for a range of experiences that are serious or ongoing and likely to challenge children's coping. Actual definitions are varied. However, some key elements are:

- Adversity refers to both a single serious event, and/or a series of events that continue over time.[1]
- Experiences of adversity are those "associated with disruption, danger, and stress, which deviate from the normative and expected environment",[2] and that require major adaptation for most tamariki.
- This deviation can take two forms, both the "absence of expected inputs" (e.g. neglect), and "the presence of unexpected inputs"[3] (e.g. abuse).

1. McLaughlin, 2016
2. Felitti & Anda, 1997, Gest et al., 1999, and, McLaughlin, 2016, cited by Thompson et al., 2019, p. 87
3. McLaughlin, 2016, p. 363

Exposure to adversity can have lasting and widespread effects on many aspects of health throughout life.

- Adversity can be both direct and indirect. Some forms of adversity affect tamariki directly, (e.g. physical abuse). Other forms of adversity affect children more indirectly, through impacting on their living environments, (e.g. conflict between parents).[4]
- Adversity doesn't cover every stressful experience that tamariki or rangatahi might encounter. For example, whilst moving to a new school might be stressful, a couple of such changes are a typical part of growing up.[5]
- Some definitions specify that adversity is beyond the typically expected experiences of childhood. However, others highlight that some types of adversity are reasonably common.[6] For example, the ACE studies included parental separation (a relatively common occurrence) as one of their categories of adversity. (So just because something is relatively common does not mean it does not have a negative impact.)

In general, the term adversity refers to the experiences or events a child has been exposed to; not to the effects these experiences may have had on the tamaiti.[7] As we will see, having similar experiences can impact individuals very differently, and is also dependent on other factors in their lives.

It's important to note that while 'typically expected events,' may be expected from an adult perspective, they may still be very unexpected, stressful and potentially traumatic for a child (e.g. the death of a grandparent). In other words, children's development can be impacted by their experiences, whether or not these experiences fit a definition of adversity.

The ACE studies

The oft-cited Adverse Childhood Experiences (ACE) studies looked at a broad range of early childhood stressors and their relationship to many and varied health and social problems across the life span.[8] The studies were undertaken with members of Kaiser Permanente's San Diego Health Appraisal Clinic (a primary health care provider) who had completed standardised medical evaluations in 1995-96. Members were mailed the survey regarding childhood events, and the findings are based on more than 9500 responses.[9]

The initial ACE studies looked at seven categories of adversity:

- psychological, physical, or sexual abuse;
- violence against mother;
- living with household members who were
  - substance abusers;
  - mentally ill or suicidal; or
  - ever imprisoned.[10]

Some of these ACEs involved direct harm to children (for example, abuse) while others had more indirect effects (for example, a parent in prison).[11] Participants were asked to answer a series of questions about experiences during the first 18 years of their life.

"Respondents were defined as exposed to a category if they responded 'yes' to 1 or more of the questions in that category."[12] Over half of those surveyed reported at least one, and a quarter reported 2 or more categories of exposure. 6.2% reported 4 or more.[13] (It's worth noting that those studied were disproportionately white and middle class.[14])

A second wave of the study conducted in mid-1997 added some questions regarding:

- emotional and physical neglect, and also
- parental separation/divorce.

There were more than 8000 respondents in this wave of data.[15] Two thirds of those surveyed reported at least one ACE.[16]

In this way, the term 'ACEs' came to represent a combined measure of childhood adversity.[17] An 'ACE score' refers to the number of types of adversity an individual experienced prior to the age of 18 years. ACE scores range from zero, when none of the adversities studied had been experienced, to 7, (in the first wave of data), or 10 (in the second wave of the study).[18]

ACE scores reflect the number of different types of adversity an individual has experienced, but do not indicate the frequency or severity of their experiences, nor their effect on the child.[19] For example, a person would score once for physical abuse, whether this was severe and ongoing through their childhood, or much less severe and occurring on one occasion.

4. Hughes et al., 2017
5. McLaughlin, 2016
6. Felitti, 2009
7. McLaughlin, 2016
8. Anda, et al., 2010
9. Felitti et al., 1998
10. Felitti et al., 1998
11. Hughes et al., 2017
12. Felitti et al., 1998, p. 248
13. Felitti et al., 1998
14. Felitti et al., 1998, cited by Hunt et al, 2017
15. Dong et al., 2005
16. Dong, Anda, et al., 2004
17. Felitti et al., 1998, cited by Bellis et al., 2019
18. Dong, Anda, et al., 2004
19. Massetti et al., 2020

The strengths of the study include its large sample and good access to health data. This enabled links to be seen between childhood experiences and objective data about diagnosis and treatment for many health outcomes.

Prevalence

ACEs are relatively common. The study by Felitti and colleagues found more than half those studied had experienced one or more ACE, and a quarter reported 2 or more ACEs.[20] Subsequent research, with a more socio-economically diverse sample, found ACEs to be more prevalent with approximately 75% exposed to at least one.[21]

New Zealand data, from the Dunedin study, found approximately 65% exposed to at least one ACE, with 15% reporting four or more.[22]

Adversity: Cumulative & interconnected

Research on ACEs has consistently found a dose-response relationship between ACE scores and health outcomes; in other words, as the ACE score i.e. the number of types of adverse experiences increased, the likelihood of poor health outcomes also increased.[23] The cumulative impact of multiple ACEs is greater than the impact of any individual ACE on its own.[24] In other words, the effects of multiple adversities often compound.

Some types of ACE are highly connected to other types. For example, various forms of violence are frequently connected to household dysfunction, such as parental mental illness, substance use or involvement in crime. This makes each ACE in turn very powerful as they are so likely to be linked with a multitude of problems. On the other hand, adversities like death and divorce were less likely to occur alongside other ACEs.[25]

Wide ranging outcomes

Exposure to adversity can have lasting and widespread effects on many aspects of health throughout life. ACEs are associated with some of the "leading causes of the global burden of disease".[26] In the following section we explore examples of the range of these effects; this is not an exhaustive list. It is important to note that the methodology of the ACE studies, whilst showing associations between ACEs and health outcomes, does not enable causation to be established.

Children's behaviour and mental health can be negatively affected by experiences of adversity.

"Stressful or traumatic childhood experiences such as abuse, neglect, or forms of household dysfunction are a common pathway to social, emotional, and cognitive impairments that lead to increased risk of unhealthy behaviours, violence or re-victimization, disease, disability, and premature mortality."[27]

1. Health risk behaviours

An analysis of multiple studies found that those with 4+ as an ACE score were more than 2x as likely to smoke or drink heavily and 6x as likely to have problem drinking than those with 0 ACEs.[28] It was suggested that risk behaviours such as smoking, over eating and physical inactivity may occur as ways for people to cope with the stresses they have experienced.[29]

Using data from over 5000 women the researchers studied the impact of early adversity on sexual risk behaviours in women. They found that each category of adversity was "associated with increases in the risk of early onset of intercourse, multiple sexual partners and self-perceived risk of AIDS."[30] Further, as the women's ACE score increased, so did the prevalence of sexual risk behaviour.

2. Physical health

Arguably, the most striking finding from the original ACE studies, and the many others since, is the link between experiencing childhood adversity and increased risk for a wide range of health issues in adulthood. This is striking because while most people understand the risk of long-lasting emotional and social harm from childhood adversity, few realise the strong association between a difficult childhood and poor physical health.

A dose-response relationship was found between the ACE score and the risk of many health issues. These included - cancer, skeletal fractures, liver disease, ischemic heart disease, stroke and chronic lung disease. As the ACE score increased so did the risk of poor health outcomes.[31] Two examples of these health issues, namely auto-immune disorders and ischemic heart disease, are discussed in more detail below.

20. Felitti et al., 1998
21. Hunt et al., 2017
22. Reuben et al., 2016, cited by M. C. Walsh et al., 2019
23. Tourangeau & Yan, 2007, cited by Massetti et al., 2020
24. Hunt et al., 2017
25. Kessler et al., 2010, cited by Massetti et al., 2020
26. Hughes et al., 2017, p. e365
27. Anda et al., 2010, p. 95
28. Hughes et al., 2017
29. Dong, Giles, et al., 2004
30. Hillis, Anda, Felitti, & Marchbanks, 2001, p. 210
31. Felitti et al., 1998

The ACE scores were studied in relation to 21 auto-immune disorders including coeliac disease, rheumatoid arthritis, multiple sclerosis, insulin-dependent diabetes mellitus, and irritable bowel disease.[32] These conditions disproportionately affect women, with approximately 80% of affected people being women.[33] Among the women studied, every increase in their ACE score was associated with 20% increased likelihood of being hospitalised for an auto-immune disorder.[34]

Using the ACE scores it was found that the risk of ischemic heart disease (IHD) was significantly increased among those exposed to any individual ACE, with the exception of marital discord.[35] Further, there was a graded relation whereby those with 7 or more ACEs were more than 3 times as likely to have IHD than those with no ACEs.

3. Mental health

Globally, the "burden of disease related to mental illness" is growing and childhood is an important time in laying the foundations for later mental health.[36]

For example, the ACE studies found that childhood adversity was associated with increased likelihood of experiencing hallucinations. This finding was independent of any substance abuse history. Those with an ACE score of 7 or more were five times more likely than those with an ACE score of 0 to report hallucinations.[37] In addition, those exposed to 4 or more ACE categories were at increased risk for depression, drug abuse, and alcoholism.[38]

In keeping with this, further studies have found that exposure to ACEs increases the likelihood of most types of mental illness.

Mood disorders, anxiety, substance dependence, psychosis, personality disorders, behavioural disorders and suicidal behaviour are all more likely amongst those exposed to ACEs.[39] The impact of ACEs on mental health can be seen across the lifespan, into old age.[40] This means that those who were exposed to ACEs are at increased risk of poorer mental health many decades later, suggesting that the "negative effects of childhood adversity do not become significantly weaker in later life."[41]

WHO's world mental health survey, of more than 51,000 adults from 21 countries[42] found childhood adversity was strongly associated with all 20 disorders studied. Their findings suggest that elimination of childhood adversity would lead to an almost 30% reduction in all mental disorders.[43]

Work conducted by Teicher and colleagues has also found that children exposed to maltreatment are more likely to experience mental illness. In addition, they found that children who have been maltreated are likely to experience mental illness at younger ages, with greater severity, and respond less positively to treatment.[44] Comorbidity, the presence of two or more conditions in the same person, is also more common amongst those who have been maltreated.

The original ACE study found a strong relationship between the ACE score and attempted suicide, with the risk being increased 2-5 times.[45] ACEs were found to account for approximately two-thirds of suicide attempts among the adults studied, which also indicated the long-term impact of these childhood experiences. Recent studies lend further weight to the link between ACEs and suicide attempts.

Childhood effects of adversity

The original ACE studies highlighted the connection between adversity in childhood and health outcomes well into adulthood, as the average age of study participants was 57 years[48] However, while these effects can be seen well into adulthood, this doesn't mean they begin then. Other studies indicate that the effects of adversity can be seen and experienced in childhood, sometimes quite early in childhood. Health, learning and behaviour can be affected. Some examples of these are described below.

Physical health concerns linked with ACEs include asthma, headaches, digestive conditions and poorer childhood health.[49] An ACE score of 4 or more has been associated with being overweight and obese.[50]

ACEs have been associated with lower school attendance/ higher absenteeism, poorer academic skills, learning disorders and lower school achievement.[51] When it comes to absenteeism, for example, those with 4 or more ACEs were approximately 6 times more likely to miss more than 20 days of school per year; even those with 2 or 3 ACEs had double the rate of school absenteeism.[52]

Children's behaviour and mental health can be negatively affected by experiences of adversity. Examples include increases in anti-social and violent behaviour, internalising and externalising behaviour issues, and poorer childhood mental health amongst those who've experienced adversity.[53] Those with an ACE score of 4 or more were 33 times more likely to have learning or behaviour disorders than those with no ACEs.[54]

32. Dube et al., 2009
33. Jacobsen et al., 1997, cited by Dube et al., 2009
34. Dube et al., 2009
35. Dong, Giles, et al., 2004
36. Bellis et al., 2019, p. e525
37. Whitfield et al., 2005
38. Felitti et al., 1998
39. Jorm & Mulder, 2018
40. Kessler et al., 2010, and, Raposo et al., 2014, cited by Jorm & Mulder, 2018
41. Raposo et al., 2014, p. 8
42. Kessler et al., 2010
43. Kessler et al., 2010
44. Teicher & Samson, 2013
45. Dube et al., 2001
46. Dube et al., 2001
47. Choi et al., 2017
48. Dube et al., 2001
49. Bellis et al., 2018
50. Burke et al., 2011
51. Bellis et al., 2018; Burke et al., 2011:Jimenez et al., 2016, cited by M. C. Walsh et al., 2019
52. Bellis et al., 2018
53. Bellis et al., 2018; Hunt et al., 2017; Jimenez et al., 2016, cited by M. C. Walsh et al., 2019
54. Burke et al., 2011

NZ research, from the Growing Up in NZ (GUiNZ) study, found higher levels of behaviour problems in children as young as 4.5 years amongst those exposed to adversity.[55] By this age more than half the tamariki had been exposed to at least one ACE. Those exposed to ACEs also performed more poorly on tests indicating readiness for school, including counting, recognising letters and the ability to delay gratification, in a dose-response fashion.[56]

Protective factors

Despite the findings that exposure to ACEs increases the risk of a multitude of poor outcomes, a large subset of exposed children do not have poor health outcomes. This is because many factors can be protective against this risk.[57] The following section looks at some of these factors.

As well as looking at increased risk, the ACE study considered family strengths and their potentially protective effects against early initiation of sexual activity, adolescent pregnancy and its long-term psychosocial consequences among more than 4600 women. The family strengths included "family closeness, support, loyalty, protection, love, importance, and responsiveness to health needs".[58]

Each category of family strength was associated with a significant 30% to 40% decreased risk of adolescent pregnancy, and as the number of family strengths increased, the risk of adolescent pregnancy further decreased.[59] These family strengths were found to be especially protective against early initiation of sexual activity for women who had experienced abuse or family dysfunction. Those with high levels of family strength had approximately half the rate of teen pregnancy, compared with women who had one or no family strengths.[60]

A sense of connection to one's culture, traditions, or faith has been found to be protective against the risks posed by adversity.[61] For example, a positive view of their own ethnic identity and greater access to Māori cultural traditions is linked with greater resilience and protective against poor outcomes among Māori.[62]

A recent study found that positive childhood experiences (PCEs) have a dose-response relationship to adult mental health, similar to that of ACEs. In other words, those with more of the positive experiences studied were more likely to enjoy good mental health in adulthood, despite the presence of ACEs.[63] The PCEs studied were: being able to talk to family about their feelings, feeling that family stood by them in difficult times, feeling safe & protected by an adult in their home, having had at least 2 non-parent adults who took a genuine interest in them, feeling supported by friends, a sense of belonging at high school, and enjoyed participating in community traditions.[64]

There is much support in the literature for the powerful role of nurturing caregiving, which can protect against the physiological effects of adversity on cortisol reactivity, inflammation and cell aging.[65]

Closer to home, analysis of the Growing Up in New Zealand data explored protective factors of children who were at risk of having a high ACE score, and yet experienced no ACEs by 4.5 years of age. Protective factors included the mother-partner relationship, family finances, parent health, community/neighbourhood factors, and the relationship between the parent and child. Of particular note was their finding regarding the significance of the mother-partner relationship.[66]

As has been pointed out, "it is crucial that alongside public discussion of ACEs there is at least as much emphasis on resilience and potential for change towards more positive trajectories."[67] There is a lot of "potential for recovery and resilience among children exposed to various forms of adversity."[68]

Where do poverty & racism fit?

ACEs are relatively common, and can occur across socio-economic groups. However, some populations, including those growing up in poverty, are more likely to experience multiple adversities, than those whose family have sufficient resources.[69] Social and structural factors influence ACE exposure, which in turn intensify "inequities in health, social and economic outcomes across generations."[70]

Some studies include poverty as an adversity,[71] whilst others see it as a risk factor, or macro-driver for many childhood adversities.[72] Given poverty's link to increased ACE exposure, reducing poverty is likely to reduce the prevalence of ACEs.[73]

The association between family income and ACEs has also been found in Aotearoa. For example, the GUiNZ data indicates that tamariki whose family income was $20,000 or less experienced more than 3 times the number of ACES than did children whose family income exceeded $150,000.[74]

There has been some criticism of ACE-awareness initiatives that focus narrowly on individual or whānau level factors, and do not address factors at the societal level. [75] Reducing poverty is an important element in reducing ACE exposure, with interventions such as income supplementation and housing showing effectiveness in ACE reduction.[76]

55. Wallander et al., 2019
56. M. C. Walsh et al., 2019
57. Center on the Developing Child at Harvard University, 2015, cited by Bellis et al., 2018
58. Hillis et al., 2010, p. 18
59. Hillis et al., 2010
60. Hillis et al., 2010
61. Bellis et al., 2018; National Scientific Council on the Developing Child, 2015
62. Houkamau & Sibley, 2011; Muriwai et al., 2015
63. Bethell et al., 2019
64. Bethell et al., 2019
65. Berens et al., 2017
66. M. C. Walsh et al., 2020
67. Lacey & Minnis, 2020, p. 122
68. Leve & Cicchetti, 2016, p. 622
69. Lacey et al., 2020; Merrick et al., 2018
70. Merrick et al., 2018, p. E4
71. Appleton et al., 2017, cited by Lacey et al., 2020
72. Lacey et al., 2020; Massetti et al., 2020
73. Liming, 2008, cited by Lacey & Minnis, 2020; D. Walsh et al., 2019
74. M. C. Walsh et al., 2019
75. Fond et al., 2015, cited by Lacey & Minnis, 2020
76. Lacey et al., 2020

Despite the richness of indigenous culture, members of indigenous communities are more likely to be living in poverty.[77]

Poverty is often entwined with racism and the ongoing impacts of colonisation in Aotearoa. These include the loss of land, language and cultural connection, not adequately accounted for in ACEs checklists.[78]

While the ACE studies consider parental imprisonment an indication of family dysfunction, racism at a societal level also plays a role in the greatly differing levels of imprisonment between those of different ethnicities.[79]

There are increasing calls for research to consider the impacts of sociopolitical systems and their impact on families.[80]

Conclusions

The ACE studies increased awareness of "the detrimental impact of 'adversity' on physical health, mental health, social functioning, health risk behaviours, and life expectancy."[81] These findings have since been replicated in many other countries.[82]

Key findings from the ACE studies include:

- ACE exposure is prevalent, with exposure to one or more ACE common
- Many ACEs are interconnected; exposure to one ACE is often associated with exposure to others as well
- ACEs operate cumulatively; in other words, as the number of ACEs increase, so does the likelihood of poor health outcomes
- The effects can be wide ranging, across many aspects of physical and mental health
- Associations between adversity during childhood can be seen across the lifespan, decades after the exposure

Other points to note:

- A limitation of the ACE studies is their focus on family level factors without consideration of the wider social or economic factors that influence them. It's important to understand the possible impact of family level factors on child outcomes but not at the expense of factors at other levels
- Positive experiences, notably nurturing relationships with committed adults, support resilience in the face of exposure to adversity, and reduce the risk of poor outcomes[83]
- "Care should be taken that the messages from ACEs research are not communicated in a deterministic way. Crucially, risk at the population level does not imply that an individual is going to have negative future outcomes"[84]
- Exposure to ACEs, even multiple ones, does not "mean that poor outcomes are inevitable"[85]
- The impact of adversity is felt not only by the exposed individual, but also the wider community[86]

As with any research, the ACE studies do not provide all the answers. They do provide a strong indication of the potentially lasting effects of adversity, reinforcing the need to both reduce exposure to them, and provide timely, effective supports for those who have been affected.

Glossary of Māori words

Tamaiti - child
Tamariki - children
Rangatahi - youth, younger generation

If you found this article useful, here are others that may be of interest

Family Violence: children get hurt
https://www.brainwave.org.nz/family-violence-children-get-hurt/

The experience of poverty for infants and young children
http://www.brainwave.org.nz/the-experience-of-poverty-for-infants-and-young-children/

Risk & protective factors in child development
https://brainwave.org.nz/article/risk-and-protective-factors-in-child-development/

The fully referenced version of this article can be found at www.brainwave.org.nz

77. World Bank, n.d., cited by Witherspoon et al., 2020
78. Taonui, 2010, and, Ware et al., 2017, cited by Joy & Beddoe, 2019
79. Alexander, 2011, cited by Allen & Abresch, 2018
80. Witherspoon et al., 2020
81. Hambrick et al., 2019, p. 1
82. Hughes et al., 2017
83. Bethell et al., 2019; Lacey & Minnis, 2020
84. Lacey & Minnis, 2020, p. 122
85. Lacey & Minnis, 2020, p. 122
86. Massetti et al., 2020

getting the brain you need for the world you find yourself in

why early brain development matters

Written by Sue Younger, MA(Hons), MCW (Hons), DipTchg, DipProfEth, Trustee

Ko te ahurei o te tamaiti arahia ō tatou māhi.
Let the uniqueness of the child guide our work.

From the moment they are conceived until about the end of their third year of life, humans grow faster than they will ever grow again, developing from a few microscopic cells into the delightful, walking, talking, climbing, challenging, empathetic bundles of personality that are three-year-olds.

What makes tamariki turn out the way they do? How are they able to learn so much so quickly? Why do they react in their own ways? Genes play an essential part. So too does the environment of the womb they are nurtured in. And, of course, the world they are born into, especially their relationships with others.

Individuals, whānau, iwi, communities, services and governments play a critical role. While genes provide essential potential, there is much evidence that early experiences, both positive and negative, can have life-long consequences for health and well-being. For babies and tamariki, their early interactions with the world, working with their genes, lay the foundations for their lives.

Much of this is related to the development of their brain at a microscopic level.

The brain & body are connected

While different regions of the brain have varied functions, they are extremely inter-connected. Naming different parts as 'responsible' for something is always over-simplifying. In turn, the brain is intricately linked to the immune system, the gut, the heart, the blood, the muscles, the bones and there is a constant 'backwards and forwards' flow of information and learning from one organ, or system, to another.

The brain constantly reads, interprets and influences what is happening within the tinana (body) and in the world around us, throughout our lives. Understanding some of the ways early brain development occurs gives us insight into the lifelong effects of early experiences.

Importantly, the infant brain is enormously 'plastic' - that is, able to learn, adapt and change. Although we continue to learn throughout our lives, this ability gets less with age.

Brain development pre-birth

Beginning just days after conception, brain development before birth forms a critical foundation for later learning. While in utero babies grow the majority of the neurons, or nerve cells, they will ever have.[1] These multiply at an astonishing rate, differentiate into different types of cells for specific parts of the brain, form into 'structures 'and begun to 'connect up.' All this in just 7-9 months! During this pre-birth period, factors such as Mum's health, her nutrition, and the support she has, interact with genes to shape the rapid development of the brain.[2]

Brain development after birth

Babies are born with brains that, though tiny, are organised very much like adult brains. Newborns are well wired for 'survival'. The most 'developed' area of their brain is the brainstem, at the bottom. They can breathe, the organs in their body are usually fully formed and working, they can cry for what they want, and they can suck and digest milk for food. But they still need adults in order to survive. Very soon they learn to smile and to chuckle, and to charm some adults completely.

As babies look around, hear sounds, feel things on their skin, taste things and move their body in space, their brain grows and changes rapidly. More and more they are able to take clues from the world around, and these clues become increasingly powerful in shaping who they become. In turn, who it is they are becoming helps shape their experiences and the way others react to them. Are they curious? Are they funny? Are they empathetic?

Most of the growth and development of the brain after birth is not about forming new neurons, or nerve cells, which has almost all happened in utero. It is more about forming crucial connections between those neurons. Synapses, which allow the brain cells to 'connect' and communicate with each other, form rapidly. Networks of connection that will last their entire life form for different functions. This is driven by both genes and experiences.

As the brain continues to grow rapidly, there is also a cascade of growth of other brain cells - usually known as glia - that are not neurons. Sometimes called 'caretaker' cells, they carry out a variety of tasks that support and strengthen the neurons. Glia are multiplying enormously after birth, as well as differentiating and maturing.[3] They are very important in the way the brain will function.

With different sensory input, the brain develops differently.[4] A powerful influence on this growth and connecting up in these early years is the gentle touching, smell and language of those who love, nurture and protect them. Caregivers and whānau influence both the types of experiences babies have, and the way in which they understand and react to those experiences.

Timing Matters

By one year the brain is 2.5 times the weight it was at birth and by the age of two it is 3 times the birth weight and roughly 80% of the adult weight.[5] Although brain weight is but a very raw measure of how the brain is functioning, nevertheless this growth is striking.

It's important to remember, though, that while a two-year old's brain is around 80% of the weight of an adult brain, it is not functioning at 80% of an adult's brain.[6] While they are amazing at learning to talk and run, it would be wrong to try to teach them to drive, for example. There is a lot of brain change to come. Some of it is about making their brains more efficient.

Thus, the process of both growth and development tends to follow patterns over time. Learning builds on the skills they have already built.

Take physical movement. We watch as pēpi learns to support their own head, rolls, sits, crawls, walks with help and then walks unsupported. Whānau provide space, safety and opportunity for all this to happen and it usually happens in order and within a general time frame.

Babies need adults.

A very similar process is occurring less visibly in many areas of the brain including, importantly, the way the individual learns to react to stress, to regulate their own behaviour, and to relate to others.

At first, babies rely on adults to soothe and calm them down, to feed them when they are hungry, and put them to bed when they are tired. Gradually, they learn to soothe themselves and to cope with stress in their own ways.

Relationships with others are very important, for self-regulation and for many other things. The networks for relationships begin forming very early indeed. It's a two way street - babies both influence, and learn from, the relationships they have with those around them.[7]

Just think about the experience of swimming in the sea. A tamaiti can be delighted by the ocean, and cooled by it. If Dad, or others who love the child, are nearby, holding him when he is a baby, standing near him when he is a toddler and watching him from the shore as he grows older, he will learn usually to stand up, to swim, to delight, to balance, to marvel. It is ok if he falls occasionally, or suddenly gulps salt water, and cries.

1. Webb et al., 2001
2. Monk et al., 2019
3. Stiles & Jernigan, 2010
4. Stiles & Jernigan, 2010
5. Dekaban & Sadowsky, 1978
6. Levitt and Eagleson, 2018
7. Parsons et al., 2010

If Mum is there to pick him up, cuddle him, laugh with him at the surprise he got, he is likely to try again. She learns to understand which challenges her child is ready for, responds to the way her child is reacting to the water and reassures them if they are frightened. And every child will be different in the way they react.

But if a child wanders into the ocean, and no-one is watching or supporting her, even a little current, or a tiny wave is likely to swamp or knock her over. Her risk of being overwhelmed with fear and stress is high. She will have no understanding of why this 'stuff' (water) is so terrifying, although she will probably learn that it is to be feared. She may take great persuasion to ever try again.

In this way, the support of caregivers helps pēpi and tamariki to learn about the world, safely in a positive way and at about the time they are ready.

Some skills even have a set period of time when they can be learned, and sometimes this can close if a baby does not get the sensory experiences they need. Thus babies who suffer early neglect may struggle to 'catch up' or fully develop their potential.

Trial and Error

One thing that makes humans enormously adaptable is that there is a lot of room for 'trial and error'. Many, many connections are formed, and only some of them are strengthened and made more efficient. All the way through there is a process of over-production and then 'pruning' of the connections, and this is the principal way the brain is developed and shaped in the early years. Thus not every negative or positive experience is critical on its own.

Generally those connections that are most used are strengthened, and those used less often are pruned away.[8] This is where repetition comes in. Children need to do things over and over again, in order to develop, strengthen and preserve their neural networks of connections. Tamariki seem to know this; whether it's repeatedly dropping objects onto the floor or asking for the same bedtime story for many nights in a row. Think how practise makes us better at riding a bike, or learning a language. Tamariki are practising everything. Play is one major way of doing this.

All children will have both negative and positive experiences at different times. But it is the experiences they have over and over again that most influence which connections are pruned and which are kept. This teaches them about the world.

If their experiences are mostly positive, and if they are well supported through their negative experiences, this might help them to 'trust' the world and lessen their stress. However, if the world is often overwhelming and frightening, and they are without adult support, they may form a different brain. While they could be excellent at 'surviving' under stress, this could come at the cost of learning other skills, and potentially also at the cost of 'flourishing'. 'Surviving' and 'flourishing' are two very different outcomes.[9]

A lovely phrase we use at Brainwave is that early brain development is 'experience made flesh'. This captures the idea that experience can actually physically change the structure and the organization of the brain. This is the way we get the brain we need to suit the very different worlds that we all live in.[10] It's an incredibly adaptable system.

Glossary of Māori terms

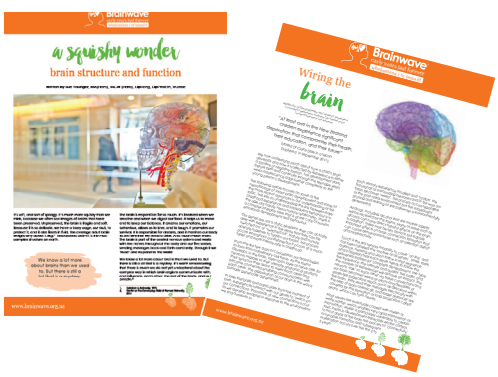
pēpi - baby
tamariki - children
tamaiti - child
tinana - body
whānau - extended family

If you enjoyed this article, here are a couple of others that may be of interest:

A Squishy Wonder. Brain Structure and Function
https://www.brainwave.org.nz/a-squishy-wonder-brain-structure-and-function/

Wiring the brain
https://brainwave.org.nz/article/wiring-the-brain/

The fully referenced version of this article can be found at www.brainwave.org.nz



8. Levitt & Eagleson, 2018
9. Moore et al., 2017
10. Stiles & Jernigan, 2010

Brainwave Conference 2021 - Online

This year's Brainwave Conference is going online. Our 2020 conference was postponed due to the Coronavirius (COVID-19) outbreak, so an online format has been adopted.

The focus remains the same: The importance of genuine engagement with families through a nurturing system that lifts and supports them.

We are pleased to announce an additional keynote speaker - Assistant Māori Children's Commissioner, Glenis Philip-Barbara. She joins Dr Robyn Mildon – Executive Director – Centre for Evidence and Implementation; Knowledge Translation & Implementation, Melbourne

To book tickets, or to find out more, head to:
https://brainwave.org.nz/event/brainwave-online-conference-2021/

Fundraising

Brainwave Kaiako Debbie Rewiri, presenting Tiakina te Tamaiti

Brainwave Trust Aotearoa is a registered charity.

Support from the community enables us to work towards our vision that all children in Aotearoa New Zealand are valued and nurtured in order to reach their full potential.

All donations received go towards fulfilling our mission of sharing knowledge about the critical importance of the first thousand days of life.

Donations can be made via our website.

An acknowledgement and GST receipt will be sent promptly for all donations.

Thank you for your support.

Charities Commission Registration Number: CC40312.

Brainwave Trust Aotearoa
Whakamana i te tamaiti

Every childhood matters. That's why we speak up about the importance of brain development in the early years. Brainwave's vision is that all children in Aotearoa New Zealand are valued and nurtured so they can reach their full potential.

We are a charitable trust that aims to educate everyone involved in the life of a child about the importance of early experiences on brain development and their lifelong impact.

Brainwave has no political or religious affiliations and is known for relying on strong evidence and for the scientific integrity of all its material.

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