

Picking-up, supporting, and nurturing youth who feel a sense of belonging and pride in our communities, and who achieve their full potential to secure their future.

Young people's vulnerability: Toxic stress and the executive function.

Abstract

When we first started working with young people, we thought that improving their academic achievement and helping with behavior management would lead to better engagement with learning and education. When we looked at our data and outcomes, we realized that most of what we were doing with the young people centered on improving executive function, which then led to improved outcomes in learning and behavior. We discovered that toxic stress was robbing these young people of their executive functions. The sheer effort it takes to cope with the stressors in their day-to-day lives negatively affects their ability to self-manage, to plan, to focus, and to adapt. This presents itself as kids who are easily distracted in the classroom, who have poor self-control over their emotions and behaviors, who can't focus, and have poor decision-making. Young people living with high risk factors [and the toxicity this creates] is what determines vulnerability and poor child outcomes – a national issue this country is grappling with. Investing in the health and wellbeing of our young people is conducive to our social and economic goals for a sustainable future, but it is also our moral and ethical responsibilities as a society.

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“A manuia fanau, e manuia aiga, nu’u, ma Ekalesia” – This is a well-known Samoan saying that many Samoans in New Zealand and the homelands have grown up with. In English, it translates to: "when our children succeed and do well, it has positive spillover effects for their families, villages, churches, and nation".

In Samoan and many Pacific societies, children are believed to be a *tofi* (inheritance) from God. The Christian bible teaches us to ‘Train up a child in the way he should go; and when he is old, he will not depart from it’ -Proverbs 22:6. Samoa also has a well-known saying “*O le tama a le tagata e fafaga i upu ma tala, a o le tama a le manu e fafaga i fuga o laau*” – “The offspring of men are fed with words but the offspring of birds are fed with seeds”. In the Congregational Christian Church of Samoa tradition, when a child is baptised, all who witness this sacred ceremony (the family and the church community) are endowed with the responsibility of raising the baptised child in the ways of the church and in the fa’aSamoa (Samoan way of life). Hence the saying: ‘it takes a village to raise a child’.

These Pacific values and beliefs about the importance of nurturing children within loving, caring, and supportive collective social networks is echoed in the scientific literature, specifically in the neuroscience and psychological fields dedicated to research on children and young people's healthy development and wellbeing. In their technical report on the lifelong effects of early childhood adversity and toxic stress, Jack Shonkoff and colleagues concluded that:

“A vital and productive society with a prosperous and sustainable future is built on a foundation of healthy child development” (Shonkoff et al., 2012, p.242).

With the goal of securing New Zealand’s economic future, amidst the country’s ageing population and shrinking labour force, the health and wellbeing of youth have increasingly become the subject of government policies and strategies. As manifested in the Ministry of Youth Affairs strategy for child and youth development: “educational or employment failure for any group of young people will cut deeply into our health and wellbeing as a society”. (2002, p. 4)

New Zealand, like all nations across the world is facing a number of economic and social challenges that must be met to secure a promising future. Central to this task is the need to produce a well-educated and healthy adult population that is sufficiently skilled to participate in a global economy and to become responsible stakeholders in a proactive society. While this goal speaks to society's economic, political, and social interests, equally important are our ethical and moral values, whereby we prioritize nurturing, protecting, and ensuring the health and wellbeing of all young children as an important objective in its own right, regardless of whether measurable returns can be documented in the future.

Advances in neuroscience, molecular biology, epigenetics, and the behavioural and social sciences indicate that the foundations of educational achievement, lifelong health, economic productivity, and responsible citizenship are formed early in life (Shonkoff, 2011). This shift is supported and driven by compelling evidence that demonstrates the robust relations amongst genes, early experiences, and environmental influences in shaping the architecture and function of the developing brain. Young children do not simply follow fixed genetic trajectories, environments do matter, and significant early adversity can have lifelong consequences for learning, behaviour, and health (Shonkoff & Levitt, 2010).

Young children, the developing brain, and toxic stress.

An environment of stable, stimulating, and protective relationships builds a strong foundation for a lifetime of effective learning. In contrast, when young children are burdened by significant adversity, stress response systems are overactivated, maturing brain circuits can be impaired, metabolic regulatory systems and developing organs can be disrupted, and the probabilities increase for long-term problems in learning, behaviour, and physical and mental health (Garner, 2013; Heyman & Hauser-Cram, 2015; Shonkoff & Levitt, 2010; Shonkoff, 2011).

As the primary organ for stress and adaptation, the brain interprets and regulates behavioral, neuroendocrine, autonomic, and immunologic responses to adverse events, serves as a target of both psychosocial and physical threats, and changes both structurally and functionally because of

significant adversity (McEwen, 1998a; 1998b; 1999; 2007).

There is extensive evidence that significant adversity can lead to excessive activation of stress response systems (including persistently elevated stress hormones, such as cortisol) that can disrupt the developing brain (Garner, 2013; Gershoff, 2016; Kishiyama, Boyce, Jimenez, Perry, & Knight, 2009; Kostolitz, Hyman, & Gold, 2014, McEwen, 1998a; 1998b; Shonkoff & Levitt, 2010; Shonkoff, 2011; Shonkoff et al., 2012). When children experience recurrent threat, fear conditioning affects developing circuits in the amygdala and hippocampus which can lead to anxiety that impairs learning. This “fear learning” can begin early in infancy, whereas, “fear unlearning” requires further developments of the prefrontal cortex (PFC) later in childhood. Because these higher-level neural circuits have extensive interconnections with deeper structures in the amygdala and hippocampus that control simple memory formation and responses to stress, executive function skills both influence and are affected by a young child’s management of strong emotions. Thus, early and repeated exposure to adversity can lead to emotional problems, as well as comprised working memory, cognitive flexibility, and inhibitory control (Shonkoff et al., 2012).

The National Scientific Council on the Developing Child proposed a simplified three-level taxonomy – positive, tolerable, and toxic – to describe the physiological expression of the stress-response system (not the nature of the stressor or the distinction between objectively measured versus perceived stress) that can affect brain development.

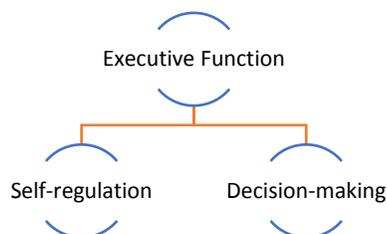
- **Positive stress** is characterized by moderate, short-lived increases in heart rate, blood pressure, and stress hormone levels. Precipitants include such challenges as dealing with frustration and separation anxiety. The essential nature of positive stress is that it is an important aspect of healthy development that is experienced in the context of stable and supportive adult relationships which facilitate adaptive responses that restore the stress-response system to baseline status.
- **Tolerable stress** refers to a physiological state that could potentially disrupt brain architecture (e.g., through cortisol-induced damage of neural circuits or neuronal death)

but is buffered by supportive relationships that facilitate adaptive coping. Precipitants include the death or serious illness of a love or a natural disaster. The defining characteristic of tolerable stress is that it occurs within a time-limited period during which productive relationships help to bring the body's stress-response systems back into homeostatic balance, thereby giving the brain enough time to recover from potentially damaging effects.

- **Toxic stress** refers to intense, frequent, and/or prolonged activation of the body's stress-response and autonomic systems in the absence of the buffering protection of adult support. Major risk factors include chronic neglect, recurrent abuse, severe maternal depression, parental substance abuse, and family violence, with or without the additional burdens of poverty. The defining characteristics of toxic stress is that it disrupts brain architecture and neurochemistry, adversely affects other organs, and leads to stress-management systems that establish lower thresholds for responsiveness that persist throughout life. Stated simply, toxic stress during the early childhood period increases the risk of physical and mental illness, as well as cognitive impairment, well into the adult years.

Young children who experience the burdens of multiple economic and social stressors enter preschool with higher rates of emotional difficulties related to fear and anxiety, disruptive behaviors, impairments in executive function and self-regulation, and a range of difficulties categorized as behavior problems, learning disabilities, attention deficit hyperactive disorders, or mental health problems (Morton, Atatoa Carr, Grant, Berry, Mohal, & Pillai, 2015). Vulnerable children who do well in school often have well-developed capacities in executive function and emotional regulation, which help them manage adversity more effectively and provide a solid foundation for academic achievement and social competence (Fishbane, 2007; Garner, 2013; Gershoff, 2016; Kishiyama et al., 2009; Kostolitz et al., 2014).

Executive Function - self-regulation & decision-making: A common reservoir



The capacity to hold in mind multiple concepts, suppress inappropriate thoughts and responses, delay gratification, self-monitor and reflect on performance, think more strategically, and sustain goal-directed actions requires the brains *executive function skills*. *Self-regulation*, which is housed under the executive function of the self, is the self's ability to exert control to override a prepotent response, with the assumption that replacing one response with another is done to attain goals and conform to standards. Like self-regulation, *decision making* is also housed under the self's executive function. The rich complexity of life is partly attributable to *choice*. Each day millions of people make multiple decisions. Moreover, choices have proliferated, increasing the number of decisions people can (and must) make. The proliferation of choice is evident in the number of television channels, dating partners, investment options, and coffee brands for example, that we can choose from (Baumeister, 2003; Farley & Kim-Spoon, 2014; Stucke & Baumeister, 2006; Vohs, Baumeister, Schmeichel, Twenge, Nelson, & Tice, 2014).

Psychological studies have shown that many of the self's activities (self-regulation & decision-making) depend on a common resource (i.e., a common reservoir), akin to energy or strength. All of these activities draw on the same resource, which is limited and seems easily depleted (also termed ego depletion). Ego depletion has been linked to multiple behavioral problems, including overeating by dieters, prejudicial responding, ineffective self-presentation, intellectual underachievement, inappropriate sexual responses, and impulsive overspending (Vohs et al., 2014). For example, trying to maintain a healthy weight by exercising regularly and eating a healthy diet (*decision-making*), while at the same time controlling the urge to eat unhealthy foods and stay in bed all day (*self-regulation*) is physically taxing on this common reservoir. If this

reservoir is not replenished (e.g., through positive self-affirmations, glucose consumption), then we are unable to exercise self-control in other areas of our lives (e.g. we procrastinate in our school work, or we over-spend beyond our available finances).

During adolescence, youth experience increased demands to juggle multiple school assignments, integrate higher level academic material, and negotiate social peer groups. The adolescent years are also critical to the formation of one's "identity". At any point in history we will find that the opportunities available to youth for identity formation differ. For instance, for the grandparents of today's youth, cultural exploration was restricted by geographical boundaries and the only cultures available was that of their families, church and communities. With increasing globalization and the popularity of social media, today's youth literally have access to thousands of cultures and opportunities for identification at their fingertips.

A myriad of options to choose from can be distressing for any individual. But this can be especially stressful for adolescents whose brain areas that are responsible for executive function tasks (i.e. self-control, decision making) are not yet fully mature (see review of the literature in Gluckman & Hayne, 2011). While this is typical development for most adolescents, for those with a history of multiple risk factors, the structural and functional changes in the brain regions responsible for executive functions due to toxic stress may further hinder their abilities to navigate the complexities of adolescence. For example, Toglia and Berg (2013) compared abilities and strategy-use of at-risk youth with those of a community sample of high school students using a performance measure of executive function and found that the at-risk group made more errors, used fewer strategies, and broke more rules than the community group. Other studies have shown that youth with a history of multiple risk factors are more likely to initiate drinking alcohol as a means of coping with stress than for social reasons, manifest higher rates of risk taking behaviors (e.g., drug use, gambling), and are more likely to be at risk of school failure, gang membership, unemployment, poverty, homelessness, violent crime, incarceration, and becoming a single parent (Anda, Croft, & Felitti, 1999; Compass, 2006; Gunnar & Quevedo, 2007; Rothman, Edwards, Heeren & Hingson, 2008; Scherrer, Xian, Kapp et al., 2007; Wickrama, Conger, Lorezon & Jung, 2008).

Other studies have shown that adults in the high-risk group who become parents themselves are less likely to be able to provide the kind of stable and supportive relationships that are needed to be able to provide the kind of stable and supportive relationships that are needed to protect children from the damages of toxic stress. This intergenerational cycle of significant adversity with its predictable repetition of limited educational achievement and poor health, is mediated, at least in part by the social and disrupted social networks that contribute to fragile families and parenting difficulties (Raver & Blair, 2016; Shonkoff, 2011; Shonkoff et al., 2012).

Statistics on the status of Pacific youth in New Zealand

Pacific youth face more challenges in attaining good health and well-being, in comparison to other young New Zealanders (Ministry of Health, 2008). Majority of Pacific youth are growing up in New Zealand's most impoverished neighborhoods, which are generally characterized by "lower standards of living, more overcrowded housing, low-decile schools and fewer social, sports, and leisure facilities for youth" (Ministry of Health, 2008, p. vii). Of concern also is the relatively high number of Pacific youth engaging in or exposed to: youth gangs and group violence (Brooking, Gardiner, & Calvert, 2008; Ioane, Lambie, & Percival, 2014; Tunufa'i, 2013; Tupuola, 2004); youth suicide (Lino, 2015; Tiatia, 1998); truancy (Baleinakorodawa, 2009), binge drinking, alcohol abuse, and drug use (Helu, Robinson, Grant, Herd, & Denny, 2009; McMillen, Kalafatelis, & De Bonnaire, 2004); unsafe sexual practices (Sparrow et al., 2007); poor help-seeking behaviours, violence in the homes, and engaging in sedentary behaviours such as spending long hours watching TV (Helu et al., 2009; Mila-Schaaf, Robinson, Schaaf, Denny, & Watson, 2008). These findings are problematic, especially given the growing youthfulness of the Pacific population in New Zealand (46.1% are less than 20 years old, compared with 27.4% for the total New Zealand population; Ministry for Pacific Peoples, 2016; Statistics New Zealand and Ministry of Pacific Island Affairs, 2010), and young Pacific peoples are key stakeholders in the positive and long-term transformation of Pacific peoples both here in Aotearoa and their respective island countries. Growing strong and resilient youth is vital to the attainment of New Zealand's goals of equity and justice, and its aspirations as a culturally diverse nation. As recognized in the Pacific Youth Health report: "*continuing to address risk factors and develop effective interventions for Pacific youth at risk of poor health outcomes needs to be considered a worthwhile investment in the future of the nation*" (MOH, 2008, p.vii).

Conclusion

Over and above its toll on individuals, it is also important to address the enormous social and economic costs of toxic stress and its consequences for all of society. The multiple dimensions of these costs extend from differential levels of civic participation and their impacts on the quality of community life to the health and skills of the nation's workforce and its ability to participate successfully in a global economy. Evidence that executive function and self-regulation predict literacy and numeracy skills underscores the salience of these capacities for targeted intervention. The same neuroplasticity that leaves these capacities vulnerable to early disruptions also enables their facilitation during sensitive developmental periods (Shonkoff et al., 20.12). The scientific case for investment in vulnerable, young people is clear – brains require more physiological energy to compensate later in life when neural circuits are not formed appropriately in the beginning, and society is likely to pay higher cost in remedial education, clinical treatment, public assistance, and incarceration when opportunities for preventive intervention are ignored (Shonkoff, 2011).

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