Childhood Trauma and Neural Development.

Indicators for Interventions with Special Reference to Rural and remote Environments

By
Dr Pieter Rossouw
Current Neurobiological research indicates that most mental illnesses begin earlier in life than was previously believed (Insel, Fenton 2005). An alarming epidemiological study of 10,000 adolescents in the USA indicates that one in every four to five youths meets the criteria of a mental disorder with severe impairment across the lifetime (Merikangas et. al. 2010). The study indicates the need for strategies that are based on prevention and early intervention. Studies indicate the need for enhancing neural development by decreasing exposure to unhelpful stressors that up regulate the HPA (hypothalamus-pituitary-adrenal) axis (Schonkoff 2011). Schonkoff and colleagues (2011) indicate that interventions that enhance executive function and self-regulation and enhance the abilities of vulnerable mothers (beginning as early as pregnancy), offer promising markers to protect the developing brains of their children from detrimental neural development.
Neural development & attachment

The attachment relationship is central in the development of early intervention programs (Schore & Schore 2008). The neurobiological basis of John Bowlby’s attachment theory (Bowlby 1969, 1973, 1980, 1988) points towards its biological nature – the structural connectivity of the right hemisphere, limbic connectivity and neural facilitation of the implicit self (Schore 2008). Whereas Bowlby focused on the behavioural and cognitive development in early childhood, modern attachment theory focuses on neural connectivity. Down regulation of limbic alertness plays a vital role in the development of a safe, secure attachment relationship whereas unstable patterns (that is unstable emotional or physical attachment) lead to insecure, ambivalent or disorganised attachment.

These attachment patterns tend to stabilise into long term patterns of functionality or dysfunctionality, depending on the initial trajectory, with an alarming stability of seventy percent twenty years post initial assessment (Waters et al 2000). This study is in line with the trend projected by the study of Merikongas 2010.

Violations of the basic human needs for attachment and control (Epstein 1993; Grawe 2007), lead to the onset of up-regulated limbic alertness, down regulation of cortical neural sprouting, and decreased right frontal cortical development.

Violations of the basic human needs for attachment and control, lead to the onset of up-regulated limbic alertness, down regulation of cortical neural sprouting, and decreased right frontal cortical development

significant resilience against the expression of genetic risk. Animal studies by Shen and Battersby clearly indicate protection against expressions of genetic risk through enriched environments (Shen & Battersby 2000). Programs to enhance secure attachments and the down regulation of stress responses are highly indicated to reduce the risk and onset of mental illness.

Childhood trauma & neural growth

Childhood trauma violates the basic needs of attachment and control. Abuse (physical and/or emotional) up regulates the survival response and inhibits frontal cortical sprouting. Early interventions to address these needs are highly indicated. Effective programs need to be based on two key principles of neural anatomy and neural development:

1. The principle that the brain develops from the bottom to the top:

   - The first phase of neural development involves the formation of the primitive brain – the brain stem, pons and the cerebellum (the survival systems). Large numbers of precursor (stem) cells activate the production of specific neurons in targeted areas (up to 250,000 per minute).


   - The second phase of neural development involves the development of the paleomammalian brain - limbic structures – thalamus, amygdala, hypothalamus, hippocampus and basal ganglia (the stress and emotional response systems)

   - The third phase of neural development is the development of the cortical regions – the neocortex (the executive control systems).

Childhood trauma & neural growth

Childhood trauma violates the basic needs of attachment and control. Abuse (physical and/or emotional) up regulates the survival response and inhibits frontal cortical sprouting. Early interventions to address these needs are highly indicated. Effective programs need to be based on two key principles of neural anatomy and neural development:

1. The principle that the brain develops from the bottom to the top:

   - The first phase of neural development involves the formation of the primitive brain – the brain stem, pons and the cerebellum (the survival systems). Large numbers of precursor (stem) cells activate the production of specific neurons in targeted areas (up to 250,000 per minute).

2. Second: the principle of neural development and proliferation. The principle of neural development indicates that the brain is not fully developed at birth.
The first area of the brain to fully develop is the brainstem and then the lower part of the midbrain. These areas control bodily functions necessary for life – sometimes referred to as the autonomic functions. At birth, these lower functions are fully developed and functional facilitating basic survival responses: breathing, eating, sleeping, seeing, hearing, smelling, making noise, feeling sensations and recognising people. These are crucial functions – all needed for basic survival. Violation of any of these functions will compromise survival. This is the area that MacLean named the primitive / reptilian brain – a capability shared with all living creatures. This neurological ability is crucial in the quest to understand mental well-being and disorders. Recent findings in neuroscience indicated that synaptic connections (synaptic potentials) form the basis of what constitutes “an individual” and when neural connections change, the neural networks change resulting in the individual “changing” – emotionally, cognitively and behaviourally. These changes facilitate healthy development (given safe, enriched environments) or pathology (in situations where there are violations of basic needs).

The second region that develops in the prenatal brain is the region that involves the structures on top of the brain stem and lower midbrain – the areas in the upper midbrain section. McLean coined the term “limbic” structures (MacLean 1990) – the thalamus (chamber), the amygdala (almond) the hypothalamus (below-chamber) and the hippocampus (sea horse). These structures evolve on each side of the brain as it begins to development towards the two hemispheres in the cortical regions. The limbic areas are fully developed at birth but do not function optimally (in comparison to the brain stem areas that are fully operational at birth. These areas need environmental interaction to assist with the activation process. During the first ten to twelve months of the newborn’s life most of the expressions of these functions occur. Input from the environment shapes the limbic structures.

The infant brain comprises around one hundred billion neurons. Each neuron has up to ten thousand synapses – resulting in a capacity of one trillion connections. During the first ten months post birth synaptogenesis is facilitated at blistering pace. By year three the young brain has up to three trillion neural connections. Then the process turns around – the neural connection reduces at an even more blistering pace – millions of connections stop connecting every minute – reducing the connections back to around one trillion within a few years. And whilst this reduction is happening the brain is still developing through the process of neural pruning as the neural network be-
comes stronger. Effective pruning is vital for effective growth but it can only activate effectively in a down regulated limbic system facilitated by a healthy, supportive and rich environment.

Violation of the safe environment (any threat to basic safety, or basic needs) also leads to changes in the synaptic connections. These changes result in closed neural systems of protection that are facilitated by the overproduction of stress hormones (adreno-corticotrophin hormone, adrenalin and cortisol) which push the brain into constant hyper alertness and closed neural firing – altering the networks of healthy neural patterns.

The third phase of neural development involves the upper region of the neural system - the cortex. This region is greatly undeveloped at birth, making it most susceptible to signals from the environment during development. A good, supportive, healthy and enriched environment (where the basic needs of secure attachment, control, development of sense of self, and pleasure maximization) is essential for the brain to develop connections and networks that support well-being. Violation of any of these needs causes major disruption in the chemical production, the neural connectivity, neural plasticity, and ultimately the neural networks (Kandel et.al 2013).

The implications are significant in terms of our understanding of the development of wellbeing, the pathogenesis of mental disorders and trauma, and even more important in the consideration of strategies to address these issues (Van Eekelen et.al. 2011).

**Bottom up development**

The development of the brain from the bottom to the top also indicates the neural pathway for the activation of distress signals. Distress signals follow a particular pattern in the excitation and inhibition of neural connections. These activities lead to changes in cortical blood flow from the upper neural (cortical) regions to the deeper neural regions to ensure effective ability to maximise the survival response. Over activation of this survival mechanism leads to inhibition of neural sprouting to the cortical areas. Ongoing activation of this pattern has an inverse relationship with long term neural sprouting and proliferation (Rossouw 2012). In severe cases of violation, atrophy occurs in key limbic areas (especially the hippocampus), and cortical regions (anterior cingulate and subgenual areas of the prefrontal cortex), and hinders the ability of the individual to manage even low intensity stress. Cognitive, and especially emotional, development is also significantly inhibited (Van Der Kolk, Burbridge & Susiki 1997; Drevets 2001; Schore 2012; Rossouw 2012b).

Without effective down regulation of limbic alertness (triggered by stress factors and violations of basic needs), neural sprouting will be inhibited (Kandel 2006).

**Implications for interventions: rural & remote areas**

The implications for service delivery are significant. Effective delivery of early interventions is required to assess, identify and address violations of basic needs (especially the needs for safety and control) are indicated. Effective service delivery, to enhance neural development has to be a collaborative activity between mental health services and attachment structures (parental systems).

Many rural communities have collective sense of suffering due to current and historical traumas such as Aboriginal communities affected by removal of children. These painful memories are triggered by intervening agencies attempting to assist in cases of need – especially when assistance is not community based but linked to services that...
are provided outside of local areas.

Unfortunately the history of service delivery in rural and remote Australia (and more specifically our indigenous communities) shows little understanding of the implications of these neural principles. When provision of safety became a priority, without understanding the need for attachment and control, children were removed not only from the immediate area of risk but also from the whole community. These removals from community may have provided safety but could not effectively down regulate the stress/fear/control response. Further, removal from a community disempowers the community to provide care and enhances community pathology. This does not only have historical relevance as there are current cases under tribunal investigation that involve removal of young children from highly disenfranchised Aboriginal communities in far north Queensland. The preliminary findings of research at the University of Queensland coincides with the study at Edith Cowen University and shows that Aboriginal community responses have been undermined as a result of colonialism and the impact of western culture (Hovane 2012). Service delivery has mostly happened outside the communities and not in close collaboration with communities, resulting in increased community disempowerment and enhancing the risk of pathology.

Service delivery to maximise neural growth needs to occur in the close proximity of the social network (community) to maximise a sense of attachment and control to facilitate healing and empowerment. Children living in rural and remote areas face significant challenges when they are in need of interventions. All research clearly indicates the need for early intervention to minimise the development of unhelpful neural patterns. But early diagnosis and/or intervention is often lacking in rural and remote areas. Localised services are often not available. This leads to interventions that may compromise the basic needs of developing children resulting in higher presentation of uncontrollable incongruence. The net result is the reduced opportunity to maximise neural sprouting, enhanced stress response activation, and long term frontal cortical deficits; resilience to HPA activation, effective emotional and personality development, high level of cognitive integration and approach behavioural patterns.

Preventative programs to enhance parental awareness of secure attachment, control maximization, neural development, nutrition, limbic regulation, and frontal cortical activation to enhance resilience needs to be facilitated.

Practical strategies to maximise neural sprouting (such as sleep, hygiene, nutrition, exercise, reduced substance abuse) need to be provided in a safe, trusting environment to reduce the risk of trans-generational pathology and enhance genetic expressions towards strong, safe, supportive and well communities.
References


Dr Pieter Rossouw

specialises in Neuropsychotherapy in Australia and is an expert in anxiety and mood disorders. He has published five scientific books and over twenty scientific articles. He has been involved in research in extensive clinical trials and presented research papers at thirty international conferences worldwide. He is on the Advisory Board of The Neuropsychotherapist.
Pieter J. Rossouw
M Clin Psych; PhD; MAPS; CCLIN.

Pieter is the Director of the Master of Counselling Program at the School of Psychology and the School of Social Work and Human Services at The University of Queensland, Australia. His research and teaching focuses on Neuropsychotherapy. Pieter is also the Director of Mediros – a company that provides training in Neurobiology and Neuropsychotherapy.

Pieter has established a distinguished career as Clinical Psychologist, Lecturer, Clinical Consultant and Supervisor. He has been in Private Practice for the past 25 years. Pieter holds Honours Degrees in Philosophy and Psychology, a Master Degree in Clinical Psychology and a PhD. Pieter is a member of the Australian Psychological Society and the APS College of Clinical Psychologists. He provides Mental Health training for GP’s and is accredited at the Royal Australian College of General Practitioners. In this role he developed and facilitated a Clinical Audit for General Practitioners (30 PD point activity) with over 600 GP’s Nationwide involved in the training.

Before relocating to Australia, Pieter was a Professor in Clinical Psychology for 11 years. He was a guest lecturer at Universities in Canada, Holland and South Africa where he also spearheaded a Psycho-Therapeutic Assistance Program to support people being exposed to trauma. In Sydney he worked as Senior Clinical Psychologist at the Northern Beaches Adolescent Service – Department of Health, he was the Clinical Director of the St John of God Psychiatric Hospitals – both Richmond and Burwood Hospitals as well as worked in Private Practice. He provided clinical supervision to many Masters and PhD students as Clinical Associate of the Universities of Sydney, New South Wales, Western Sydney, Macquarie, Wollongong and Newcastle. Currently he is involved in full time research in the fields of neurobiology and neuropsychotherapy as well as clinical training for clinicians, psychologists and general practitioners.

Pieter specialises in neuropsychotherapy and is an expert in anxiety and mood disorders. He has published 5 Scientific Books and 20 scientific articles. He has been involved in research in extensive clinical trials and presented research papers at 30 International Conferences worldwide.

He is a member of the Global Association for Interpersonal Neurobiology Studies, the International Society for Traumatic Stress Studies, the International Association for Family Therapy and the Professional Association for Drug and Alcohol Workers. He also facilitates a Global Neuropsychotherapeutic Interest Group through its e-Journal (Neuropsychotherapy in Australia) and local specialist research and discussion groups. Currently it has over 2500 active members – comprising of clinicians and academics in the field of neuroscience.

Pieter developed three 2-day APS, specialist endorsed workshops – The Brain and Anxiety: Utilizing Neurobiological Information as Psychotherapeutic Tool; The Neuroscience of Depression: New Opportunities for Effective Treatment; and The Developing Brain and the Neuroscience of Memory and Trauma. He also runs neuropsychotherapy applied skills classes.

— Contact Pieter: p.rossouw@uq.edu.au
pieter@mediros.com.au

Go to www.mediros.com.au for information on Australian Neuropsychotherapy Workshops

Mediros Clinical Solutions
The Developing Brain and the Neuroscience of Memory & Trauma

*Implications for effective skills based interventions*

The psychological and neurobiological effects of trauma have significant implications for well being. Theoretical and treatment modalities for trauma have been the focus of study for many researchers. Recent discoveries in neurobiology have changed the landscape of theory and treatment of Psychological Trauma. These discoveries assisted with our understanding of neural processes, memory and neural communication. Clarity about these concepts assists clinicians towards more effective interventions with clients suffering from the aftermath of trauma.

The Brain and Anxiety

*Utilizing neurobiological information as a psychotherapeutic tool*

Anxiety is a prevalent problem among Australians. Over one quarter of adults suffer from anxiety in any given year. The last decade of brain research made possible by fascinating advances in brain imaging and neurobiological data has moved the understanding of anxiety disorders into a new dimension. Although we can successfully treat clients without knowing the full implication of research, we can be more effective with more people in less time if we have a grasp of the neurobiology and why and how our treatment methods change brain function.

The Neuroscience of Depression

*New opportunities for effective treatment*

Depression is a common disorder without geographic, educational, socioeconomic, or racial boundaries. Recent advances in neuroscience provided new dimensions to the understanding and treatment of depression. Discoveries in the association of depression with neural plasticity and neurogenesis as well as insight in the role of talking therapies to change neural functioning as well as neural structure opened fascinating new perspectives and treatment options.

Neuropsychotherapy for Anxiety

Neuropsychotherapy for Depression

*Applied strategies for treatment*

These workshops look at recent advances and research into anxiety and depression and the implications for therapeutic interventions.