ACCELERATING INNOVATION:

TELLING THE BRAIN STORY TO INSPIRE ACTION

Summary Report

Symposium 2013

October 27 – November 1 Edmonton, Alberta, Canada

Alberta family wellness initiative

Volume 1

Published September 2014.

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SUGGESTED CITATION FOR THIS REPORT

Norlien Foundation. 2014. Accelerating Innovation: Telling the Brain Story to Inspire Action. Summary Report. Volume 1. Calgary, AB: Norlien Foundation.

PURPOSE OF REPORT

This report describes the first Symposium of the second phase of the Norlien Foundation's multi-year knowledge-mobilization strategy in early brain and biological development, mental health, and addiction.

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"I'm really proud to be associated with the work that the Norlien Foundation and the Harvard Center are doing. I see this as the way forward for improving the well-being and the ultimate chances for kids who come from backgrounds of severe early adversity."

Philip Fisher, PhD

This Symposium, Accelerating Innovation: Telling the Brain Story to Inspire Action, marks the beginning of the second phase of the Alberta Family Wellness Initiative's (AFWI) multi-year knowledge-mobilization strategy.

In this effort to improve the lives of children and their families in Alberta, we have brought leaders in the science of early brain development and addiction to Alberta to share the most up-to-date knowledge in their fields. We have heard from experienced change leaders how information gets translated into policy and practice and how organizational change is successfully implemented. We also have heard how change is already underway in Alberta in the mental health and addiction system and in the broader human services system and how our initiative is playing an important part in that process. Observers tell us that what we are doing here in Alberta is unique in its breadth of vertical and horizontal engagement of science, policy, and practice and that Alberta may be a model for other jurisdictions. While remarkable progress has been achieved, more is needed. Change is an ongoing process. What is needed now is innovation – new ways of doing things while continuing to value effective current practice. Participants who are returning as mentors and those who are new to this initiative are in a unique position to advance knowledge to influence research agendas, cross-ministerial collaboration, policy development, decision-making, program design, and practice. Now is the time to move into action and, by using innovative strategies, turn what we know into what we do to shape our future and the world of generations of Albertans to come.

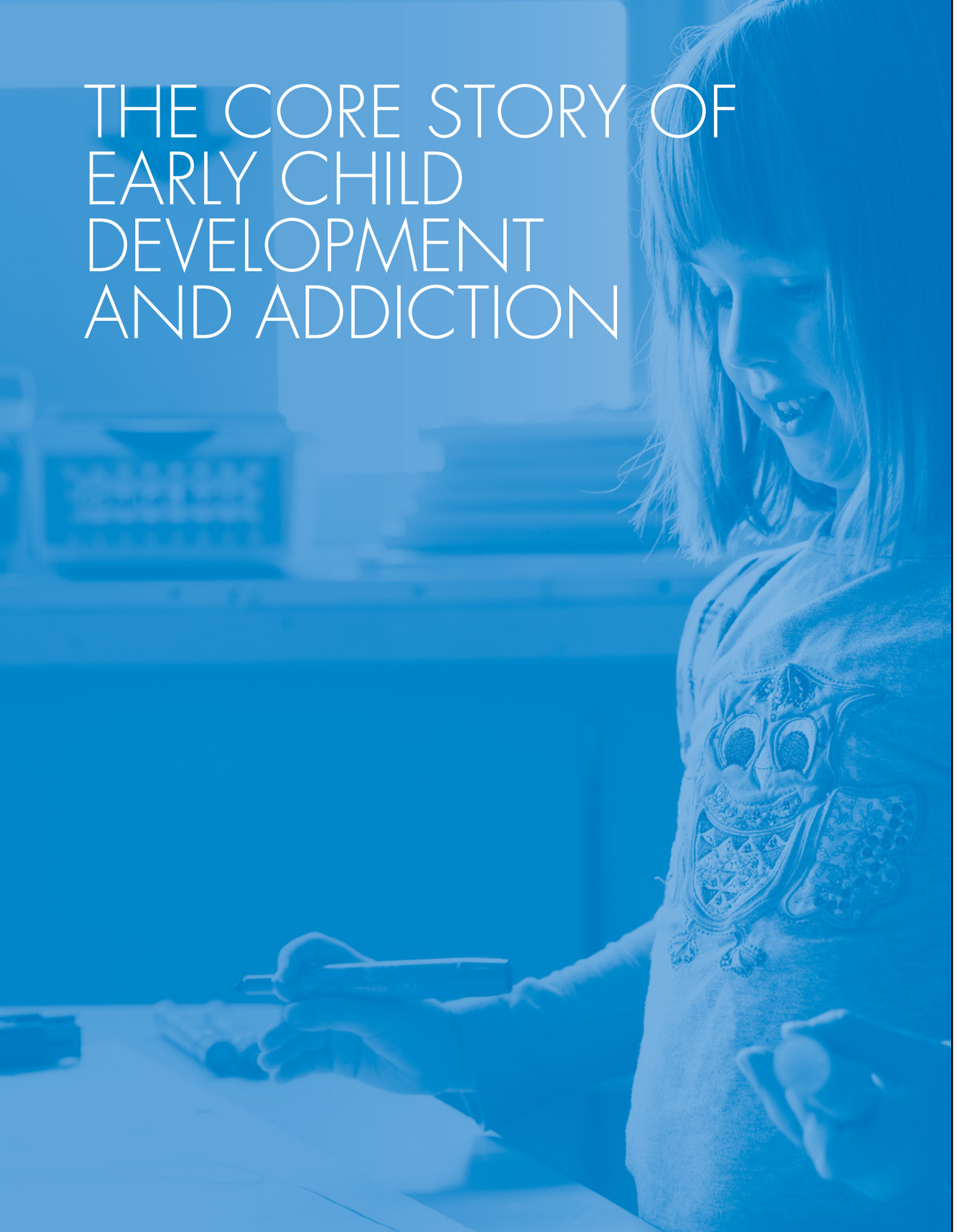
Nancy Mannix, JD
Chair and Patron, Norlien Foundation

CONTENTS

Norlien Foundation

Created in 1997, the Norlien Foundation is a proactive private foundation with offices in Calgary and Edmonton, AB. The Foundation is active in knowledge translation and transfer, applied research, evaluation, and networking. It has established partnerships with numerous national and international organizations working in the areas of childhood development, addiction, and mental health. The Foundation initiates strategic projects to enhance the quality of life for all Canadians, particularly those living in Alberta.

THE CORE STORY OF EARLY CHILD DEVELOPMENT AND ADDICTION



The FrameWorks Institute developed the core story of early child development and addiction in collaboration with the Harvard Center on the Developing Child and the National Scientific Council on the Developing Child. FrameWorks is an interdisciplinary group of academics known for its development of Strategic Frame Analysis™, an empirically driven communications process that makes research understandable, interesting, and usable to help non-profits further public understanding about societal issues.

The core story is based on a set of principles that experts across the field of neuroscience and early childhood development believe are important for citizens and policy-makers to understand in order to make informed decisions about broad societal concerns ranging from health and education to justice and social services. A fully framed core story provides a consistent narrative framework for a variety of expert communications around an issue. The work of the Alberta Family Wellness Initiative (AFWI) is grounded in the core story of brain development.

A fundamental concept in the core story is the idea that experiences in early life interact with genes to affect the developing brain and influence health outcomes throughout life, including those relevant to mental health and addiction. As a knowledge broker, the AFWI strives to mobilize this scientific understanding across multiple sectors in Alberta to influence decision-making at the policy and practice levels.

Alberta Family Wellness Initiative

In 2007, the Norlien Foundation created the Alberta Family Wellness Initiative (AFWI). Based on a framework of epigenetics and developmental and behavioural neurosciences, the AFWI creates opportunities to better understand and apply scientific knowledge to factors influencing child development and its relationship to addiction and other mental health outcomes. It is hoped these efforts will encourage more informed decision-making to create, deliver, and fund a wide variety of appropriate services, programs, and policies that support healthy families in Alberta.

THE CORE STORY

What actually develops?

It all begins with **brain architecture**. The early years matter because early experiences affect the architecture of the maturing brain. The quality of that architecture establishes the foundation for all of the development and behaviour that follow. Getting things right the first time is easier than trying to fix them later. The brain's architecture is composed of social, emotional, and cognitive strands that get woven together, strongly or weakly, to support subsequent development. What affects one affects all.

How does it work?

The process by which the brain gets built is much like the **serve and return** of a tennis game. Serve and return happens when young children instinctively reach out for interaction, through babbling, facial expressions, gestures, and cries, and adults respond by getting in sync and returning the same kinds of sounds and gestures. Serve and return works best with adults who are familiar to the child. If adults do not respond, the child's learning process is interrupted and incomplete. Young children need many of these interactions per day, since they are literally the building blocks of brain architecture.

What matters most, genes or environment?

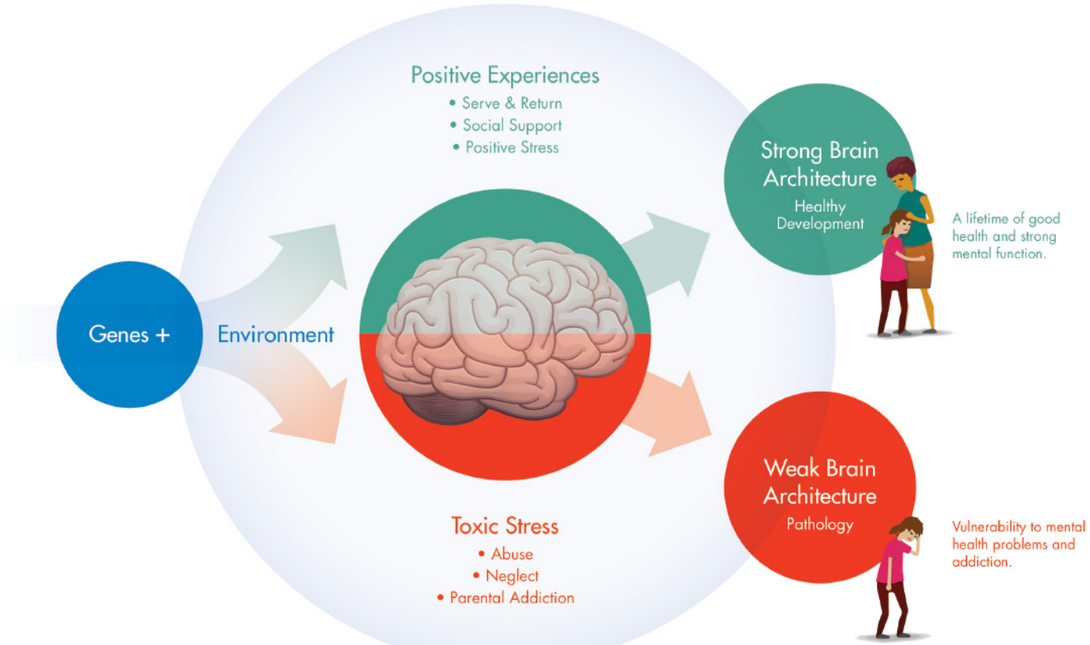
Experiences and environments count as much as genes and can even influence how genes work. Our genes have instructions on them that tell our bodies how to work. However, the environment has to authorize the instructions for them to be carried out. Positive experiences are environmental signatures that authorize instructions for positive outcomes. Negative experiences, like exposure to violence or abuse, authorize instructions for negative outcomes. Because **environmental signatures** on a person's genes can last a lifetime, society needs to ensure that genes get positve environmental signatures early on.

Early learning is foundational to everything that follows.

Children learn very early to pay attention by developing the **air traffic control** system in their brains. As a child learns to regulate the flow of his or her attention and to focus on tasks, he or she creates mental priorities. This mechanism – called **executive function** – needs to be geared up as early as possible. This can be done through innovative programs that give children opportunities to practise recognizing roles and sequences and joining in on cue, such as play-acting or taking turns. This mental flexibility makes it easier to learn new information and use skills in new and complex situations throughout life. Facilitating executive function skills requires parents and society as a whole to create, sustain, and support opportunities for children to use these skills, so that each successive phase of learning and development builds on a solid base.

What derails development?

Stress is the bad guy in the story of child development, but we have a lot to say as a society about the power of the stress our children are exposed to. A **positive stress** response happens in situations like the first day with a new caregiver or receiving an immunization. It's a normal part of healthy development and is characterized by short increases in heart rate and hormone levels. **Tolerable stress** activates the body's alert systems to a greater degree as a result of more severe, longer-lasting difficulties, such as the loss of a loved one or a frightening injury. If the stress is time-limited and buffered by supportive relationships with adults who help the child adapt, the brain and body recover from what might otherwise be damaging effects. A **toxic stress** response occurs when a child experiences strong, frequent, and/or prolonged adversity – such as physical or emotional abuse, chronic neglect, mental illness or addiction in a caregiver, exposure to violence, and/or chronic family economic hardship – without adequate adult support. Prolonged activation of the stress-response systems can disrupt the development of brain architecture and other organ systems, and increase the risk for stress-related disease and cognitive impairment well into adulthood. Toxic stress literally gets built into the brain and the body. Society can work to prevent toxic stress responses in young children by reducing their exposure to extreme environments and by providing buffering relationships at home, at school, and in the community.

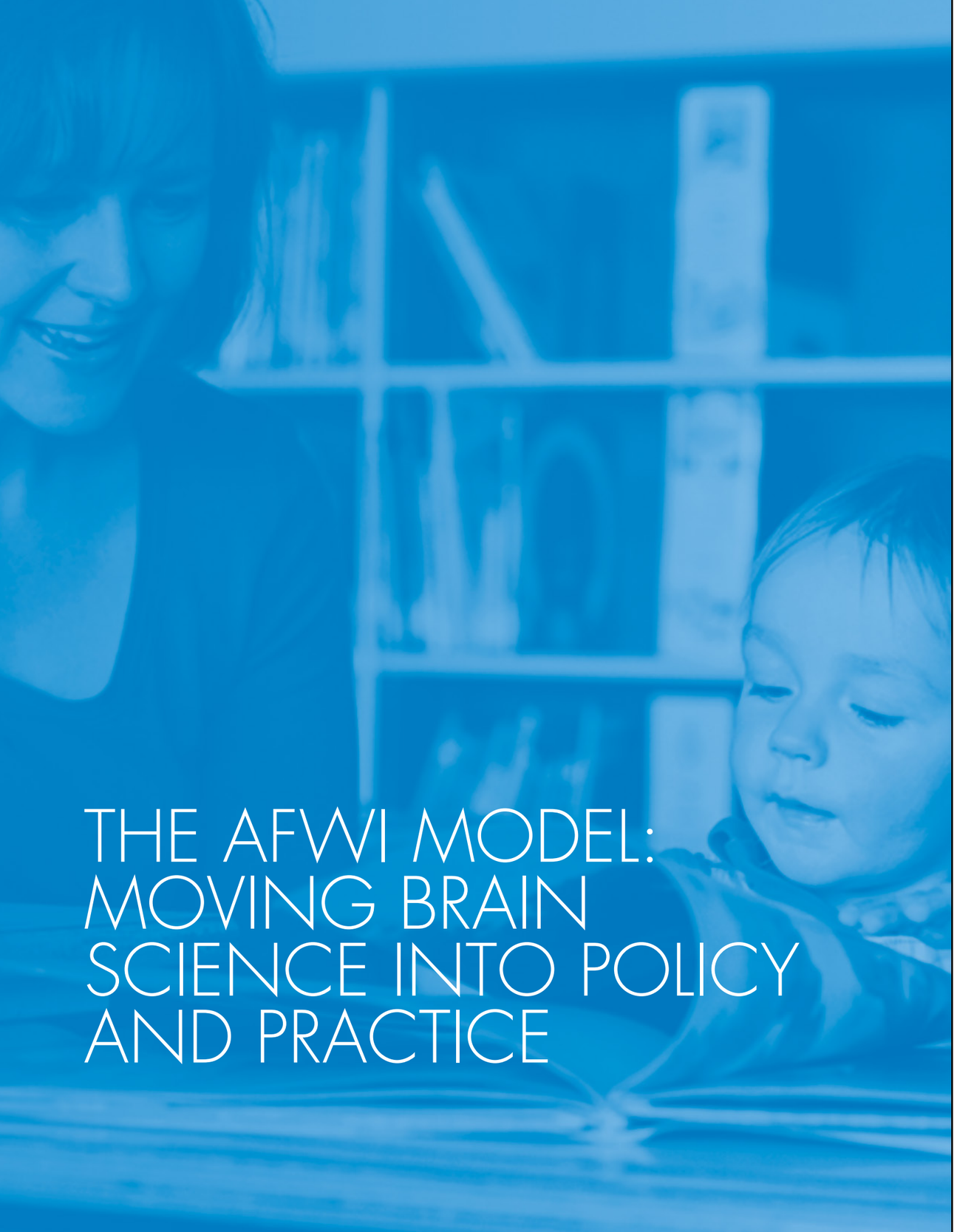


Can we prevent negative outcomes?

For many children, the consequences of early adversity, such as poor physical or mental health or addiction, may be many years in the future – or, if they are fortunate to land in strong communities, may not be triggered at all. Early negative experiences affect later development in the same way that faultlines sometime result in full-blown earthquakes. Like a faultline in the earth, **brain faultlines** can form in a number of ways. In some cases, they appear as the brain develops, or they can develop over time as people experience stress without supportive relationships. Also, people may have been born with brain faultlines. Just because there is a faultline doesn't mean there will be an earthquake. Brain faultlines are triggered by factors and experiences that turn them into earthquakes, which can do a huge amount of damage. There are things we can do to help prevent faultlines from developing, and to minimize the chances that existing faultlines will turn into earthquakes. There are also things we can do once traumas or addictions have happened to prevent damage from happening again.

What can we do to protect children from harm?

To prevent toxic stress and avoid triggering brain faultlines, society needs to focus on the child's ability to function at home and in the community. Promoting children's mental health is like using a sugar packet to level a table. The table can't function properly if it is on a slanted floor or if one of its legs is uneven. Similarly, children can't function fully if the environment in which they grow is unstable. This affects their mental health and undermines their development. The table can't level itself: we have to step in and provide assistance to steady the table's base. Putting a child in a violent or extremely unsupportive environment is like placing a table on uneven ground. When we intervene, by stabilizing the child's environment and helping him or her level out, the child's mental health is supported and he or she can get back in sync with a stable environment. Whether it's by supporting parents in their role, particularly those with addiction or mental health problems, providing stability in foster care placement, or making mental health professionals better trained and more available in very early care programs, interventions can help children achieve the levelness they need to grow a strong foundation for later development.

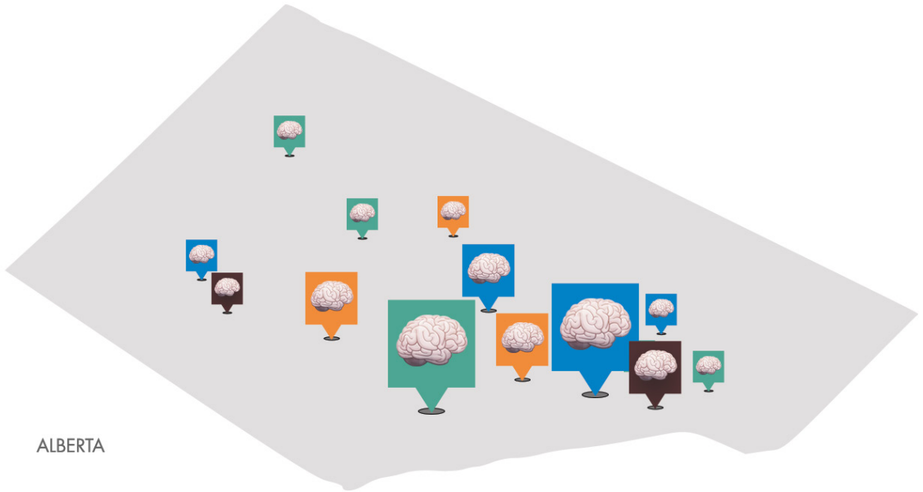


THE AFWI MODEL: MOVING BRAIN SCIENCE INTO POLICY AND PRACTICE

Modern brain science has identified links between early childhood development, mental health, and addiction. We know that early experiences interact with genes to influence the developing brain, with lifelong effects, for good or ill, on health and capacity for success in school, work, and relationships. The Alberta Family Wellness Initiative (AFWI) funds and originates a variety of activities and programs designed to drive science-based change to bridge the gap between what we know from science and what we do in policy and practice. Accelerating Innovation: Telling the Brain Story to Inspire Action launched the second phase of a far-reaching, multi-year, multi-disciplinary strategy to further this objective for the benefit of Alberta and its families.

The AFWI's knowledge-mobilization strategy

The AFWI developed a unique model for knowledge-mobilization that recognizes the link between early childhood development, mental health, and addiction and the need for an interdisciplinary approach to effect positive change in policy and practice. In 2010, the AFWI partnered with the Government of Alberta and Alberta Health Services (AHS) to launch the first phase of a knowledge-mobilization strategy that involved over 100 participants in each of two parallel streams focusing on Early Brain & Biological Development (EBBD), and Recovery from Addiction (RFA). Each stream involved three annual Symposia where participants attended presentations and workshops by leading scientists and change experts, discussed the implications of the up-to-date scientific knowledge to the Alberta context in multi-disciplinary cohort groups, and worked together in learning teams in the intervening years between Symposia to integrate that knowledge into their circles of influence. Participants were change leaders selected for their capacity to influence research agendas, cross-ministerial collaboration, policy development, decision-making, professional development, training, program design, and practice at the institutional and community levels. They represented the broad reach of early childhood development, mental health, and addiction across society, from health and education to justice and human services.



Telling the core story in the Alberta context

Fundamental to the AFWI model is a common language and framework of understanding to enable productive collaboration among this wide range of relevant researchers, practitioners, policy-makers, and the public. The AFWI supported the FrameWorks Institute in conducting research to uncover the values and cultural models underlying Albertans' knowledge and attitudes about early childhood and brain development, mental health, and addiction. FrameWorks researchers shared their findings at the Symposia. They also provided participants with workshops on framing the scientific knowledge into a common core story with narrative components – developed by FrameWorks in conjunction with the Harvard Center on the Developing Child and the National Scientific Council on the Developing Child and informed by Alberta values – that has the proven potential to increase public understanding. This core story provided the common language and framework that supported collaboration and facilitated the significant progress made during the first phase of the AFWI strategy.

Strategy makes system-wide impact

Over 80 per cent of participants remained engaged throughout the three-year initial phase of the AFWI strategy. They remained connected and expanded their networks, spreading change and innovation throughout the system in Alberta and beyond. Within the first year the Government of Alberta produced two major policy documents incorporating key learnings from the AFWI Symposia. *Let's Talk About the Early Years*, a report by Alberta's Chief Medical Officer of Health, incorporated many elements of the core story of early child development and addiction and key concepts from the EBBD 2010 Symposium, underscoring the importance of investing wisely in the early years. In 2011, the Alberta government published *Creating Connections: Alberta's Addiction and Mental Health Strategy*, which strongly reflects learnings from the 2010 EBBD and RFA Symposia. Many Symposia participants played a part in building the Strategy.

In 2013, the Alberta government launched Together We Raise Tomorrow: An Alberta Approach to Early Childhood Development, a province-wide initiative to support the well-being, safety, security, education, and health of all children in Alberta. The document cited scientific knowledge about early childhood and brain development using language and elements of the core story and some of the learnings from the AFWI Symposia. The initiative invited Albertans to get involved in conversations and activities in their communities over the following year to identify local solutions and supports toward an integrated early childhood development system in Alberta.

A small sampling of the numerous other developments across the province includes:

- Use of the core story language and concepts in TeleHealth presentations for public health nurses, high school prevention programs for drug and alcohol use, and nurse education programming.
- Use of key concepts of the core story by Calgary Police Services, Alberta Health Services, Addiction Prevention and Treatment, and partners in the school system to develop projects that address vulnerabilities in youth and addiction issues.
- Development of training vignettes for social workers using presentations from the AFWI Symposia.
- Development of a pilot Parenting After Separation course in collaboration with an EBBD Symposium presenter.
- Participants reporting use of research to inform their practices (e.g., chronic disease management model and trauma-informed approach for addiction treatment, a more family-centred approach, and more integration of services for addiction and mental health).
- Increased sharing and mobilization of knowledge (e.g., research findings, core story, and chronic disease model for addiction) among researchers, students, public policy-makers, family and youth judges, and patients through workshops, presentations, formal education, and in clinical practice.
- The entire Fall 2012 issue of AHS' *Apple* magazine devoted to early childhood and brain development.

- Core story messaging embedded in AHS' Prenatal/Postnatal and Early Childhood (PEaCh) resources for expectant parents and parents of children 0-5 years old.

At the national level, the Association of Faculties of Medicine of Canada and the Norlien Foundation have developed a set of e-learning tools on early brain and biological development and addiction – including 13 podcasts based on lectures from the EBBD and RFA Symposia – for undergraduate medical education.

Perhaps most significant, the language of the core story of early brain development is entering common usage across the board in the research, policy, and practice communities. The foundation is now set for the next step in the AFWI strategy: translating our collective knowledge into practice and ultimately into positive outcomes for Alberta's children and families.

The AFWI advances to Phase 2 and a new model for change

Early childhood policy and practice to date have been based on the theory that an enriched language environment, parental education, and better nutrition create the foundation for a healthy growth trajectory. The revised, science-based hypothesis, outlined in the core story, is that enrichment efforts in the early years are limited by toxic stress and that new protective interventions can counter early childhood adversity and restore a healthy trajectory. This theory was formulated by Frontiers of Innovation (FOI), an initiative of the Center on the Developing Child at Harvard University, in a new model for change that could inform early childhood policies and programs more effectively. The Norlien Foundation is a major supporter of FOI.

FOI is focused on the work of more than 400 researchers, practitioners, policy-makers, philanthropists, and experts in system change across North America. FOI uses scientific advances about the effects of early childhood adversity to generate innovations in policy and practice that can achieve breakthrough outcomes for vulnerable young children. The organization identifies innovating community-level programs and innovating jurisdictions where a focused resource push could result in faster change. Alberta is one of those jurisdictions.

The work that has been done in Alberta, led by the Norlien Foundation and the Government of Alberta, has laid the groundwork here for innovation. From front-line clinics to the provincial policy-making level, Alberta now has a multi-disciplinary community spanning research, policy, and practice and sharing a language, knowledge, and aspirations focused on improved outcomes for early childhood development and for individuals and families affected by addiction. Progress to date in Alberta has been cited by observers as a model for other jurisdictions.

Phase 2 of the AFWI's strategy will focus on innovation, including new ways of doing things and better ways to deliver current effective practices. This strategy will build on current strategies and momentum in the province and will further the understanding of the brain story in the policy and practice communities and in the general public. The goal is to build communities of purpose aimed at finding sustainable solutions that will improve outcomes for children and families.

This initiative will unfold over two years and engages a new cohort of almost 200 Alberta change leaders along with 39 mentors who participated in the initial phase. Phase 2 kicked off with Accelerating Innovation: Telling the Brain Story to Inspire Action, a Symposium held October 27 through November 1, 2013, in Edmonton, AB.

EXECUTIVE SUMMARY

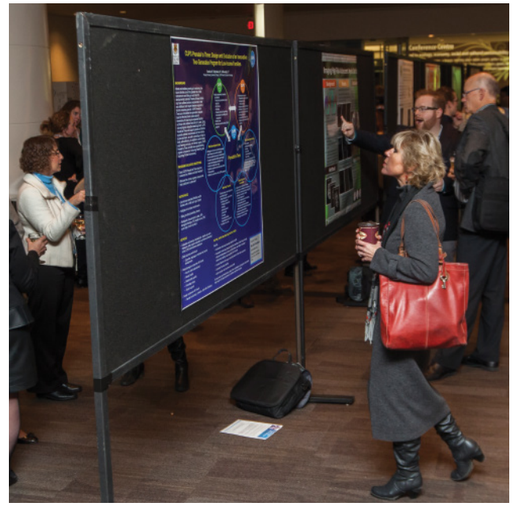
Accelerating Innovation: Telling the Brain Story to Inspire Action kicked off the second phase of the AFWI's (Alberta Family Wellness Initiative) multi-year knowledge-mobilization strategy.

The Symposium was held October 27 through November 1 at the Shaw Conference Centre in Edmonton. The Symposium's overarching goal was to create positive change in outcomes for children by mobilizing knowledge about the intergenerational impact of addictions and toxic stress on the developing brain. Daily presentations by expert scientific Faculty inspired a comprehensive program of workshops, Interdisciplinary Cohort discussions, and Innovation Team planning sessions throughout the week.

The AFWI welcomed 197 new participants as well as 39 participants from Phase 1 of the initiative who returned as mentors in this far-reaching endeavour to improve outcomes for children and families in Alberta. Participants represented a diverse range of backgrounds, perspectives, and professions across the health and human services systems in the province. Attendees also included a team of observers from Germany and several observers from other jurisdictions in Canada and the United States.

Moderators opened the Symposium with a video in which Phase I participants told how learnings and engagement in the AFWI strategy have changed their own work and are influencing positive change throughout Alberta's health and human services systems. A key feature is the core story of early child development and addiction, which has become commonplace across Alberta due to the AFWI and is an essential component of how the Government of Alberta moves forward in these areas. Specific changes include:

- New gender-responsive, trauma-informed programs have been put in place to meet the needs of female offenders.
- The qualifying exam for physicians has been updated to include epigenetics, process addiction, and substance abuse.
- Current scientific information on addiction has been incorporated into undergraduate nursing curricula.



- Knowledge of the core story in the justice system is leading to a shift from thinking of addiction as a choice requiring punishment to a more hopeful understanding of addiction as a disease that can be treated, managed, and prevented.
- There is a renewed emphasis on training (including the importance of the serve-and-return principle) for the caregiving workforce.

At a reception and poster session on the first evening, a number of participants showcased research and programs that show how concepts from Early Brain & Biological Development and Recovery from Addiction learnings are translating into action. After dinner, Judy Cameron, Professor of Psychiatry at the University of Pittsburgh, spoke on Brain Architecture in Action, describing how early experiences and genetics interact to influence how the developing brain is built. Dr. Cameron spoke of the Brain Architecture Game, an engaging, hands-on learning experience that allows players to use core concepts to "build" a brain and understand the importance of early life experiences and support systems to optimal brain development.

Morning plenary sessions featured expert presentations on current scientific knowledge in early childhood and brain development, and addiction; effective treatment and intervention strategies; and implications for policy and practice. Smaller afternoon sessions each day included workshops by the presenters exploring aspects of their topics in more detail; Interdisciplinary Cohort discussions looking at the implications of the morning's learnings for innovation in the Alberta context; and meetings of participants organized into Innovation Teams tasked with developing action plans for applying Symposium learnings. On the final morning, Innovation Teams made presentations to a guest panel of senior-level decision-makers from academic, government, and health-related sectors describing how they planned to apply innovation to achieve the Symposium's overarching goal in their own spheres.

Foundational knowledge

The dialogue began each day with presentations by Faculty members – scientists, researchers, clinicians, policy-developers, and change leaders – from Canada, the U.S., and the U.K. Each day's plenary session focused on a different facet of the overall Symposium theme.

The first day set the stage with a presentation on how Harvard University's Frontiers of Innovation (FOI), of which Alberta is a member, is forging cross-sector connections and accelerating innovation to impact the lives of young children whose needs are not being met by existing practices. Another presentation made the case for family treatment as essential in recovery from addiction. Alberta speakers outlined progress on Alberta's approach to early childhood development. Participants also heard how the core story of early child development, child mental health, and the early roots of addiction can be used to secure public support for evidence-based policies and programs.

The second day focused on the intergenerational story. A talk on the intergenerational transmission

of health outcomes discussed how parental mental health affects brain wiring and the development of social and emotional behaviour. A presentation on the complex interplay of genetic, biological, and environmental risks associated with attention deficit hyperactivity disorder (ADHD) emphasized the importance of combined pharmacological and behavioural interventions to achieve optimal outcomes. Interventions tailored to children in foster care, adopted children, and others who have experienced abuse and neglect were described along with a low-cost strategy for evidence-based prevention practice involving parents/caregivers in a community setting.

Origins of addiction and opportunities for intervention were featured on the third day. A presentation on how neuroadaptations of the reward, stress, and executive function systems lead to a loss of control over drug-taking provided new insights into identifying vulnerabilities to addiction and novel treatments. Process addictions and their similarities to and differences from substance addictions were the topic of a second presentation, with food addiction as an example. A third presentation described how the prescription opioid crisis has infected the healthcare workplace and how aspects of the successful Physician Health Programs may be adopted as a model for treatment of addiction in the general population.

The presentations on the fourth day looked at implications and innovations for policy and practice. The rocky road from research to policy and practice, from the point of view of someone who worked inside high-level political policy circles, was outlined with illustrations of how things go off track and practical advice on how to bring research to bear on public policy. Another presentation looked at the process of setting a United Nations global development goal for early childhood development. The presentation looked at global examples of how improving the quality of existing programs has been an effective and economical approach to ensuring children's developmental potential. A final Symposium talk presented an insider's account of the 2010 roll-out of the U.S. government's drug strategy and lessons Alberta can take home from what went right and what went wrong.

Implications for policy and practice

Addiction and other negative health outcomes are too often transmitted in families from one generation to the next. When it comes to prevention, earlier is better. Universal prenatal screening and guidance and postnatal screening and treatment are essential to ensure the best possible start in life and improve outcomes for children. Programs that improve parents' executive functioning skills and involve parents in modelling and practising those skills have been shown to enhance parental capacity and optimize social, emotional, and cognitive development in children. It is possible to offer such programs inexpensively at the community level. There is convincing evidence from the United States that screening and brief intervention, and referral to treatment (SBIRT) by primary care practitioners at the level of risky and medically harmful substance use can avert negative effects on existing health problems and result in significant savings in the healthcare system. Alberta's Addiction and Mental Health Strategic Clinical Network, in which primary care will play a key role, is currently working to identify priority areas for establishing treatment and services in an alcohol pathway and has an opportunity to learn from the U.S. experience. Addiction treatment protocols offered within Physician Health Programs have shown significant success and elements of these programs can be used as a model for improving outcomes in the general population of addicted individuals. We know from science that recovery from addiction requires long-term treatment and monitoring in a chronic care model. Mere abstinence is not recovery. Therapy needs to address the entire family. This knowledge needs to become commonplace throughout society.

Communicating the science

From the beginning of the AFWI's multi-year knowledge-mobilization strategy, the FrameWorks Institute has been engaged in research to uncover the values and attitudes that underpin Albertans' understanding of early child development, child mental health, and addiction and in developing the ever-evolving core story that integrates the science in these fields into an understandable narrative for the general public. FrameWorks researchers explained how a well-constructed core story can displace unproductive or damaging cultural models that people use to think about early childhood, brain development, and addiction and replace them with empirically tested values and explanatory metaphors that create public support for policies, programs, and practices that work. FrameWorks introduced two new elements being tested for addition to the core story that frame a neurodevelopmental perspective on addiction. The reward dial metaphor counters the idea of addiction being a matter of willpower by comparing the reward system to the volume dial on a stereo that needs recalibrating. The metaphor of redirecting the river helps people think about what constitutes effective treatment: it is complex and difficult to do, requires a team of experts and sustained effort, and must start early before the groove of habit deepens.

What's next?

Participants were divided into 21 Innovation Teams tasked with identifying innovative ways to apply new or known information to prevention, intervention, and treatment of mental health and addiction issues across the lifespan, including interventions for children experiencing toxic stress. Innovation Teams met daily to work on Innovation Team action strategies, including long- and short-term goals for their group to accomplish in the coming year and an action plan for achieving them. Each team member developed a personal action strategy indicating how he or she will contribute to the team's action strategy. Team members will stay in touch over the year and support each other in implementing their action plans in their individual practices and workplaces. Teams will attend the next Symposium, to be held in the fall of 2014 in Calgary, to continue this work.

Resources

The AFWI website (http://www.albertafamilywellness.org) provides a portal for accessing an ever-expanding range of resources on early brain and biological development, child mental health, and addiction geared specifically to researchers, healthcare professionals, front-line professionals, policy-makers, and the general public. These include document and video libraries, learning modules, event listings, and information updates via e-mail. The resource library's robust collection includes all Symposia speaker presentations and summaries, the complete collection of Working Papers from the National Scientific Council on the Developing Child, the AFWI's first animated video – How Brains Are Built: The Core Story of Brain Development – and a growing body of policy documents, public-centred resources, and Alberta resources. The website is referenced as a resource in professional education and professional development curricula and is a continuing source of current informatio for all stakeholders.

THE SYMPOSIUM EXPERIENCE

The second phase of the Alberta Family Wellness Initiative (AFWI) builds upon the achievements and momentum generated over the first three-year component of AFWI's knowledge-mobilization strategy. The Early Brain & Biological Development (EBBD) and Recovery from Addiction (RFA) initiatives laid the foundation for a burgeoning multi-disciplinary community of purpose that is motivated, interconnected, and focused on action aimed at harnessing innovation to improve outcomes for Alberta's children and their families.

Key Objectives

The key objective of Phase 2 of the AFWI's multi-year initiative is to create positive change in outcomes for children by mobilizing knowledge about the intergenerational impact of addiction and toxic stress on the developing brain. During the Accelerating Innovation: Telling the Brain Story to Inspire Action 2013 Symposium and over the following two years, the focus will be on:

- Mobilizing and linking the science of brain development with mental health and addiction.
- Developing a shared understanding of the intergenerational effects of toxic stress and addiction at different ages and stages of development and the implications related to research, policy, and practice.
- Fostering communities of purpose that will be able to communicate and apply the knowledge to develop innovative and integrated approaches for prevention, intervention, and treatment of mental health and addiction issues across the lifespan.

Daily Content Themes

Day 1
Setting the Stage

Day 2
The Intergenerational Story

Day 3
Origins of Addiction and Opportunities for Intervention

Day 4
Implications and Innovations for Policy and Practice

Day 5
Creating Change: Innovation Team Presentations

Guest Panel Representatives

Erica di Ruggiero, MHS
Associate Director
Institute of Population
and Public Health
Canadian Institutes
of Health Research

Tim Grant, MSc
Deputy Minister
Justice and Solicitor General
Government of Alberta

Dave Hancock, BA, LLB
Minister of Human Services
Government House Leader
Government of Alberta

Jon Meddings, MD, FRCPC
Dean of Medicine
University of Calgary

Glenn Monteith
Chief Delivery Officer
Alberta Health
Government of Alberta

Cathy Pryce, RN, MN
Vice President, Addiction
and Mental Health Strategic
Clinical Network
Alberta Health Services

Donna Romyn, MN, PhD
Acting Associate Vice
President of Research
Athabasca University

James Talbot, MD, PhD
Chief Medical Officer of Health
Government of Alberta

Daniel J. Weeks, MSc, PhD
Vice President of Research
University of Lethbridge

The Learning-to-Action Process

Each day of the week-long Symposium was broadly themed to move the dialogue and learnings from understanding the intergenerational transmission of health outcomes and the origins of addiction to opportunities for intervention and implications for policy and practice.

Plenary sessions

Each day opened with a plenary session featuring presentations by scientific experts and change leaders that provided the foundation for the discussion sessions to follow in the afternoon. Presenters formed a panel at the end of each plenary session, providing participants with the opportunity to ask questions inspired by their talks. Throughout each morning a team of graphic facilitators diagrammed highlights of the presentations and discussions as they happened for later display in the main hall.

Workshops

Each afternoon participants had a choice of several workshops presented by Symposium Faculty. Some expanded upon topics introduced in the morning plenary session and provided opportunities to explore applications to the Alberta context. Workshops included an in-depth look at treatment of addiction in the family through the lens of a developmental model; a deeper exploration of the genetic, biological, and environmental risk factors that shape the outcomes for children in grade school and middle school; a discussion of the work done at the Hazelden Addiction Treatment Center with respect to adopting innovative interventions in the face of organizational and policy resistance; and an exploration of how quality-improvement initiatives in early childhood development programs might be of value in the Alberta context. Daily workshops gave participants the chance to play the Brain Architecture Game; boost their communication skills and experiment with new core story narrative elements created by FrameWorks for use with the Alberta public; and deepen their understanding of the Frontiers of Innovation program and explore how its principles can be applied to help build a culture of innovation in Alberta.

Reception and poster session

A poster session held during a reception on the first evening featured a variety of projects in Alberta involving the AFWI participants and learnings. Examples included a study of the association between maternal early life adversity and allergies in the next generation; a look at the effects of adverse childhood experiences in the Alberta primary care population; and the Calgary Urban Project Society's (CUPS) work in early education, parenting education, and family support, including the design and evaluation of an innovative two-generation program for low-income families in its prenatal to age three program and its leadership in strengthening families through promoting participation in the Supporting Father Involvement project by agencies throughout Alberta.

Interdisciplinary Cohort discussions

Participants were assigned to six smaller facilitated Interdisciplinary Cohort Groups, each consisting of people involved in research, policy-making, and clinical practice. These groups met each afternoon to review and discuss the morning's speaker presentations at the strategic level and examine the advantages, opportunities, and challenges of applying Symposium content in Alberta.

Innovation Team activities

Each participant was also assigned to one of 21 Innovation Teams, which met each day to focus on practical ways to innovate in the context of their work. Each team was tasked with developing an action strategy for the coming year including short- and long-term goals and a list of actions for achieving them. Each team member developed a personal action strategy indicating how he or she would contribute to the team action strategy. Each team had a returning participant who acted as mentor to the group. Innovation Teams are intended to work collaboratively and develop into communities of practice in which members learn together and from each other and develop a shared body of resources and approaches to addressing issues. It is hoped their experience in the AFWI strategy will inspire them to eventually evolve into communities of purpose geared toward empowering each other to action to achieve common goals.

Innovation Team presentations

On the final morning, the Symposium culminated in a full gathering of participants to view brief presentations by the Innovation Teams to a special guest panel of high-level academic, policy, and government leaders. A spokesperson for each team summarized how the team planned to contribute to the overall strategic goal of the Symposium: to create positive change in outcomes for children by mobilizing knowledge about the intergenerational impact of addiction and toxic stress on the developing brain. Included among the strategies outlined were:

- Transforming the family justice system by finding alternative options to court that won't increase toxic stress in divorce cases.
- Implementing projects designed to help culturally diverse families receive and understand the core story.
- An innovation project for youth involving creation of a scientific core message about the adolescent brain and delivering it to youth.
- Development of "charging stations" in child care, preschool, school, and other settings in the community where children exist and where adults skilled in serve-and-return interaction can buffer the effects of toxic stress and help support children's healthy brain development.
- Using the network provided by the AFWI Symposium experience to spread the core story throughout the justice system and reinforce the idea that people can be redeemed and lives turned around through the justice system.

Participants and observers

Among the 230 participants, roughly one-sixth were returning from engagement in Phase 1 of the AFWI initiative as mentors to the new group. Several observers also attended, including a team from Germany interested in breaking down silos in that country and inspiring innovation in the areas of early childhood development and mental health.

Symposium Sponsors

The 2013 Accelerating Innovation Symposium was made possible by the following private and public-sector sponsors:

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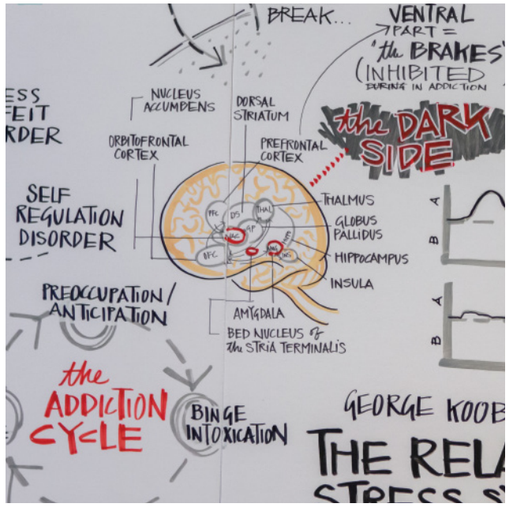
Participants came from varied backgrounds, professions, and perspectives, including many from Government of Alberta ministries, Alberta Health Services, Alberta's research-intensive universities, and community groups. They included policy-makers, program developers, members of the judicial and corrections systems, health practitioners, clinicians, researchers, psychiatric residents in training, educators, students, advocates, funders, and representatives of professional organizations. Between Symposia, participants are expected to continue to communicate with their fellow team members and to take advantage of additional learning opportunities. Their employers have agreed to support the AFWI program by incorporating these activities into the participants' job responsibilities. (See Appendix 3 for a complete list of participants.)

Accreditation

The Symposium program met the accreditation criteria of the College of Family Physicians of Canada and was accredited by the Alberta College of Family Physicians for up to 28 Mainpro-M1 credits.



SYMPOSIUM LEARNINGS: WHAT WE KNOW

Knowledge shared by expert Faculty presenters in Symposium plenary sessions laid the groundwork for all discussion and activity that followed. Returning Faculty and others new to the Alberta Family Wellness Initiative (AFWI) delivered the most current scientific knowledge about early childhood and brain development and the origins and treatment of addiction.

Evidence-based science

The importance of addressing the family system as part of addiction treatment was emphasized. The intergenerational story of brain development and the origins of addiction were illuminated in talks about how parental mental health affects brain wiring and development of social and emotional behaviour in children, and about the complex genetic, biological, and environmental factors that are implicated in ADHD-type behaviours and their potential for self-harm and addiction outcomes. Work with children in foster care and others who have experienced abuse and neglect has uncovered more evidence of the effects of early stress on neurobiological systems and areas of the pre-frontal cortex involved in executive functioning and has led to innovative preventive interventions, including a simple two-generational intervention that can be delivered in community settings.

Another presentation shed new light on neurobiological and neuroadaptive mechanisms related to the reward, stress, and executive function systems, how they are disrupted in addiction, and how this knowledge can help identify vulnerabilities to addiction and novel treatments. Process addictions and their similarities to and differences from substance addictions were the topic of a presentation that focused on food and eating as an example and outlined the environmental and social challenges to the prevention of food addiction, obesity, and related health problems. Participants also learned about the prescription opioid addiction crisis, its prevalence in the healthcare sector, and the potential to transfer parts of the successful Physician Health Program model to treatment programs in the public sector.

Frontiers of Innovation and the Alberta lens

The work of Frontiers of Innovation (FOI) at Harvard University's Center on the Developing Child was highlighted as a model for leveraging science to achieve greater impacts on the lives of young children whose needs are not being met by current policies and programs. The FOI initiative has two priorities: forging cross-sector connections and accelerating innovation. Participants learned about progress underway on the Government of Alberta's approach to early childhood development and how FOI's accelerated innovation model is being integrated into policies, programs, practices, and partnerships across government and in communities throughout the province.

Toward evidence-based policy and practice

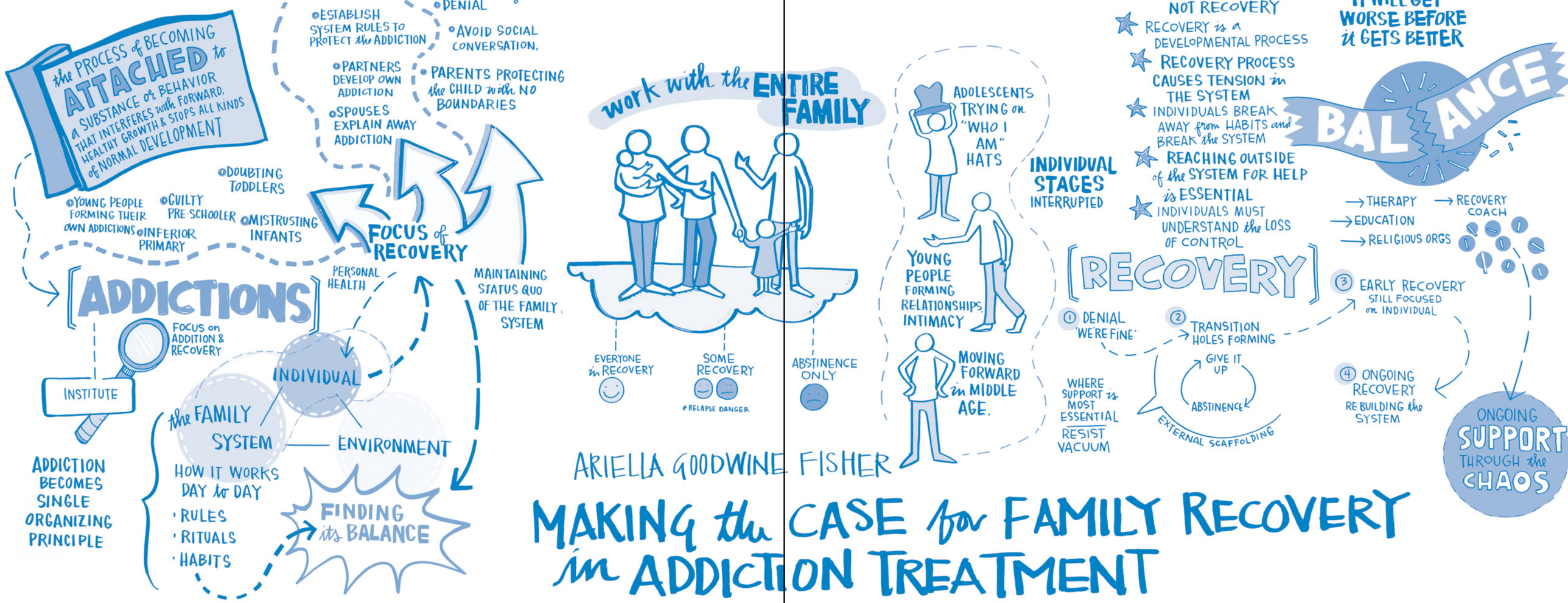
The mission to move research into evidence-based policy and practice is fraught with challenges. Some of these challenges were highlighted, and innovative ways to avoid them and effectively move research into practice were offered. On the global scale, a case was made for quality improvement of existing early childhood development (ECD) programs, and examples were presented of innovative approaches to quality improvement in ECD programs in high-, middle-, and low-income countries. A case study of the 2010 roll-out of the U.S. drug strategy was presented with analysis of what worked and what didn't and lessons for other jurisdictions trying to implement change.

Ultimately, effective communication is the key to achieving evidence-based policy and practice. Participants learned how a core story can be used to bring together early childhood development, mental health, and the early roots of addiction into an explanatory narrative that unites these fields and raises public support for evidence-based policies and programs that work.







Abstract:

Making the Case for Family Recovery in Addiction Treatment

By **Ariella Goodwine Fisher,** MFT

Recovery is a developmental process both for the individual and the family. Addiction is a disorder of attachment and loss of control in an individual. An addicted family system is one in which addiction becomes the central organizing principle that everyone in the family operates around, each sacrificing attachment to healthy development in order to maintain the status quo. Treatment is incomplete if the family system is not addressed.

Addiction in this treatment model is defined as: "The process of becoming attached to a substance or behaviour that interferes with forward, healthy growth and stops normal development." The addiction of an individual occurs within a family system that is structured around rules, roles, rituals, and boundaries. These change and adapt to protect the addiction and maintain the status quo no matter how dysfunctional the family becomes. Roles and boundaries may be reversed and family members may sacrifice the self or attachment to a healthy development in order to organize around and protect the addiction. To acknowledge that this is happening is too threatening.

How do family members sacrifice the self to protect the addiction? Parents of an addicted adolescent may be reluctant to set boundaries for fear they may be forced to acknowledge what is going on if the child can't meet that bar. They may restrict their own social lives to avoid questions about their kids, argue between themselves about the addicted child, or neglect other children in the family. When a parent has an addiction, the non-addicted co-parent may collude in a narrative that explains away the addiction or may develop his or her own pathology or addiction. Often the non-using parent sets up the rules and the way of interacting for the rest of the family to protect the addiction. Normal developmental processes of the children may be disrupted. For example, infants need to establish a sense of trust, but there is not enough consistency or responsiveness in an addictive family system to support that sense of trust Preschoolers need to develop a sense of purpose and initiative, but if they are growing up in a chaotic, addictive environment where their development is not nurtured, they may feel a sense of guilt instead. School-agers may end up feeling inferior, and adolescents may be confused about their identity and develop addictions of their own.

What happens to the family system when the addict stops? The Family Recovery Project of Stephanie Brown and Virginia Lewis looked at the experiences of 55 couples and families with lengths of abstinence ranging from 79 days to 18 years. Nine key assumptions and paradoxes came out of this project:

1. Abstinence is not recovery, but a key cornerstone of recovery.
2. Recovery is a developmental process, not a prescribed outcome.
3. Recovery is an interactive process with no predetermined end or goal to achieve. It is different for every family and every person that goes through it.
4. The process of recovery creates tension within the family. During recovery, a family needs to break their system apart and focus as individuals on their attachment to their own healthy development. This process is part of the treatment, so service providers need to resist the instinct to put things back together. They need to allow the system to fall apart and to contain it in order for recovery to take place.
5. A most important part of recovery is for the family to be able to reach outside for help. Twelve-step programs are a valuable source of this help.
6. Therapists are also valuable sources of help for people facing addiction.
7. This model of recovery is transformational: family members need to understand that they have lost control and that their way of organizing around the addiction no longer works.
8. This developmental model of addiction and recovery is organized by core beliefs about control.
9. Recovery takes time.

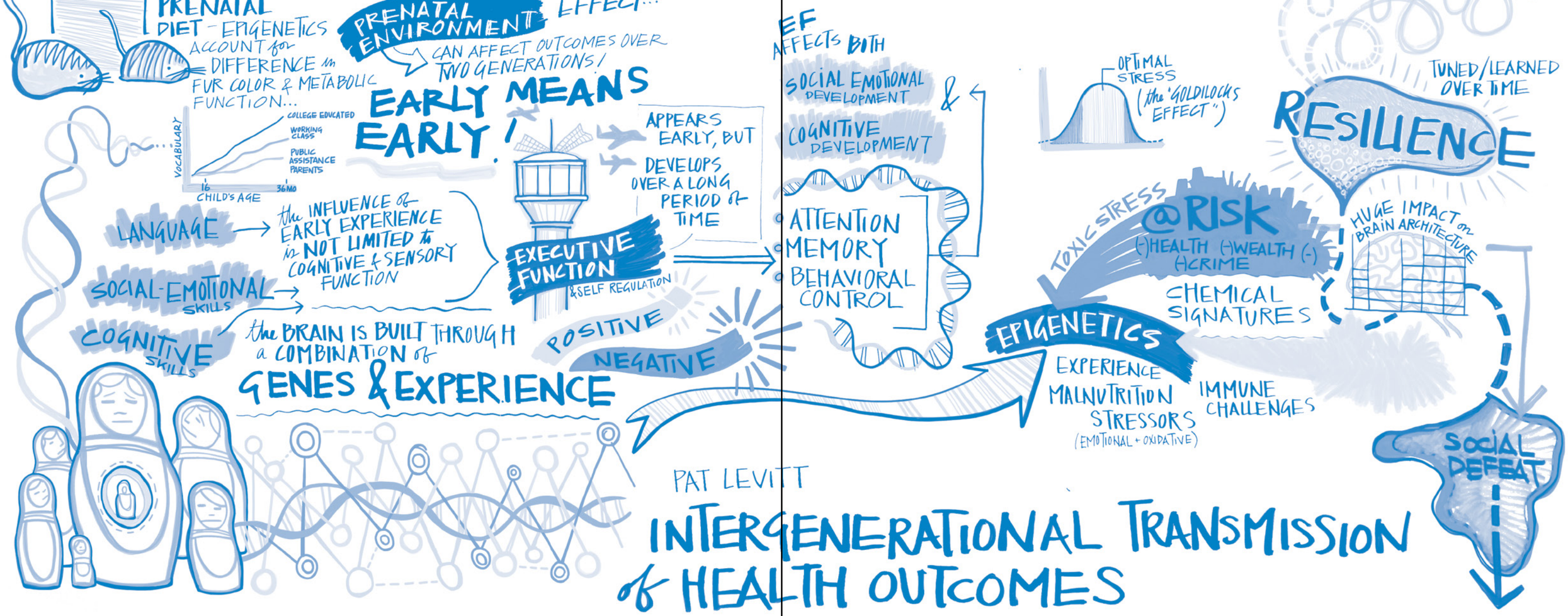
"Abstinence is an event and recovery is a process. At 79 days a person may have abstinence, which is a cornerstone of recovery, but they don't have recovery, which is something that develops over time."

Ariella Goodwine Fisher, MFT

Families go through four stages from addiction to ongoing recovery.

1. Active addiction: the family works hard to deny and explain the substance abuse at the same time, focused on protecting the addiction and maintaining balance in the family system.
2. Transition phase: the family begins to realize the reality of the addiction and loss of control and focuses on ending the substance abuse and beginning abstinence. Maintaining the status quo gets harder to do and there is chaos because of a vacuum between the status quo and the unknown destination of the process. Reliance on outside support is important here.
3. Early recovery: this is a time of action as new ways of thinking and living are taking shape. The focus is still on the individual, so vulnerabilities in the family are acute. Children may not be getting the attention they need; there may be unequal commitment between partners to the recovery process.
4. Ongoing recovery: family members are solid in their individual attachment to recovery and the focus shifts to rebuilding family relationships in a healthy way.

External scaffolding for the family is vital to recovery. The Recovery Project found three types of families in terms of involvement in the recovery process and long-term happiness: 1. Everyone is in recovery; 2. Some are in recovery and some not; and 3. No one is attached to recovery and the system remains unchanged. The second type of family is the most vulnerable to divorce and to maintaining a chaotic system. This underscores the importance of having programs in place that support the family and not just the addict. Providing this external scaffolding for the family is vital.



Abstract:

Risk and Reward: The Core Story of Healthy Brain Development

By **Pat Levitt,** PhD

To understand the origins of addiction across early childhood and adolescence, it is necessary to understand how parenting, environments, and epigenetic factors affect the intergenerational transmission of health outcomes. In particular, it is important to understand how parental mental health status and toxic stress affect brain wiring, the development of social and emotional behaviour, and ultimately adult health and well-being. Given this knowledge, the conclusion is clear: early intervention means earlier than originally thought, even before birth.

Why are early experiences so powerful? The brain starts with many more neural connections than it will use. These are pruned by experiences; circuits used most frequently remain and are developed. A lab rat exposed only to high-frequency sounds will excel at hearing high-frequency sounds, but not low-frequency sounds. In terms of language skills, a child raised by college-educated parents develops a capacity for word complexity by age 36 months significantly higher than that of a child raised by caregivers with a less complex language repertoire. An important key to the powerful effect of early experience is the serve-and-return social interaction between the child and the adult caregiver, which builds not only cognitive skills but also social skills that are essential to meeting life's challenges. Toxic stress damages circuits involved in multiple processes, producing cognitive as well as emotional and social effects.

Executive function – a person's "air traffic control" system – combines elements of cognition, emotional regulation, reward, and motivation. Executive function controls attention, working memory, long-term memory, response selection, and emotions. Early executive function disruptions, such as difficulty of toddlers in regulating their emotional states, are early predictors of physical health, substance abuse, financial and other problems in adolescence and adulthood, including single parenthood and incarceration. The frontal cortex area of the brain responsible for executive function takes a long time – well into the 20s – to mature. This provides opportunities to influence how executive function develops, but it also provides a long time over which things can go wrong. This is an important issue to consider when developing programs for intervention.

Why does toxic stress have such long-lasting, even transgenerational effects? We have known that a primary caregiver's executive-function deficits affect his or her ability to parent. Now science tells us that early experiences can also change the expression of the genes we inherit. In this process, called epigenetics, experiences activate brain cells during a sensitive time in development and actually change the chemical signatures on our DNA. This occurs either through methylation, which essentially shuts genes off, or through acetylation, which can change when and where genes are turned on or off. This process can take place not only in somatic cells, but also in germ cells, thereby having transgenerational effects. The science of epigenetics has identified how we translate experiences – such as malnutrition, emotional stressors, or immune challenges – that happen in the first three years, or even prenatally, into changes in gene expression with long-lasting effects that may be permanent.

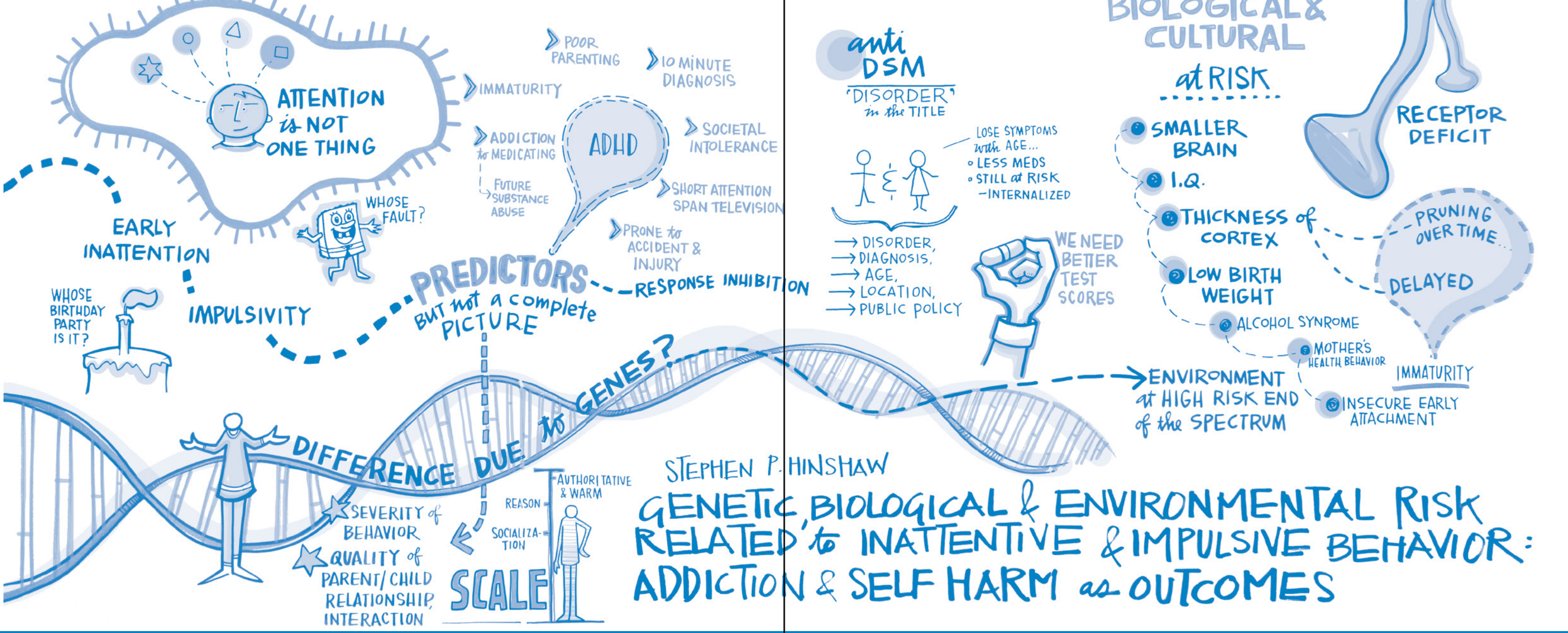
Risk factors for adult substance abuse are embedded in adverse childhood experiences. We know that primary caregiver interactions, both in humans and in animal models, have an enormous impact, through epigenetic changes, on how individuals will respond to challenges when they are adults. Research by Michael Meaney shows how low-level grooming behaviour in mother rats is linked to methylation of the glucocorticoid receptor gene in baby rats, reducing its expression and altering the stress-response system,

"We now know it's not about the genes that we inherit, it's about what we do with those genes and how experience changes those genes in a way that creates havoc with developing neural circuits. This process that we call epigenetics actually changes the chemical signatures in our DNA. It's not clear whether these changes are reversible or not, but the more that scientists study this, the more they realize that these chemical signatures under a lot of circumstances will be permanent."

Pat Levitt, PhD

and ultimately leaving the individual with a lifetime of heightened stress sensitivity. Increasingly, data show that the same thing happens in humans. Early childhood experiences also impact brain structure. One study showed that individuals who had high levels of maternal support tested significantly lower on depression severity and had larger hippocampi (part of the brain involved in learning, memory, and stress response) than individuals who had low maternal support. Ability to cope with stress results from a combination of factors including inherited genes, epigenetics, and early tuning of the stress system through positive or moderate short-lived stress.

Even the prenatal environment can change the way genes will act. The field of developmental programming looks at epigenetic transmission of character traits driven by experiences during sensitive periods of time, pre- or postnatally. Maternal diet changes during pregnancy can cause significant differences in fur colour, obesity, and cancer risk in genetically identical mice. Prenatal factors can also be transmitted non-genetically across generations. Research on mouse models has shown that normal embryos transplanted into host moms that have a serotonin receptor gene mutation (involved in mood regulation) will show high anxiety as adults even when given to a normal mom for postnatal care. This effect can be seen for at least two generations of offspring without the mutant gene. The take-home message of these epigenetic findings: early means early, even before birth.



STEPHEN P. HINSHAW

GENETIC, BIOLOGICAL & ENVIRONMENTAL RISK RELATED to INATTENTIVE & IMPULSIVE BEHAVIOR: ADDICTION & SELF HARM as OUTCOMES

Abstract:

Genetic, Biological, and Environmental Risk Related to Inattentive and Impulsive Behaviour: Addiction and Self-Harm as Outcomes

By **Stephen Hinshaw,** PhD

Inattention and hyperactivity/impulsivity are dimensions of behaviour that can show up during the early years and lead increasingly, at their extremes, to diagnoses of attention deficit hyperactivity disorder (ADHD). Research suggests that ADHD is not a static "disorder": different pathways lead to a diagnosis of ADHD, and early ADHD symptoms lead to different outcomes, including addiction and self-harm. Genetic/biological risks interact with environmental factors that may or may not be causal in determining various outcomes. Combined pharmacologic and behaviour interventions have been shown to produce optimal outcomes.

Inattention and hyperactivity/impulsivity exist on a bell curve in the general population. Persons at the extremes of either dimension are likely to be diagnosed with ADHD. The diagnosis can depend on little more than comments about the child's behaviour by the parents or teacher, often leading either to false positives or false negatives. Careful assessment is crucial, since children at the extreme ends of these dimensions are responsible for over $100 billion in direct costs for services and indirect costs involving the school system, juvenile justice, and eventual employment problems. Kids diagnosed with ADHD are often rejected by peers, and families dealing with these difficult temperaments get locked into patterns that can maintain or promote the behaviour. Kids with poor impulse control are highly accident prone and tend to generate other problems over time. Children with ADHD, particularly those showing high levels of inattention in grade school, are at high risk for substance use/abuse outcomes in adolescence, with school failure and subsequent high school dropout being clear mediating factors toward substance abuse.

The rate of ADHD diagnosis has exploded in recent years. One theory suggests that social forces resulting from the U.S. federal No Child Left Behind Act, which linked school financing to students' standardized test performance, may have played a role in driving up the U.S. figures. Researchers found that when a state passed laws rewarding or punishing schools for student performance, ADHD diagnoses increased, possibly because ADHD treatment helps boost achievement test scores, or because, in many states, those diagnosed with ADHD are excluded from a district's test score average.

What explains today's high levels of inattention and impulse control problems? Numerous factors are related to but not necessarily the cause of ADHD. Rather than a disorder with a unified cause, ADHD is a complex syndrome. A meta-analysis of the research literature shows that children diagnosed with ADHD demonstrated wide variability in performance on the same tests across time, suggesting a complicated picture at the behavioural and neural levels. Deficits in attention, inhibitory control, executive functions, self-regulation, and motivation – separately and in combination – undoubtedly underlie ADHD. Various etiological models have been put forth, ranging from dopamine transmission deficits and developmental immaturity to heritability, low birth weight, and compulsory education. None explains ADHD behaviours satisfactorily. Heritability of inattentive and response dysinhibitory/impulsive symptoms has been estimated at 75-80%; yet we know there are many ways the environment can work to switch genes on or off. The only conclusion is the equifinality of causal paths: i.e., different risk factors in various combinations produce what looks like the same syndrome at a given point in time. Moreover, some kids with equal levels of ADHD-like behaviour problems go on to very divergent outcomes (multi-finality). A study of over 700 ADHD-diagnosed preschoolers showed that only 50.1% had ADHD six years after diagnosis. Two predictors found in the latter study were severity of the temperamental dimensions of impulsivity and inattentiveness at ages 3-4 and negative quality of the parent-child interaction. This doesn't mean that the parents necessarily caused the behaviours; more likely, how the parents responded to the child's behaviour

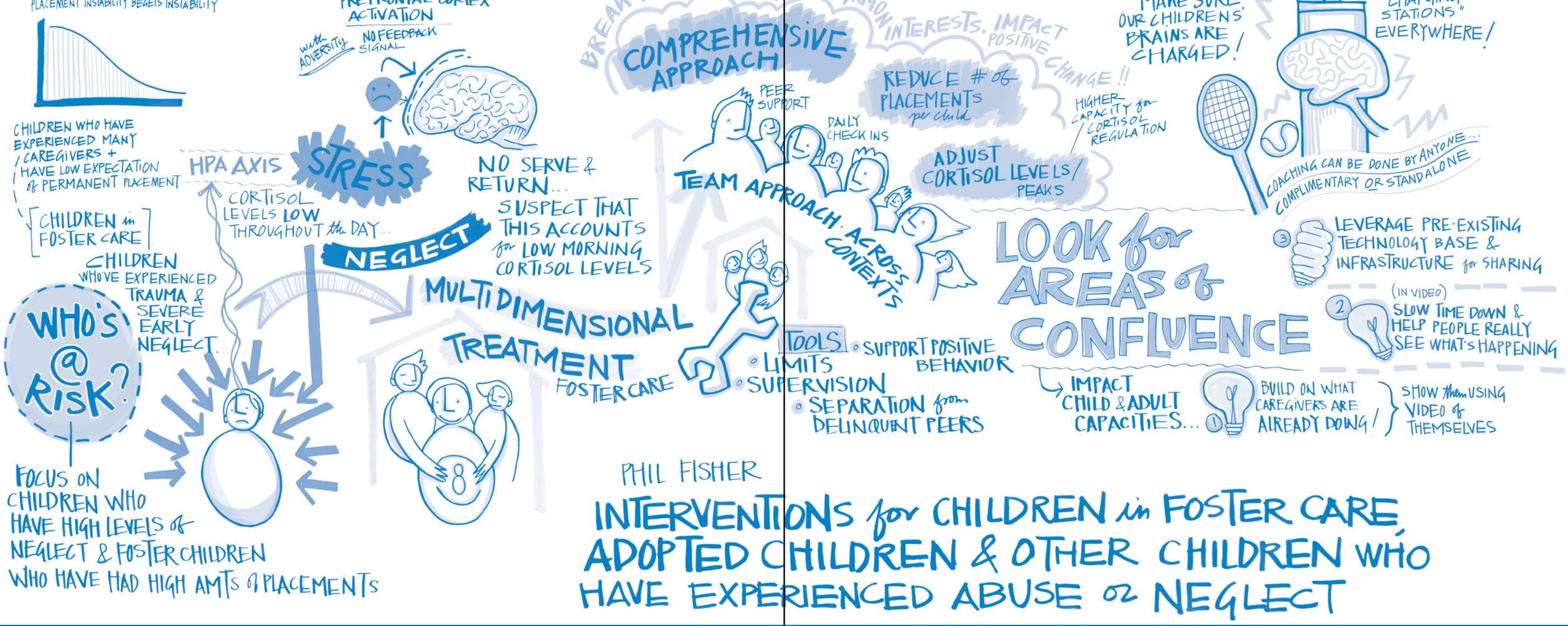
"For my money, in addition to medications that might help fine-tune the attentional system and help regulate impulsive behaviour, we can, through reward programs and sensitive scaffolding and teaching, literally teach social and academic skills so that the behaviour that is going down is replaced by adaptive behaviour that's going to make for more success, and that's what's going to change life trajectories."

Stephen Hinshaw, PhD

early on made a huge difference in outcome. This is suggested by another study, which looked at parenting behaviour with ADHD-diagnosed children and social competence measured by status with peers. An authoritative/responsive (firm but affirming) parenting style, as opposed to authoritarian or permissive parenting, produced the highest social competence outcomes.

What about gender? More boys than girls are diagnosed with ADHD-like behaviour problems, on a scale of two-and-a-half or three to one. A study of girls diagnosed with ADHD showed they had many of the same problems as ADHD-diagnosed boys in elementary school, but in a 10-year follow-up the majority no longer met ADHD diagnostic criteria. Even so, 23% of girls originally diagnosed with combined-type ADHD (inattention plus serious impulsivity) reported a serious suicide attempt between ages 15-20, compared to 8% of the childhood-diagnosed inattentive group and 6% of the controls. In addition, 51% of the girls with combined-type ADHD reported moderate to severe self-injury behaviour in late adolescence/early adulthood, compared to about 25% of the inattentive group and 19% of the controls. We know that, overall, the second 10 years of life are the risk period for girls for internalizing problems of anxiety and depression. That response magnifies in the face of problems in response inhibition and peer rejection; it cannot be ignored as girls go through ever-earlier puberty. Attention problems and impulsivity in girls constitute a public health concern of considerable magnitude.

In terms of treatment for ADHD, a combination of home and school social skills intervention and medication has shown the best results. Studies have shown that medication alone and psychosocial intervention alone are helpful, but only the combined treatment leads to dramatic improvement. In one study, 70% of kids receiving this combination achieved a near-normal range of functioning. While it is important to reduce problem behaviour, it is much more important to teach the academic, social, and executive function skills these kids will need to succeed in the world.



PHIL FISHER

INTERVENTIONS for CHILDREN in FOSTER CARE, ADOPTED CHILDREN & OTHER CHILDREN WHO HAVE EXPERIENCED ABUSE or NEGLECT

Abstract:

Interventions for Children in Foster Care, Adopted Children, and Other Children Who Have Experienced Abuse and Neglect

By **Philip Fisher,** PhD

The science of early brain development is helping us to understand the needs of maltreated children in ways never before possible. Now we can be increasingly precise about which children are at greatest risk for poor outcomes. Not every child in care needs a vast amount of services, and brain science helps to identify those who do. Evidence-based interventions that leverage our understanding of the brain's plasticity in early childhood have the potential to mitigate some of the risks conferred by adverse early experiences. Innovative two-generation interventions under development have the potential to vastly accelerate progress in this area.

Children in foster care show the effects of toxic stress and are at risk for poor outcomes across a broad range of domains. These include cognitive, language, emotional, and physical development. Advances in brain science allow us to be more precise in identifying specific populations and targeting interventions to their needs. For example, the science of serve and return suggests that the children at greatest risk are not simply those who have experienced trauma, but in addition children who have experienced early severe neglect. It's not just about bad things that happen in children's lives but about good things that don't happen.

Science shows a connection between neglectful early care and flat cortisol levels throughout the day. Activation of the HPA axis, a component of the stress response system that helps the body deal with perceived stressors, leads to the production of cortisol, a hormone that plays a key role in response to threat. Cortisol also shows a daily rhythm of production, with the highest levels in the morning, then decreasing levels throughout the day to almost zero by bedtime. Kids from backgrounds of maltreatment show flat levels of cortisol throughout the day with no morning peak. Low morning cortisol has been associated with a number of psychiatric and mental health problems over the course of development. The absence of serve-and-return interaction is a toxic stressor and affects the development of the HPA axis.

Children who experience many placement changes are at risk of poor outcomes and have a reduced likelihood of securing permanent placement. Frequent changes in the caregiver environment appear to interfere with development of executive function, including self-control, mental flexibility, and the ability to hold in mind and manipulate concepts. In a brain imaging study, children in foster care showed less focus and a more diffuse pattern of activation than children in the community during a cognitive task measuring response inhibition. Studies like this allow an empirically based approach to identifying high-risk children in foster care and focusing resources to address deficits in their development, particularly in executive function. Children in foster care who have not moved around a lot are less likely to have these executive function challenges. They still require monitoring and possibly other services such as those to address trauma. Brain science helps to identify those who require additional intervention to address developmental deficits.

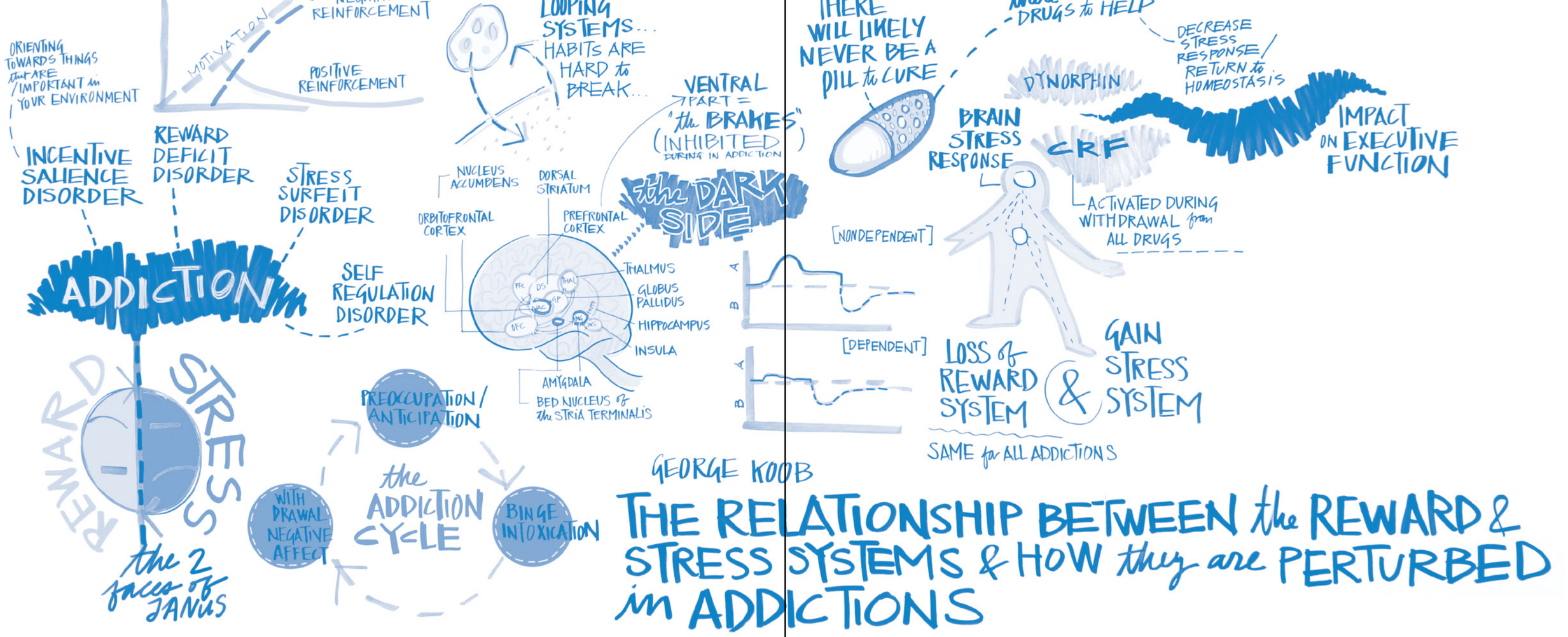
Interventions that leverage the brain's plasticity in early childhood have potential to mitigate some of the biobehavioural effects of early life stress. Multidimensional Treatment Foster Care (MTFC), an evidence-based intervention developed in Oregon, breaks away from traditional models that assign foster parents a custodial role and treats the foster home itself as a therapeutic milieu. MTFC is a comprehensive program that provides tools to caregivers that are simple, practical, and effective with emphasis on supporting and encouraging positive behaviour, setting clear and consistent limits, and close supervision of the child. It uses a team approach primarily focused on the caregiver-child relationship and on addressing the child's developmental needs. Services are co-ordinated across the various contexts in which the child functions: home, community, and school. Ongoing support is provided to the caregivers, with staff on call 24/7, daily telephone checks, and weekly support group meetings. Coaches help the child develop social skills. Support is also provided to the intended long-term caregiver to enable a smooth transition from the foster family to a permanent placement.

MTFC client follow-up shows dramatic results. The program reduced the risk of placement instability from 85-90% to less than 10%. Children who were in the MTFC program showed emergence of a morning peak in cortisol that corresponded to a decrease in problem behaviour and much more regulated patterns of cortisol across time in spite of what might be going on in their environments. This suggests that the intervention can buffer the children and prevent their stress systems from becoming dysregulated in response to stress in their environments. In terms of executive function, children in the program showed a normalization in electrical activity in the brain in response to feedback that they had made a mistake in playing a computer game. This change corresponded to improvement in teacher ratings of the child's social skills.

"To realize the full potential of these scientific advances, we need to break down the silos that have typically separated us into different professions, perspectives, and disciplines. Only then can we see the common interests we share and how we can work together to bring about change."

Philip Fisher, PhD

Innovative two-generation models leverage brain science to make an immediate, larger impact at the community level. This approach works with the existing caregiver-child interaction and uses video to build on it by showing caregivers what they are already doing to support a child's development. Slowing the video captures serve-and-return moments, and subsequent coaching shows the parents how to recognize the child's serves and expand upon their own returns. If we think of the brain as a battery and serve and return as a charger, the potential of this low-cost, simple intervention is powerful. The more ways we find to facilitate serve-and-return "charging stations" in the child's home, school, and community settings, the more we maximize the potential of every child.



Abstract:

The Relationship Between the Reward and Stress Systems and How They Are Perturbed in Addiction

By **George F. Koob,** PhD

Drug addiction is a complex brain disorder in which neurobiological and neuroadaptive mechanisms lead to loss of control over drug-taking. The pathophysiology of addiction is rooted in the reciprocal interactions that result when overactivation of the reward system engages the stress system. Bottom line: addiction is an incentive-salience disorder, a reward-deficit disorder, a stress-surfeit disorder, and an executive-function disorder. Understanding the neuroadaptations in the reward, stress, and executive function systems is providing new insights into identifying vulnerabilities to addiction and novel treatments.

What is addiction? Addiction can be defined as a chronically relapsing disorder characterized by a compulsion to seek and take a drug or stimulus, loss of control in limiting intake, and emergence of a negative emotional state (e.g., dysphoria, anxiety, irritability) when access to the drug or stimulus is prevented. The addiction cycle moves from the binge/intoxication stage to the withdrawal/negative affect stage to the preoccupation/anticipation, or craving, stage. In this model, the compulsive behaviour is driven not only by positive reinforcement but, in later stages of addiction, negative reinforcement, or the drive to remove the negative emotional state of drug withdrawal. These patterns of behaviour are common to process addiction as well.

This model can be superimposed on the neurocircuitry that involves the basal ganglia, the amygdala, the hippocampus, and the pre-frontal cortex components of the brain. The reward system, located in the basal ganglia, uses dopamine as its main neurotransmitter. This system orients us toward stimuli in the environment (incentive salience) that are important for survival and produces positive reinforcement – a burst of dopamine that feels good – when we find them. While a natural reinforcer like sex or food produces a 20-30% release of dopamine, crack cocaine and methamphetamines can produce a 400% increase. Normally, the released dopamine binds to a receptor and then gets taken back up into the neuron terminal in a homeostatic process. But cocaine blocks the reuptake process and methamphetamines actually reverse the process. Alcohol and opioids act in an equally powerful way on the nucleus accumbens to release neuropeptides called endorphins, which also increase dopamine release. Neuroscientists are now studying the neuroadaptations that occur when the system is overwhelmed with large amounts of circulating dopamine. One thing that appears to happen is the formation of circuits looping from the basal ganglia to the cortex that progressively become codified into drug-seeking habits that are difficult to break.

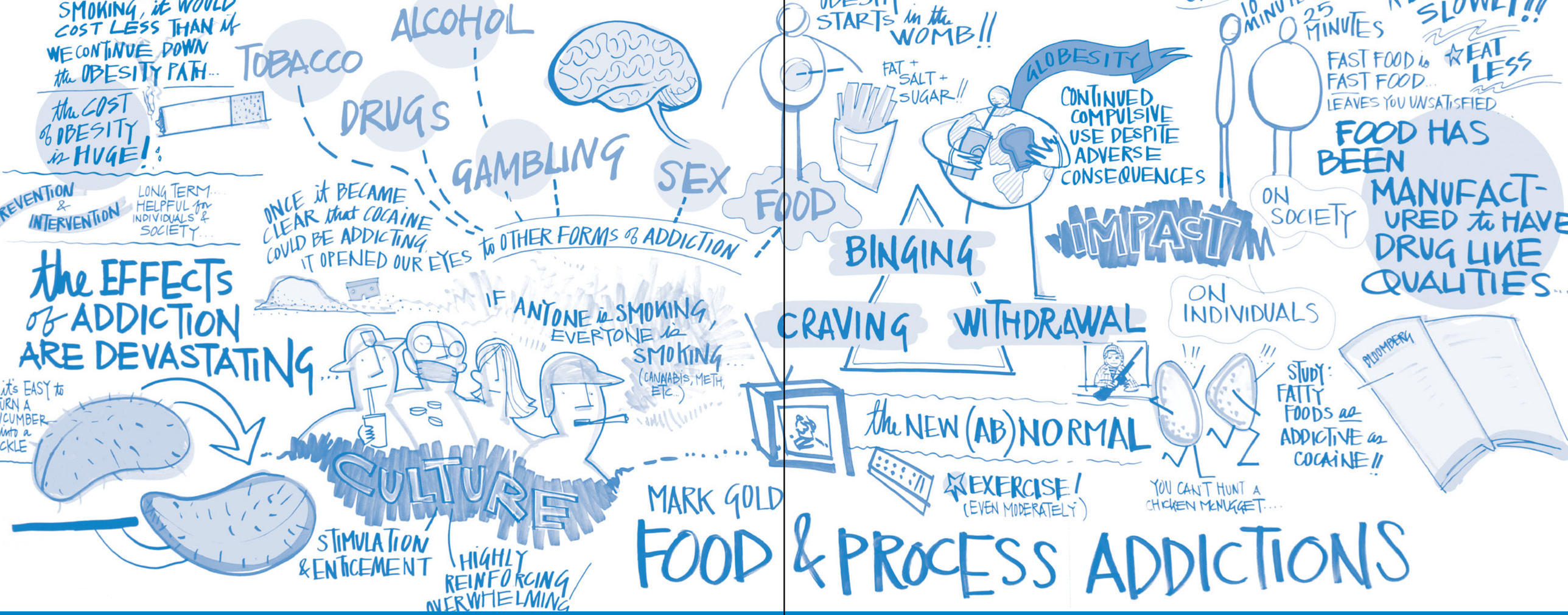
In the withdrawal/negative affect stage, the activity of the reward system is blunted and the stress system is activated. Brain imaging shows robust dopamine binding in the basal ganglia of a normal human, but dramatically decreased binding in a cocaine abuser one month into withdrawal. Four months into withdrawal, the dopamine function begins to recover, illustrating that neuroadaptations may underlie the processes of both addiction and recovery. This observation has been replicated for every major drug of abuse as well as for compulsive eating and, in some studies, pathological gambling and Internet addiction. In addition to blunting the reward system, withdrawal from any major drug of abuse activates the CRF (corticotropin releasing factor) system, which conducts the body's stress response. CRF drives the HPA (hypothalamic-pituitary-adrenal) response to stress and the associated elevation of cortisol; the sympathetic nervous system response to stress (increased blood pressure and heart rate); and the behavioural response to stress. In addition to cortisol, two other prominent anti-reward transmitters are associated with the brain's stress response – dynorphin and norepinephrine. Each time a person binges on a drug and withdraws, the stress system is re-activated. Ultimately the system becomes sensitized.

"If you become dependent on a drug, if you become addicted, you lose your reward system and you gain your stress system. This is a double whammy to our motivational systems and our emotional systems that overlaps with many, many disorders."

George F. Koob, PhD

The frontal cortex plays a key role in the craving, or preoccupation/anticipation stage of the addiction cycle. Craving is multi-determined. The dorsal part of the pre-frontal cortex, which is the "go system" or emotional response system, is involved in establishing habits linked to the environment and responds to the cues in the environment associated with a drug. Another form of craving, called relief craving, seeks the drug because of a malaise related to protracted abstinence and likely involves activating the amygdala. This may be caused by dysfunction in the ventral part of the pre-frontal cortex – the "stop system" or response-inhibition system – which normally causes the individual to step back, evaluate, and make decisions. In addiction, this system is impaired and there is evidence that the go system is facilitated. Evidence is growing that newer versions of behavioural treatments such as cognitive behavioural therapy can strengthen the stop system and inhibit the go system. There is also evidence in animal models that changes in CRF impair executive function, driving further escalation of drug intake. This suggests that the preoccupation/anticipation stage may kick in earlier than originally thought to perpetuate the negative emotional states that are key to driving addiction.

Neuroscience will advance a Rosetta Stone approach to developing medications that may be helpful in treating addiction. Animal models are being screened and validated for use in human laboratory studies to predict drugs that might be used as adjuncts to behaviour therapy in treating addiction. Also, compounds in the public domain that have been used for other indications have been validated in animal models. One major success is a clinical trial with a drug called Gabapentin, which has a remarkable effect in preventing relapse, decreasing excessive drinking, and aiding in sleep disorders associated with alcoholism. There is a major focus now on developing other drugs that would help to regulate the stress system.



Abstract:

Food and Process Addictions

By **Mark S. Gold,** MD

Experts and the general public have been slow to recognize process addictions, particularly food addiction, as meeting the definition of addiction. While obesity has become a global problem of epidemic proportions, there is little agreement on its cause or appropriate treatment. Recent research makes a compelling case for food as an addiction and points the way to innovative treatment and public health measures to prevent obesity.

What is an addiction? Addiction is a chronically relapsing disorder for which detoxification alone does not work. However, pioneering work done with physicians shows that appropriate treatment achieves positive results. The redefinition of addiction over 20 years ago to include cocaine in the Diagnostic and Statistical Manual of Mental Disorders (DSM), on the basis of pathological attachment and continued compulsive use despite the consequences, opened the door to reclassifying behaviours like compulsive eating, gambling, and compulsive sexual behaviour as forms of addiction. Gambling was reclassified as an addiction in the DSM-5 released in May 2013 and is the first process addiction to be labelled formally as an addiction rather than an impulse-control disorder. As neuroscience advances, data are accumulating to include food addiction and other process addictions in future editions.

Could food have drug-like properties? Obesity has become a global problem, renamed by the World Health Organization (WHO) as epidemic "globesity." At current rates, by 2030, half the adult population of the United States will be obese. The biggest increase in obesity is in the most obese, despite warnings that continued overeating will most likely lead to diabetes. In this respect – compulsive use despite adverse consequences – obesity is similar to alcohol or drug addiction, and brain imaging studies show that even the effects on the brain are the same. Neuroimaging shows that the down-regulation of dopamine commonly associated with alcohol and drugs is produced equally by obesity. There are no significant differences in PET images between an alcoholic and a morbidly obese person. The bottom line is that drug abuse and obesity have a lot in common.

Food preference, not appetite, is the key factor. Food preference starts early and continues throughout life. If laboratory rats are fed sugar and milkshakes, their offspring can be born preferring sugar and milkshakes. Yet there are no firm guidelines on eating for pregnant women. Laboratory studies show that sugars and fats make food an object of desire and can produce cravings. The more pleasure the food provides, the more likely it is to become addictive. Worse, our brains have not yet adapted to the era of food abundance in which we live. Instead, we find food that feels good, consume a lot of it, and store it in preparation for the next flood or famine.

Research evidence suggests that the brain actually changes in response to fast food exposure. Studies conducted in China showed that if an agrarian person who has never experienced fast food views a fast food symbol, such as McDonald's golden arches, his or her brain registers no reaction. But if that person moves to the city and is later restudied, his or her brain reacts as if it were exposed to the label of a favourite brand of alcohol. This does not happen with bland food, such as rice cakes. Further, functional imaging studies show that it takes about 12 minutes for a thin person to receive a food signal in the brain, but it takes about 25 minutes for an overweight person to get a food signal to the brain. This means that eating fast food on the run can feel like not having eaten at all, leading to the urge to eat more. This is the situation: we are surrounded by fast food that is manufactured to have drug-like qualities to stimulate its own taking, a prenatal environment that is devoid of guidance, and child-rearing that uses treats as rewards. We also lead a sedentary lifestyle and eat abnormally fast.

"I think it would be hard to be addicted to food if you didn't have enough. It would be hard to be addicted to food if you were a farmer and you grew your own food and ate it. But it's easy to think about being addicted to food when what you're eating is manufactured and it's manufactured in a way to make you want it, crave it, need it, take it again, seek it out, and give you a sense of pleasure. That's really the modern-day food."

Mark S. Gold, MD

What can we do about it?

We need to stop doing what we are currently doing. We need to stop blaming the patient, stop telling people to go on a diet. Instead, we could:

- Understand sugar signals to the brain and eat slowly.
- Reduce portion sizes.
- Reduce and tax soft drink consumption.
- Incorporate more exercise into everyday living.
- Forego carb loading at the gym.

Obesity requires an addiction model of intervention. Currently there are no board certifications or training programs for physicians in obesity. Instead, obesity symptoms and consequences are being treated separately by a variety of specialists. What is needed is an integrated chronic disease model of intervention for obesity. This would include medications, cognitive therapy, and structured eating and reprogramming aimed at a long-term outcome that is healthy for the person, his or her children, and society.

Abstract:

The Prescription Opioid Crisis Has Infected the Healthcare Workplace

By **Marvin D. Seppala,** MD

Prescription opioid dependency is the fastest-growing addiction in the United States. Overdoses associated with prescription drugs are now the number-one cause of accidental deaths in the U.S. Some of those becoming addicted work in the healthcare setting, where they have easy access to these drugs of abuse. Long-term treatment programs designed for physicians who become addicted have shown excellent outcomes for those who remain in treatment. Information gained from Physician Treatment Programs can help improve treatment in the general population.

Prescription opioids are easily accessible. Most of these medications are provided in fast-paced primary care settings. In the mid-1990s, there was an exponential increase in prescriptions of pain-relieving medications coincident with the release of oxycodone, which was remarkably more powerful than previously available opioid medications. It was generally acknowledged that up to that point, pain wasn't being treated adequately. Then the pendulum swung in the opposite direction and far too many of these medications were prescribed. Over an 11-year period between 1992 and 2003, while the U.S. population increased 14%, the number of people abusing controlled prescription drugs jumped 81%. Prescription pain medications (opioids) are now the fourth most abused substances in the U.S. behind marijuana, alcohol, and tobacco. In some states, pain relievers are often the drug of initiation by youth, and, combined with heroin in overall totals, they are almost tied with marijuana as the initiation drug. This is a frightening trend.

In the last decade, 125,000 people in the U.S. have died of an opioid overdose. This is a health crisis. Between 1999 and 2010, the rate of opioid pain reliever overdose death increased in tandem with the amount of opioid pain reliever sold. In 2011 alone there were 16,500 deaths in the U.S. from prescription opioid overdoses. Meanwhile, treatment admissions for prescription opioid dependency increased fourfold in the U.S. from 1998 to 2008. The number-one group using prescription opioids, and dying, is youth, a sector that increased from 15% to over 40% of treatment admissions at the Hazelden Foundation between 2001 and 2011. A major part of the problem is that people often decide to leave after detox, not understanding that treatment is a long-term process and detox is only the beginning. Given that addiction is a chronic illness, they most often return to substance use. There is also a problem of sudden death if a person returns to use right after treatment. This is due to lowered drug tolerance during abstinence and a tendency to return to the higher level of use the person had reached prior to treatment.

Opioid addiction is a major problem in the healthcare workplace. Any employee in the healthcare workplace is capable of diversion of psychoactive substances, from physicians diverting fentanyl at the surgical table to housekeeping staff stealing sharps boxes. They are often stellar employees who would not be under suspicion until they reach the end stage of addiction, when their work begins to suffer. People with the most access are the most likely to become addicted, with nurse anaesthetists and anaesthesiologists in particular showing a remarkable death rate and loss-of-job rate over their lifespans due to addiction. Diversion is a multi-victim crime, not only putting the addict, whose executive dysfunction can lead to accidental overdose, at risk but also patients, co-workers, employers, and society in general. Monitoring is essential to prevent patient harm.

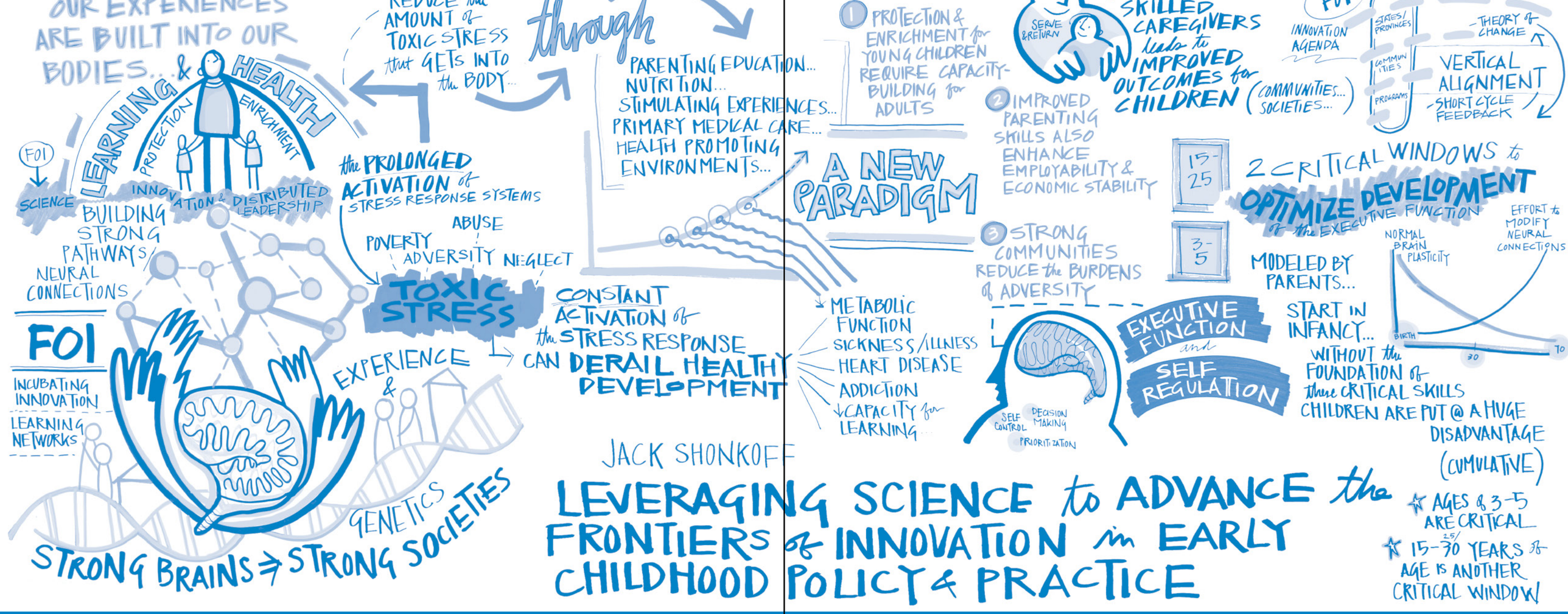
"Physician and healthcare professional addiction treatment and monitoring over time have had tremendous outcomes. As a result, we've been able to learn from that and incorporate some of the successful aspects of those programs into our general treatment for the rest of the population."

Marvin D. Seppala, MD

Healthcare professional treatment and monitoring programs have produced impressive outcomes and provide a model for improving treatment of addiction. Physician Health Programs (PHPs) provide long-term treatment and monitoring for addiction and have shown dramatic outcomes for those who complete their programs. Success with these programs has provided information and insight for treatment of addiction in the general population. Evidence from PHPs underscores the concept that addiction is a chronic illness and treatment must be long-term. It also points to positive family history and co-existing psychiatric illness as major predictors of addiction and of relapse. Environment, including exposure to drugs and type of drugs (e.g., powerfully reinforcing opioids in the healthcare workplace), also plays a key role. Essential ingredients to long-term recovery and maintenance, based on outcomes of PHPs, include:

1. Contingency management, such as adding rewards or sanctions to the program
2. Frequent random drug testing
3. Linkage to 12-step programs
4. Active management of relapses
5. Continuing care approach – at least five-year and possibly even career-long monitoring
6. Focus on lifelong recovery

Electronic approaches to long-term care are under study, including online aftercare/coaching, apps that help people who may not have the resources to continue long-term care in person, and texting, which appears to improve outcomes with the youth population.



Abstract:

Leveraging Science to Advance the Frontiers of Innovation in Early Childhood Policy and Practice

By **Jack P. Shonkoff,** MD

Revolutionary advances in neuroscience, molecular biology, genomics, and the behavioural and social sciences indicate that early experiences are built into our bodies and can affect a lifetime of learning, behaviour, and health. This science informs the core story of early childhood development and suggests new intervention strategies to produce better brain development. The goal of Harvard's Frontiers of Innovation (FOI), in which Alberta is a partner, is to catalyze substantially greater impacts for children whose needs are not being fully met by existing policies and programs.

Early childhood is a time of great promise and considerable risk. Strong neural connections are made during the early critical period of brain development through responsive serve-and-return interactions between children and the adults who raise them. Neural circuits become interconnected as skill builds upon skill, from simple to more complex. *When* neural circuits are built is determined by genetics, but *how* circuits are built is affected by experience and the environment in which the child lives.

Early adversity impairs development. We have known for some time that children who face significant adversity – such as abuse, neglect, severe poverty, or addiction or mental health problems in the family – are at risk for negative outcomes in learning, health, and emotional and social development. Now science is helping us understand how adversity gets into the body and affects the brain and other organs. The culprit is toxic stress – excessive activation of stress-response systems that extends over a long period of time without protective buffering from adult caregivers. The body's normal stress responses, such as increases in heart rate, blood pressure, and stress hormones, fuel our fight-or-flight response, help us deal with acute threat, and then return to baseline. But in the case of toxic stress, the stress responses have a wear-and-tear effect on the body. This effect can disrupt circuits in the brain that are developing new connections, suppress the immune system, accelerate atherosclerosis, affect metabolic systems, and generally leave children more vulnerable to problems.

What can we do about it? As science uncovers the causal links between significant childhood adversity and lifelong impairments in learning, behaviour, and health, it becomes possible to design and test innovative intervention strategies to reduce or mitigate the effects of early toxic stress. Current early childhood policy and practice are based on the hypothesis that parenting education and preschool enrichment programs will ensure that a child comes to school at age six ready to succeed. But some children still arrive in school unprepared due to impairments from adverse early experiences. Frontiers of Innovation (FOI) operates at the interface of science, policy, and practice to address this population. FOI has generated new hypotheses based on the themes that early experiences affect lifelong health *and* learning and that healthy development requires protection *and* enrichment. These hypotheses are:

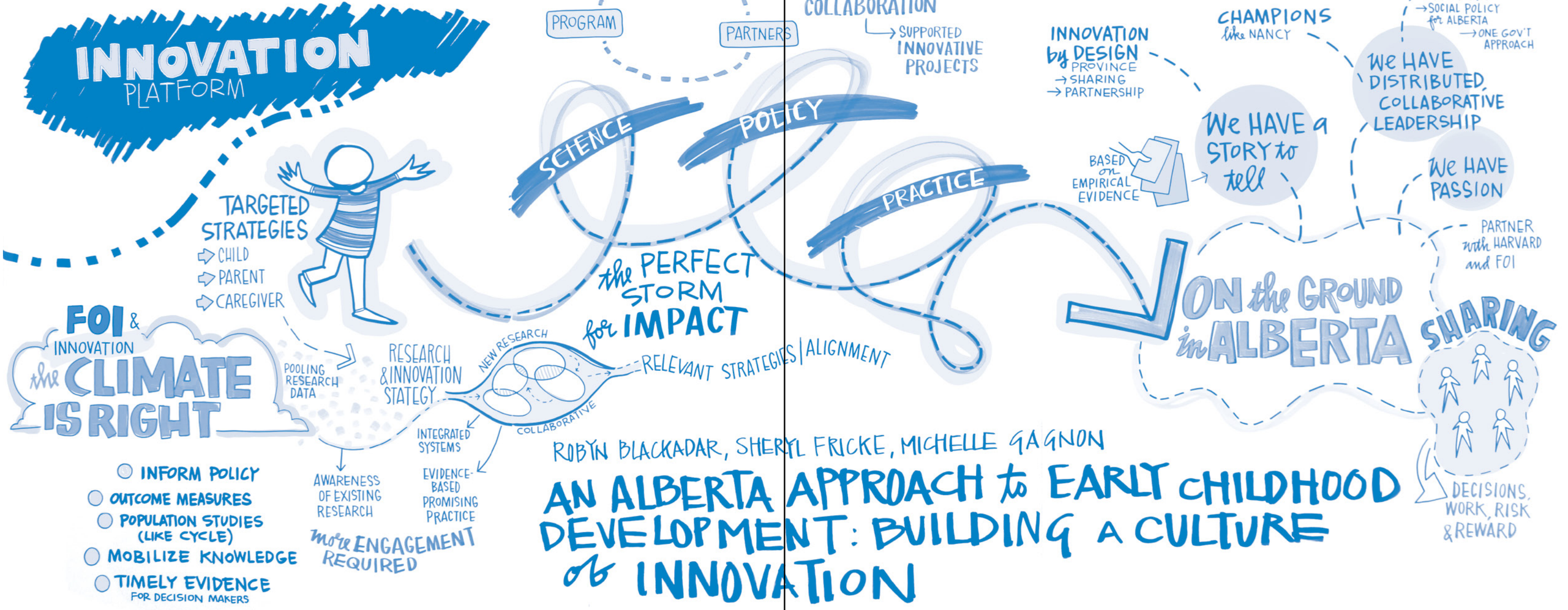
1. Protection and enrichment for young children require capacity-building for the most important adults in young children's lives.
2. Improved parenting skills are the same skills that enhance employability and economic self-sufficiency
3. Strong communities reduce the burdens of adversity by making it easier for parents to successfully raise their children

"Alberta is a shining example of how we can not only understand the science, but also act on it and show the rest of the continent and the rest of the world what leveraging this science can do for advancing innovation."

Jack P. Shonkoff, MD

Executive function and self-regulation skills – the air traffic control system in the brain – are the core dimensions of adult competence. A child who starts school without a good foundation in these skills will not do as well as children who are refining these skills. The gap widens as these children reach the job market, and the cycle starts again when these children become parents. Data from nearly 50 years of studies of early education programs in the U.S. and Canada confirm that the addition of active modelling/skill-building for parents has a much greater impact on children's early reading and math skills than just working with the children alone or involving the parents in a passive way. The focus on strengthening adult capabilities is critical: these skills develop from coaching and role modelling, and adults have to scaffold the development of those capacities in young children. While the ability to change brains and behaviour decreases over time, executive functioning skills are located in regions of the brain that show an extended period of development. FOI takes advantage of this opportunity with a new strength-based model that provides coaching to build these essential adult skills.

FOI is a virtual learning community of researchers, policy-makers, philanthropists, and clinicians focused on developing, testing, and taking to scale new ideas. FOI is science based and drives innovation through risk-taking, short-cycle feedback, "failing fast," learning from failure and revising strategies, leading ultimately to breakthrough outcomes. It starts in a climate that understands the core story of early childhood development and is open to trying new approaches. Working groups, such as Building Caregiver Capacities, are tasked with developing new ideas, or seeds, that can be tested and incubated in the soil of innovating communities. Alberta has been involved from the start in April 2011 and is one of FOI's three innovating states and provinces that are incubators for innovation.



Abstract:

An Alberta Approach to Early Childhood Development: Building a Culture of Innovation

By **Robyn Blackadar**, MBA; **Sheryl Fricke**, MBA; **Michelle Gagnon**, MBA, PhD

Improving child health and development in the early years is a priority for the Government of Alberta. The policy platform and focused path for this initiative is a made-in-Alberta approach that is grounded in the core story of brain development and focused on improving outcomes for children and families.

Alberta is well positioned for embarking on an early childhood development (ECD) initiative. A number of things have come about in the province recently on which to build this initiative. Alberta's Premier decided to make ECD and improved measures of child health and development in Alberta one of five government priorities. Because children grow within a context of family and community, a cross-departmental Social Policy Framework was introduced. The work of the Alberta Family Wellness Initiative (AFWI) in championing the issue and bringing the core story of early childhood development to this province has been pivotal. Following an introduction by the AFWI, the province is now exploring a partnership with Frontiers of Innovation (FOI) at the invitation of the Harvard Center on the Developing Child. The aim is to achieve breakthrough outcomes at the child, family, and community levels by building communities of purpose to engage in evidence-based practices.

Alberta's Social Policy Framework looks at the whole person and supports people across the life course. The Framework is designed to enable collaboration and partnerships, create a person-centred system of high-quality services, reduce inequality, and protect the vulnerable. Building on the principles of this Framework, Together We Raise Tomorrow is a province-wide initiative working to create a children's charter, a poverty reduction strategy, and an Alberta approach to ECD. The ultimate goal is better policies for children, elimination of child poverty, and improved ECD health and development outcomes.

Brain science will show the way forward, and the core story provides a new language to explain why this agenda is important. Currently about 27% of Alberta's children arrive in kindergarten without the basic developmental skills required to be successful in school. This is a significant percentage. These data are mobilizing communities and ECD coalitions across the province that are talking to Albertans about the core story and what we know about how our children are doing.

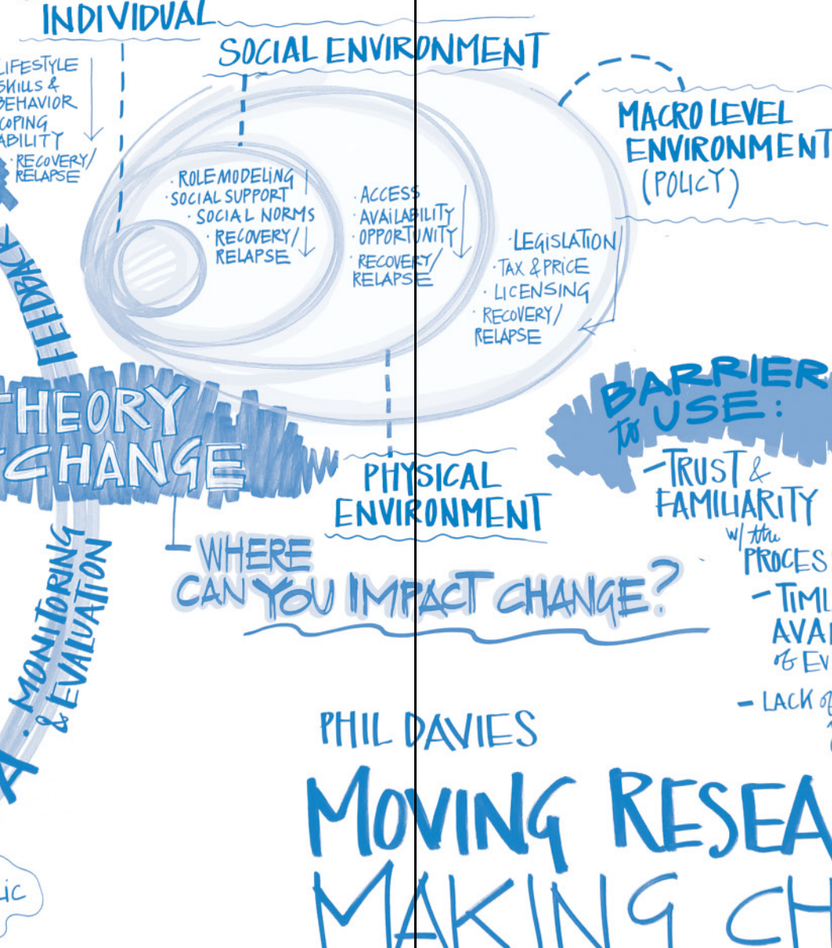
Alberta has an excellent foundation of programs, innovation, and research to build upon. It involves three government departments – Health, Human Services, and Education – and a host of agencies, organizations, municipalities, service providers, and other related jurisdictions. However, there is no system of support around ECD that parents can easily understand or access. With a Human Services lead and Education and Health as partners, Alberta is now moving toward consolidating ECD services into an integrated system. The Alberta approach to ECD looks to support all children but also to include more targeted interventions for those who need more support. Efforts are focused in four areas: a healthy start for children, children realizing their full potential by the time they enter school, parents providing stable environments for their children, and safe and supportive community environments where children can grow and thrive. To achieve these outcomes, the initiative has four strategic priorities: improve maternal, infant, and child health; enhance parenting supports and resources; enrich early learning and care environments; and promote safe and supportive environments for children in communities. Strategies to achieve these outcomes range from a preschool screening framework for early identification and action to coaching, skill-building, and mentoring to improve caregiver capacities among parents and the ECD workforce. Collaboration with communities is also needed to build an integrated system.

"Can you imagine a better place to work in early childhood development than Alberta right now? We have a collective story to tell that is based on empirical data from science that's allowed us to bring to the table people we've never been able to bring to the fold before. We have a focused distributed leadership. And we have the passion to make things happen."

Sheryl Fricke, MBA

Alberta has the elements necessary to fit the FOI agenda. Alberta already has many innovative processes, ideas, and projects underway. Now it needs a well-defined ECD research and innovation strategy, including fast-cycle innovation to test, evaluate, and scale successful pilot projects and bring them into the system. Three communities in Alberta – in Wood Buffalo, Edmonton, and Lethbridge – are now looking at participating in FOI. Two programs – CUPS (Calgary Urban Project Society) and CASA Child, Adolescent and Family Mental Health – are also part of Alberta's FOI agenda. Each has a team of researchers, policy-makers, and practitioners.

The Alberta Centre for Child, Family & Community Research (ACCFCR), the AFWI and the Government of Alberta are working at building Alberta's research and innovation strategy. The ACCFCR was created in 2003 to fund, conduct, and mobilize research in the areas of early childhood development, middle childhood and youth well-being, family and community capacity-building, and tracking long-term outcomes. In 2013, the ACCFCR was appointed to co-chair with government an advisory committee to create and implement a research and innovation strategy as a key enabler to the Together We Raise Tomorrow Framework. While significant accomplishments have been achieved, by global standards there is still much to be done to improve the current state of early childhood development in the province and beyond. The goals for the strategy are to build awareness of existing research; influence the creation of new knowledge to address gaps and anticipate ongoing research needs; and create a collaborative environment that enhances relationships between researchers, policy-makers, practitioners, and the public. The strategy will inform explicit policy directions; facilitate inter-disciplinary applied research, evaluation, and capacity-building; align funding with outcomes; be supported by longitudinal, population-based studies; and mobilize knowledge on a timely-basis among decision-makers, program leaders, and the public. Above all, the strategy will build support for the value of ECD to society. The AFWI has been working since late 2012 to create a research collective focused on ECD, bringing together members of the Harvard Center, academics from Alberta's research universities, and people in government. The AFWI has supported meetings of researchers in Alberta to build awareness of FOI, foster relationships, and define the next generation of early brain research. The AFWI is also partnering with the ACCFCR to support seed grant opportunities in ECD research and knowledge transfer.



PHIL DAVIES

MOVING RESEARCH into PRACTICE - MAKING CHANGE

Abstract:

Moving Research into Practice: Making Change

By **Phil Davies,** PhD

Excellent research is conducted every day, and interventions are proven to be either effective or not. However, these research outcomes are often not put into policy and practice. Knowledge gained from good research is not enough to bring about change. In the real world of competing interests, political expediency, and time constraints, it is essential to develop creative and effective ways to move research into practice.

Evidence-based policy is about helping people use the best available evidence to make better decisions and achieve better outcomes. It is about not only doing what works, but also knowing what works for which groups of people, under which conditions, over what time span, and at what cost. It is also about integrating research knowledge with the decision-makers' own knowledge, skills, experience, expertise, and judgment.

How do we determine what is an effective intervention? The true impact of an intervention is not its total effect but its net effect compared with what might be achieved by other options, including doing nothing. Interrupted time series analysis (using real-time monitoring data), various matched comparison evaluations, randomized controlled trials, and statistical meta-analysis are some methods for establishing net effect. However, research evidence can be misleading. For example, if there is considerable variance in the quality and/or context of the studies included in a meta-analysis, the results could be unreliable. To influence policy and practice, and make a change, evaluators usually have to consider, if not formally evaluate, the local contexts and conditions in which the proposed intervention will be carried out.

Build in real-time monitoring when developing a theory of change, laying out the early and intermediate-term changes needed to reach a long-term goal. Once an intervention tests successfully for efficacy, it still must prove effective in the real world. What factors are required, in what sequence, to make the program work? What data are needed in order to know whether or not the program is working? When rolling out a new program, it is important to build in real-time monitoring to acquire that data. Sometimes the data suggest a policy or program is not achievable as is and requires more field-testing under different conditions, a result that could be unpopular at policy levels.

Interventions in health and addiction are complex and involve multiple levels of influence. At the individual level, recovery or relapse can depend on skills and behaviours acquired to deal with stress, and intervention involves interfacing with counsellors or therapists. At the social level, intervention looks to the social environment in which people live, including family, friends, and peers who provide role models and social norms. Does the addict have the social support necessary to recover from dependency? In the physical environment, the issues of access and opportunity create another level of intervention. At the macro level of government and industry, change can be effected through avenues such as legislation, taxing, pricing, and licensing. A person needs to identify the level over which he or she has the most control and can make the most impact.

Research evidence gets used and disseminated in many ways. Academics sometimes assume that publishing research results is enough to ensure the evidence will be used. It is rare that a policy decision is based directly on evidence. Sometimes research results are sought and used to legitimize decisions already made. Knowledge can percolate and influence action indirectly, but it can take many years for a proven healthcare intervention to work its way into use.

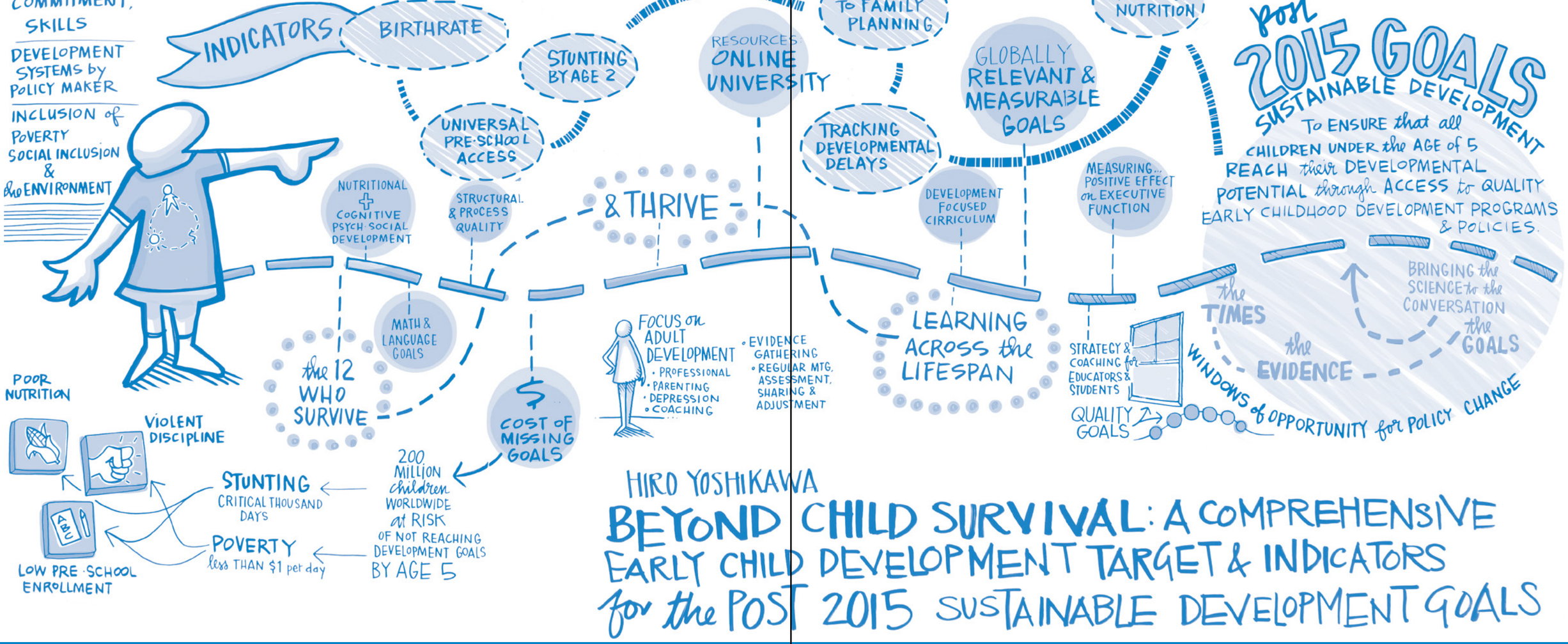
"To get messages into policy and practice, you've got to engage with the interpersonal networks in the policy process. You've got to find the intermediaries, the people who can get you to the right places. They don't hang their shingle on the door; you've got to go and find them. So you've got to be a networker. And the more you can network, the better you will be."

Phil Davies, PhD

Knowledge depends for its circulation on interpersonal networks and will only diffuse if these social networks are taken into account and utilized. For example, rather than using direct evidence, clinicians have been found to use "mindlines," or collectively reinforced, tacit guidelines informed mainly by their own and their colleagues' experience, and their interactions with each other.

Research needs evidence brokers. It is not enough to get research to the right people. It is important to find out what drives the potential users' behaviour. Competition from other sources of information requires that the synthesis of evidence be actively managed. Succinct accounts of evidence must be targeted and taken upstream and downstream to people of influence, including executives, legislators, policy-makers, front-line staff, professional associations, pressure groups, political parties and their think tanks, and the judiciary. Evidence must be carefully embedded in multiple media, including today's all-important electronic media and social media, as well as through interpersonal relationships and diminishing, but still useful, print media.

Find ways to overcome barriers to the use of evidence. Researchers often lack familiarity with policy-makers and vice versa. Better interactions between researchers and policy-makers are essential. Physical access to evidence available through resources such as Internet databases, as well as cognitive access, or training in how to understand and use data, should be facilitated at policy and practice levels. Lack of clarity in the presentation of evidence is a major barrier; researchers should be trained to extract the take-home message from their work and communicate it clearly and succinctly but without watering down important caveats. To ensure the availability of a solid body of evidence when it is needed, thinking strategically is important. This means identifying gaps in evidence and working to build a robust evidence base for 10 or 15 years into the future. At all times, it is important to take advantage of the right KT (knowledge transfer) moment. This involves working with policy timetables – e.g., legislative timetables, initiation of impact assessments, upcoming pilot/policy trials – and being aware of opportunities to use research to influence not only the formation of policy but also the implementation and delivery of policy and public services.



HIRO YOSHIKAWA

BEYOND CHILD SURVIVAL: A COMPREHENSIVE EARLY CHILD DEVELOPMENT TARGET & INDICATORS for the POST 2015 SUSTAINABLE DEVELOPMENT GOALS

Abstract:

Beyond Child Survival: An Early Childhood Development Goal for Global Sustainable Development

By **Hirokazu Yoshikawa,** PhD

The United Nations Sustainable Development Solutions Network (SDSN) is preparing the next set of global development goals, which will come into effect when the current Millennium Development Goals expire in 2015. Of the 10 current goals, early childhood development (ECD) is not included, beyond infant and maternal mortality. Now, not only is there a sense that beyond survival, children have a right to thrive, there is also a much stronger evidence base to support investment in early childhood. The SDSN's working group on education in ECD has the opportunity to bring the science of ECD for the first time to the global development conversation.

The proposed SDSN education goal is to "ensure effective learning for all children and youth for life and livelihood." One target of this goal encompasses comprehensive ECD. The costs of carrying on business as usual are sobering. Based on just two indicators – stunting and absolute poverty – more than 200 million children worldwide are at risk of not reaching developmental potential by age five, and therefore never reaching their potential. Preprimary school enrollment in low-income countries in 2010 was only about 15%. Raising preschool enrollment to 50% in all low- and middle-income countries would generate an estimated US$33 billion in societal benefits.

The proposed target on ECD is to "ensure that all children under the age of five reach their developmental potential through access to quality early childhood development programs and policies." Among nine proposed indicators for measuring progress, one of the most significant is the addition of parenting support focused on responsiveness and cognitive stimulation for families with children under three receiving nutrition intervention and primary healthcare. Several studies worldwide show that adding a parenting component to the work of community health workers significantly improves children's cognitive development. Two other key indicators are the proportion of children receiving at least one year of a quality preprimary education program and the percentage of annual public spending on preprimary education. Recent studies comparing preschool quality improvement strategies to existing preschool programs demonstrate how these targets can be achieved.

Intensive coaching with modelling, feedback, and practice is the essential ingredient for professional development in both parent-focused and centre-based preschool programs. A study in Pakistan involved integrating a responsive parenting model at scale into a national community health home-visit program that focuses on health and nutrition in the first 1,000 days. Coaches for the health workers engaged in the kind of nurturing and responsive interactions that the health workers were expected to use with the parents and the parents in turn with their children. The study showed positive effects on parenting and ultimately on children's learning, health, and behaviour.

A Boston program illustrates how quality improvement can ensure developmental potential in centre-based early care and education. The Boston Public School system diverted money in its prekindergarten program from expansion to quality improvement. Coaches trained teachers in two evidence-based curricula – language and math – providing classroom supports with weekly visits. After two years, the program showed unprecedented positive effects on language, literacy, and math, with positive spillover effects on executive function skills. The program benefited all children but had the most effect on the less advantaged, and completely eliminated disparities between Latino and white students in literacy and math skills at school entry.

A teacher professional development program in Chile uses coaching to improve children's language, health, and socio-emotional development. The first phase, conducted in Santiago public schools,

"Adults don't learn by just getting books or manuals. Whether you're a parent learning about a new way to engage your kids around their behaviour or a teacher who is being asked to implement a particular form of instruction in the classroom, the one-on-one relationship with a coach or a facilitator providing feedback and support is a key example of how adult learning can happen. And when that learning involves skills like serve-and-return interactions or content-based instruction that makes a difference for children's development, then we see big benefits."

Hirokazu Yoshikawa, PhD

provided prekindergarten and kindergarten teachers with coaching involving a didactic workshop and in-classroom modelling, practice, and feedback. Using the Classroom Assessment and Scoring System (CLASS) to measure impact on educational process quality, researchers found a large effect on emotional support and a moderate effect on classroom organization, but little effect on language outcomes, likely due to high rates of absenteeism. The program was expanded into a rural area using the Institute on Healthcare Improvement's Continuous Quality Improvement model, which compresses innovation into rapid Plan Do Study Act (PDSA) cycles. The project achieved buy-in by forming a network of principals, teachers, aides, parents, coaches, municipal departments of education, and other regional members to work together to establish targets, support teachers, and determine and track indicators. Working in three-month PDSA cycles, schools achieved significant improvements in attendance and obesity prevention, and there was an overall improvement in language outcomes beyond that achieved in Santiago.

These studies underscore the key principles of quality improvement in centres and preschool programs:

- Curricula should be developmentally focused and implemented with activities that children and teachers enjoy.
- Effectiveness factors in ECD quality can be increased through in-service training in classrooms by coaches.
- Continuous Quality Improvement is a powerful model and comprehensive approach applicable to any system.

Ensuring the developmental potential of the world's young children requires improving the skills of adult caregivers, parents, teachers, or other community members; co-ordinated and effective governance horizontally and vertically from poverty to health to education at every level, from national to local community; and integration of ECD with the three dimensions of global sustainable development – economic development, social inclusion, and environmental sustainability.

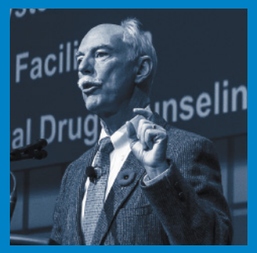
TOM MCLELLAN

A STRATEGY CHECK-UP: WHAT HAPPENED to US DRUG STRATEGY? ARE THERE LESSONS for ALBERTA'S FRAMEWORK?

Abstract:

A Strategy Check-Up: What Happened to the U.S. Drug Strategy? Are There Lessons for Alberta's Framework?

By **Thomas McLellan,** PhD



The U.S. drug strategy rolled out in 2010 under the Obama administration was a major departure from long-standing drug policy. It was evidence-based, oriented toward health as opposed to criminal justice, geared toward community ownership, and consonant with a chronic care model. The strategy recognized the full range of substance use disorders and addressed appropriate programs, from prevention to specialty care. The strategy has achieved some successes, but has also encountered unanticipated difficulties.

The U.S. drug strategy tried to offer services for the full spectrum of substance use disorders. Substance use disorders can be visualized as a pyramid with severity increasing from base to apex. Most people are situated at the base, which corresponds to rare or no use and where prevention and early intervention measures can be used effectively. In the middle is medically harmful use, the point where substance use can exacerbate conditions such as hypertension, asthma, diabetes, and breast cancer. About 60 million Americans are in this category. At the apex is addiction, the most severe and complex substance use disorder, affecting about 23 million American adults and requiring specialty care. Addiction is the only area that had been recognized before, and it had been dealt with more often in the criminal justice system than in the healthcare system. The new strategy called for evidence-based prevention and early intervention at the lowest level of the pyramid, screening and brief intervention at the middle level, and specialty continuing care for those with serious addiction. A major challenge was to integrate the concept of substance use disorders into public understanding.

The U.S. strategy:

1. Create prevention-prepared communities that surround teens with consonant health messaging and incentives from all parts of the community, including schools, law enforcement, parents, healthcare, and commercial groups.
2. Build capacity to screen and intervene early in emergency, hospital and primary care settings, and in schools.
3. Change the specialty care system – procedures, financing, evaluation – to focus more on chronic care, in line with current brain science.
4. Take a smarter approach to punishing drug offenders – combine sanctions with treatment and constructive monitoring.
5. Build timely, performance-oriented reporting systems to inform policy-makers and service-delivery organizations.

The Alberta Framework:

1. Build broad public understanding of addiction as a predictable but preventable consequence of unhealthy child rearing and toxic stress in the family and community environment.
2. Use the new public understanding to foster more scientifically sound and efficient community health and corrections policies.
3. Build upon the new public understanding and improved policies to create more and broader prevention and early intervention strategies in communities to produce healthier, more resilient children.
4. Enhance community-based services and supports; align their services and approach with the new scientific evidence regarding the role of childhood development.
5. Enhance specialty addiction and mental health care to address patients with complex needs.

Both the U.S. and Alberta approaches have a strong community focus and promote science-based services. The U.S. strategy is drug focused and deals with public safety and health. Alberta's has an early childhood development/health focus. How has the U.S. strategy worked out? Here's a brief report on the first three components of the strategy:

1. Create prevention-prepared communities.

"One of the things that Alberta has done so well is quite literally change the conversation – developing and putting into practice a set of new terms that have a grounding in science, but have a shared meaning. When you have these simple phrases like toxic stress, brain architecture, and serve and return, they reframe not just conversation, but understanding, and that's the foundation for solutions that are politically and financially sensible. Without the language and the resulting shared understanding, you're usually at cross purposes."

Thomas McLellan, PhD

The science says the at-risk age window is roughly between 10 and 21; that interventions that reduce drug use also address other risk factors in this age group, such as delinquency, school drop-out, and mental health problems; and that combining interventions produces better results than the sum of interventions applied separately. In a randomized controlled trial, communities that applied this knowledge and adopted more evidence-based interventions showed lower substance use and lower delinquency. Lobbyists for existing prevention programs convinced Congress not to fund this program. However, community-based programs are being introduced increasingly at the state and community levels.

2. Build capacity to screen and intervene early.

Addressing the middle level of the pyramid, federal codes were introduced to allow healthcare professionals for the first time to be paid for screening and brief intervention. The State of Washington conducted a trial in emergency departments, providing screening to half the patient sample, and screening and brief intervention to the other half. In the following year, there was an average saving of $4,000 in health costs per patient for the group receiving brief intervention. In spite of these excellent results, hardly anyone is using this protocol, especially in primary care. This is most likely because doctors don't know what to do with a case of addiction when they find one.

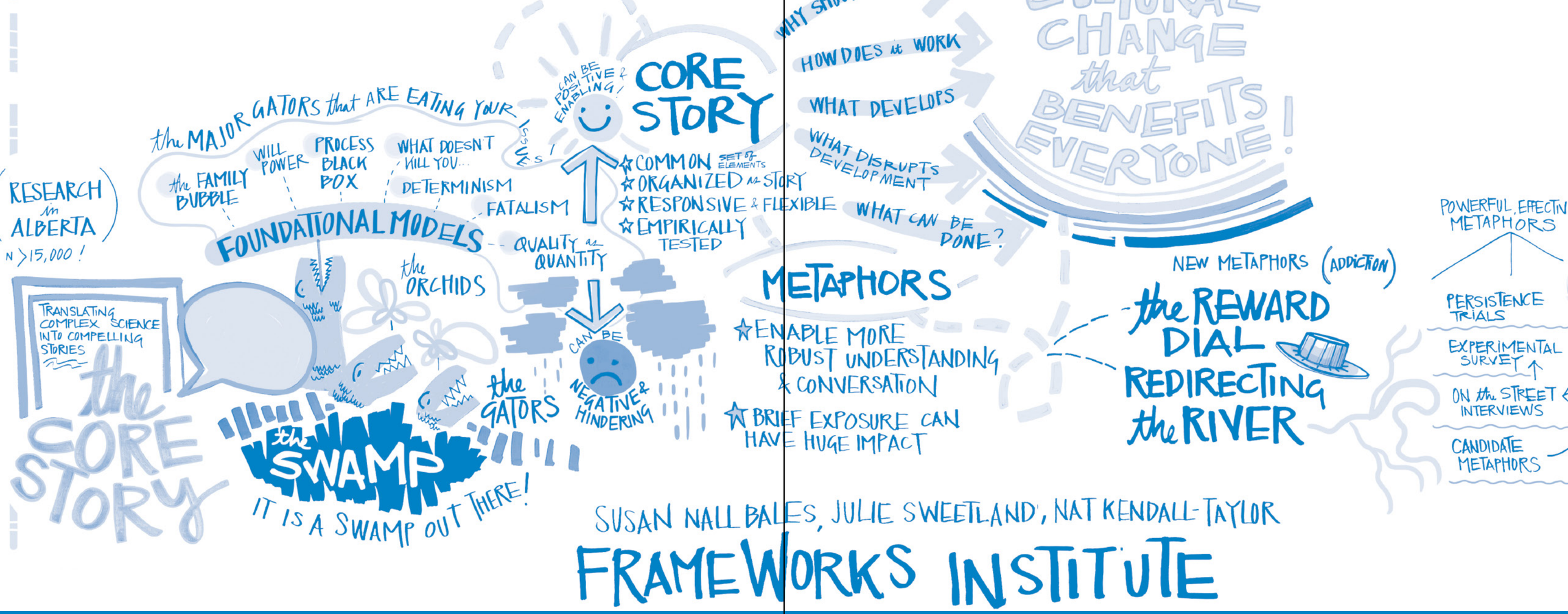
3. Change the specialty care system.

The strategy's goals were to integrate evidence-based addiction treatments into mainstream health using a chronic care model, triple the number of patients in treatment to 7 million, and consolidate specialty care treatment. There has been good success in integrating screening and brief intervention substance use services into federally qualified health centres, but little success in uptake of a chronic care model for managing substance use services. There has been growing consolidation of programs, but there are now 2,000 fewer specialty care programs, with adolescent programs particularly hard hit. It is not clear why this has happened.

The U.S. strategy has had mixed results. Mental health and substance abuse services are now essential health services under Obamacare. Medical schools have begun to include substance abuse in their curricula, but mostly in response to the prescription opioid overdose problem; doctors are not yet convinced that attention to substance use will help in treating other health problems. The strategy has not been a robust success. There was no new money available because of the recession. It was difficult to get attention for a whole new approach to substance abuse when the rest of the healthcare system was changing dramatically toward Obamacare. Also, there was pushback from agencies already operating in the field. Most important, there was no public demand for change: people did not know the science behind substance use and did not understand it as a health issue.

What are the lessons for Alberta in the U.S. drug strategy experience?

1. Maintain the focus on children. The science supports this approach.
2. Maintain the focus on community. Policy may start at the top, but it gets adopted at the community level.
3. Continue the public communication effort.
4. Do not look to politicians for leadership. Instead, look to them to be responsive to your needs.



Abstract:

Using Story to Translate Science

By **Nathaniel Kendall-Taylor,** PhD

The FrameWorks Institute is an independent non-profit research organization that works to advance the non-profit sector's communications capacity by identifying, translating, and modelling relevant scholarly research on science and social issues. It has become known for its development of Strategic Frame Analysis ™, which roots communications practice in the cognitive and social sciences. Based on research carried out in the United States and Alberta, FrameWorks has developed and empirically tested a set of frame elements – such as values and metaphors – that can be used to translate the science of early childhood development, child mental health, and the early roots of addiction. Assembled as a narrative, these tools can be used to elevate public support for evidence-based policies and programs aimed at prevention, intervention, and treatment in these areas.

The "swamp" describes dominant features of public thinking. The swamp of public understanding comprises patterns of reasoning and assumptions that can help or hinder the successful communication of a message. Some existing cultural models, or dominant patterns of thinking, are like alligators in the swamp: they eat messages and twist their meaning so that the intention of communication and its actual perception are two very different things – creating powerful "lost in translation" moments. In communicating about early childhood development, these "major gators" include the ideas that it is the exclusive responsibility of parents to raise children; that successful development is wholly dependent upon individual drive and motivation; that developmental outcomes are genetically determined, so there's not much that can be done about them; and that what doesn't kill you makes you stronger. These and other ways of thinking about children and development impede people's ability to consider fundamental tenets of the science of development. These major gators underpin much of how Albertans think about children, childhood development, and a broad range of other issues – such as education and addiction.

The swamp is the key to a game-changing approach to communications: a core story. A core story helps communicators navigate the swamp, communicate messages effectively, and create support for more effective policies, programs, and practices. A core story is a Common set of elements, that is Organized as a story, Responsive and flexible, and Empirically tested. The core story of early child development (see page 8) answers a series of questions that people ask, such as: why should I care? (interdependence, prevention); how does development work? (environment of experiences, serve and return, levelness); what develops? (brain architecture, air traffic control); what disrupts development? (toxic stress); what can be done to improve developmental outcomes? (ingenuity, effectiveness factors). We know that if communications don't fill in these questions, people will. And we know that when left to fill in the answers to these questions, they apply the major gators from the swamp, which eat these science messages and distort their meaning.

Empirically tested values and explanatory metaphors can be used to displace dominant cultural models and provide new ways for people to think about and use the science of early childhood development, mental health, and addiction. An example is the video, How Brains Are Built: The Core Story of Brain Development, which was produced by the Alberta Family Wellness Initiative (AFWI) with input from the Harvard Center on the Developing Child and the FrameWorks Institute. By using elements that had been empirically tested for their ability to structure new ways of thinking and talking about child development, the video is a powerful tool for creating a more robust conversation about how development works, why it matters, and what can be done to improve outcomes.

The core story can also be used to frame a neurodevelopmental perspective on addiction. During initial research, Albertans had narrow definitions of addiction and difficulty thinking about the causes of addiction, which they tended to view as the result of poor individual choices and a lack of willpower. Adding elements to the core story of early childhood development – such as the explanatory

"These major gators not only underpin what people think about brain development, but also shape the way people think about a broad range of major issues and their solutions, such as education and addiction. If you can address these cultural models when you talk about addiction, you can make people better reasoners and thinkers about all of these social issues. A core story that takes in all of these major issues can be used in different ways to lift all boats."

Nathaniel Kendall-Taylor, PhD

metaphors of the "reward dial" and "redirecting the river" – was shown to help people think more productively about addiction issues and arrive at explanations for causes, effects, and solutions that were in line with the science. The reward dial metaphor compares the body's reward system to the volume dial on a stereo: through over-use or faulty wiring, the reward system can lose its power to regulate the system's volume. The system can be recalibrated, but this takes time, requires specialists, and must be done gradually. In testing, this metaphor was very powerful in inoculating against the idea of addiction as a failure of willpower.

Likening addiction treatment to redirecting a river proved to be another powerful metaphor. This concept helped people think about the complexities of addiction and what constitutes effective approaches to treatment by looking at all the tributaries that feed the addiction path. After being exposed to the metaphor in the research, people talked about the importance of sustained multi-modal treatment and of the power of intervening before addiction "grooves" become deeply engraved. Most of all, this metaphor inoculated against people's tendency to individualize addiction by focusing attention on the role and importance of context in redirecting the river.

Empirical research showed that the addiction metaphors are effective communication tools. The reward dial and redirecting the river metaphors performed well with members of the Alberta public in multi-method testing – including on-street interviews, experimental surveys, and persistence trials. In addition, FrameWorks pioneered two new research methods to test the degree to which the metaphors were usable by experts when discussing and explaining their work on addiction issues. Both metaphors passed the "smell test" when a group of experts confirmed and demonstrated that they could use them in their work. In a final usability test, experts were taught the metaphors and then tasked with using them to explain their work to members of the general public. Both metaphors were highly usable and easily employed to counter disruptive cultural models introduced by members of the public during these sessions.

This research demonstrates the power of a core story approach. Communicators can use the core story to address challenges in the swamp of cultural models and create messaging strategies that effectively communicate the science of child development, mental health, and addiction. Availed of this science, policy-makers and members of the public become more informed on these issues and better able to use science in thinking about using public policy to improve outcomes in Alberta.

IMPLICATIONS FOR INNOVATION IN ALBERTA: WHAT WE NEED TO DO NEXT

The first phase of the Alberta Family Wellness Initiative's (AFWI) knowledge-mobilization strategy set the stage for innovation across the broad system of policies and services that impact the lives of children and their families in Alberta. This province is increasingly seen as a leader in North America for having put together the elements necessary to inspire innovation and move scientific knowledge into policy and practice. Connections have been made both vertically and horizontally across ministries, disciplines, and jurisdictions, and from front-line practice to policy-making levels. Researchers, clinicians, and policy-makers are sharing the common language and understanding of the core story of early childhood and brain development and the origins of addiction. Many are now coalescing into communities of purpose with the common aim of developing innovative approaches to the prevention, intervention, and treatment of mental health and addiction issues across the lifespan.

While acknowledging these successes to date, the learnings of the Accelerating Innovation: Telling the Brain Story to Inspire Action Symposium defined the magnitude of the job still to be done and pointed the way toward accomplishing it. This is no time to rest on laurels but to renew our commitment to action toward breakthrough outcomes that will make a difference in the lives and well-being of children and families today and of generations to come in Alberta.

Early screening to ensure a healthy start

The science tells us that addiction and other negative health outcomes are too often transmitted in families from one generation to the next. A parent's addiction or mental health issues, such as depression, can co-opt the parent's reward and/or stress-response systems, resulting in the parent becoming preoccupied with his or her own stress relief or not engaging with the child at all. This increases the potential for neglect or abuse that negatively impacts the developing brain of the child and his or her capacity as an adult to parent the next generation. When it comes to prevention, earlier is better. The prenatal environment, whether influenced by the mental health, substance use, or nutritional status of the mother or other factors, has been shown to affect the mental and physical health of offspring. Universal prenatal screening and guidance are essential to ensure the best possible start in life. Universal postnatal public health screening and treatment can reduce maternal depression and improve outcomes for children.

Enhanced parenting engagement

In the past it was considered enough to provide parents with educational materials to ensure good parenting. Recent studies show that parental education combined with coaching, modelling, and feedback is the most effective approach to aiding the development of good parenting skills and ultimately of optimal emotional and social development and executive functioning capacity in the young child. Examples were given in the plenary sessions of successful, inexpensive programs at the community level that can enhance parental capacity. One involved the video recording of serve-and-return interaction between a parent or a foster parent and child to help the parent focus on enhancing what he or she is already doing right. The other, which took place in Pakistan, is a quality-improvement program that involved training and coaching of community health workers in the responsive and nurturing behaviours they were expected to pass on to parents in addition to health and nutrition information; the parents would in turn employ these behaviours with their children.

The emphasis on building adult competencies – essentially executive functioning skills –by coaching, mentoring, role modelling, and practice is fundamental to the Frontiers of Innovation (FOI) theory of change. Programs that improve parents' executive functioning skills and involve them in modelling and practising those skills have a much greater impact on their children's development than those that just focus on the children or involve the parents only in a passive way. Adults must be able to model what is expected of their children.

Prevention-prepared communities

The U.S. drug strategy used the term "prevention-prepared communities" for communities that understand the at-risk period for addiction – between ages 10 and 21 – and target evidence-based interventions at all points on this age continuum. Schools, parents, law enforcement, and environmental policies (such as the number of bars allowed within areas of a certain size) are all part of the prevention effort. Communities that have adopted these ideas have had success not only in reducing substance use behaviours but also delinquent behaviours in the targeted age group after four years. Evidence-based community prevention programs are spreading throughout the U.S. Alberta's approach to early childhood development and the province's Addiction and Mental Health Strategy emphasize safe, supportive communities and neighbourhood supports for families. Through Alberta's involvement in the FOI community, there may be opportunities to learn from or exchange information with communities that have had experience with this approach.

The concept of community charging stations was mentioned several times throughout the Symposium week. The term was used to describe an informal network of agencies, services, meeting places, and people available in communities to provide help or support for young people whenever they need it and wherever they are. Identifying and filling gaps in the community is an initiative that should involve young people in the process, from planning to implementation.

The role of primary care in addiction prevention, intervention, and treatment

There is convincing evidence that intervention by primary care practitioners at the level of risky and medically harmful substance use can avert negative effects of substance use on existing health problems and result in significant savings for the healthcare system. The widespread use of this approach – known as screening, brief intervention, and referral to treatment or SBIRT – was part of the U.S. drug policy rolled out in 2010. It involves a simple question about substance use during a routine physical examination, brief discussion of the possible negative impact of substance use on existing conditions such as diabetes or high blood pressure, and referral of more serious cases of substance use to treatment. There has been very little uptake of this approach by primary care practitioners in the U.S., possibly because physicians are not knowledgeable enough about addiction treatment programs in their areas and don't know what to do with such cases. The AFWI has partnered with the Association of Faculties of Medicine of Canada to develop a suite of e-learning resources on early brain and biological development and addiction for undergraduate medical students and educators. Meanwhile, primary care will be a key system within Alberta's Addiction and Mental Health Strategic Clinical Network (AMHSCN). Research is currently underway to identify priority areas for establishing treatment and services in an alcohol pathway. Development in this area will be critical to expanding adoption of the chronic care model for addiction treatment across Alberta.

Addiction treatment and recovery as a long-term process

We know that recovery from addiction requires a long-term course of treatment and monitoring in a chronic care model. But too often detoxification is confused with treatment and recovery. Individuals with addiction become trapped in a revolving door: they complete a short-term detoxification program, return to the community, and without long-term monitoring in a chronic care model, they eventually return to substance use, sometimes with life-threatening consequences. The concept of addiction as a chronic brain disease requiring long-term treatment and monitoring needs to become commonplace throughout society.

The presence of addiction in a family affects the whole family system. Family members subvert their own development as they organize around and protect the addiction to maintain the status quo, no matter how unhealthy. Again, mere abstinence is not recovery. Treatment is a long-term process. Therapy needs to address the entire family system, allow the unhealthy system to collapse, then provide scaffolding and supports for family members as they rebuild a healthier family dynamic. Treating addiction through the family lens may require access to qualified practitioners in this area as well as professional development opportunities for addiction counsellors. Research has shown significant success for the addiction treatment protocols offered within physician health programs (PHPs). These programs include contingency management, random drug testing, linkage to 12-step programs, active management of relapses, a continuing care approach, treatment for family members, and a focus on lifelong recovery. Elements of these programs can be used as a model for improving outcomes in the general population of addicted individuals.

There are also innovative approaches available for the digitally inclined or others who may not have the ability or finances to continue long-term care. These include online aftercare including check-ins with recovery coaches, texting options, and specialized electronic apps.

Continued evolution and dissemination of the core story

The dissemination and adoption of the core story has been rapid among healthcare professionals. The scientifically framed narrative of early childhood and brain development and addiction is penetrating the human services and justice systems and will spread further as the AFWI strategy unfolds. Some participants have committed to testing the story with immigrant and Aboriginal communities to ensure it is culturally diverse in its reach.

The experience of the U.S. drug policy holds a cautionary tale: politicians and policy-makers generally do not lead, but respond to public opinion and demand. The core story must become common currency with the general public in order to engage public support for and to ensure continued progress toward an innovative, evidence-based early childhood development, mental health, and addiction system.

Innovation as process, not destination

Alberta's engagement with Frontiers of Innovation is already indicative of the significant change in outlook and approach to early childhood development and addiction issues in this province. Members of the FOI community are focused on achieving breakthrough outcomes for children and families. The FOI approach treats innovation as a continuous process, not a destination. It uses short-cycle feedback; encourages risk-taking, learning from failure, changing, and adapting; and eventually takes more effective intervention strategies to scale. Alberta's approach to early childhood development and addiction has placed this province among the early innovating jurisdictions in the FOI community. Alberta is building the network infrastructure needed to incorporate innovative ideas as they develop in this stimulating environment as well as to share Alberta-made innovation with other FOI jurisdictions.

Appendix 1

Symposium People: Development and Management

Planning Committee

Members of the Planning Committee helped develop the strategy and design of the Accelerating Innovation: Telling the Brain Story to Inspire Action 2013 Symposium.

Marisa Etmanski, Director, Edmonton Office, Norlien Foundation

Karen Ferguson, Assistant Deputy Minister, Human Services, Government of Alberta

Michelle Gagnon, MBA, PhD, Vice President, Norlien Foundation; Senior Program Manager, Alberta Family Wellness Initiative

Glenda MacQueen, MD, PhD, FRCPC, Vice Dean, Faculty of Medicine, and Professor, Department of Psychiatry, University of Calgary

Nancy Mannix, JD, Chair and Patron, Norlien Foundation

A. Thomas McLellan, PhD, Chief Executive Officer, Treatment Research Institute

Gillian Najarian, BA, EdM, Managing Director, Center on the Developing Child, Harvard University

Cathy Pryce, RN, MN, Vice President, Addiction and Mental Health Strategic Clinical Network, Alberta Health Services

Trish Reay, PhD, Associate Professor, Department of Strategic Management and Organization, School of Business, University of Alberta

Nancy Reynolds, DOT, BScOT, President, Sterling Lifestyle Solutions; Symposium Planning Committee Chair

Nicole Sherren, PhD, Scientific Director and Program Officer, Norlien Foundation

Peter Silverstone, MB BS, MD, FRCPC, ICD.D, Professor Departments of Psychiatry and Center for Neuroscience, and Adjunct Professor, School of Business, University of Alberta; Scientific Director for Addiction and Mental Health Strategic Clinical Network, Alberta Health Services

Ralph Strother, MD, Senior Program Officer, Max Bell Foundation

Paula Tyler, President, Norlien Foundation; Executive Director, Alberta Family Wellness Initiative

Susan Williams, Assistant Deputy Minister, Primary Health Care Division, Health, Government of Alberta

Credit for their invaluable input and advice in developing this Symposium also goes to:

Andrea Allen, Alberta Health Services
Barry Andres, Alberta Health Services
Kate Bailey, BUKSA Strategic Conference Services
Laurie Beverley, Alberta Health Services
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Deborah Hopkins, Human Services, Government of Alberta
Tori James, Evans Hunt
Cindy King, Alberta Health Services
Yasmeen Krameddine, University of Alberta
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David Ray, Aboriginal Relations, Government of Alberta
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Kesa Shikaze, Health, Government of Alberta
Donna Vermillion, Tsuu T'ina Nation Health Care
Arlene Weidner, Arlene Weidner Consulting Ltd.
Jennifer Wells, Justice and Solicitor General, Government of Alberta
Sandra Woitas, Edmonton Public Schools Foundation
Judy Wry, BUKSA Strategic Conference Services

Appendix 2

Symposium People: Presenters and Faculty

Susan Bales, MA
FrameWorks Institute

Founder and President, the FrameWorks Institute; Senior Fellow, Center on the Developing Child at Harvard University. A veteran communications strategist and issues campaigner, she has more than 30 years of experience researching, designing, and implementing campaigns on social issues. Her work has been presented at Brandeis, Yale, Rice, and Harvard universities and at the White House. She served as Vice President for communications at the National Association of Children's Hospitals and founded the Coalition for America's Children.

Robyn Blackadar, BA, MBA
Alberta Centre for Child, Family and Community Research

President and Chief Executive Officer, Alberta Centre for Child, Family and Community Research. She has over 20 years of experience in health system development, quality improvement, and social and health policy in government, provincial, and regional service-delivery sectors. She is co-leader of the Early Childhood Development Research and Innovation Strategy with the Government of Alberta and is a member of the Addiction and Mental Health Advisory Committee.

Judy Cameron, PhD
University of Pittsburgh

Professor of Psychiatry and Director of Science Outreach, University of Pittsburgh. Over the past 10 years she has been a member of the MacArthur Foundation Research Network on Early Experience and Brain Development and is currently a member of the National Scientific Council on the Developing Child and the Dana Alliances for Brain Initiatives, a non-profit organization of neuroscientists committed to advancing public awareness of brain research in an accessible fashion. In this role, she gives numerous public lectures each year.

Phil Davies, PhD
Oxford Evidentia Limited

Executive Director, Oxford Evidentia Limited. His U.K.-based research and consultancy company specializes in policy evaluation, evidence-based policy-making, and analysis and use of evidence. He is also head of the London office of 3ie, the International Initiative for Impact Evaluation. From 2000 to 2007, he was a senior civil servant in the U.K. Cabinet Office and HM Treasury responsible for policy evaluation and analysis. He was a lecturer in social and political science at the University of Oxford, has held academic positions at the University of Aberdeen and the University of California, San Diego, and has taught courses on evidence-based policy-making in various countries worldwide.

Philip Fisher, PhD
University of Oregon

Professor of Clinical Psychology, University of Oregon; Senior Scientist, Oregon Social Learning Center. He is also Science Director for the National Forum on Early Childhood Policy and Programs and a Senior Fellow at the Center on the Developing Child, both based at Harvard University. His work on children in foster care and the child welfare system includes basic research characterizing the effects of early stress on neurobiological systems such as the HPA axis and areas of the pre-frontal cortex involved in executive functioning, development of preventive interventions, and dissemination of evidence-based practice in community settings. His intervention programs are being implemented at sites throughout the United States and Europe.

Sheryl Fricke, MBA
Early Childhood and Community Supports Division,
Human Services, Government of Alberta

Executive Director, Early Childhood Development Priority Initiative, Early Childhood and Community Supports Division, Alberta Human Services. Her key role in this initiative is to work across government and with community partners to move the Alberta Approach to Early Childhood Development forward to improve measures of success for child health and development. She has over 20 years of senior management experience leading social programs and change initiatives in municipal and provincial governments.

Michelle Gagnon, MBA, PhD
Norlien Foundation

Vice President, Norlien Foundation; Senior Program Manager, Alberta Family Wellness Initiative. She spent several years working at the Canadian Institutes of Health Research in a variety of roles, including Assistant Director with the Institutes of Population and Public Health, and Health Services and Policy Research; Director of Knowledge Transition; and Director of Research Capacity Development. More recently, she worked with Alberta Health Services, where she was Director, Provincial Research Strategy and Priorities, focusing on Alberta's new Strategic Clinical Networks.

Mark S. Gold, MD
University of Florida

Donald Dizney Eminent Scholar, Distinguished Professor and Chair of Psychiatry, McKnight Brain Institute, University of Florida. He is also a founder of the U.F. Center for Alcohol and Drug Research and Education. He has worked for nearly 40 years to develop models for understanding the effects of tobacco, cocaine, and other drugs, as well as food, on the brain and behaviour. He has developed translational research models that have led to new treatments for addicts. He has been recognized many times as an innovator and as an inventor.

Ariella Goodwine Fisher, MFT
Licensed Marriage and Family Therapist

Psychotherapist with a private practice specializing in working with individuals and families facing issues of addiction. She is also an Associate at The Addictions Institute, an outpatient clinic offering comprehensive treatment for all addiction problems. The clinic's treatment model integrates family systems and developmental perspectives to understand childhood and adult difficulties related to addiction and recovery. She has lectured and provided training in the field of addiction in the family and has served as a family therapist, supervisor, and Clinical Director for the Women's Recovery Association in Burlingame, California.

Stephen Hinshaw, PhD
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Professor of Psychology, University of California, Berkeley; Vice Chair, Department of Psychiatry, University of California, San Francisco. His work focuses on developmental psychopathology. He has authored over 250 publications and nine books, including *The Mark of Shame: Stigma of Mental Illness and an Agenda for Change*, *The Triple Bind: Saving Our Teenage Girls from Today's Pressures*, and *The ADHD Explosion and Today's Push for Performance*. He is also editor of *Psychological Bulletin*.

Nathaniel Kendall-Taylor, PhD
FrameWorks Institute

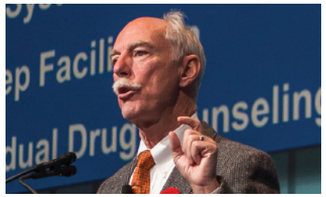
Vice President of Research, the FrameWorks Institute. A medical anthropologist, he employs social science theory and research methods from anthropology to improve the ability of public policy to positively influence health and social issues. This involves studying how cognitive theory can be applied in understanding how people interpret information and make meaning of their social worlds. His past research has focused on child and family health and on understanding the social and cultural factors that create health disparities and affect decision-making.

George F. Koob, PhD
Scripps Research Institute

Professor and Chair of the Committee on the Neurobiology of Addictive Disorders, Scripps Research Institute. An authority on drug addiction and stress, he has contributed to our understanding of the neurocircuitry associated with the acute reinforcing effects of drugs of abuse and the neuroadaptations of the reward and stress circuits associated with the transition to dependence. In collaboration with Dr. Michel Le Moal, he wrote the renowned book *Neurobiology of Addiction* and has received numerous awards for excellence in research.

Pat Levitt, PhD
Children's Hospital Los Angeles, University of Southern California

Provost Professor and Director, Program in Developmental Neurogenetics, IDM, Children's Hospital Los Angeles, University of Southern California. His research focuses on the development of circuitry that controls learning and emotional and social behaviour, genetic and environmental factors that influence circuit formation, and the factors that increase risk for neurodevelopmental and neuropsychiatric disorders. He has held chair and institute directorships at the Keck School of Medicine of the University of Southern California, Vanderbilt University Medical Center, and the University of Pittsburgh School of Medicine.



A. Thomas McLellan, PhD, Presenter and Moderator
Treatment Research Institute

Chief Executive Officer and co-founder, Treatment Research Institute. From 2009 to 2010, he was Science Advisor and Deputy Director of the White House Office of National Drug Control Policy, where he helped shape the country's public policy approach to illicit drug use, including formulation and implementation of the President's National Drug Control Strategy and promotion of drug treatment through the broader revamping of the national healthcare system. He has more than 35 years of experience in addiction treatment research. In 1992, he co-founded the Treatment Research Institute to transform the way research is employed in the treatment of and policy-making around substance use and abuse. He is the recipient of several distinguished awards, including the Life Achievement awards of the American and British societies of addiction medicine and awards for Distinguished Contribution to Addiction Medicine from the Swedish and Italian medical associations.

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Hazelden Foundation

Chief Medical Officer, Hazelden Foundation; Adjunct Assistant Professor, Hazelden Graduate School of Addiction Studies. He is responsible for overseeing all interdisciplinary clinical practices at Hazelden, maintaining and improving standards of care, and supporting growth strategies for Hazelden's residential and nonresidential addiction treatment programs and services throughout the United States. He is the author of *Clinician's Guide to the Twelve Step Principles*, *Prescription Painkillers: History, Pharmacology and Treatment*, and co-author of *When Painkillers Become Dangerous and Pain-Free Living for Drug-Free People*.

Jack P. Shonkoff, MD
Harvard University

Director, Center on the Developing Child, Harvard University; Julius B. Richmond FAMRI Professor of Child Health and Development, Harvard School of Public Health and Harvard Graduate School of Education; Professor of Pediatrics, Harvard Medical School and Boston Children's Hospital. He is chair of the National Scientific Council on the Developing Child, a multi-university collaboration comprising leading scholars in neuroscience, psychology, pediatrics, and economics, whose mission is to bring credible science to bear on public policy affecting young children.

Paula Tyler, Moderator
Norlien Foundation

President, Norlien Foundation; Executive Director, Alberta Family Wellness Initiative. She has had a long and distinguished career in the field of human services, most recently as Vice President – Child and Women's Health and Specialized Clinical Services for the Calgary Health Region. She served as Vice President and CEO – Mental Health at Capital Health in Edmonton, Chief Executive – Child Youth and Family Services for the Government of New Zealand, and Deputy Minister for Alberta Children's Services. She has held several other senior executive positions with the Alberta Government, including Deputy Commissioner for Children's Services and Assistant Deputy Minister for Alberta Family and Social Services.

Hirokazu Yoshikawa, PhD
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Courtney Sale Ross University Professor of Globalization and Education and Co-director, Institute for Globalization and Education, New York University. He conducts research in the U.S. and low- and middle-income countries on the effects of public policies and programs related to immigration, early childhood, parental employment and education, and poverty reduction on children's development. He currently serves as co-chair of the education workgroup of the U.N. Sustainable Development Solutions Network, the research and technical group advising the Secretary General on post-2015 global development goals. His recent books include *Immigrants Raising Citizens: Undocumented Parents and Their Young Children*.

Workshop Presenters

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Appendix 3

Symposium People: Participants by Innovation Team

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Appendix 4

Additional Resources: Knowledge-Transfer Reports, Policy Documents, Research Papers, Organizations, Websites

**Each of the resources featured below is available online at no cost. Note that this is not an exhaustive list.*

A Parent's Guide to the Teen Brain. A multi-media website for parents that presents research-based information on neurodevelopmental aspects of addiction risk for adolescents. This site was created by The Partnership at Drugfree.org, the Treatment Research Institute, and the WGBH Educational Foundation.
http://teenbrain.drugfree.org/

A Science-Based Framework for Early Childhood Policy: Using Evidence to Improve Outcomes in Learning, Behavior, and Health for Vulnerable Children. 2007. Boston, MA: Center on the Developing Child at Harvard University.
http://developingchild.harvard.edu/index.php/resources/reports_and_working_papers/policy_framework

Adverse Childhood Experiences (ACE) Study. One of the largest investigations ever conducted to assess associations between childhood maltreatment and later-life health and well-being. The site was created by the United States Centers for Disease Control and Prevention.
http://www.cdc.gov/ace/index.htm

Alberta Family Wellness Initiative. A multi-disciplinary initiative that connects early brain and biological development and children's mental health with addiction research, prevention, and treatment. This site is a portal for accessing a wide range of resources geared specifically to researchers, healthcare professionals, front-line professionals, policy-makers, and the general public. These include document and video libraries, learning modules, event listings, and information updates via email.
http://www.albertafamilywellness.org/

Alberta Health Services (AHS) – Addiction & Substance Abuse. Website featuring a large collection of resources and other information about addiction and substance abuse, including services provided by AHS.
http://www.albertahealthservices.ca/addiction.asp

Alberta Medical Association – Physician & Family Support Program. Association-sponsored program that serves Alberta physicians, residents, medical students, and their immediate families experiencing difficulties with substance abuse and addiction, psychiatric and mental health concerns, and a variety of other health and work/life issues.
https://www.albertadoctors.org/services/physicians/pfsp

Brain Hero. Based loosely on such games as Guitar Hero, SimCity, and The Game of Life, this three-minute video depicts how actions by a range of people in the family and community can affect a child's development.
http://developingchild.harvard.edu/resources/multimedia/videos/brain_hero/

Calgary and Area Addiction Services Guide. Online inventory of major addiction-related services in the Calgary area.
http://www.calgaryaddiction.com/

Canadian Centre on Substance Abuse. Organization with a legislated mandate to provide national leadership and evidence-informed analyses and advice to mobilize collaborative efforts to reduce alcohol- and other drug-related harms.
http://www.ccsa.ca/

Canadian Institutes of Health Research (CIHR) – Institute of Neurosciences, Mental Health and Addiction (INMHA). A unique institute designed to address all aspects of research dealing with brain-mind relationships. INMHA is a government organization that supports research on the functioning and disorders of the brain, the spinal cord, the sensory and motor systems, and the mind through prevention strategies, screening, diagnosis, treatment, support systems, and palliation.
http://www.cihr-irsc.gc.ca/e/8602.html

Child Maltreatment Report. 2012. U.S. Department of Health and Human Services, Administration for Children and Families, Administration on Children, Youth and Families, Children's Bureau. Rockville, MD: Author.
http://www.acf.hhs.gov/programs/cb/stats_research/index.htm#can

Connections Canada. An online knowledge exchange for professionals and agencies serving women with substance abuse issues and their children. It is funded by the Canadian Institutes of Health Research (CIHR) and administered by McMaster University.
http://www.connectionscanada.ca/

Creating Connections: Alberta's Addiction and Mental Health Strategy. 2011. Government of Alberta.
http://www.health.alberta.ca/documents/Creating-Connections-2011-Strategy.pdf

Depression in Parents, Parenting, and Children: Opportunities to Improve Identification, Treatment, and Prevention. England MJ, Sims LJ, editors. National Research Council and Institute of Medicine. 2009. Washington, DC: The National Academies Press. (Can read entire book online at no cost.)
http://www.nap.edu/catalog.php?record_id=12565

Early Brain & Biological Development: A Science in Society Symposium. Summary Report, Volume 1. 2010. Calgary, AB: Norlien Foundation.

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http://www.albertafamilywellness.org/resources/search

From Neurons to Neighborhoods: The Science of Early Childhood Development. Shonkoff JP, Phillips DA, editors. 2000. Washington, DC: The National Academies Press.
http://www.nap.edu/openbook.php?isbn=0309069882

Frontiers of Innovation (FOI). In collaboration with a broad network of people and organizations across North America, FOI works to drive the design of intervention strategies grounded in scientific research that produce breakthrough outcomes for children facing adversity.
http://developingchild.harvard.edu/index.php/activities/frontiers_of_innovation/

Hazelden Betty Ford Foundation. A merger of the Hazelden Foundation and the Betty Ford Center, this Foundation is the largest non-profit treatment provider in the United States. With 15 sites in California, Minnesota, Oregon, Illinois, New York, Florida, Massachusetts, Colorado, and Texas, the Foundation offers recovery solutions across the entire continuum of care for youth and adults and includes the largest recovery publishing house in the country, a fully-accredited graduate school of addiction studies, an addiction research centre, an education arm for medical professionals, and a unique children's program.
http://www.hazeldenbettyford.org/

Healthy Development: A Summit on Young Children's Mental Health. Partnering with communication scientists, collaborating across disciplines and leveraging impact to promote children's mental health. 2009. Washington, DC: Society for Research in Child Development.
http://www.apa.org/pi/families/summit-report.pdf

International Institute for Trauma and Addiction Professionals. Organization that provides clinical training for professionals in trauma and addiction and manages the Sex Addiction Therapist (CSAT®) Certification Program. Also has a directory of CSAT-certified therapists.
http://www.IITAP.com

KnowMo. A knowledge-mobilization website, affiliated with the University of Alberta, that is designed as a hub for addictions and mental health information in Alberta.
http://www.knowmo.ca

Let's Talk About the Early Years: Report by the Chief Medical Officer of Health. 2011. Alberta Health and Wellness, Government of Alberta.
http://www.health.alberta.ca/about/OCMOH-reports.html

National Institute of Drug Abuse (NIDA). NIDA's mission is to apply science to drug abuse and addiction problems by supporting research across a broad range of disciplines and encouraging the dissemination and use of research to improve prevention, treatment, and policy.
http://www.drugabuse.gov/

Network for the Improvement of Addiction Treatment (NIATx). A learning collaborative at the University of Wisconsin-Madison's Center for Health Enhancement Systems Studies. The Centre supports payers and providers of addiction services through the application of process-improvement techniques to improve the cost and effectiveness of the care-delivery system. http://www.niatx.net/

New Directions in Child Abuse and Neglect Research. Petersen A, Joseph J, Feit M, editors. 2014. Washington, DC: The National Academies Press. (Can read the entire book online at no cost). In 1993, the National Research Council (NRC) issued the report, Understanding Child Abuse and Neglect, which provided an overview of the research on child abuse and neglect. New Directions in Child Abuse and Neglect Research updates the 1993 report and provides new recommendations to respond to this public health challenge. http://www.nap.edu/catalog.php?record_id=18331

Preventing Child Maltreatment: A Guide to Taking Action and Generating Evidence. Butchart A, Harvey AP, Mian M, Furniss T. World Health Organization and International Society for the Prevention of Child Abuse and Neglect. 2006. Geneva: WHO. http://whqlibdoc.who.int/publications/2006/9241594365_eng.pdf

Preventing Child Maltreatment: Program Activities Guide. Centers for Disease Control and Prevention. Atlanta, GA: Author. http://www.cdc.gov/ViolencePrevention/childmaltreatment/index.html

Preventing Mental, Emotional, and Behavioral Disorders Among Young People: Progress and Possibilities. A consensus report from the Committee on the Prevention of Mental Disorders and Substance Abuse Among Children, Youth and Young Adults. National Research Council and Institute of Medicine. 2009. Washington, DC: The National Academies Press. http://www.iom.edu/Reports/2009/Preventing-Mental-Emotional-and-Behavioral-Disorders-Among-Young-People-Progress-and-Possibilities.aspx

Recovery from Addiction: A Science in Action Symposium. Summary Report, Volume 2. 2011. Calgary, AB: Norlien Foundation.

Recovery from Addiction: A Science in Action Symposium. Summary Report, Volume 4. 2012. Calgary, AB: Norlien Foundation.

Recovery from Addiction: A Science in Action Symposium. Summary Report, Volume 6. 2013. Calgary, AB: Norlien Foundation. http://www.albertafamilywellness.org/resources/search

Sharing the Brain Story. AFWI's Knowledge-Mobilization Strategy: Transforming Research, Policy, and Practice in Alberta. 2013. Calgary, AB: Norlien Foundation. A summary of the first three years of the Alberta Family Wellness Initiative's (AFWI) multi-pronged strategy to connect policy-makers, professionals, and the public with the very best science on brain development, early childhood development, children's mental health, and addiction. http://www.albertafamilywellness.org/resources/search

Society for the Advancement of Sexual Health. Professional organization for the field of sexual addiction treatment. This website offers information and resources to those seeking support for sexual addiction. http://www.sash.net

Strengthening Benefit-Cost Analysis of Early Childhood Interventions: Workshop Summary. Beatty A, Committee on Strengthening Benefit-Cost Methodology for the Evaluation of Early Childhood. National Research Council and Institute of Medicine. 2009. Washington, DC: The National Academies Press. http://www.nap.edu/catalog/12777.html

Substance Abuse and Mental Health Services Administration. Large U.S. federal government-sponsored organization focusing on prevention, treatment, and recovery issues for substance abuse and mental health problems. http://www.samhsa.gov/

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Transformative Neurodevelopment Research in Mental Illness: Report of the National Advisory Mental Health Council's Workgroup. 2008. Bethesda, MD: National Institute of Mental Health. http://www.nimh.nih.gov/about/advisory-boards-and-groups/namhc/neurodevelopment_workgroup_report.pdf

Treatment Research Institute. A non-profit research and development organization located in Philadelphia, PA, dedicated to science-driven reform of treatment and policy in substance abuse. http://www.tresearch.org/

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Why Your DNA Isn't Your Destiny. Cloud, J. 2010, Jan 6. Time magazine. http://www.time.com/timehealtharticle/0,8599,1951968,00.html

National Scientific Council on the Developing Child Working Papers

Available from: http://developingchild.harvard.edu/resources/reports_and_working_papers/

Working Paper 1. Young Children Develop in an Environment of Relationships. 2004.

Working Paper 2. Children's Emotional Development is Built into the Architecture of Their Brains. 2004.

Working Paper 3. Excessive Stress Disrupts the Architecture of the Developing Brain. 2005.

Working Paper 4. Early Exposure to Toxic Substances Damages Brain Architecture. 2006.

Working Paper 5. The Timing and Quality of Early Experiences Combine to Shape Brain Architecture. 2007.

Working Paper 6. Mental Health Problems in Early Childhood Can Impair Learning and Behavior for Life. 2008.

Working Paper 7. Workforce Development, Welfare Reform, and Development of Young Children. 2008.

Working Paper 8. Maternal Depression Can Undermine the Development of Young Children. 2009.

Working Paper 9. Persistent Fear and Anxiety Can Affect Young Children's Learning and Development. 2010.

Working Paper 10. Early Experiences Can Alter Gene Expression and Affect Long-Term Development. 2010.

Working Paper 11. Building the Brain's "Air Traffic Control" System: How Early Experiences Shape the Development of Executive Function. 2011.

Working Paper 12. The Science of Neglect: The Persistent Absence of Responsive Care Disrupts the Developing Brain. 2012.

Appendix 5

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Glossary

Addiction – Addiction is a primary, chronic disease of brain reward, motivation, memory, and related circuitry. Dysfunction in these circuits leads to characteristic biological, psychological, social, and spiritual manifestations. This is reflected in an individual pathologically pursuing reward and/or relief by substance use and other behaviours. Addiction is characterized by inability to consistently abstain, impairment in behavioural control, craving, diminished recognition of significant problems with one's behaviours and interpersonal relationships, and a dysfunctional emotional response. Like other chronic diseases, addiction often involves cycles of relapse and remission. Without treatment or engagement in recovery activities, addiction is progressive and can result in disability or premature death. *The American Society of Addiction Medicine*

Amygdala – Part of the brain that performs a primary function in the processing of memory, fear, and emotional reactions.

Anxiety – Anxiety is a multi-system response to a perceived threat or danger. It reflects a combination of biochemical changes in the body, the patient's personal history and memory, and the social situation. Free-floating anxiety – anxiety that lacks a definite focus or content – frequently occurs as a symptom in other categories of psychiatric disturbance, such as depression.

Attachment Disorder – Disorder of behaviour and social relationships resulting from a failure to form normal attachments to primary caregiving figures in early childhood, leading to problematic social expectations and behaviours.

Brain Architecture – The basic architecture or physical structure of the human brain is constructed through an ongoing process that begins before birth and continues into adulthood. Like the construction of a home, the building process begins with laying the foundation, framing the rooms, and wiring the electrical system in a predictable sequence. Early experiences literally shape how the brain gets built; a strong foundation in the early years increases the probability of positive outcomes. A weak foundation increases the odds of later difficulties.

Brain Faultlines – A metaphor used to describe scientific knowledge about how addictions occur. Faultlines can appear as the brain develops, often due to toxic stress, or people may have been born with brain faultlines. Just as faultlines can set off earthquakes, faultlines in the brain can affect brain architecture.

Brain Plasticity – Capacity of the brain to change structure, function, or organization of neurons in response to experience. This ability persists throughout the lifetime, but specific types of plasticity are age dependent.

Chronic Disease Management Model – A healthcare delivery model currently used to manage chronic diseases such as diabetes and hypertension and gaining favour for treating addiction. The goal is to keep patients healthier and disease-free for as long as possible through screening and early detection, multi-disciplinary and holistic care teams, patient education and self-care, and ongoing case management.

Core Story – A knowledge-translation technique from the FrameWorks Institute. A core story defines a topic in a consistent way, prioritizes the scientific knowledge, identifies the key points, and removes unnecessary detail. A good core story unifies the many messages from the scientific community into a single storyline with several basic themes. This simpler model can be used to create a link between scientific findings and policy.

Cortisol – A steroid hormone produced by the adrenal cortex that regulates carbohydrate metabolism and maintains blood pressure. Cortisol is released in response to stress and prepares the body's systems for a "fight or flight" response. However, prolonged cortisol secretion due to chronic stress can have negative effects on development and far-reaching health effects into adulthood.

Depression – A psychiatric condition involving a primary disturbance of mood that affects a person's thoughts, feelings, behaviours, and physical functioning. Symptoms include feelings of sadness, hopelessness, worthlessness, anxiety, guilt, irritability, fatigue, and pain that persist for a significant period of time.

Dopamine – A neurotransmitter in the brain that is involved in movement, motivation, and reward; also the neurotransmitter most closely associated with addiction. Dopamine is the main neurotransmitter of the reward system and becomes dysregulated in addiction.

Epigenetics – The study of heritable changes in gene expression due to mechanisms other than changes in the underlying DNA sequence. A gene is basically like any other molecule in the cell and thus is subject to physical modifications. Collectively, these modifications can be considered as an additional layer of information that is contained within the genome and are referred to as the epigenome (from the Greek "epi" meaning "over" and genome).

Executive Function – A set of cognitive abilities that control and regulate other abilities and behaviours. Executive functions include planning and decision-making, abstract thinking, rule acquisition, and cognitive flexibility.

Exposure Therapy – A behaviour therapy technique that gradually and safely exposes a patient to a feared object or situation. Exposure therapy is effective in treating a variety of anxiety disorders such as phobias and post-traumatic stress disorder (PTSD).

Glucocorticoid – A hormone that predominantly affects the metabolism of carbohydrates and, to a lesser extent, fats and proteins (and has other effects). Glucocorticoids are made in the outside portion (the cortex) of the adrenal gland and are chemically classed as steroids. Cortisol, which is released in response to stress, is the major natural glucocorticoid.

Hippocampus – A part of the cerebral cortex that plays important roles in short-term and long-term memory and spatial navigation.

HPA Axis – Hypothalamic-pituitary-adrenal axis, a complex set of direct influences and feedback interactions among the hypothalamus, the pituitary gland, and the adrenal glands that control reactions to stress and regulate many body processes.

Nucleus Accumbens – Part of the brain that plays an important role in reward, reinforcement, and addiction. Rewarding behaviours and drugs of abuse cause the neurotransmitter dopamine to be released into the nucleus accumbens.

Opioids – Exogenous compounds that relieve pain. Opioids reduce the intensity of pain signals reaching the brain and affect those brain areas controlling emotion, which diminishes the effects of a painful stimulus. They include hydrocodone, oxycodone, morphine, codeine, and related opioid drugs.

Positive Stress – Positive stress is moderate and short-lived, and is an important and necessary contributor to healthy brain development. It can help motivate individuals to accomplish tasks and achieve goals.

Pre-frontal Cortex – A part of the forebrain that is involved in executive functions such as working memory, decision-making, planning, and judgment.

Process Addiction – An addiction to a particular behaviour rather than to a foreign chemical. Process addictions can occur in behaviours such as gambling, sexual activity, pornography, eating, shopping, work, and using the Internet.

Secure Attachments – Strong, positive, and trusting emotional attachments formed between infants and their mothers and other caregivers.

Serve and Return – The metaphor of a game of tennis used in the core story of brain development to describe the positive interaction between a child and caregiver required for healthy development. The interactive influences of genes and experience shape the developing brain. Like the process of serve and return in a game of tennis, young children naturally reach out for interaction. When adults respond by mirroring back those interactive gestures in a consistent way, the child's learning process is complete.

Stress-Response System – A fight-or-flight function of the autonomic nervous system that initiates, within seconds of a perceived threat, an integrated repertoire of biobehavioural changes associated with accelerations of heart and respiratory rates, sweat production, and other physiological changes.

Tolerable Stress – Tolerable stress is a severe form of stress, but it occurs in the context of supportive relationships that help buffer its effects and facilitate adaptive coping. Tolerable stress does not produce long-lasting damage to the body.

Toxic Stress – Intense, long-lasting, or uncontrollable stress occurring in the absence of supportive relationships to buffer its effects. In children, toxic stress can occur as a result of unpredictable home environments, abuse, or being cared for by a parent who is addicted or mentally ill. Toxic stress in the early years of life damages the developing brain and can lead to lifelong problems in learning and behaviour, and increased risk for physical and mental illness.

Trauma-Informed Approach – A model for services that are provided for problems other than trauma but require knowledge about the impact of trauma, thereby increasing their effectiveness. This model takes the experience of trauma into account and avoids triggering trauma reactions and/or traumatizing the individual. The behaviour of staff and organizations is adjusted to support the individual's coping capacity so that he or she is able to access, retain, and benefit from the services.

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