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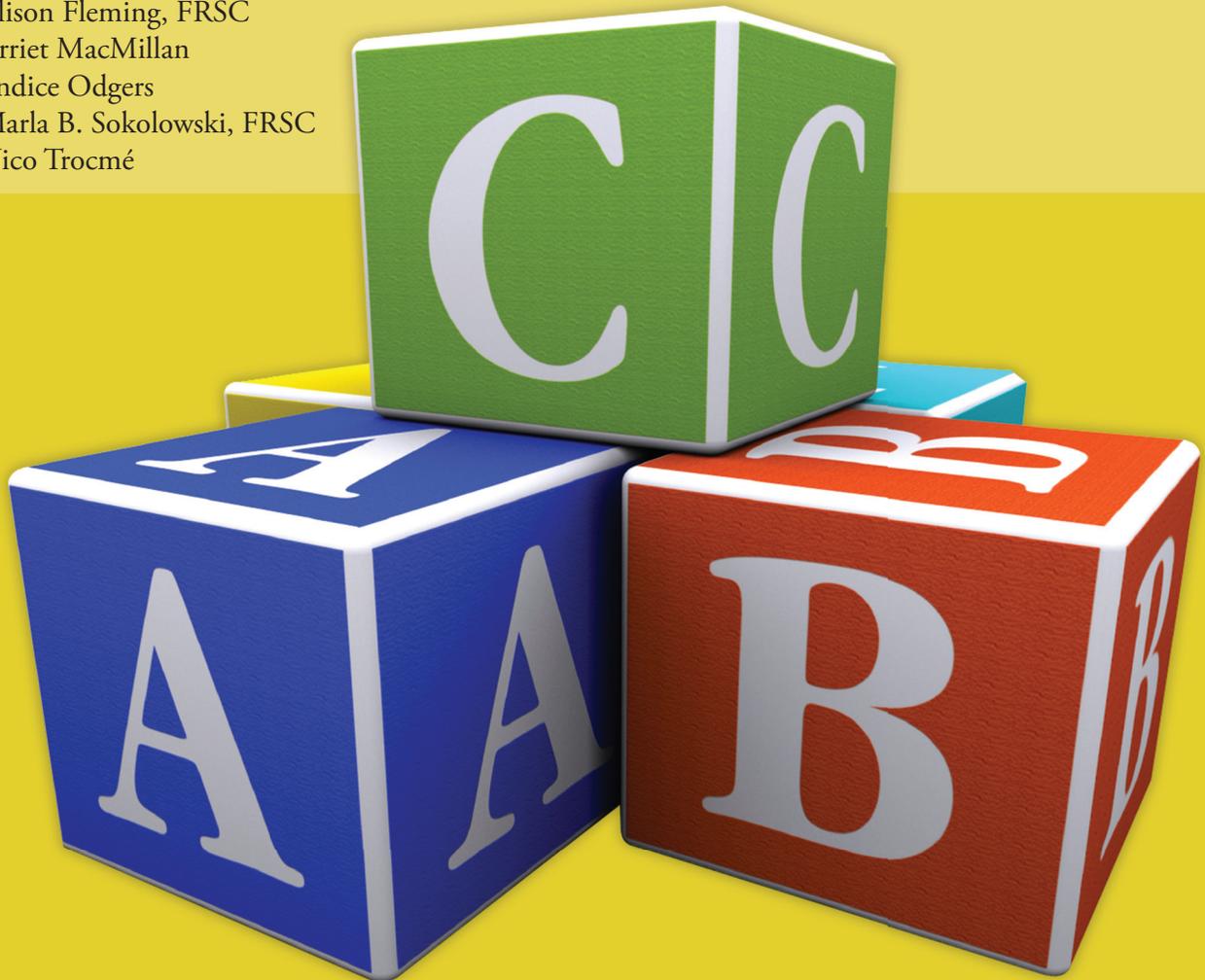


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REPORT IN BRIEF

**The Royal Society of Canada &
The Canadian Academy of Health Sciences Expert Panel
Early Childhood Development
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REPORT IN BRIEF — EARLY CHILDHOOD DEVELOPMENT

Early childhood is an extremely sensitive period in human development, during which the brain, especially the circuitry governing emotion, attention, self-control and stress, is shaped by a child's environment. As children grow, the biological and environmental factors that determine their development become intertwined. When the environment is a secure, positive one, these factors join forces to help maximize children's potential. But when children face enduring obstacles to healthy development, such as poverty, inappropriate care, or violence, environment and biology may route them on a course to emotional, physical and mental health problems.

Early childhood development should be a critical concern for Canadians. There were 85,440 substantiated investigations of maltreatment of children in Canada in 2008 (Trocmé, Shlonsky, Mulcahy, & Esposito, 2009). An estimated 610,000 Canadian children and their families live in poverty (Campaign 2000, 2010). Countless other children are growing up in families, schools and neighbourhoods where they are exposed to violence, substance use, and toxic daily stressors. Such difficulties can lead to great suffering for children, not only when they are young and vulnerable, but throughout their lives. And those damaged lives—those children's lost opportunities in learning, training and employment, their increased risk of addiction, mental and physical illness, and criminal behaviour—take a terrible toll on them and on society.

It is now generally accepted that child, adolescent and adult mental health, effective functioning and well-being all result from a complex array of biological, social and environmental factors interacting over the life course. However, the developmental processes through which these different determinants operate need to be clarified. To advance public discussion on the role of early adversity in shaping adolescence and young adulthood, the Royal Society of Canada and the Canadian Academy of Health Sciences asked an Expert Panel on Early Childhood Development to produce a consensus document on these questions:

1. Are there identifiable adverse childhood experiences such as abuse, neglect, chronic poverty, family dysfunction, chronic illness, family addiction and/or mental illness that lead to poor mental health and unhealthy behaviours, such as addiction, in the adolescent and young adult? Is there evidence that they have their effects through changes to brain structure and function? Do these factors operate together to produce their changes? Are there factors that mitigate the influence of adverse early experiences?

2. What is the evidence for the effectiveness of a variety of interventions to mitigate the adverse effects of environmental influences [including social, political and chemical/biological] on the developing child? To what extent are such interventions being implemented in Canada?

These questions are not new. For the last half-century, the scientific evidence on the importance of the early years for later healthy development has been mounting. Since the turn of the new millennium, however, research has made formidable progress in the areas of child development, epidemiology, neuroscience, genetics, epigenetics (chemical processes that change the structure or conformation of DNA, and determine whether a gene expresses its characteristics). At the same time, many longitudinal (long-term) studies of very young children launched in the 1970s and 1980s reached maturity and began yielding new information on their developmental trajectories into adulthood; many studies were upgraded, and new ones begun, to include genetic and biological markers among the factors shaping early childhood.

This wealth of information has generated new insights regarding the nature of the links between early adverse environment and later outcomes. We know more about how persistent adversity may combine with a cascade of ensuing environmental events and contexts to influence future development. We also have a deeper understanding of how the brain regulates and controls the neurobiological pathways that affect health (physical and mental), learning, and behaviour. Gene-environment interplay has been documented, revealing for example, how some adverse experiences seem to bring out negative health

outcomes among those who have specific genetic profile while having little or no effect on others. Recent advances in developmental neurobiology point to epigenetic processes whereby environmental conditions may “get under the skin”, *i.e.*, provoking changes that become embedded in neurobiological systems. Finally, the last decade has seen prevention research generate an increasing number of interventions aimed at mitigating early adverse experiences and their negative impact on the developing child.

The resulting picture is typical of a fast-evolving field of knowledge: highly intricate and multifaceted, at times imprecise, and certainly not definitive. However, from this work in progress, we can distinguish the outline of an emerging science, which integrates knowledge in genetics, epigenetics, basic neuroscience and applied developmental science. The dots are not all connected, but from this new corpus of research a coherent epigenetic-developmental landscape has begun to emerge, in which we begin to explore and understand how the social environment and biology are intertwined. Three general assumptions have gained support from this recent research and guide our report: (1) a life-long developmental perspective according to which the origins of adult physical and mental health and well-being can often be found among processes occurring in the first years of life; (2) a bio-ecological approach that takes into account the multifaceted nature of the environment as it relates to developmental health; and (3) the imperative of a biosocial synthesis emphasizing the dynamic character of nature-nurture interplay in development.

In reviewing the evidence regarding early childhood adversity and developmental health, we looked at four sources of data:

Longitudinal studies: what we have learned from studies that followed children from early childhood to young adulthood;

Neurogenomic science: an exploration of the emerging biology linking early life adversities with mental health disorders and diminished wellbeing in adulthood;

Transmission of parenting styles through neuropsychology, neurobiology and epigenetics: a look at how ‘poor’ parenting not only causes adjustment problems later in

life, but can become embedded in families, persisting across generations;

Interventions to prevent maltreatment of children: an overview of interventions for preventing one of the most pervasive and serious adversities, the maltreatment of children.

Because experience and biology are intertwined throughout children's development, exploring their unique and joined contribution to children's development is a challenge. Much more detail on how this is accomplished (with relevant references) is available in the long form of this report, available on the Royal Society of Canada website at www.rsc-src.ca.

Longitudinal studies

Learning from studies that have followed children from early childhood to young adulthood.

Studying large groups of individuals longitudinally from early childhood to mid-life can show us the long-term association between early experiences and later behaviour and health. We looked at several studies that prospectively followed population-based and more vulnerable, at-risk samples of children from early childhood into young adulthood, to see what they tell us about the longitudinal associations between early-life experiences and mental health and behaviour, including substance use and criminal involvement. We also considered a new generation of longitudinal studies that provide a finer grained resolution of the early life experiences of children alongside state-of-the art assessments of biological, familial and social factors. Many of these studies also leveraged 'natural experiments', such as twin studies to help clarify the developmental role of exposure to early adversity in explaining poor adult outcomes. Finally, we also took stock of a few well-documented preventive trials, where children from vulnerable families were exposed, in some cases through randomization, to an enriched environment and then followed longitudinally. By and large, the reports on these studies tell a similar story underlying the importance of early adverse childhood experiences.

1. Exposure to adversity in early childhood increases the odds of poor mental health and unhealthy behaviours in adolescence and adulthood.

There is a clear predictive association between persistent adverse experiences in early childhood and a variety of maladaptive outcomes later in life. This association is robust in that it has been confirmed (1) for a variety of adverse childhood experiences, ranging from chronic stressors such as family poverty and inappropriate care, to discrete episodes of child maltreatment; (2) for a wide range of outcomes, such as emotional and behavioural problems including depression and anxiety disorders, school difficulties, delinquency, substance use, criminal offending, and adaptations to stress; (3) in studies with various designs, such as retrospective and prospective longitudinal studies, and various populations, such as community based samples or from high-risk groups; (4) in studies designed to further investigate the interplay between genes and the environment in developmental trajectories. The predictive associations appear to be graded and linear, suggesting a dose-response association (i.e., the more severe the adversity, the more negative the outcome), even in populations where the majority of children have experienced at least one form of early adversity. They also extend to physical health problems, including cardiovascular disease, obesity, chronic lung disease, and cancer. However, it is important to emphasize that these predictive associations are probabilistic, not deterministic. A significant number of at-risk children do not fall on these negative trajectories, allowing us the opportunity to identify protective factors.

2. Early exposure to adversity can set children on a risky trajectory at an age when they are primed to receive and respond to input from their social worlds, which increases the likelihood they will continue to encounter new stressors.

Young children absorb experiences from the social world rapidly. As a result, both positive and negative input are likely to have long-term, cascading effects on children's social and emotional development. It is clear that persistent exposure to adverse experiences may combine with the events and contexts that form children's environments to place children on pathways toward poor adult outcomes by increasing the risk for behavioural problems, peer and school difficulties, substance use, and mental health problems during adolescence. The evidence from longitudinal studies clearly indicates

that (1) individual differences in developmental trajectories of behaviour difficulties are seen very early in life, often as soon as they can be reliably assessed, with a small but significant number of children displaying various “symptoms”; (2) these differences are predicted by a host of prenatal and perinatal factors reflecting early environmental adversity, such as low family income, being exposed to maternal smoking during pregnancy, lifetime and postnatal depressive symptoms experienced by the mother and the father, harsh parenting, and family dysfunction; (3) early adversities, such as low socioeconomic status (SES), family dysfunction, and harsh parenting, are often enduring and interact with child factors (e.g., difficult temperament, low self-control) in predicting later behaviour problems and a cascade of negative circumstances, such as peer difficulties, paving the way to later adjustment problems.

Exposure to adversity is not random. It is disproportionately present in lower SES families and communities. Impoverished children and families experience dramatically higher levels of stressors and adversities and sustain higher rates of virtually every form of malady and developmental hurdle, from low birth weight to traumatic injury, to infectious disease to psychiatric disorders. Adversity also tends to be persistent, so children who face early adversity are likely to continue it throughout their development processes, which increases their risk of health and adjustment problems over time. Hence, children who experience adverse events early are at increased risk for experiencing repeated and chronic stressors at future stages of development and at increased risk of health and adjustment problems over time.

3. Early-onset, persistent antisocial behaviour is one of the most detrimental pathways for children and is closely linked to childhood experiences of adversity.

One of the most costly life outcomes for an individual and society is involvement in crime. The link between adverse childhood experiences and involvement in antisocial behaviour in childhood, adolescence and young adulthood is firmly established. Over the last 15 years, children showing early signs of antisocial behaviour have been intensively studied. Although only a relatively small subgroup of those children persistently engage in antisocial behaviour, they are characterized by social, familial and neuro-

developmental risks starting in early childhood and are responsible for far more than their share of the health burden by the time that they reach early adulthood.

Preventing early-onset, persistent aggressive and antisocial behaviour has become a top priority for researchers, clinicians and educators. Many believe preventing early-onset antisocial behaviour is key for altering children's future developmental trajectories. However, it is important to note that more than half of children who show signs of early-onset antisocial behaviour do not persist in it. It will take effective early identification measures to ensure intervention programs are provided to the children who need them.

4. Individual differences in the effects of exposure to adverse childhood events appear to be the norm. These differences are conditioned by a combination of individual level factors and environmental factors.

Exposure to early adversity is a good predictor of later problems, but not all children who are exposed to adversity early in life grow up to experience problems. Rather, children vary tremendously in their response to adverse childhood experiences; there is no single path from early adversity to poor mental health outcomes. The effects of early adversity are moderated by a wide range of factors, from genes to community-level social supports. The pervasiveness of gene-environment interactions in accounting for later adjustment appears to be the norm rather than the exception. However, there is still a great deal we don't know about how genes and environment interact during development to create individual differences in developmental health.

5. Intervening early through intensive programs aimed at children and their close environment may have long-term beneficial effects.

Although few in numbers, prevention studies converge in showing that an experimentally induced enriched environment may have long-term protective effects for 'at-risk' children. On a larger scale though, such as trying to move families out of poverty or, more globally, ameliorating their socioeconomic conditions through policies and programs, the evidence has been mixed. We know poverty and socioeconomic deprivation are important adverse childhood experiences, but we still have much to learn

about how strategies to reduce poverty might reduce the burden of poor mental health and unhealthy behaviour in adolescence and adulthood. Better functioning communities seem to buffer the relation between socioeconomic factors and adverse outcomes. However, that evidence has rarely been translated into interventions for improving mental health and reducing unhealthy behaviour, which might be done through social programs aimed at reducing poverty in a community, or targeted to families with low SES. This area deserves more research.

6. Children believed to be the most ‘at risk’ may also be the most responsive to interventions designed to enrich early environments.

The majority of research linking early life experiences to later mental health problems has focused on children’s reactions to adverse experiences. Some of that research shows children whose individual factors make them vulnerable may experience the worst of both worlds, because vulnerable children are also more likely to face adverse experiences at home and in the community. But new evidence suggests that assessment may be too bleak. The same children who have been considered to be the most reactive (with a low threshold for emotional responses to events) may also be those who benefit the most from enriched environments or interventions. That is, children most at risk based on individual and genetic factors, may also be those most sensitive to positive input from the environment. Thus, as we consider individual differences in reactions to adverse experiences, it is important to keep in mind the possibility that greater risk may also signal a greater opportunity for intervention to improve the lives of these children.

The Neurogenomic Science¹ of Early Adversity and Human Development

While the evidence for a strong, credible predictive association between persistent adverse experiences in early childhood and later developmental health has been steadily growing, evidence of its biological plausibility has also dramatically increased over the

¹ Note: The term Neurogenomic science refers to the study of how the genome contributes to the development of both structural and functional aspects of the nervous system.

past 10-15 years. New findings in neuroscience, genetics, and epigenetics have started to clarify the biological pathways and the conditions under which early adverse experiences and later developmental health are connected. The emerging evidence is that adversity and developmental health are linked through individual differences in the development of specific brain and peripheral nervous system circuits, and that these pathways are partly governed by complex gene-environment interactions affecting the expression of genes (i.e., the process through which the information from a gene is used to synthesize a gene product, most often a protein). This evidence, stemming from research in both animal and humans, is explained in the following points.

1. Early adversity may affect developmental health in a variety of ways: through cumulative, progressive lifetime exposure, through “biological programming” whereby early insults become biologically embedded during sensitive periods in development, and through sequential escalations in risk over time, along developmental pathways of increased risks.

These models of early influence are not mutually exclusive, and there is empirical evidence for the plausibility of each one. The extent to which each of these models accounts for the association between early adversity and developmental health is still a subject of debate. However, it is likely that they all account for a part of the association between early adversity and developmental health.

2. Early adversity and later developmental health are linked through the structural and functional development of specific brain and nervous system circuits associated with the stress-response system.

There is converging evidence for the neurobiological plausibility of an early stress pathway to developmental health. Brain circuits underlying the appraisal of threat, emotion regulation, self-control, and short-term memory, act in a coordinated way with the peripheral stress response systems to regulate the overall stress response and maintain *allostasis*, which is a dynamic physiological balance in the organism. An *allostatic load*—the wear-and-tear or the biological cost of a relentless stress response under conditions of hardship—accumulates over time among young children who live through

chronic adversity. Under chronic stress, this constant stress response is linked with possible long-term repercussions for general health, including impairing the immune system, increasing rates of infectious and chronic diseases and increasing blood pressure and the risk of cardiovascular disease. In other words, young children experiencing chronic adverse experiences are at a greater risk of disease, and their health is undermined then and in adulthood.

3. There is substantial evidence that the stress-response system is malleable in young children, and extensively shaped by early experiences of stress and parental care.

Significant exposure to adversity, especially during early childhood and in a family environment of poverty, or in environments of abuse and deprivation is associated with changes in the structure and function of brain circuitry and the reactivity of peripheral stress responsive pathways. Importantly, these neurodevelopmental differences are found across the entire spectrum of socio-economic status, not just at the impoverished end. This suggests that neural differences linked to social circumstances apply to the entire population, albeit to different degrees. Changes associated with early adversity lay a biological foundation for lifelong escalation of mental and physical disorders. Thus, the biological repercussions of stressors and adversities sustained in early life continue to echo through the decades of adult life, escalating rates of mental and biomedical disorders and increasing the chance of early death. However, not all children are equally affected, partly due to gene-environment interactions.

4. These brain development processes, and their associated behaviour and health outcomes are partly governed by complex gene-environment interactions affecting the expression of genes.

Gene-environment interaction means that (multiple) genes convey a general susceptibility that may result in a negative outcome depending upon the child's experience of environmental stressors. Gene-environment interactions are pervasive in development. They help explain how differences in developmental health among individuals emerge from unique combinations of differences in experiences and genetic make-up. Our genes do not determine our traits; rather there is a dynamic interplay between nature (genes)

and nurture (environment). The developmental perspective is critical as gene-environment interactions, themselves, evolve and change throughout development. Genes only convey a probability that behavioural traits will be expressed in a given environment. Genetic determinism rarely, if ever, applies to complex behavioural traits in individuals or in populations. The important individual differences in physical, social/emotional, and cognitive development resulting from early adversity are largely accounted for by such interplay of genetic factors and early environmental adversity. The challenge for developmental science now is to better understand how these different processes operate and co-exist in guiding developmental pathways.

One form of gene-environment interplay that has been the subject of increasing attention in recent years relates to epigenetic processes, specifically to the possibility that the environment may change the way genes are expressed in the human brain. From conception onwards, environments act like dimmer switches, dialing gene expression up or down. Genes listen to the environment, and their expression is partly influenced by experience. Recent advances in epigenetics, mainly using animal models and centering on the neuroendocrine response to stress, now provide us with mechanisms that explain how this may happen biologically. There is emerging evidence in humans suggesting that brain development could be partly molded through changes in gene expression, embedding early experience in our biology and leading to individual differences in developmental health trajectories. More research on humans is necessary to tell to what extent this is the case.

To help children with this emerging knowledge of gene-environment interplay and epigenetics, we need to study what type of adversities interact with the genome and the epigenome, and at what point in development children are particularly vulnerable to their impact. Studies of different epigenetic signatures among children from widely divergent early life circumstances will help us to do a better job defining which aspects of early nurturing environments have the capacity to biologically embed and influence developmental trajectories.

Epigenetics is the study of changes in gene expression that occur through mechanisms that don't involve changes in DNA sequence. Bird defines epigenetic events as “a change of state that leads an identical combination of genes to produce a different developmental outcome.” (Bird, 2007)

Transmission of parenting styles

Parenting is embedded in a complex social system.

Families provide most early stimuli for children, define the social and economic resources available to the child, and largely control children's contact with the wider environment and the terms upon which it occurs. Social resources include parenting skills and education, cultural practices and approaches, intra-familial relations, and the health status of family members. Parenting behaviours are especially important in the early years when the maturation of neurophysiological systems makes the young child particularly receptive to, and dependent on sensitive parenting care for his/her emotional and behavioural regulation.

Unfortunately, not all children benefit from this nurturing contribution. Early signs of adjustment problems in the child have been associated with inconsistent, non-sensitive, and hostile parenting behaviours. However, to understand the meaning of this association, it is important to consider that parenting is embedded in a complex social system; it is influenced by parent and child characteristics, but also by contextual stress and supports.

Parents bring their personality and personal history to their early interactions with the young child. This background, as well as more immediate environmental constraints, may influence their parenting beliefs, expectations and practices.

Early adversity and the transmission of parenting styles across generations through neuropsychology, neurobiology and epigenetics.

How to bring up children is an early, but mostly implicit, life lesson. Few parents consciously teach a child how to raise children, but the information is absorbed and often

duplicated in the next generation. When the home environment is difficult, adverse childhood experiences and parenting may become intertwined over time, leading to negative developmental outcomes that can persist across generations if there are no intervening positive influences on the child. It appears that the underlying mechanisms linking early adversity and later parenting difficulties act to disrupt behavioural and physiological processes usually involved in normal parenting. These include alterations in the brain mechanisms and neurochemistry that regulate parents' emotions, ability to be attentive, impulsivity, and ability to be rewarded by the infant or child, and to regulate stress responsiveness. Learning, experience, and modeling are other behavioural systems through which intergenerational transmission of parenting could work. These mechanisms develop across the first few years of life and are susceptible to many early environmental influences.

We need to understand how poor parenting begets poor parenting in the next generation. Only by understanding the phenomenology of parenting, its precursors and consequences, and its underlying mechanisms, will we be in a position to address the needs of the parents, to enhance their overall wellbeing and to help them gain the tools to attend to the needs of their children more effectively.

To build that understanding, we looked at the psychological and physiological mechanisms that regulate parenting, and those that account for parenting being handed on from one generation to another. Because most studies of parenting focus on the mother, that literature constitutes the focus of the present report. However, principles derived from this work could well apply to fathers and hopefully future studies will indicate ways in which the regulation of parenting is similar and ways in which it differs across the two parents.

Children who grow up neglected or abused or under extreme distress are at risk of developing a host of unhealthy behaviours that affect their future lives. They tend to be less equipped to take on parenting and, in adverse circumstances, are more likely to perpetuate negative and adverse parenting across generations.

There is a growing literature, both in humans and in other animals, showing that one of the most powerful predictors of the quality of mothering is how mothers were parented themselves; that is, their own experiences growing up. In humans, important aspects of these early life experiences are the warmth expressed by mothers, whether mother-infant interaction involved physical contact, play, vocal exchanges, looking at each other and the extent to which mothers responded to their infant in a timely and appropriate way.

At the same time, a parent's history of emotional abuse and neglect is associated with increased anxiety, depression, post-traumatic stress and physical symptoms, and some of these scars—specifically, poorer emotional and physical functioning—persist over time and put a parent at risk for difficulty parenting. Women who report early sexual abuse display less interest in becoming mothers and when they do, show higher levels of neglect, use of physical punishment, and a lack of emotional control in parenting situations, while mothers abused as children are more likely to abuse their own children, than mothers not reporting abuse.

Although infrequently studied, a small percentage of fathers (5 to 10 per cent of new fathers as opposed to 15 to 20 per cent of new mothers) also become depressed during the first postnatal year. In one small study, paternal depression has been related to more frequent spanking and less positive engagement with the child.

Mothers who are depressed, reactive, inattentive, impulsive, aggressive, or simply not interested in their children are more likely to adopt inappropriate parenting behaviours, especially in stressful situations.

The perceptual, cognitive and emotional deficits that many parents experience affect their children in different ways. Depressed mothers who are not treated can put their children at risk for depression. Children who are physically abused or are the target of harsh

parenting may come to be harsh parents themselves. Neglectful parenting, inconsistent parenting or insensitive parenting can produce problems in the child's own attachments and later relationships.

Mothers with postpartum depression are more irritable, and less sensitive toward to their newborn child, and likely to respond more negatively to their infant and demonstrate disrupted patterns of communication when compared to mothers without postpartum depression. Later in the postpartum period, depressed mother-baby pairs show less mutual attentiveness and communicate, touch and smile less than non-depressed mothers and babies.

Despite the probabilistic associations between early adversity and later emotional and parenting problems, most parents who experienced extreme adversity do not adopt the same pattern with their child.

Personal factors, such as the new mother having a different temperament than her mother did or having a supportive spouse, are positive elements in breaking the cycle of poor parenting. Parents may also buffer the effects of early adversity on the young child by providing warmth and protection to the child, conditions that foster a secure parent-child attachment. Environmental factors, such as social support for the mother from family or the community are also important for mitigating the risk of inappropriate parenting.

If, in some cases, the reasons for these inappropriate parenting behaviours can be traced back to events earlier in a parent's life, there is also a clear association with more contemporary events.

A number of studies report a definite connection between actual or recent negative life events and situations and psychological distress manifested in the form of depression, anxiety, hostility, as well as eating and sleep problems. A restrictive, punitive and emotionally aloof parental style has been associated with stressful and undesirable life events, such as divorce and marital discord. Economic hardship has been associated with parents' distress and non-optimal parenting behaviours, such as disciplinary techniques characterized by excessive and restrictive control, disapproval and punishment. At the

same time, children from economically disadvantage families are likely to sustain more frequent and severe psychological stressors relative to their higher SES peers. Thus, in addition to the material exigencies in the lives of lower SES children and families, systematically greater exposures to acute and chronic stress appears to play an important role in the social stratification of child health. Parents' psychological distress and their inappropriate parental behaviours might explain the connection between difficult living conditions and later chronic morbidities in the child and in adult life. The degree to which these direct or indirect processes take precedence in the development of negative outcomes is still the object of debate and research, but clearly, families do not operate in isolation.

Our work suggests that it will take a multi-faceted approach to improve parenting, and thereby reduce childhood adversity. We need social policies (such as efforts to reduce poverty and drug abuse, and to improve education) and interventions specifically designed to protect children from adverse experiences. There is also a role for the larger community and policies in supporting the development of positive parenting strategies, especially under conditions of adversity. There is evidence that supports to the mother starting in pregnancy build her competencies to prevent a wide range of poor outcomes. But we also need to consider interventions that focus on parenting difficulties, including programs aimed at improving parents' ability to regulate their emotions, strengthen their impulse control, attention and improve their cognitive capacity to cope with stress. Specific training for parenting, such as understanding infant signals, should be the object of attention in future research.

Interventions to prevent maltreatment of children

Interventions to prevent maltreatment of children and lessen the impairments that result in childhood and adolescence.

“Adverse childhood experience” is a dry term for a broad range of sad realities too many children face, including poverty, parental substance abuse, and maltreatment. We could not review interventions for all the adversities children face, so for this report we

prepared an overview of interventions for preventing one of the most pervasive—the maltreatment of children. There are five major types of maltreatment: physical abuse, sexual abuse, emotional abuse, neglect and exposure to intimate partner violence. For this review, we adopted a framework from a recent review of child maltreatment preventions (MacMillan et al., 2009). We included interventions aimed at preventing maltreatment and interventions intended to prevent recurrence of maltreatment and/or reduce the impairment that maltreatment causes in children and adolescents.

The following summary is drawn from this review. The interested reader can access more specific details in the main report.

1. Responses to child maltreatment in Canada and in the USA have focused first and foremost on the reporting and investigating of cases. Only a small proportion of children receive services as a result of these investigations. Unfortunately, few of these services are based on intervention models that have been evaluated, or have even been described.
2. It is difficult to determine the extent to which evidence-based interventions to prevent child maltreatment and its impairment are implemented in Canada, other than for those interventions where dissemination of the program is monitored and/or under the control of those who developed the intervention.
3. The strongest evidence of program effectiveness is available for intensive targeted programs designed *to prevent child abuse and neglect*. The program with the best evidence for preventing child physical abuse and neglect is the Nurse-Family Partnership, in which reductions in child maltreatment and associated impairments have been reported that have been sustained for up to 15 years. Attempts to adapt the program using less structured or less intense services have not been found to be effective. The Triple P-Positive Parenting Program, a population-based prevention model that involves increasingly intense levels of intervention tailored to the needs of different groups of parents, has shown

promising results with maltreating families in a community-level randomized controlled trial, but further replication is required with individual-level data before firm conclusions can be drawn. Education programs targeted to parents and aimed at preventing shaken baby syndrome in the perinatal period are feasible and have shown promise. However, their effectiveness in reducing the incidence of shaken baby syndrome requires replication. Promising results from the evaluation of attachment-based interventions show a reduction in maternal insensitivity, which may be a precursor of some forms of emotional maltreatment.

4. There is far less evidence for the effectiveness of prevention efforts targeting other forms of maltreatment. Prevention programs targeting sexual abuse have tended to focus on the potential victims rather than the perpetrators, and have focused on knowledge and awareness rather than victimization. We found surprisingly limited evidence for effective prevention programs to reduce either Intimate Partner Violence or the effects of exposure to Intimate Partner Violence.
5. Little is known about the effectiveness of interventions to prevent the *recurrence* of maltreatment. Parent-child interaction therapy has shown benefits in preventing recurrence of physical abuse, but not neglect. SafeCare, an in-home behavioural skills training program, shows promise in reducing recurrence of maltreatment. The paucity of programs demonstrated effective in preventing recurrence underscores the difficulties inherent in bringing about change in situations where maltreating patterns of parenting are already well established. Given the emphasis that has been put on detecting and investigating child maltreatment, it is surprising that programs to prevent the recurrence of child maltreatment have not been better developed and evaluated.
6. More progress has been made in developing approaches to *reduce impairment*. For children with posttraumatic stress symptoms following exposure to child sexual abuse, there is evidence for the effectiveness of cognitive behavioural therapy in reducing such symptoms. This treatment has also shown benefits in

reducing posttraumatic stress symptoms following exposure to IPV. While out-of-home placement presumably provides short-term protection from the recurrence of maltreatment at home, there is still little evidence that these short-term placements lead to significant and lasting improvements for children. Nevertheless, in contrast to policies that emphasize early reunification, foster care placement can lead to benefits for abused or neglected children compared with those who remain at home or who reunify from foster care. Out-of-home placements in programs that include well-defined therapeutic components for the children have yielded more positive results. Out-of-home care appears to be more effective when it goes beyond short-term protection and is designed to address impairment resulting from past maltreatment.

Overall, the results of research on the effectiveness of prevention of child maltreatment and of impairment are consistent with the research from the previous chapters. They point to the following conclusions.

1. Despite consistent evidence of the severe and long-lasting effects of child maltreatment, research on how best to intervene to prevent maltreatment and its recurrence is surprisingly limited. The evidence reviewed suggests that effective responses require a much higher intensity of services than are currently being deployed.
2. Given the overlap among the five major subtypes of child maltreatment as outlined earlier, it is surprising that more interventions do not consider integrating approaches to prevention, especially for those types that show common risk factors, such as child physical abuse and intimate partner violence.
3. The success of intense and sustained prevention programs targeting high-risk families during the perinatal period and early childhood is consistent with the research reviewed in previous chapters pointing to early childhood being a high priority window of opportunity for intervention.

4. The limited evidence of the effectiveness of interventions targeting families where maltreatment has already occurred is consistent with evidence that patterns of parent-child interactions are more difficult to change at later stages of development and that children's development has already been influenced in response to these negative interactions.
5. While poverty is a key risk factor for child maltreatment, it is rarely tackled by child maltreatment intervention programs. This could only be addressed as part of a larger discussion dealing with broader population health approaches that is largely outside of the scope of this chapter.
6. Child protection programs have been developed around a case identification system that focuses on reporting and investigating individual incidents of maltreatment, while placing less emphasis on assessing child functioning and quality of parenting. The evidence from the literature indicates, however, that in most situations it is the chronic exposure to maltreatment, poor parenting and other adversity rather than an individual occurrence of maltreatment that is most damaging, and that the effects of this chronic exposure are particularly severe for some children. A "harm reduction model" that focuses less on predicting risk of maltreatment and preventing recurrence of individual events and more on emphasizing development of protective factors may be more successful in minimizing the occurrence and effects of adverse events.

This chapter provides an evidence-based overview of what we know from the peer-reviewed literature about the effectiveness of specific interventions in reducing child maltreatment and associated impairment. Similar approaches to assessing preventive interventions for problems such as addiction and mental health challenges in teenage and young adulthood would be appropriate.

Key features of an emerging perspective

The last decade of research has revealed a new developmental landscape characterised by a growing integration of the biological and social aspects of development. Clearly, the biosocial synthesis is now an imperative for any significant understanding of the links between early adversity and developmental health. Here, we identify important features of this new emerging biosocial synthesis and their possible implications for policy and practice.

1. Individual differences in developmental difficulties are established very early in life and are associated with a variety of prenatal and perinatal risk factors reflecting early environmental adversity. Early childhood is a period of high plasticity in brain development, a period which progressively gives rise to the consolidation of individual differences. Thus, prevention needs to start strong in that period, and more than at any later time in development. It should also persist over time and be tailored to the changing competencies of the developing child. In addition, the development of young children should be monitored longitudinally to more precisely account for the continuities and changes over time. We need an early and developmentally integrated approach to services and social policy.
2. Adverse childhood experiences are multifaceted and multileveled, as they vary from intimate to societal. However, much of what is known about the role of adversity revolves around the proximal (e.g., parenting), rather than the distal, broader (i.e., at the community or societal level) determinants of development. The knowledge gap between these two levels of adversity needs to be bridged in order to better understand to what extent and how the more global determinants affect child development through their impact on more proximal environments, such as the family.
3. Adverse childhood experiences are not just about dramatic events; day-to-day interactions in children's lives are more important than we knew. We need to

invest in services aimed at enhancing and supporting sensitive and effective parenting in various contexts. Such support should be ongoing and complemented through childcare, school and community programs aimed at laying the foundations of better health and preventing addictions and mental health problems.

4. Children exposed to early adversity are not affected similarly. Clearly, *genes alone do not determine our health and behaviour. Neither do environments.* Gene-environment interactions (G x E) are ubiquitous, and nowhere is the interplay between genes and environment more evident than in the relationship between the early rearing environment of humans and vulnerability/resistance to chronic illness, cognitive, social and emotional wellbeing. This G x E framework is still in the making. One of the challenges facing the G x E framework is to understand how multiple interactions combine in individuals to influence developmental trajectories. Another challenge is to integrate this knowledge to inform policy and services. A current obstacle to this understanding is the lack of trans-disciplinary breadth in our training programs on early childhood development. Researchers must go beyond the old habits of working in silos, and reach across disciplines to integrate the relevant knowledge. Hopefully, these challenges will be met and the G x E will provide a sophisticated framework for a deeper understanding of human development, as well as important prospects for translational and intervention research.

5. *Early experience can alter children's trajectories through the biological embedding of early childhood experiences during sensitive periods of development and through the accumulation of damage over time.* A priority for future research will be to trace how early experiences 'get under the skin' to influence children's development. Epigenetic programming is a promising possibility, but one that is still in its infancy when it comes to understanding developmental trajectories in humans. Understanding the mechanisms through which early experiences may become biologically embedded and influence the

future lives of children is important as it brings us closer to understanding how to protect children from pervasive and harmful experiences early in life.

6. There are positive feedback loops of negative events and processes across development: *child factors and factors that are external to the child tend to become developmentally intertwined through cascading effects that may spiral out of control*. It is important to understand the dynamic of development in order to understand how some children may become caught in developmental traps of increasing steepness, and guide prevention efforts accordingly.
7. We understand more about science and life course determinants of development than interventions. The evidence base is clear to the extent that it demonstrates the success of intense and sustained prevention programs targeting high-risk families during the perinatal period and early childhood. But a research agenda that would better inform policy and strategic programming is needed. Many interventions that have been formally tried do not necessarily match up with the knowledge of developmental science, or with the longitudinal evidence on the timing of adverse experiences that matter. The interventions for which we have high quality evidence are necessary but not sufficient; what is especially lacking is information on intervention addressing the community and socioeconomic determinants of developmental trajectories that lead to addictions and mental health problems.

Toward a new science of developmental research

This report has drawn heavily on the emerging evidence of how early experience gets under the skin to influence brain and biological development. In particular, the stimulation, support, nurture and participation that makes up the early childhood environment speak to our genes through credible biochemical and physiological mechanisms. In response, genes may express themselves differently, depending on early experience; and they do so in ways that influence our future lives, including risks of addiction and mental health problems.

We believe this epigenetic perspective, when combined with insights on life-course development from birth cohort studies, and with the emerging developmental neurobiology of the brain, forms a new science. The new science has the potential to transform the way we understand the challenges raised by various developmental health problems; changing our ideas of how these problems emerge and calling into question how and when society should act to address them.

But this new science is in its infancy, leaving many fundamental questions unanswered. We need to create a credible evidence base to document the precise nature and extent of the biological embedding of specific early experiences in the epigenome and the neurobiology of the developing brain. We need to test (through existing and new longitudinal studies) whether and how these processes alter trajectories of human development. The interesting concepts that have emerged from the first generation of the new science, such as biological sensitivity to context, need to be validated through strategic longitudinal and developmental neurobiology studies. Finally, we need to address the remarkable disjunction between the developmental and population health approaches to understand the determinants of developmental health, and the individual-based approaches we favour for interventions.

Various elements of this multifaceted agenda are being documented in Europe, North America, Australia and New Zealand, among others. But the pace of knowledge generation and its relevance to Canada could be greatly enhanced by a Canadian research strategy, with secure, long-term funding. The strategy should include:

- using the rich array of longitudinal, developmental and linked data sets in Canada in a coordinated way;
- using population-based data to identify parts of Canada with large, stable differences in rates of mental health problems in teenagers and young adults, to help identify community and societal level factors that could be modified;
- developing an intervention research strategy that adds population-health interventions with life-course and other types of prevention approaches;

- developing messages for parents and other caregivers about the importance of early development, designed to penetrate all geographic, socioeconomic, and ethnic communities in Canada;
- creating opportunities to build interdisciplinary research teams that will apply epigenetic, brain imaging, and developmental neurobiology techniques to study early childhood development in socially diverse Canadian contexts;
- having jurisdictions across Canada to agree to work together on early childhood development for the benefit of all Canadians, that is, being open to inter-jurisdictional comparisons, agreeing on standards for evaluation and supporting a pan-Canadian monitoring system.

Conclusions and recommendations for pan-Canadian action on policy and research

This report makes a strong case, based on evidence from epidemiology, biology and intervention research, for focusing on the early years as a time to break the cycle linking early childhood experiences to mental health problems and unhealthy behaviour in adolescence and young adulthood. This evidence reinforces other powerful reasons for investing in the early years, such as those highlighted by the United Nations Convention on the Rights of the Child (United Nations, 1991, 2005), the World Health Organization's Commission on the Social Determinants of Health (World Health Organization, 2008), as well as by economists who underlined the economic returns, through enhanced school success, reduced criminality, and improved well-being of investment in the early years (Heckman, 2006). For all these reasons, Canadian children and their families deserve a robust strategy for tackling unhealthy behaviour and mental health through investment in the early years.