



**Date: September, 2020**

BrainGain@PEC provides brief summaries of research or publications on family homelessness and related issues. Previous issues of BrainGain@PEC can be found at <http://bit.ly/2iaczvQ>.

## THE BRAIN-BODY CONNECTION AND EARLY CHILDHOOD DEVELOPMENT

This report summarizes “**Connecting the Brain to the Rest of the Body: Early Childhood Development and Lifelong Health Are Deeply Intertwined**,” a working paper produced by the Center on the Developing Child at Harvard University. This paper can be found at <https://bit.ly/3gQ3EZG>.

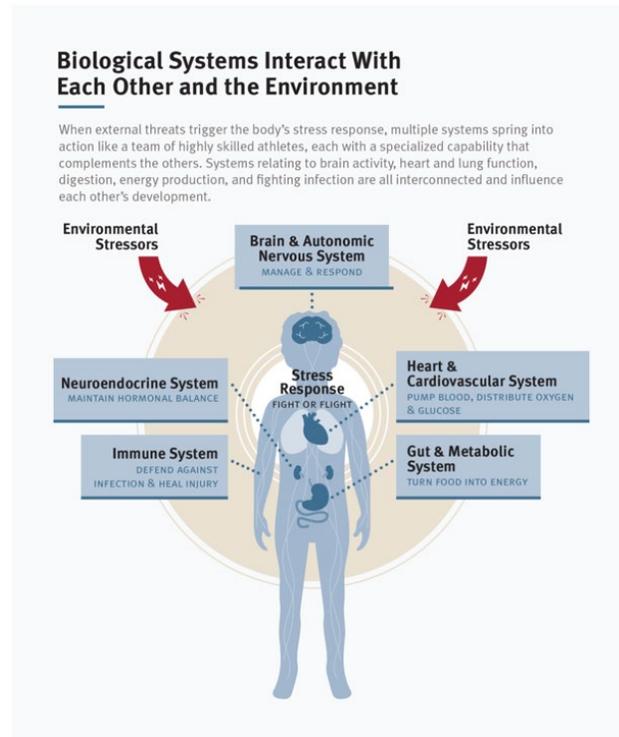
This summary is developed **for staff in emergency housing programs** who work with young children. Much of this summary is verbatim from the original document.

### HIGHLIGHTS

- There is a growing body of research on the **connections** between early childhood development (pre-natal and the first few years of life) and **lifelong** health outcomes
- **Chronic stress** in an individual’s **early years** causes a **wear-and-tear effect** that is associated with poor health in childhood and throughout adulthood
- **Inflammation** is a major part of the fight-or-flight response. Though beneficial in the short-term, **persistent inflammation** due to prolonged stress contributes to the development of a variety of diseases and has an adverse effect on long-term health
- Efforts to prevent chronic illnesses in adults **must begin in the early childhood years**
- “**Responsive relationships**” and “**language-rich experiences**” support child development and lay the foundation for academic success and health

## Section 1 – The Issue: Health and Learning are Interrelated in the Body but Separated in Policy

- Early development is the interaction of experiences, genes, age, and environment and influences **every biological system** (cardiovascular, immune, metabolic systems, etc.) in the body, not just the brain.
- The body's biological systems communicate through feedback loop, so all are impacted by the conditions of development.
- Think of the body as a sports team. Each biological system is an individual player with specific skills that complement other players' skills. Over time, teammates learn how to predict each other's actions and respond accordingly. This process intensifies the longer teammates play together, and it gets harder to change strategies. The body and its biological systems develop in a similar way. Meaning, it gets more difficult to change how a body's systems collectively respond to life as an individual ages. **It is easier to build a well-functioning system from the beginning.**

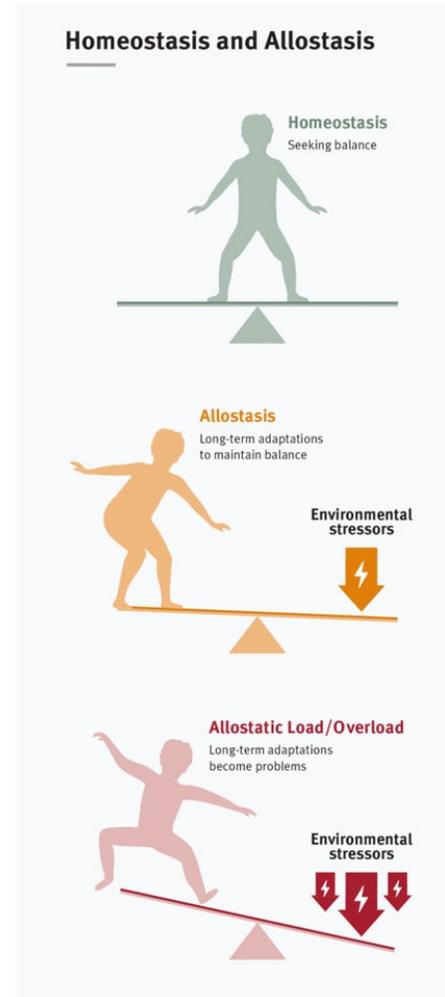


- The **downstream effects** of an insecure environment in early life are “poor educational achievement, lower economic productivity, higher rates of crime, and increased health care costs.”
- “**Strategic investments in young children** and the adults who care for them affect long-term physical and mental health as much as they affect early learning.”

## Section 2 – What 21<sup>st</sup> Century Science is Teaching Us

- Not all stressful experiences lead to poor health - “it’s the duration, severity, and timing of the experience (along with the availability of supportive relationships) that determine whether the response is ultimately harmful or growth-promoting.”

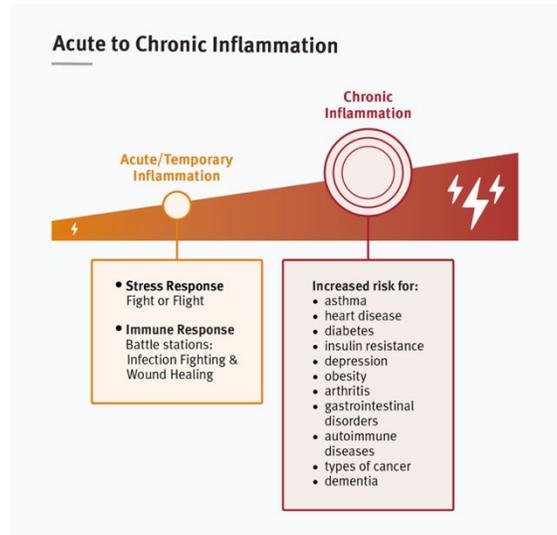
- Biological systems work together to maintain **homeostasis**, which is a state of steady physiological conditions (eg. body temperature, fluid balance) that enable the body to function optimally.
- After a child experiences a stressful event, their body will respond and return to homeostasis. For children who experience **ongoing stress**, their body is **unable to regain homeostasis**, which diverts energy away from growth and healthy development.
- The process of the body **adapting** to manage threats is what scientists call **allostasis**. If a threat or hardship is too intense or prolonged, it results in **allostatic load** or **overload**. This overload leads to breakdowns.
- Children who grow up in stable, predictable environments with manageable challenges develop a well-regulated stress response and **resilience**. Similar to the way a fire drill prepares children for an emergency, brief and intermittent stressors enable the brain to develop **healthy stress response systems** and are ultimately beneficial for development.
- For children who **experience chronic stress**, their brain is wired to expect adversity and becomes more reactive, developing a “shorter fuse” to physiologically respond to potential threats. Although this can be good for health and survival in the short-term, long-term activation is harmful to health due to a **wear-and-tear effect**, also known as **weathering**.
- Research on **weathering** provides a compelling explanation for **racial health disparities**. Interpersonal and systemic racism have a wear-and-tear effect on the body, which leads to differential health outcomes based on race, even after controlling for socioeconomic status.



**Section 3 – How Early Adversity Affects Developing Biological Systems**

<p><b>The Impact of Chronic Adversity on Three Biological Systems</b></p>		
<p><i>THE BRAIN</i></p>	<p><i>IMMUNE SYSTEM</i></p>	<p><i>CARDIOMETABOLIC SYSTEM</i></p>
<p>Brain architecture is built during the prenatal, infant, and toddler periods. It is shaped over time by the interaction of experiences, genes, and an environment of relationships.</p> <p>During these early stages of development, the brain is at its most adaptable, flexible. This means it is also highly sensitive to stress.</p> <p>Disruption in brain development directly impacts emotional regulation, memory, and executive functioning.</p> <p>The earlier in life this disruption occurs, the greater the risk for treatment-resistant health problems later in life.</p>	<p>The immune system protects the body against toxic substances and infection.</p> <p>Inflammation is a core part of the immune system’s response. Inflammation is a physiological function that attacks invading bacteria or viruses, clears out the tissue destruction they cause, and begins the repair process.</p> <p>Chronic stress means persistent inflammation, which is harmful because powerful substances that kill microbes eventually damage the body’s organs.</p> <p>Prolonged activation of the immune system also weakens it, making it less efficient at fighting off harmful microbes.</p>	<p>The cardiometabolic system produces, distributes, and/or regulates the physiological fuel (e.g., oxygen and glucose) cells need throughout the body via the circulating blood stream.</p> <p>In response to stress, this system raises the heart rate, blood pressure, and blood glucose level. This increases energy for essential survival functions and diverts energy away from nonessential tasks, like digestion. Though helpful in the short-term, this response is harmful when it is ongoing.</p> <p>Persistent cardiometabolic response to stress can lead to obesity, hypertension, type 2 diabetes, and cardiovascular disease.</p>

- Prolonged early adversity can cause the biological stress response system to either **overperform** or **underperform**. Dysregulation at either extreme can be harmful to health.
- An underperforming stress response system is most often seen in cases of chronic abuse and neglect in early life. When this happens, the neuroendocrine system produces less cortisol, which is associated with higher body fat, social/behavioral problems, and depression later in life.
- It is important to note that there are ways to promote **resilience** in the face of prolonged adversity. **Supportive relationships** in predictable environments, reducing major sources of stress, and building a toolkit of **adaptive skills** can help build resilience and prevent long-term negative health outcomes.



#### **Section 4 – Common Illnesses in Adults Have Roots in Early Childhood Adversity**

- “Three chronic health impairments in the United States—**cardiovascular disease, diabetes, and depression**—together account for more than **\$600 billion** in *direct* health care expenditures annually (above and beyond their indirect costs, such as lost productivity).”
- These three diseases are all associated with **early adversity** and the resulting **increased inflammation**.

<b>Common Illnesses Associated With Early Adversity</b>		
<i>CARDIOVASCULAR</i>	<i>DIABETES</i>	<i>DEPRESSION</i>
Chronic inflammation accelerates <b>atherosclerosis</b> (a buildup of fatty deposits that thicken and stiffen artery walls, decrease blood flow to the heart, brain, and other body tissues).	Diabetes includes several subtypes of chronic disease related to high levels of blood glucose. Type 1 diabetes is primarily genetic, whereas Type 2 diabetes (90% if diagnosed cases) is	Depression is one of the <b>most common</b> mental disorders in the US and the world.  It has a combination of <b>risk factors</b> , including genes,

<p>Atherosclerosis drives many forms of cardiovascular disease, and can <b>begin early</b> in life.</p> <p>Detecting and mitigating persistent inflammation early can help <b>prevent</b> a wide range of cardiovascular diseases.</p> <p>A healthy diet in adulthood is not the only way to prevent heart disease; <b>food scarcity</b> and <b>poor nutrition</b> during pregnancy and infancy can also contribute to cardiovascular disease later in life.</p>	<p>more related to <b>environment</b> and <b>behavior</b>.</p> <p>The body’s stress response includes an increase in blood glucose, so <b>chronic stress</b> causes persistently high <b>blood glucose levels</b>. This leads to diabetes and other diseases.</p> <p>Type 2 diabetes is caused by <b>insulin resistance</b>, which is closely related to <b>inflammation</b>.</p> <p>Accessible, affordable <b>nutritious food</b> can prevent sustained high blood sugar.</p>	<p>environment, biology, and psychology.</p> <p>Depression is associated with <b>early life trauma and adversity</b>, including poverty, homelessness, and exposure to violence.</p> <p>Women are twice as likely to experience depression, compared to men. 40 – 60% of <b>low-income women</b> report symptoms of maternal depression.</p> <p>There is strong evidence indicating that depression is associated with <b>inflammation</b> and <b>insulin resistance</b>.</p>
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**Section 5 – Facts About Health That Are Often Misunderstood**

- Lifestyle in adulthood isn’t the only significant influence on health – **early development is at least as influential** on mental and physical health later in life.
- It’s **never too late** to implement interventions to mitigate the impact of early-life adversity, but earlier is better because the brain’s ability to change and redevelop decreases as we age.
- Expanding health care access is important, but it’s essential to also analyze and address **child health outcomes and health risk indicators** in order to improve health long-term.

**Section 6 – Future Directions for Policy and Practice**

- **Support responsive relationships**
  - Paid family leave
  - Sustainable compensation and benefits for childcare workers to reduce staff turnover

- Continued contact between children and parents separated through the child welfare system
- **Reduce sources of stress for the child and caregivers**
  - Strengthen safety net policies related to food access, housing, medical care, etc.
  - Streamline the process of accessing government assistance
  - Address intimate partner violence
  - Reduce systemic racism
- **Strengthen core life skills for all family members**
  - Support programs that help parents and children build and practice skills such as setting and meeting goals, emotional management, and maintaining routines
  - Team-based health care providers are well-situated to carry out these practical strategies
  - It is essential to measure the success of policies and delivery systems by looking at child health outcomes, not just health care access and utilizations.

### Final Reflections in a COVID-19 World

There are significant **racial disparities** in **severity of illness** and **death** from COVID-19

**Pre-existing medical conditions** are associated with **worse outcomes** related to COVID

This reality underscores the importance of the science presented in this paper. We must invest in **early interventions** that prevent a multitude of chronic diseases and promote long-term health and **health equity**