

ACEs AND EPIGENETICS

The story told through our genes

▶ WHITEPAPER

WHAT IS EPIGENETICS

Each cell in our body contains 24,000 or so genes that make us who we are¹. The genes in our cells aren't always active. They are either turned on or off to direct the cells into becoming the building blocks of our bodies. Our bodies and who we are, including how we look, sound, and behave, are based on how our genes are activated in each cell. Our basic genetic makeup is called our **genotype**. How our genes are turned on or off and become perceivable is our **phenotype**.

Think of your genotype as a beloved storybook with printed words, patterns, and pictures that exist permanently on the pages. Now imagine reading that story night after night to a child. You create the story for them as you go, perhaps describing the pictures, using voices for different characters, maybe even embellishing a point or two to create a unique ending. The story may change each time you read it. The story you weave is like the phenotype. The story may change for your child depending on how you tell it (phenotype) even though the printed pages (genotype) remain the same.

Epigenetics is the study of changes in gene expression caused by the modification of genes that do not include changes to the underlying genetic code^{1,2}.

To put it another way, epigenetics is the study of changes in how the story is told, not including changes to the printed storybook. The literal translation of epigenetics is "in addition to genetics." Epigenetics are the study of changes in phenotypes that cannot

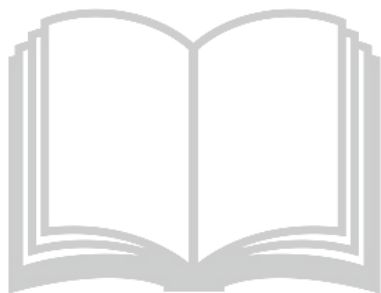
be explained by the alteration of genotypes. Epigenetic changes are natural and include changes like bodyweight, stress response, and other traits impacted by age, lifestyle, exposure to environmental factors, or even stress^{1,2}.

Emerging epigenetic research suggests that some of these changes may be inherited by the next generation³.

One lab study using mice demonstrated evidence that response to a negative stressor may be an inheritable trait. In the study, a group of mice received an electric shock whenever they were exposed to a particular smell. The offspring of the shocked mice were not shocked but they still exhibited a heightened stress response to the same smell. The smell alone did not present a threat to this generation of mice whatsoever but their bodies and brains were wired to react as if threatened³. There are a number of human studies that show similar results among groups living through threatening circumstances⁴. Studies of the grandchildren of individuals born immediately following the 1944-1945 Dutch famine show increased rates of heart disease and obesity^{4,5}.

Epigenetics is still a young field of study. The ways in which these changes are passed down and for how long they continue to be passed are complex and are still relatively unknown. What is understood is that stress is not only a powerful personal motivator but may also play a meaningful role in the development of the next generation^{1,2}.

Epigenetics is the study of changes in how the story is told



WHAT ARE ACEs:

Adverse childhood experiences (ACEs) are traumatic events that can dramatically upset a child's sense of safety and well-being.

10 types of ACEs studied in Iowa

ABUSE

- 1 Physical
- 2 Emotional
- 3 Sexual

HOUSEHOLD DYSFUNCTION

- 4 Substance abuse in home
- 5 Family member with mental illness
- 6 Incarcerated family member
- 7 Separation/divorce
- 8 Domestic violence

NEGLECT

- 9 Emotional
- 10 Physical

For more information on ACEs in Iowa visit www.iowaaces360.org

For more information on Iowa PRAMS data visit idph.iowa.gov/prams

ACEs IN IOWA: What We Know

The original Adverse Childhood Experiences Study examined several categories of early experiences of abuse, neglect, and household dysfunction and the relationship between exposure to adversity and negative, long-term outcomes. Data on individuals' exposure to 10 types of ACEs were collected in the state of Iowa from 2012-2016 through the Behavioral Risk Factor Surveillance System (BRFSS)⁶. Analysis of data collected from 2012-2014 shows that ACEs are alarmingly common and linked with long-term consequences. Iowa adults with four or more ACEs were 6 times more likely to be diagnosed with depression, 3.3 times more likely to smoke, and 3.1 times more likely to have a stroke⁶.

More recent research studies show that not only are individuals' lives impacted by early experiences of adversity, this effect can span across generations⁴. Our experiences may be woven into our children's, and even our grandchildren's, genetic code.

The prenatal period and early childhood are critical windows of time for development. It is especially important for women to be healthy during the prenatal period and for children to have access to safe, stable, nurturing environments in which to grow. A child whose caregivers are under extreme stress is at higher risk for exposure to ACEs, possibly resulting in a lifetime of struggle. The original ACE study and the ACE research in Iowa gather information from adults who are asked to consider their past. The ACEs research is not designed to collect information on the current realities of children. The Pregnancy Risk Assessment Monitoring System, or PRAMS, is a survey of new mothers in Iowa. PRAMS could give us some indication of the trauma impacting pregnant woman and young children during critical periods of development. PRAMS respondents provide a window into the homes and perhaps even the futures of Iowa's youth.

Our experiences may be woven into our children's, and even our grandchildren's, genetic code.

PRAMS

The data collected through PRAMS are representative of all births in Iowa. Through PRAMS, mothers are asked questions about their experiences before, during, and shortly after pregnancy. Their responses provide crucial information about the health, attitudes, behaviors, and stressors experienced by Iowa mothers and, thus, provide information about the earliest experiences of Iowa's youngest citizens and children's early exposure to adversities.

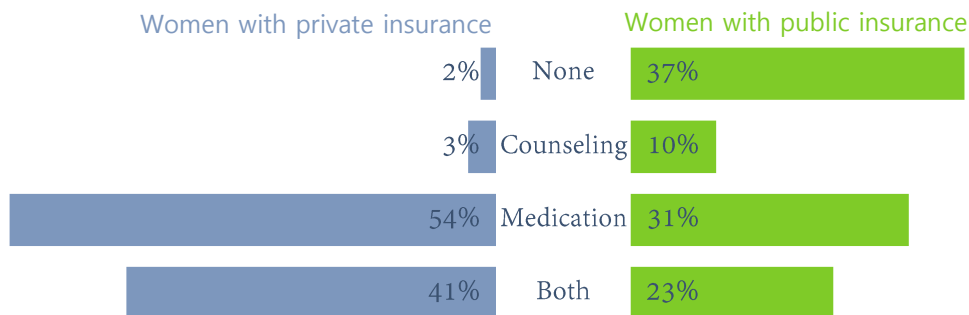
While it would be impossible to determine direct relationships from the experiences and attitudes of mothers to the inherited traits of their children, the PRAMS survey provides a window into the potential stressors, adversities, and supports that may be experienced by Iowa's next generation. Learning what we can from the current experiences of mothers could help inform appropriate, supportive responses from Iowa systems and programs. PRAMS data gives us a crucial piece of the storybook written for Iowa's children. How we interpret that story and how we respond may impact the success of Iowa's future.

PRAMS DATA Explored

DEPRESSION

Early identification and prevention of mental health concerns for families, as well as for children, can have a profound impact on life-long success. Research on maternal depression shows that children are particularly at risk if women with depression remain untreated⁷. PRAMS measures maternal depression in two ways. One question set asks moms if they have been diagnosed with postpartum depression and, if yes, has she received treatment (medications and/or counseling). A second set of questions is intended as a screener for depression to identify depressive symptoms that remain undiagnosed. In 2013, around 4,500 (12%) Iowa women who had a recent live birth were diagnosed with depression. Around 85% received treatment. However, there are another 1,800 (5%) women whose PRAMS responses indicate that they have depression but have not yet been diagnosed and are not receiving treatment. Of those who have been diagnosed with depression, 37% of women on public insurance reported that they did not receive treatment, compared to 2% of women on private insurance. There is a major gap in access to treatment between women who have private health insurance versus those who have public health insurance.

Reported mental health treatment by insurance type



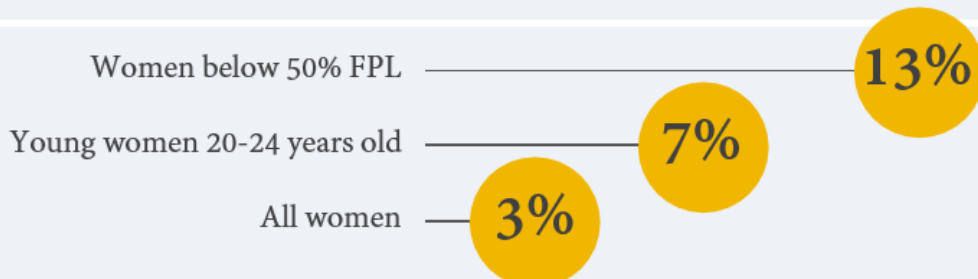
INTIMATE PARTNER VIOLENCE (IPV)

Research suggests that the risk of intimate partner violence increases during pregnancy⁸. An estimated 6.9% of Iowa moms in 2013 experienced at least one form of abuse from a partner. If a woman experienced one form, she was much more likely to face the others.

According to PRAMS data, low income

women and young mothers are more likely to report abuse than their peers, with nearly 1 out of 5 women whose households are earning less than 50% of the Federal Poverty Level reporting IPV. It is possible that children in these households are exposed to these events as ACEs.

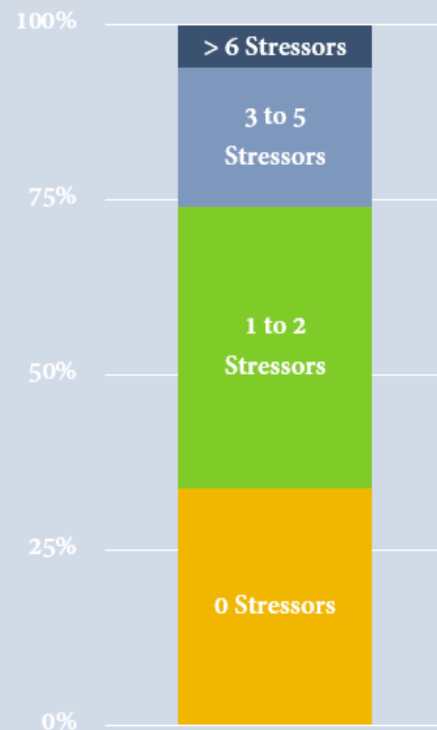
Percent of women who experienced physical abuse from a partner or husband before pregnancy



STRESS

Stress can become toxic and has the potential to overwhelm children's caregivers. Some stressful experiences for caregivers, such as mental health concerns, translate directly into ACEs for a child. Other stressors, like chronic professional or financial stress, could impact a caregiver's response to a child and could put a child at risk for future ACE exposure. The PRAMS survey includes 14 questions about stressors experienced by mothers in the 12 months before their delivery. Participants were asked to respond 'yes/no' to a list of life events that may be stressful. Some questions included: I had problems paying the rent, mortgage, or other bills; someone very close to me died; I moved to a new address. About one-third of women (34%) experienced none of these stressors.

Number of stressors women reported before pregnancy



Moving (33%), having a close family member in the hospital (26%), trouble with bills (18%) and someone close dying (17%) were the most common stressors.

Stress experienced by mothers during pregnancy may have both a biological and a psycho-social impact on children even before they are born.

MITIGATING THE RISK:

Our Opportunity to Respond

Resilience is the ability of a person to more easily and successfully overcome the effects of stress and adversity. Factors that encourage resilience include social support, access to healthcare, financial resources, or even personal qualities that help an individual overcome difficult situations. Personal resilience is not easily fostered with access to a single resilience factor. Imagine adversity balanced on one side of a scale and resilience balanced on the other. Access to more resilience factors tips the scale toward personal resilience, even when trauma occurs. Fostering communities ripe with ways to build resilience will help to mitigate the adversity facing children and families in Iowa.

According to PRAMS data, many moms in Iowa already have a good start toward stacking their scales on the side of resilience.

49%

of the women surveyed were able to **quit smoking** during pregnancy and around half of those were able to remain smoke-free at the end of the survey period.

94%

of women had at least one of four forms of **social support** included in the PRAMS survey and over 75% had all four.

27%

of women received a visit from a **home visitor** after the baby was born and 8% received one during the pregnancy.

References

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TELLING A HOPEFUL STORY IN IOWA

Understanding the health, attitudes, behaviors, and stressors experienced by Iowa mothers immediately before, during, and after pregnancy helps us begin to understand the storybook written for Iowa's next generation. Unpacking this information and utilizing it to respond systematically can help us create a positive narrative for their future.

STRENGTHS AND OPPORTUNITIES

1. Intimate partner violence may increase during pregnancy. Provide support to at-risk groups aimed at including young and lower income moms.
2. Support early identification efforts to address mental health concerns in all mothers, regardless of their insurance provider.
3. Pregnancy is a time when women tend to reduce or eliminate many forms of drug use. Continue to support those positive changes even after delivery.
4. Encourage building social support in your local community for women during and after pregnancy.
5. Continue to support already available and successful models of home visiting in Iowa.

