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Treating the Future: Our Chance to Protect the Next Generations from Diabetes

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Treating the Future: Our Chance to Protect the Next Generations from Diabetes

Gini M. Kay

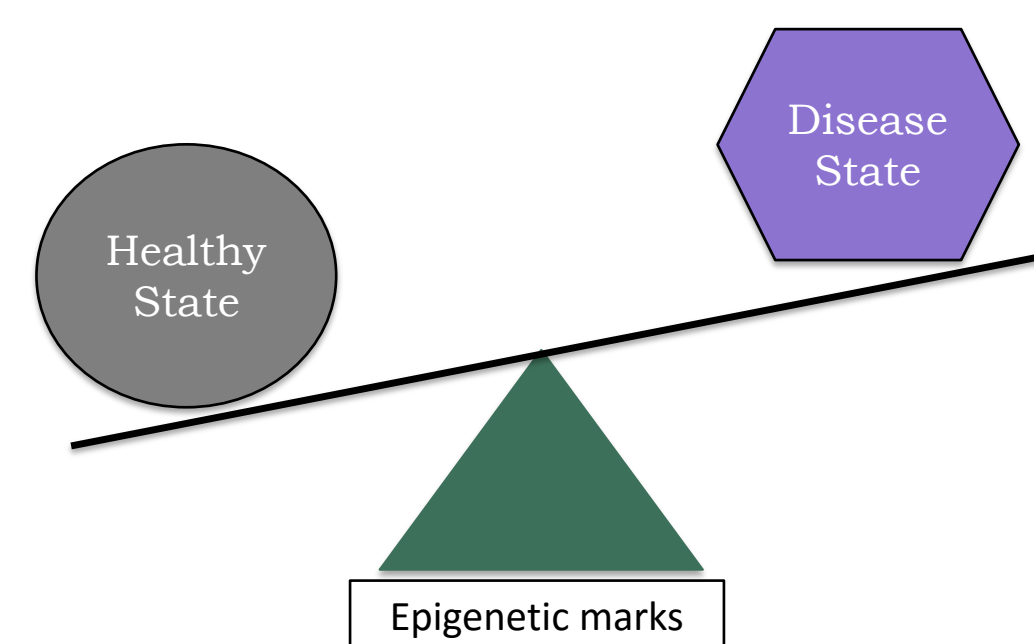
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Introduction

The population of the United States and our healthcare system is in the midst of a costly obesity and diabetes epidemic. Currently, Type 2 diabetes is a managed chronic disease with no cure. This literature review examined recently published journal articles with a focus on how healthcare professionals can use new discoveries in epigenetic research to better the health of the general population.

Diabetes Facts

- Type 2 diabetes is a complex disease that begins as insulin resistance and impaired insulin secretion⁹.
- The Center for Disease Control reports that at least 86 million people have prediabetes - more than **1 out of 3** adults - and 9 out of 10 cases are undiagnosed.
- All risk factors are on the increase in the US: having a family history of diabetes, being over weight, and having gestational diabetes.
- Total estimated cost for diabetes in 2012: \$245 billion².



What is Epigenetics?

- Epigenetic marks are chemical changes “on top” of DNA that can alter gene expression⁹. These marks allow interplay between our biology and the environment¹³.
- Environment is broadly defined to include: external and internal factors, exposures and behaviors.

- When the body’s natural state is out of balance there is an increased chance for epigenetic changes, creating a predisposition⁸ that can lead to development of chronic disease.
- The field of Epigenetics may serve as an interface between research and clinical medicine¹³.

Literature Themes

Epigenetic Research

- Epigenetic changes can be passed from one generation to another.
- Pregnancy is a critical developmental time as epigenetic marks are reset and reprogrammed based on the uterine environment and the epigenetic information passed on by both parents.
- Studies show epigenetic changes might be the link between early life exposure and adult disease risk^{5,6}.
- Mouse models show high-fat diets play a large role in developing obesity, insulin resistance, prediabetes and Type 2 diabetes⁸.

Clinical Research and Applications

- Recognize and treat prediabetes⁷ separately from Type 2 diabetes.
- Researchers have identified a panel of genes⁹ linked to Type 2 diabetes that have epigenetic alterations.
- Peripheral blood can be used to detect epigenetic profiles for prediabetes up to 10 years before diabetes diagnosis¹⁰. Tests for physicians’ use are still in development.
- Studies show dietary changes and regular exercise can alter epigenetics marks in as little as six months⁹.
- There is a strong therapeutic potential in targeting epigenetic alterations.

Public Health

- Community-based participatory research partnerships and programs^{7,10} have been organized in cooperation with community leaders to improve the health outcomes for at risk populations.
- The National Diabetes Prevention Program for adults have been proven to alter lifestyles and slow the progression of Type 2 diabetes for program participants.

Understanding the Generational Cycle and Recommendations for Change

Previous Generations

- The American diet has changed over time and is now rich in sugar, unhealthy fats and has larger proportion sizes.
- Over the past several decades the prevalence of obesity has increased at alarming rates in both adults and children.
- The changes in lifestyle due to social⁴ and environmental influences have created altered epigenetic marks¹ within many individuals.
- For every pregnancy the health of at least three generations is altered.

Current Adults

- Social environment and lifestyle choices are set by adults.
- Unhealthy lifestyle choices, increased weight and decreased physical activity create metabolic imbalances and epigenetic changes.
- Both maternal and paternal epigenetic information has the potential to create a disease predisposition³ in children.
- Many individuals go undiagnosed for years before showing diabetes symptoms.
- Having gestational diabetes increases the risk of developing Type 2 diabetes in the next 10 years by over 50%¹².

Recommendations

- Annual prediabetes screening for all individuals of child bearing age.
- Optimizing the health of adults before conceiving a child⁶ to reduce the risk of passing on an unhealthy predisposition for obesity and diabetes.
- Healthy pregnancy programs¹.

Summary

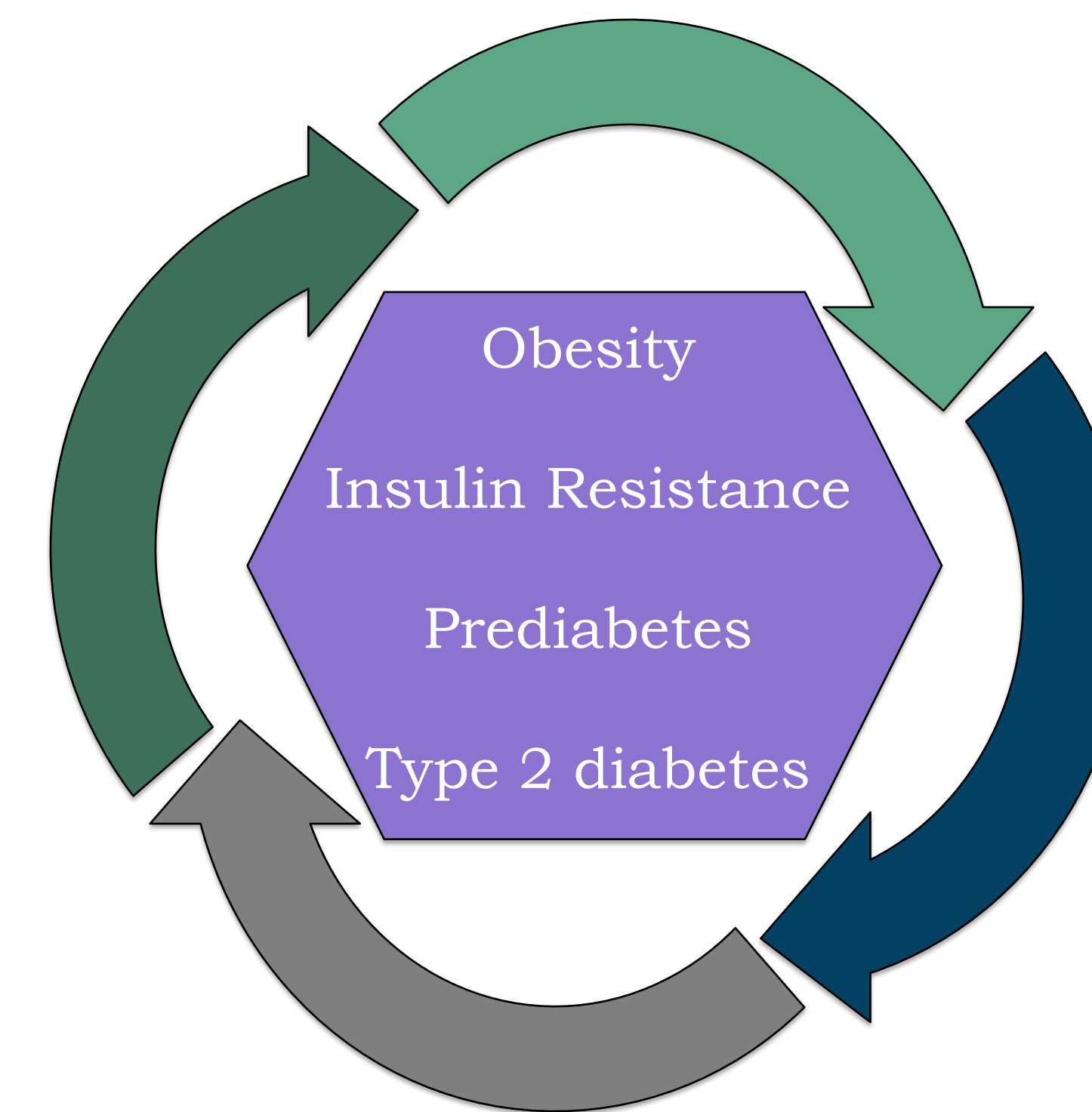
Three key factors will help reduce the burden of diabetes: applying recent advances in epigenetic research to healthcare, annual diabetes screenings for at risk populations and instituting public health prevention programs. This epidemic was created over many generations and there is no single solution to reducing the prevalence of diabetes. It is extremely important to create a healthier population in this generation. Prevention activities have the ability to reestablish healthy epigenetic marks and reduce the diabetes predisposition for future generations.

Children

- Today’s children are being born with a predisposition for adult disease⁵ and the onset is now starting before adulthood.
- Diagnoses of prediabetes and Type 2 diabetes are on the rise in obese youth and adolescents.

Recommendations

- Primary care providers need to consider *in utero* and early childhood exposures as predictors of adult-onset disease; this information should be maintained in the individual’s healthcare file¹³.
- Schools need to incorporate programs to address maintenance of good nutrition, healthy weight and active lifestyles. Including healthy breakfast and lunch programs and classroom movement activities.



Public Health Promotions

- Create a **Culture of Health** across the United States.
- Community-based participatory programs to increase public awareness⁷ of prediabetes.
 - Community outreach involving community leaders.
- Address the root causes for risk factors and implement healthy lifestyle changes.
 - Involve the entire family in prevention activities.
 - Implementation of workplace health promotions.
- Increase access to nutritional foods at affordable prices:
 - Community gardens and farmers markets; fresh fruits and vegetables.
 - Policy changes to SNAP program: remove sugary drinks, candy, and cookies.
- Create built environments and communities that incorporate active lifestyles and transportation.
- Epigenetic education for healthcare providers and continuing education opportunities.
- Community assessment: How to reach people of all demographics?
 - Use mainstream social media
 - Newspapers and news programs
- Expand current programs working on these goals.
- Conduct program evaluation and assessments.

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