



Chronic Diseases are on the Rise: Is Nutrition a Culprit?

DATE: 6 August, 2023 PRESENTED BY: Kent L. Thornburg, Professor of Medicine Emeritus
Oregon Health & Science University

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Chronic Disease Rates are Increasing in the USA

**Type 2 Diabetes, Obesity, Uncontrolled Hypertension,
Heart Failure and Many Cancers**

CHRONIC DISEASES IN AMERICA

6 IN 10

Adults in the US
have a chronic disease



4 IN 10

Adults in the US
have two or more

Annual \$4.2 Trillion 2021

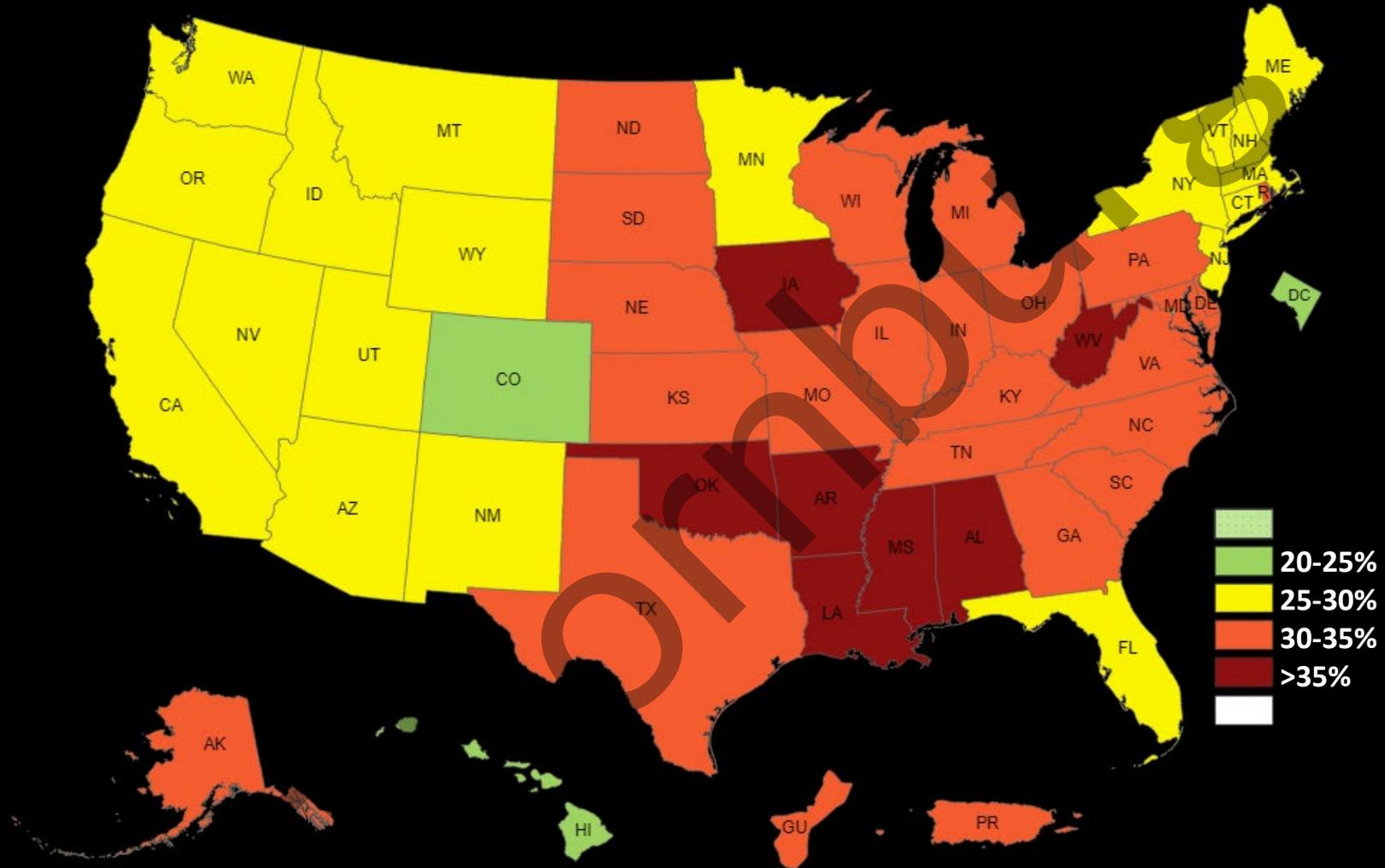


**\$1 Trillion by 2035
AHA**

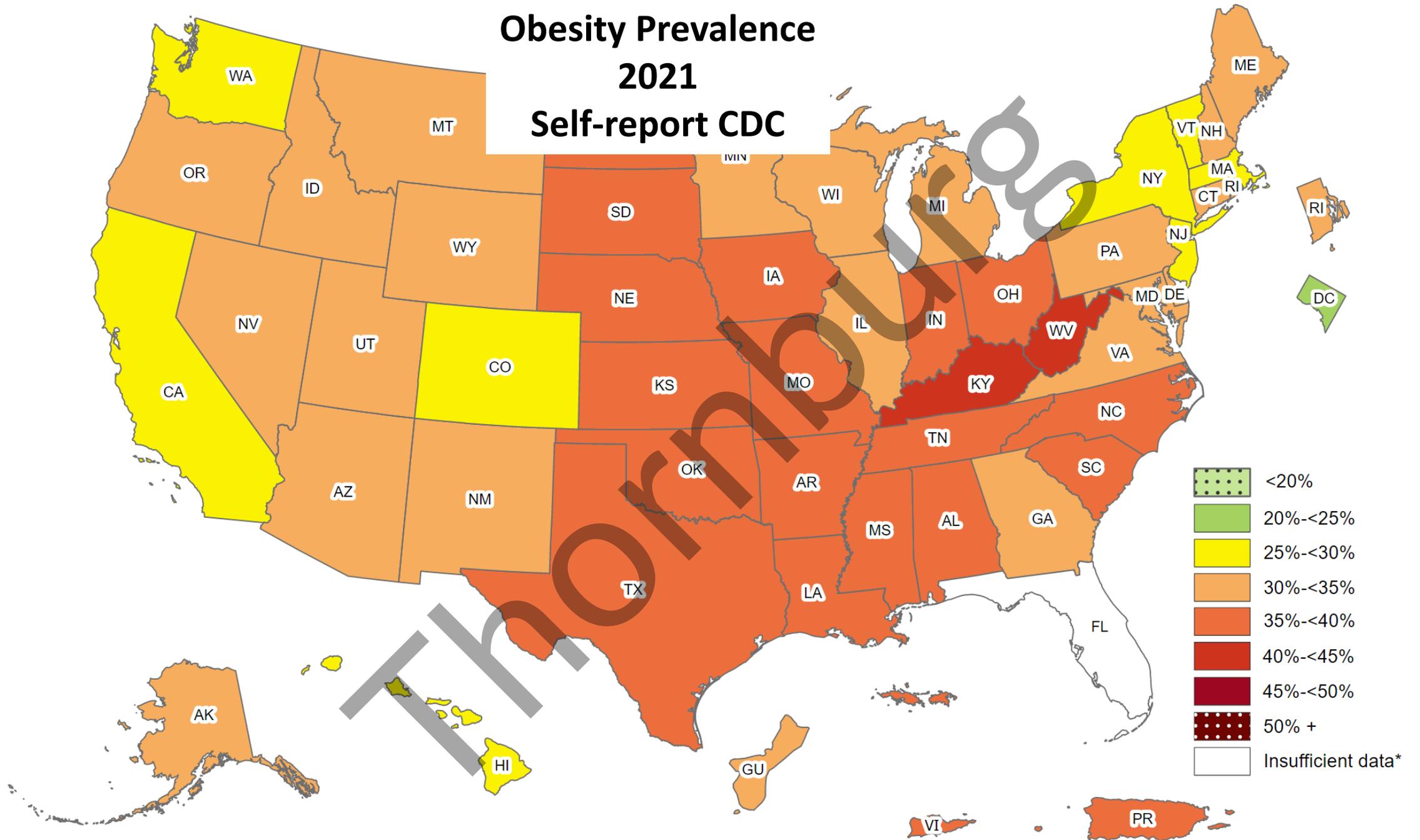
THE LEADING CAUSES OF DEATH AND DISABILITY
and Leading Drivers of the Nation's \$3.5 Trillion in Annual Health Care Costs

Obesity	 HEART DISEASE	 CANCER	 CHRONIC LUNG DISEASE	 STROKE	 ALZHEIMER'S DISEASE	 DIABETES	 CHRONIC KIDNEY DISEASE
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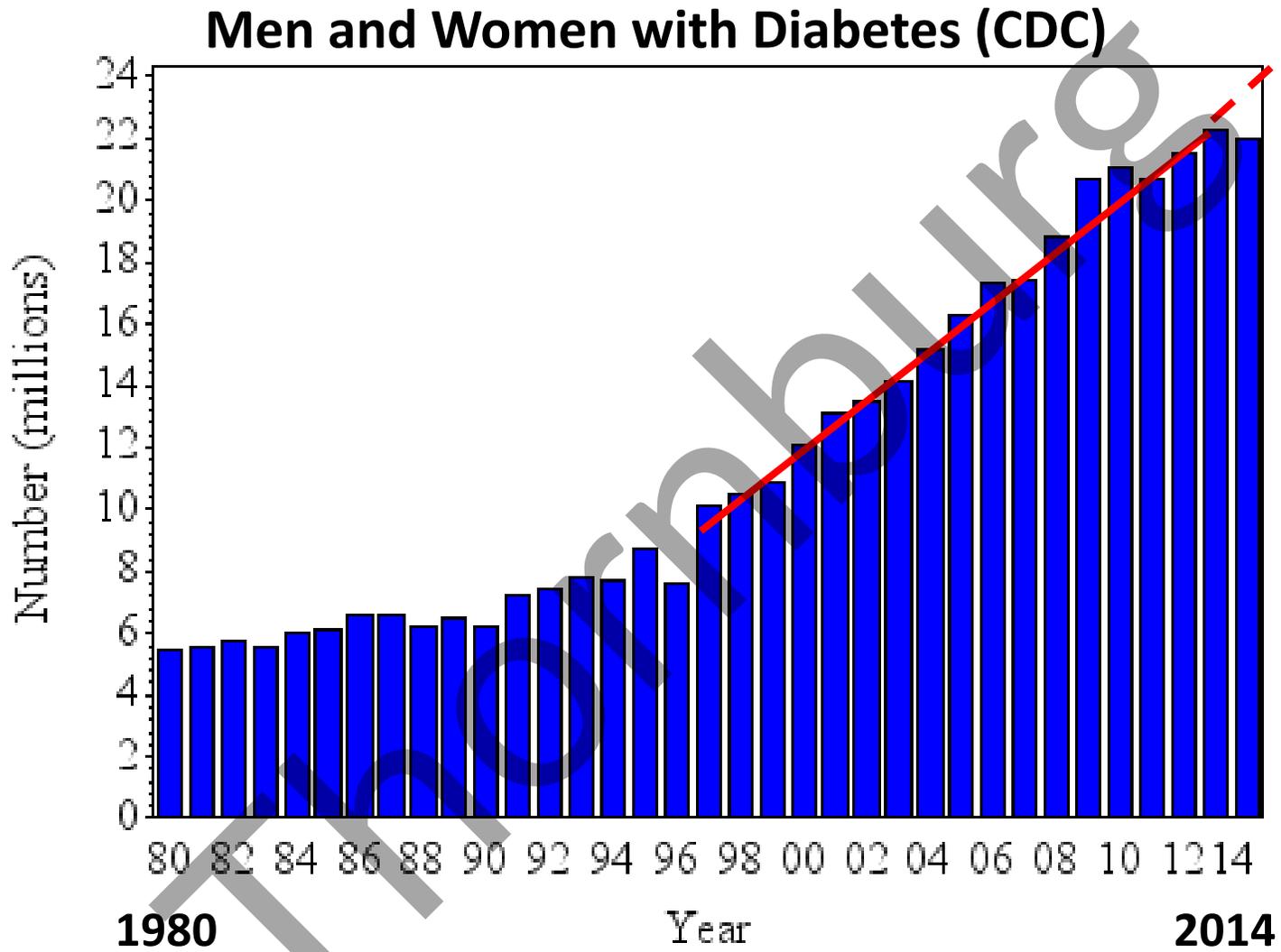
Adult Obesity Prevalence-CDC 2017



Obesity Prevalence 2021 Self-report CDC

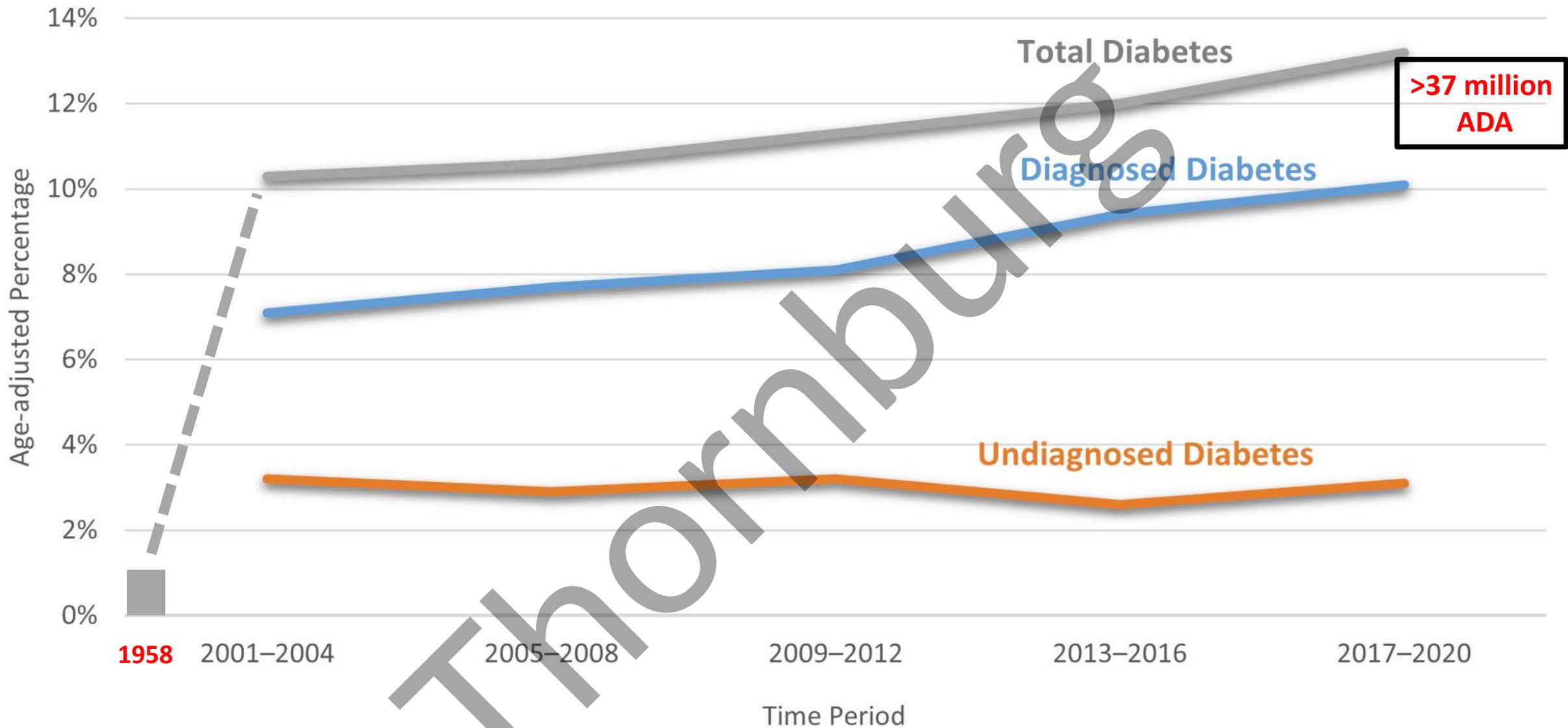


Number of US
people
diagnosed with
diabetes (CDC)



And...
Diabetes is
a major
cause of
Heart
Disease

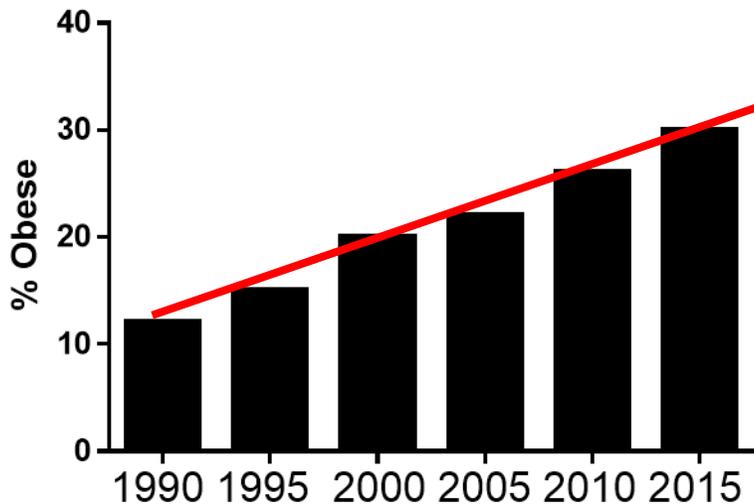
* 37M people
2022
>12%



Notes: Percentages are age-adjusted to the 2000 US Census standard population.

Adult Chronic Disease Rates in Oregon*

Obesity in Oregon



More than doubled



Heart Disease

Heart disease cases in 2010

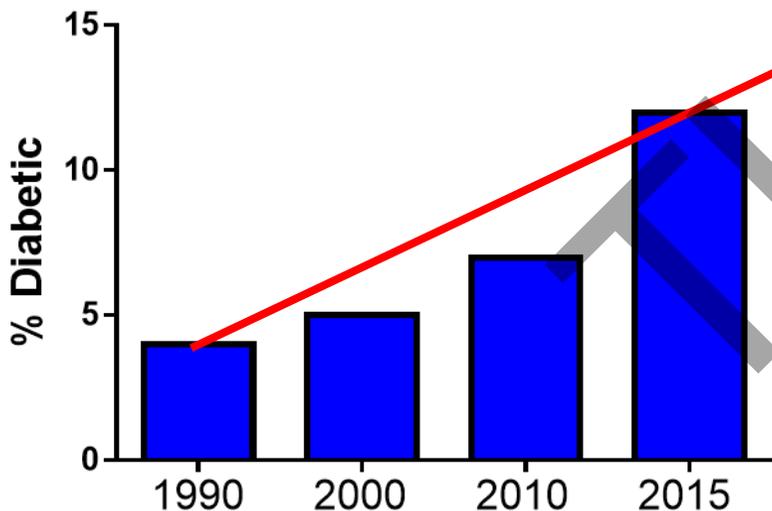
225,575 2010

Projected cases of heart disease in 2030

1,054,888 2030

*Oregon Health Authority website

Diabetes in Oregon



Tripled

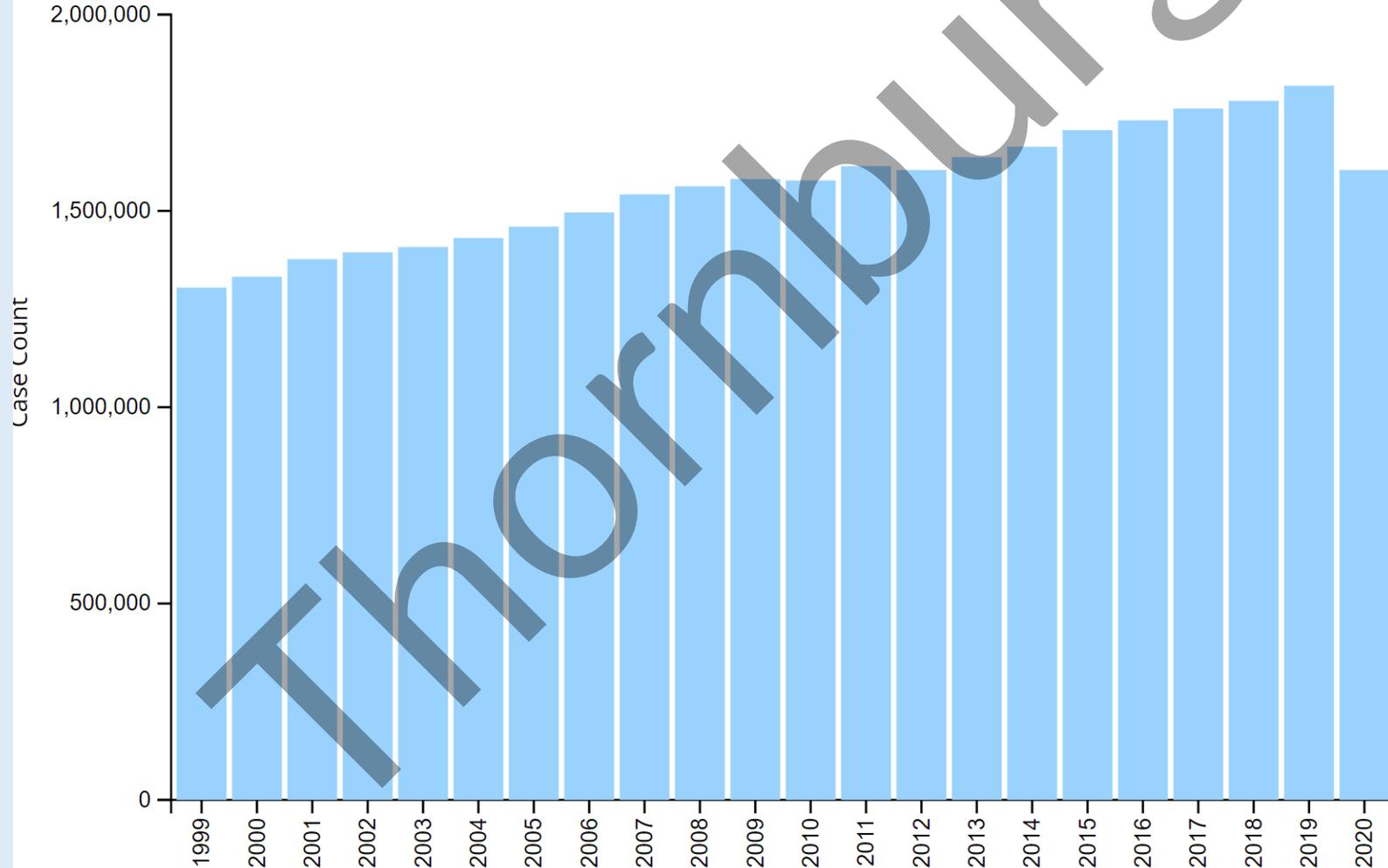


Diabetes rates are increasing rapidly, and some 70% of people with diabetes suffer cardiac disease, then...

Heart Disease must be increasing too!

Annual Number of New Cancers, 1999-2020

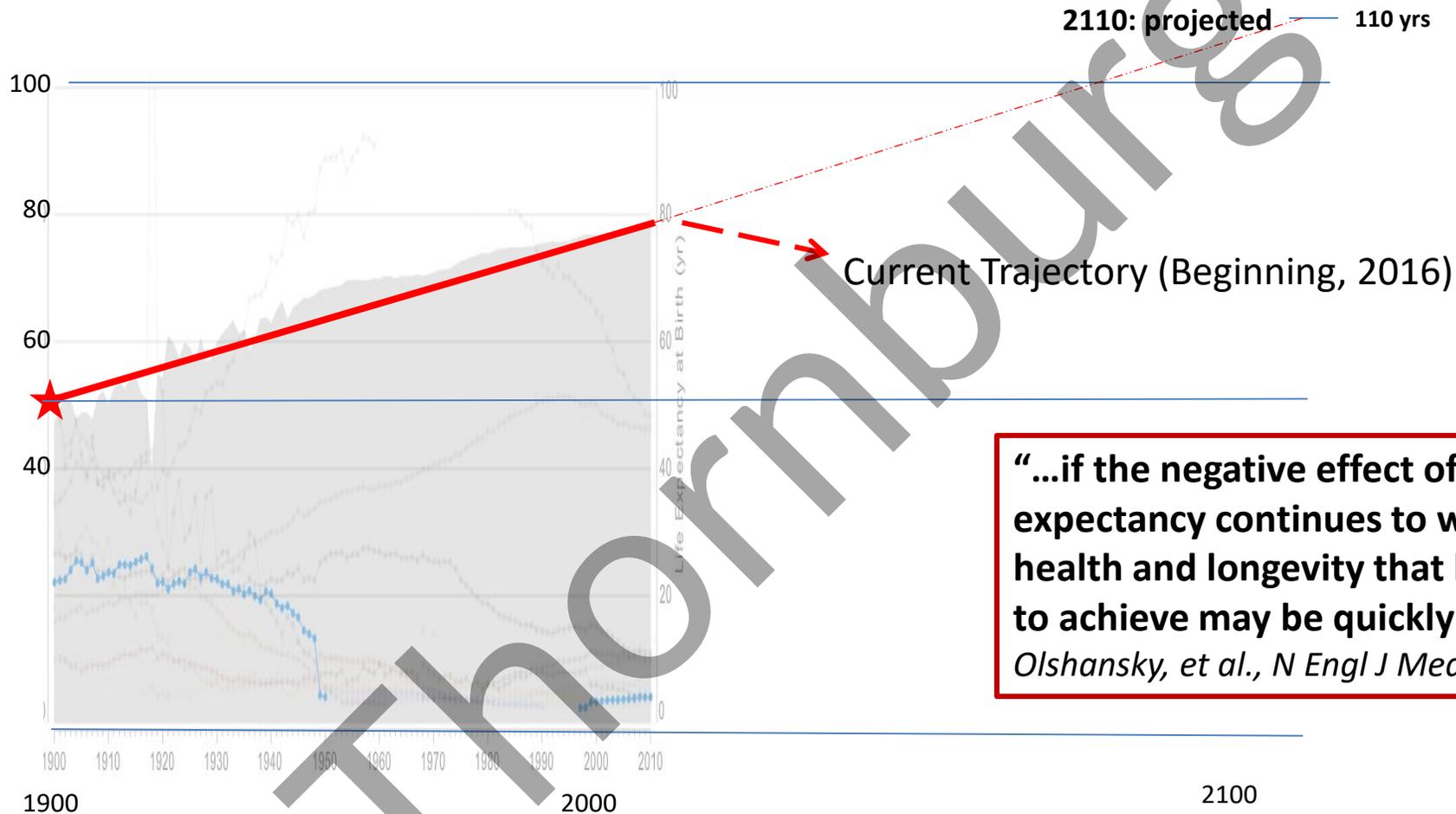
United States, All Types of Cancer



Covid Pandemic Reporting

CDC 2023 report

Average Life expectancy in years: 1900 - 2110

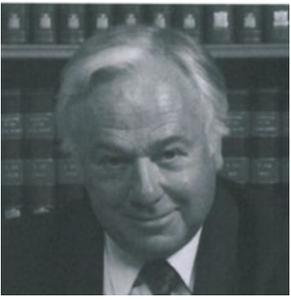


“...if the negative effect of obesity on life expectancy continues to worsen...gains in health and longevity that have taken decades to achieve may be quickly reversed.”

Olshansky, et al., N Engl J Med 2005; 352:1138-1145

Fetal growth patterns are associated with later chronic disease risk.

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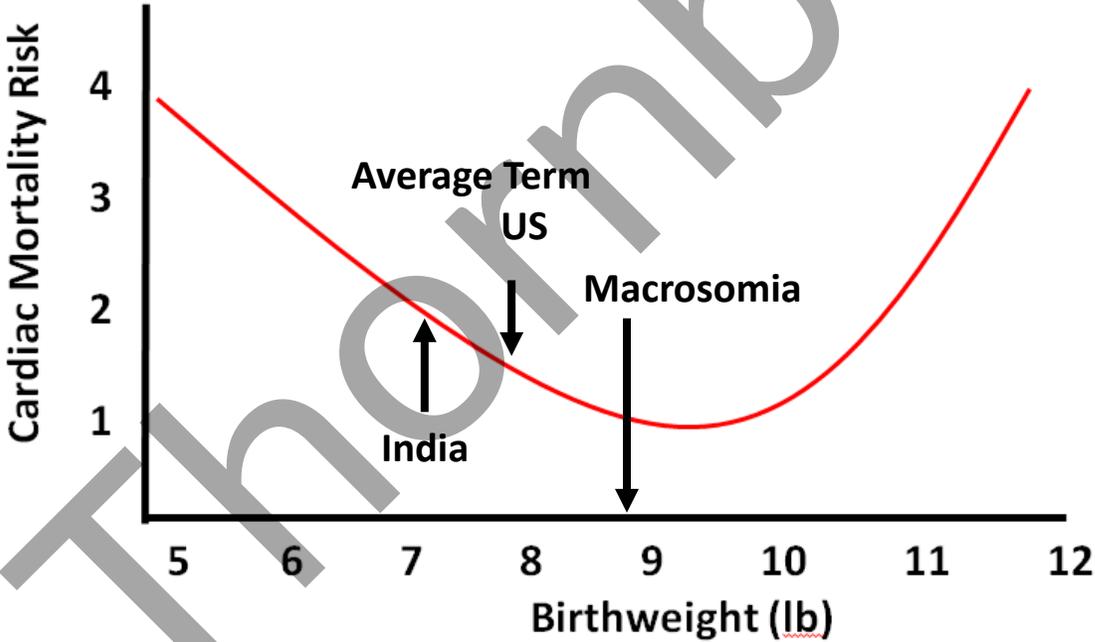
David JP Barker
1938-2013

Chronic Diseases Have Their Roots in Early Life

U.K. Barker BMJ, 298:564, 1989
India: Stein. Lancet 348:1269, 1996
USA: Rich-Edwards BMJ 315: 396, 1997
Finland: Barker Int J Epidemiol 31: 1235, 2002
China: Fan Ann of Med 42: 596, 2010

Birthweight Also Predicts:

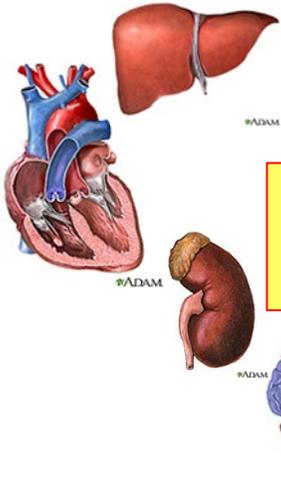
- ✓ Type 2 Diabetes
- ✓ Obesity
- ✓ Hypertension
- ✓ COPD
- ✓ Breast Cancer
- ✓ Cognitive Function



Data from Hertfordshire, UK birth/death records
Lancet. 1989; 2(8663):577-80

Rashid A. Association of High Birth Weight With Incident Heart Failure in the ARIC Study.
J Am Heart Assoc. 2019 May 7;8(9):e011524.

Intrauterine Stressors
Poor nutrition, high cortisol, low oxygen, toxic chemicals, maternal conditions



1. Structural **2. Epigenetic**

Poorly made organs Modifications of gene regulation

Genetic Background

♂ Vulnerability for Adult-Onset Chronic Disease ♀

**Passed to Future Generation(s)
-- one generation after the next**

Future Health of Mother

Paternal, Maternal and placental phenotypes predict disease

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Beyond Birthweight



1. Maternal Phenotype

Height, weight, muscle mass, fat mass, skeletal dimensions
hormone profile, blood lipids.

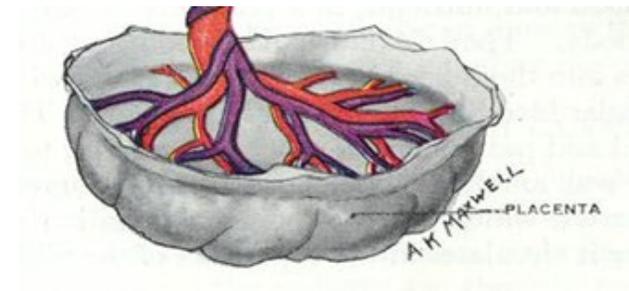
2. Fetoplacental Sex

3. Paternal Epigenotype

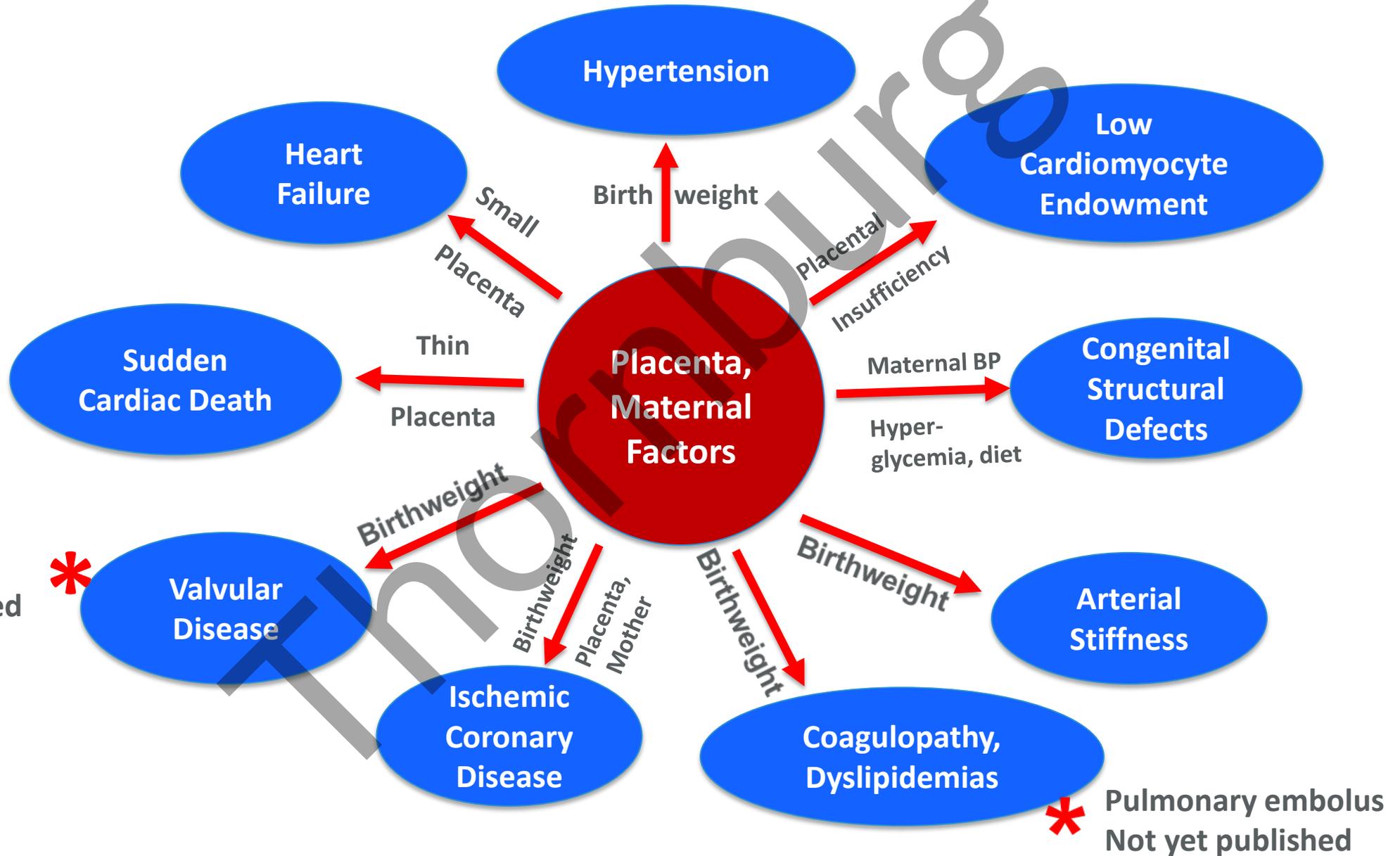
Father's diet and body phenotype

4. Placental Phenotype

Weight, width, length, thickness,
number of cotyledons, cord
insertion and length, efficiency



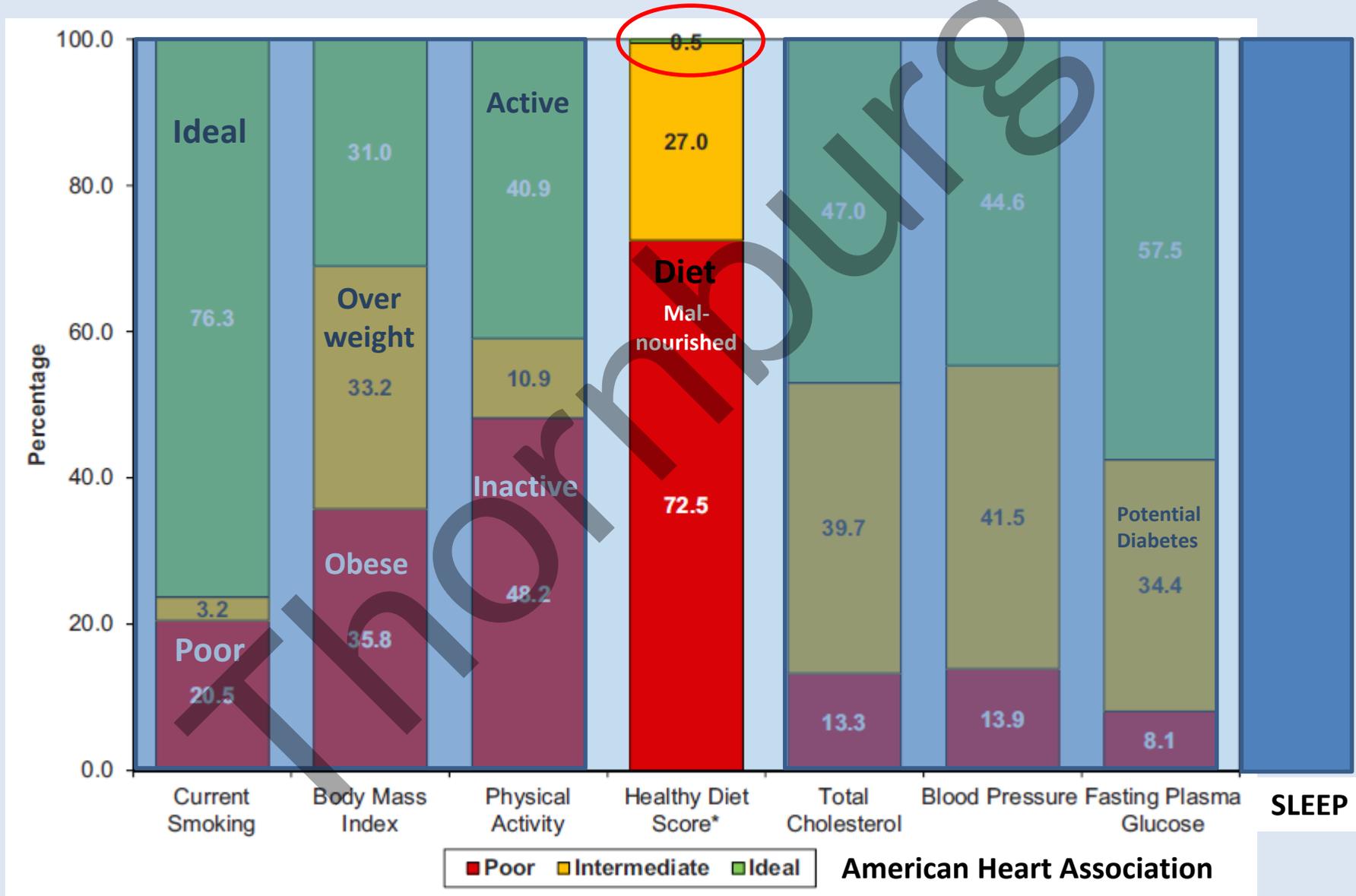
Early life conditions that lead to Adult-Onset CV Disease- Epidemiology



North Americans Suffer from High Calorie Malnutrition

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Age-standardized estimates for each of the simple-7 8 metrics of AHA 2020 Goals among adults over 20 years old



Where do Fetal Nutrients Come From?

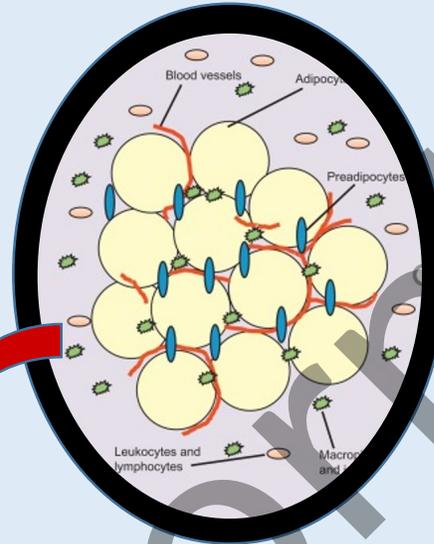
1) Maternal Diet Lipids, AA, Carbs



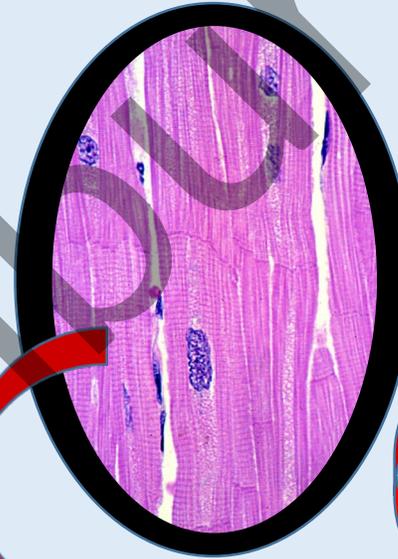
Other Nutrients

2) Maternal Tissue Stores (built up during pre-pregnancy)

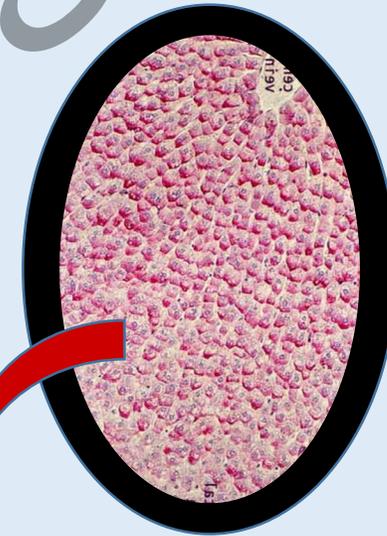
Lipids



Amino Acids



Glucose



Placenta

Adipose

Muscle

Liver Glycogen

Dutch Hunger Winter caused by German blockade of food in western the Netherlands.

December 1944 to May 1945.

Calorie deprivation down to < 500kcal/day at the end period.

Exposure to famine		
In late gestation	In mid gestation	In early gestation
Glucose intolerance	Glucose intolerance	Glucose intolerance
	Microalbuminuria	Atherogenic lipid profile
	Obstructive airways disease	Altered blood coagulation
		Obesity (women only)
		Stress sensitivity
		Coronary heart disease
		Breast cancer

“The findings of the Dutch famine birth cohort study broadly support the fetal origins hypothesis. Chronic diseases originate in the womb through adaptations made by the fetus in response to undernutrition. The effects on undernutrition, however, depend upon its timing during gestation and the organs and systems developing during that critical time window.”

Roseboom T, de Rooij S, Painter R. The Dutch famine and its long-term consequences for adult health. *Early Hum Dev.* 2006 Aug;82(8):485-91. doi: 10.1016/j.earlhumdev.2006.07.001. Epub 2006 Jul 28. PMID: 16876341.



Build it around delicious
Kraft Dinner
home cooked in 7 minutes!



Kids will want dinner to last all day
when you spoon on the Kraft's

Potato Fudge

Into the heart of a split, hot baked potato spoon a big swirl of Kraft's Potato Fudge. That chocolaty, gooey goodness your kids crave will melt right in...putting a smile on the mouth of even the most finicky eater. Kids love the taste, and you'll love the healthy vitamins and minerals they get from the natural goodness of nature's potato, the Potato.



Each Donut Fortified with a minimum of 25 units of Vitamin B1

"Yep...I'm strong for Karo Syrup

...Mom knows it's a fine quick-energy food for growing children...and all us youngsters love it!"

Most mothers know that doctors prescribe Karo for the feeding of babies...
Isn't reasonable that serving Karo Syrup to older children is equally beneficial? In fact, you should start right after the bottle-feeding period...when it's up to you to form baby's good eating habits. Then, whenever a sweetener is needed, use Karo.
Active youngsters burn up tremendous energy, which is restored with food...especially carbohydrates (the energy foods). Karo Syrup is a preferred carbohydrate...a blend of sugars, readily absorbed, non-irritating to sensitive stomachs.
Karo is rich in dextrose, food-energy sugar. Being mildly sweet and flavorful, Karo Syrup makes other foods more enticing to youngsters...and restrains their appetite for excessively sweet foods.
Karo can be served in many delicious ways...and all youngsters love it.



Note: Both light and dark Karo Syrup are delicious...equally nutritious, and rich in dextrose, food-energy sugar.



Why we have the youngest customers in the business



Nothing does it like Seven-Up!

a little TRICK

that makes a TREAT

SEVEN-UP IN MILK!

Mix chilled 7-Up and cold milk in equal parts, by pouring the 7-Up gently into the milk. Do not stir. The 7-Up adds a light and delicate flavor making a delicious blended food drink.

Mothers know that this is a wholesome combination. The addition of 7-Up gives milk a new flavor appeal that especially pleases children.



"FRESH UP" WITH SEVEN-UP!

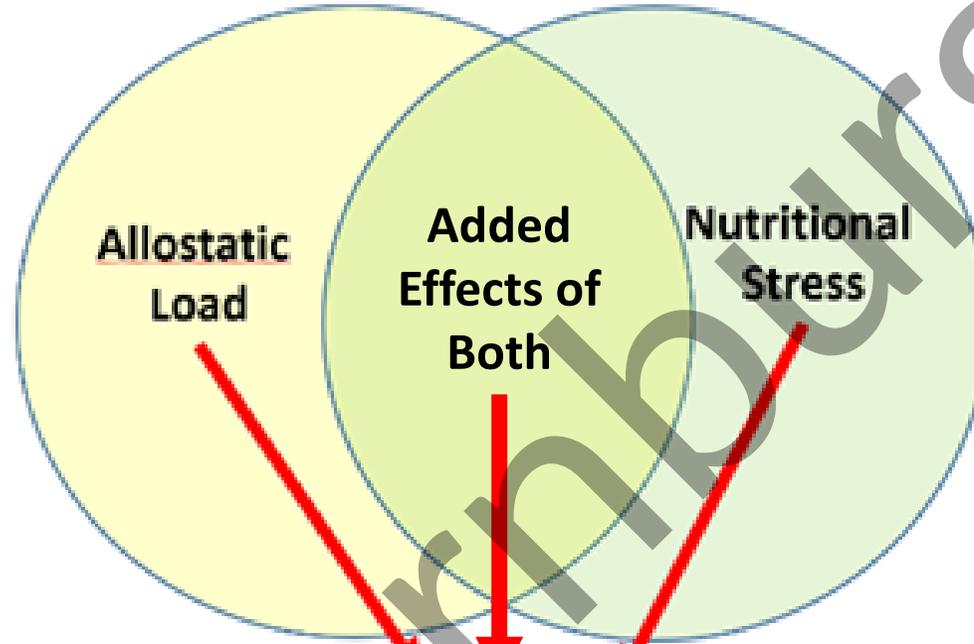
Epigenetic Mechanisms in Developmental Programming

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Nutritional and Social Stress During Pregnancy

Toxic Social Stress

Racism
Housing
Physical Abuse
Safety Fear
Poverty



Harmful Diet

Nutrient imbalance
Too much sugar
Too much refined grain
Excess saturated fat
Too many harmful oils

Epigenetic
Burden in Offspring

Adult-Onset
Disease
Risk

Epigenetics



Identical twins with different fingerprints



Genetically Identical Mice

discovermagazine.com



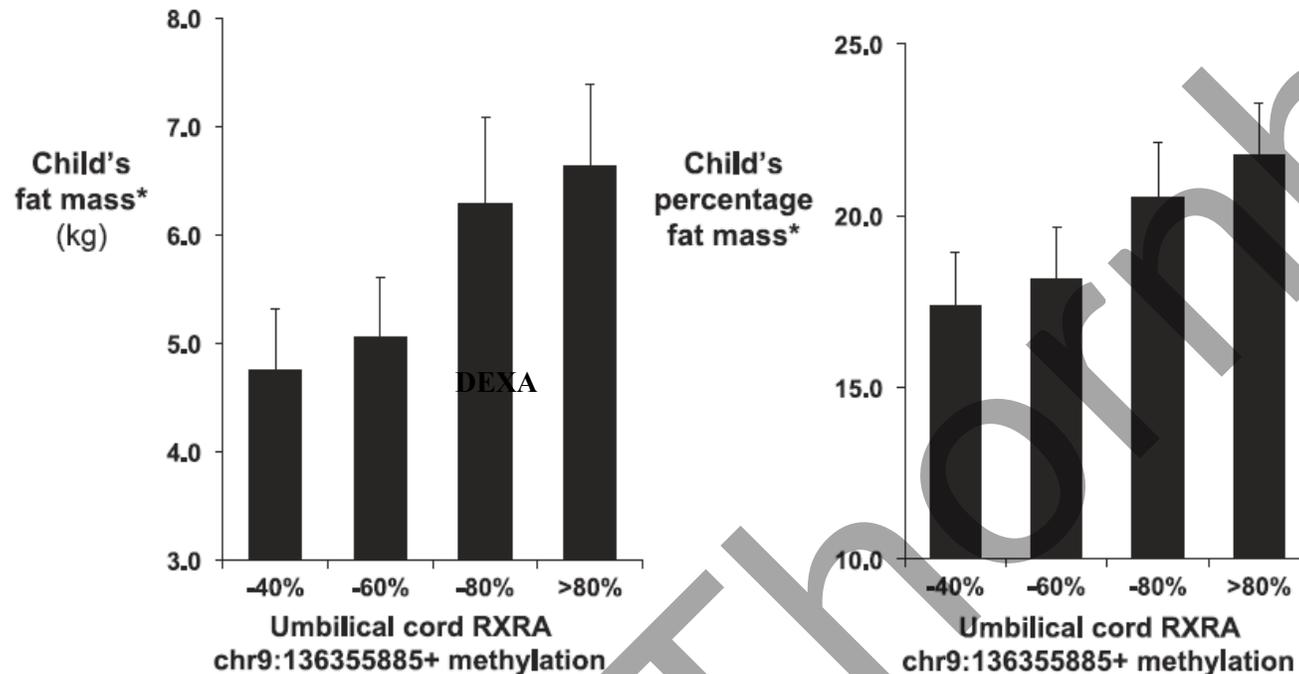
Methylation leads to
gene silencing

Epigenetic changes: DNA methylation, histone modifications, non-coding RNAs = gene regulation
Maternal diet modifies gene expression in offspring

DNA Methylation Can Be Detrimental

low maternal carbohydrate intake is associated with fat mass in 9 yr old children

Diabetes 60:1528–1534, 2011



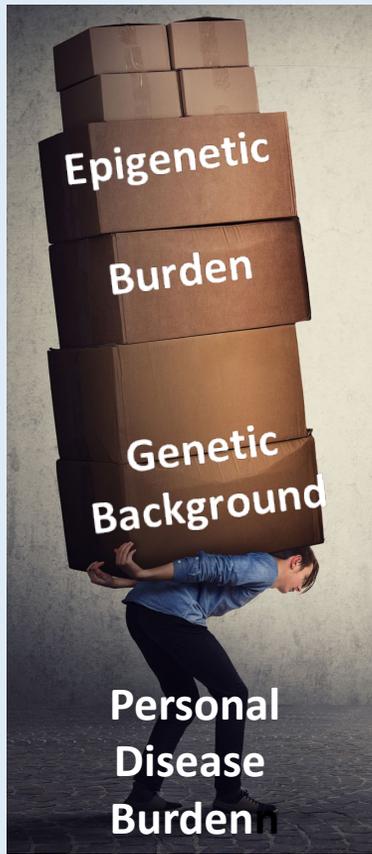
n = 64-66

The lower the carb intake of mother, the more the RXR gene was methylated.

The more the gene was methylated the higher the fat mass in 9 year old children.

FIG. 2. Child's %fat mass and fat mass at age 9 years increase with higher umbilical cord RXRA chr9:136355885+ methylation in the PAH cohort. Values are means + SEM. *Fat mass and percentage fat mass are preadjusted for sex.

Adult Epigenetic Burden = Propensity for Disease



Most \$ and effort expended here, yet most damage occurs earlier in life

Adult Lifestyle

Childhood Nutrition and Stress

Nutrition During Infancy

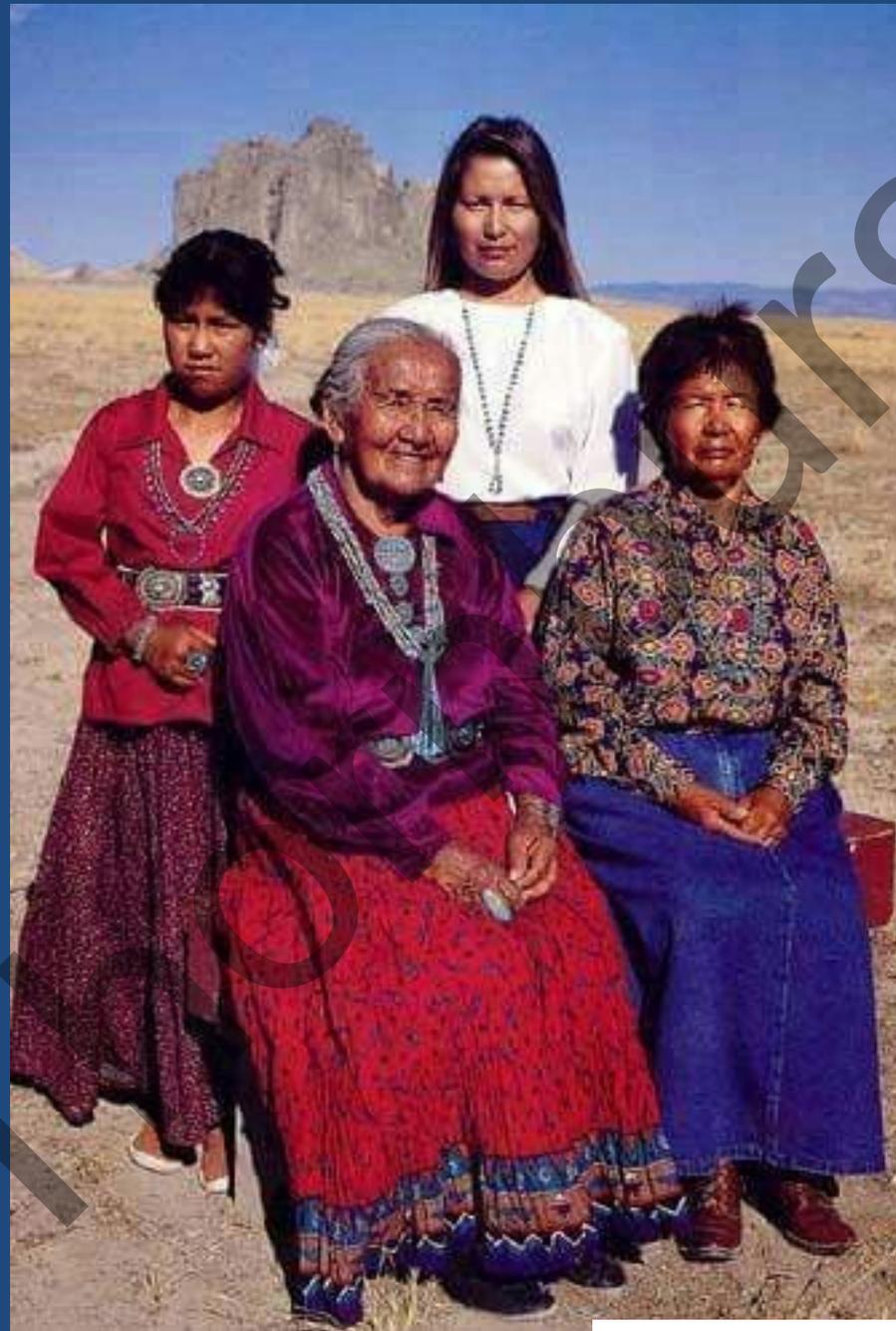
Mother's Nutrition Before and During Pregnancy

Mother's Toxic Stress

Mother and Father Epigenetics

Grandparents

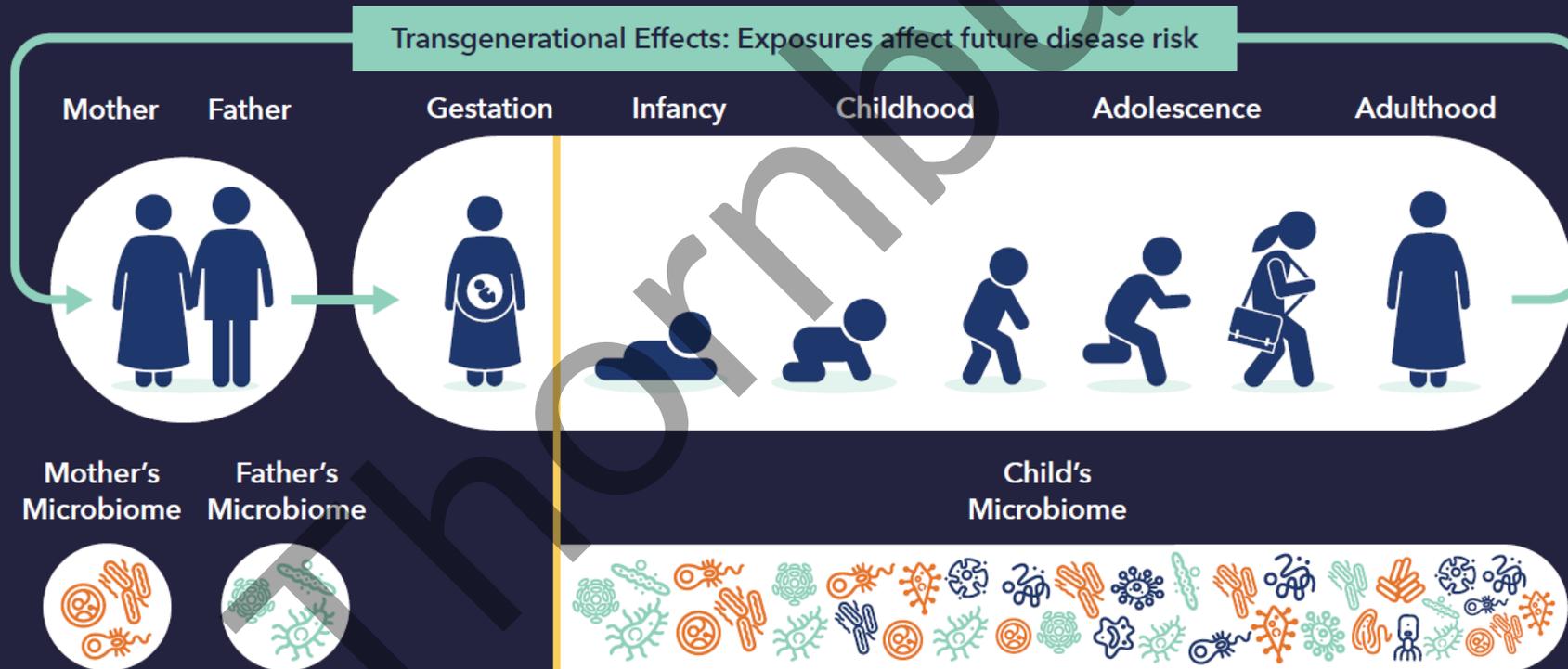
**Four
Generations
of
Navajo
Women**



NIH Strategic Plan on Nutrition 2020 – 2030

Office of Nutrition Research

Developmental Origins of Health and Disease



Epigenetic events arising from nutrition, microbiome, and environmental exposures periconceptually through early life may have lifelong and transgenerational consequences for disease risk.

All major chronic diseases are on the rise

High among causes is nutritional stress during pregnancy

There is hope that epigenetic drivers can be reversed over the next generation

**We need more scientists to be discovering underlying biology
and --- providing new ideas for public health solutions**

Our Food Culture is the Mother's Environment

Nutritional Stress

Social Stress

Chemical Toxins



Mothers are not to blame! It is our responsibility to reverse the trends