

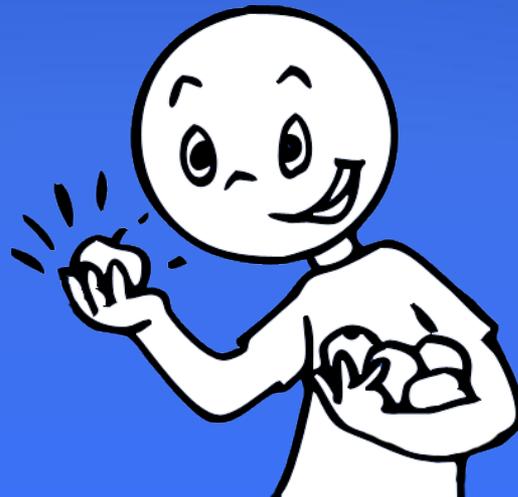
# Social and Environmental Factors in Pediatric Obesity

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# DISCLOSURE INFORMATION

- I **will not** discuss off label use or investigational use in my presentation.
- I **have no** financial relationships to disclose

# Objectives

- Identify the social and environmental influences as a causative factor for obesity
- Discuss the epidemiological evidence for obesogens actions
- Discuss the effects of obesity in the pediatric population

# Defining Childhood Obesity

- Obesity occurs when energy intake exceeds energy expenditure
- Body Mass Index (BMI) is a measure to determine childhood overweight and obesity
- Overweight is defined as a BMI at or above the 85<sup>th</sup> percentile and below the 95<sup>th</sup> percentile
- Obesity is defined as a BMI at or above the 95<sup>th</sup> percentile

<b>Weight Status Category</b>	<b>Percentile Range</b>
Underweight	Less than the 5 <sup>th</sup> percentile
Normal or Healthy Weight	5 <sup>th</sup> percentile to less than the 85 <sup>th</sup> percentile
Overweight	85 <sup>th</sup> to less than the 95 <sup>th</sup> percentile
Obese	95 <sup>th</sup> percentile or greater

# BMI

- However, BMI measurements do not reflect adiposity accurately because a muscular individual might have the same BMI as an oversized individual



- High lean body mass can elevate weight, leading to a higher BMI without corresponding high adiposity

# INTRODUCTION

- US national rates for child obesity has shown no significant changes
- Childhood obesity is still a significant problem, with 16.3% of 2–19-year-old
- Only one obesity prevention program has documented community-level changes

# INTRODUCTION

- In 2003 Texas senate bill mandates 135 min of physical activity/week and School Health Advisory Councils
- In 2004 The Texas Public School Nutrition program was instituted
- In 2007 coordinated school health programs were implemented

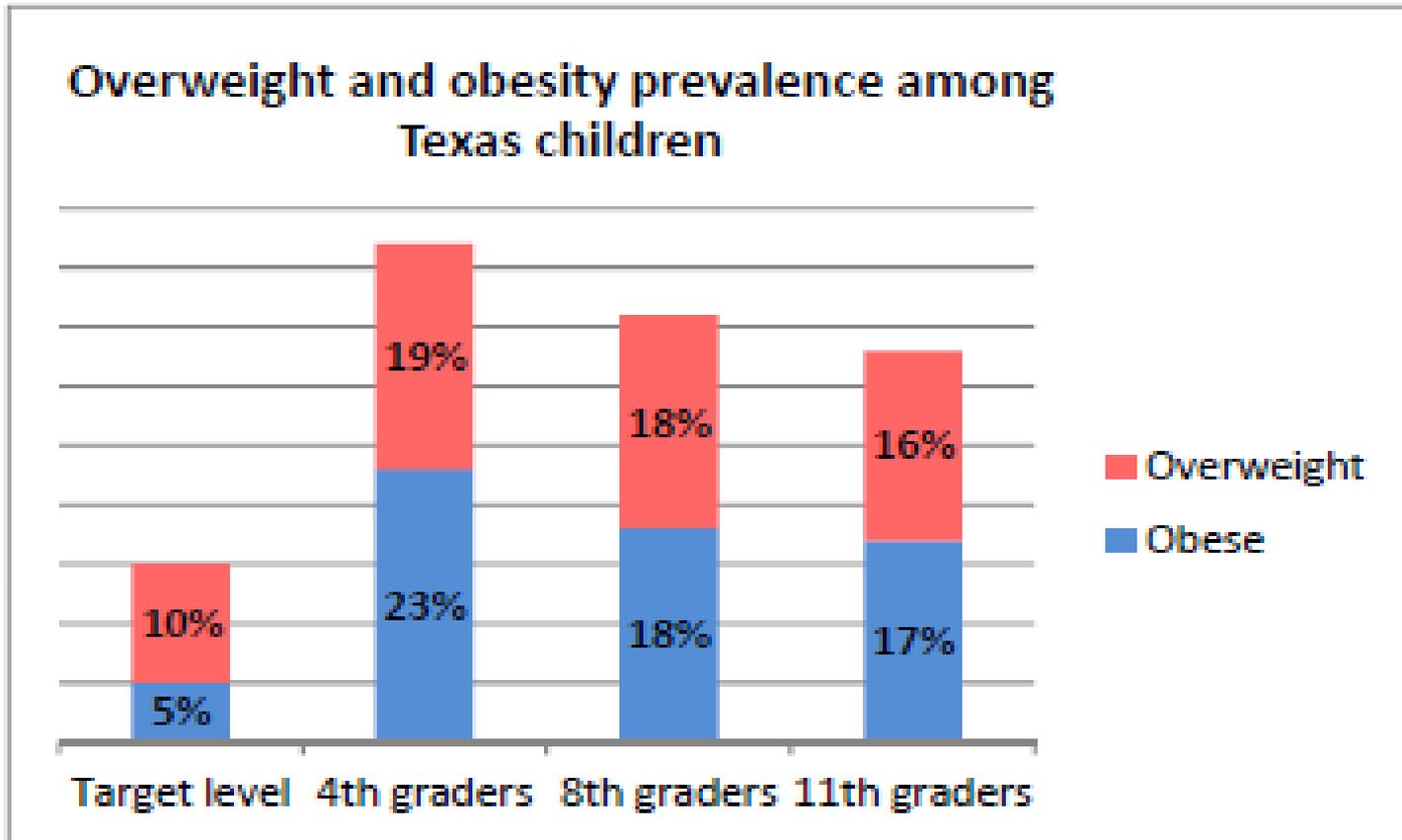
# El Paso County Public Health 2013

- “Rethink your drink: Choose water.”
- “Decrease screen time to give your child a healthier life”
- “Getting fit and healthy as a family.”
- “Everyday small steps to keep kids healthy.”

- 32 percent of children in Texas 10-17 years old were reported as being overweight or obese in 2010.
- In Texas, Hispanic children have the highest rates of overweight and obesity.
- 47% of Texas Hispanic children were obese, compared to 26% of black-non Hispanic, and 23% of white non-Hispanic children.

- Among Texas's children aged 2 to 5 years: 17% were overweight and 15% were obese
- About 25% of the population in El Paso County are obese.
- The childhood obesity rate in El Paso, TX is at 33%, higher than the national average.

# Source: DSHS Obesity Data Sheet (May 2010)



# Factors Contributing to Childhood Obesity

- The main causes are similar to those in adults and include behavior and genetics
- Behaviors can include dietary patterns, physical activity, inactivity, medication use and other exposures
- Additional factors include the environment, education and skills, and food and marketing promotion

# Factors Contributing to Childhood Obesity

- Genes play a role in pediatric obesity but do not account for the recent increase in prevalence
- Exogenous influences are more important (fast foods, prepackaged foods, and high fructose corn syrup)
- Less accessible and lower intake of fruits and vegetables
- Lack of safe areas to play outside; sedentary lifestyles with more hours of television and video game use

# Community Environment

- American society promotes increased consumption of less healthy food and physical activity

## Influences:

- Advertising of less healthy food
- Variation in licensure regulations among child care centers
- No safe or appealing place, to play or be active
- Limited access to healthy affordable food
- Greater availability of high energy-dense foods
- Increasing portion sizes
- Lack of breastfeeding support

## Risks Of Adult Obesity

14% chance if obese as an infant

25% chance if obese as preschool age child

41% chance if obese at age 7 years

75% chance if obese at age 12 years

90% chance if obese in adolescence

# Protective Factors For Obesity

- Breastfeeding
- Families who have active lifestyles
- Minimal television usage
- Having non obese parents

# Medical Complications

- Hypertension (2.9 times higher in obese children)
- Type 2 diabetes (2.9 times higher in obese)
- Hypercholesterolemia (2.1 times higher)
- Obstructive sleep apnea
- Left ventricular hypertrophy
- Mechanical stress on joints
- Coronary artery disease
- Insulin resistance, acanthosis nigricans
- Social stigma, depression, and low self-esteem

# Potential Results of Reducing BMI

- If BMI is reduced by 10%
  1. Blood pressure decreases by 10 mm Hg
  2. Triglycerides decrease below 100 mg/dl or by 200 mg/dl (if genetic defect present)
  3. High-density lipoprotein (HDL) cholesterol increases by 3 to 5 mg/dl
  4. Low-density lipoprotein cholesterol (LDL) sometimes lowers (diet/weight loss combined can lower by 25% to 30% if elevated)



# New Hypothesis

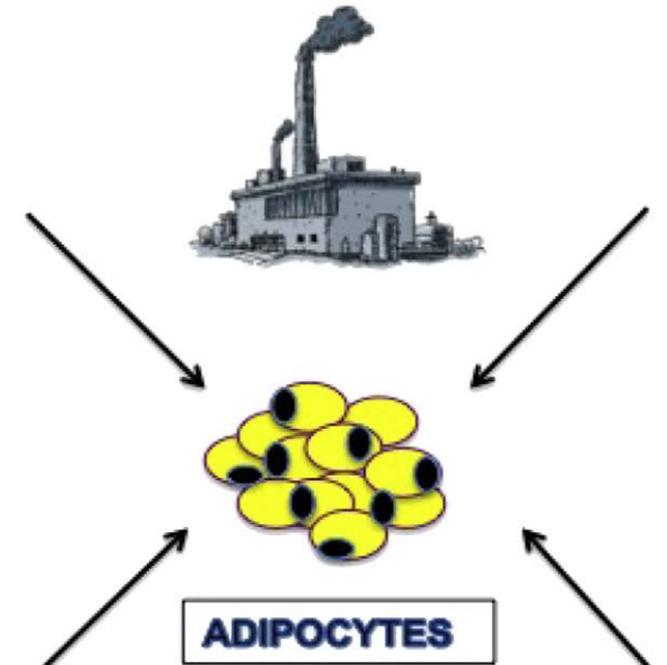
- In 2002, a new hypothesis argued that the increase in the prevalence of obesity/overweight in the US was caused by exposure to environmental toxins.
- Low-dose chemical exposures were associated with weight gain (in experimental animals)
- Chemicals present in the air, food, and water altered metabolic processes in the body and led to weight gain

# Obesogen Hypothesis

- Endocrine-disrupting chemical (EDC)
- Obesogens
- Organotins

# Environmental obesogens

ENVIRONMENTAL POLLUTANTS
Fine particulate Matter (PM <sub>2.5</sub> )
Benzo[a]pyrene
Lead
? Ozone, NO <sub>2</sub> , SO <sub>2</sub>



INDUSTRIAL CHEMICALS
Organotins
Bisphenol A
Perfluorooctanoic acid
Phthalates
Polybrominated Diphenyl Ethers
Polybrominated Biphenyl Ethers

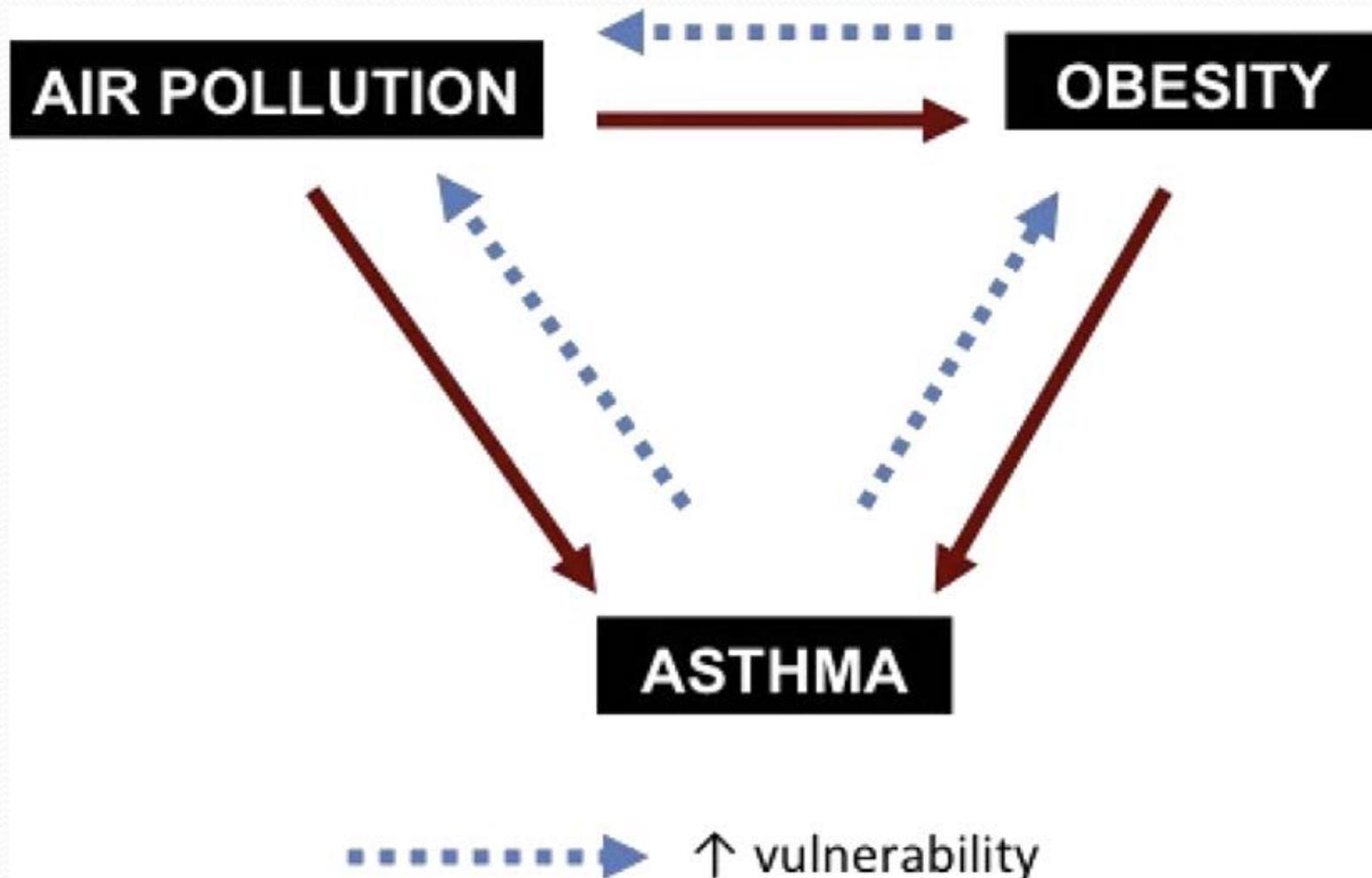
OTHER OBESOGENS
<b>Dietary Source:</b> Fructose Monosodium glutamate, Genistein
<b>Pharmaceutical:</b> Estradiol Diethylstilbestrol
<b>Smoking</b>

ORGANO-PHOSPHATE PESTICIDES
Chlorpyrifos
Diazinon
Parathion

# Air Pollution/Smoking/Obesity

- There is an association between maternal smoking and the risk of obesity in children
- The odds ratios increased with age, suggesting strengthening of the relationship over time
- The prevalence among adolescents was greater among those whose mothers smoked during pregnancy

# Vicious cycle of obesity epidemic



# How Air Pollution Causes Obesity

- The molecular mechanisms remain poorly understood
- Exposure to air pollutants occurs even before people are born
- Exposure to pollutants during fetal growth has been shown to produce metabolic reprogramming in the fetus that leads to obesity.

# Air Pollutants and Obesity



# Tobacco smoke and lipids

- Associated with greater levels of serum cholesterol during adulthood
- Associated with a 2.5-fold greater risk of having increased triglycerides
- 2.3-fold risk of having low high-density lipoprotein levels

# Polyaromatic Hydrocarbons and Estrogenic Activity

- Polyaromatic hydrocarbons are air pollutants
- Commonly generated from motor vehicular exhausts, especially from diesel vehicles
- PAH can easily cross the placental barrier after being inhaled by the pregnant mother.

- Prenatal and early life exposure to environmental estrogens has been shown to cause obesity later in life
- In utero exposure to PAH was associated with a 79% greater risk of obesity at the age of 5 years
- In utero exposure to PAH was associated with a 226% at the age of 7 years

	Obesity at Age 5 Years		Obesity at Age 7 Years	
	RR <sup>a</sup>	95% CI	RR <sup>a</sup>	95% CI
Birth weight (per 100 g)	1.04	1.00, 1.08	1.02	0.98, 1.06
Ethnicity				
Dominican	1	Reference	1	Reference
African-American	0.68	0.45, 1.01	0.72	0.49, 1.06
Maternal receipt of public assistance during pregnancy				
No	1	Reference	1	Reference
Yes	0.94	0.65, 1.36	0.78	0.54, 1.13
Child's sex				
Female	1	Reference	1	Reference
Male	1.01	0.70, 1.44	1.28	0.90, 1.82
Maternal prepregnancy obesity				
No	1	Reference	1	Reference
Yes	1.39	0.93, 2.08	2.01	1.39, 2.92
Child's age at measurement, months	1.05	1.00, 1.10	1.04	0.97, 1.11
Tertile of prenatal PAH exposure				
First (<1.73 ng/m <sup>3</sup> )	1	Reference	1	Reference
Second (1.73–3.07 ng/m <sup>3</sup> )	1.79	1.08, 2.98	2.25	1.27, 4.01
Third (≥3.08 ng/m <sup>3</sup> )	1.79	1.09, 2.96	2.26	1.28, 4.00

# Inflammation and Adipose Tissue

- Air pollution induces obesity via a systemic inflammatory pathway that targets adipocytes
- Exposure to pollutants has been shown to cause visceral adipose tissue inflammation and oxidative stress
- EDCs are highly lipophilic and accumulate in mature adipocytes, resulting in high local concentration in the fat pad.

# Effects on Endocrine and Autonomic Nervous System

- Environmental toxins induce obesity via alterations in weight-controlling hormones
- Via alterations in sensitivity to neurotransmitters
- Via alterations in the activity of the sympathetic nervous system

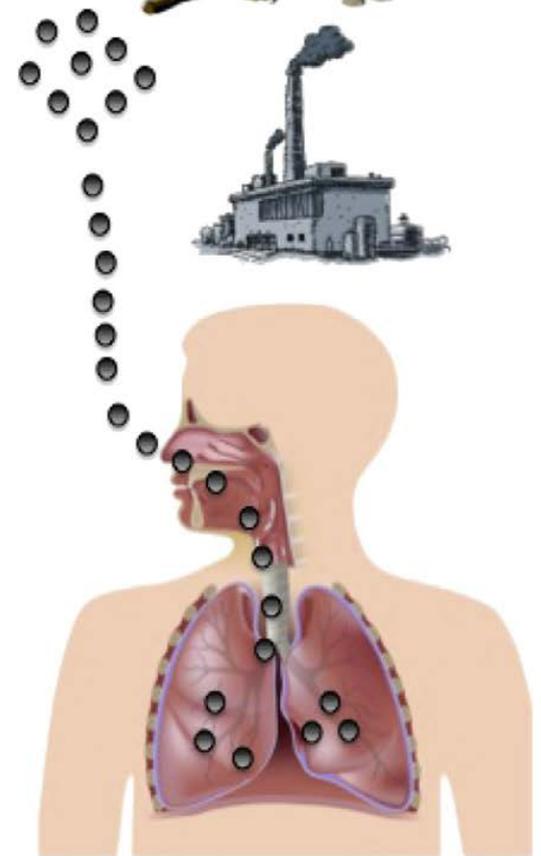
# Obesity and Air Pollution

**OBESITY INCREASES SUSCEPTIBILITY OF LUNGS TO HARMFUL EFFECTS OF AIR POLLUTION**



**OBESITY**

- Increased deposition of pollutants
- Physiological reduction in lung volumes
- Autonomic imbalance  
Increased vagal tone
- Obesity induced oxidative stress.  
ROS in circulation
- Obesity induced systemic inflammation  
IL6, IL-5, TNF- $\alpha$

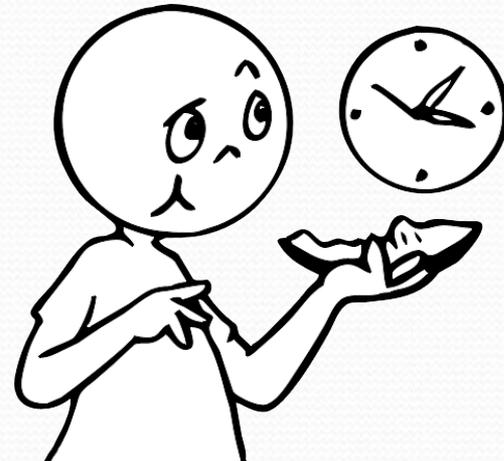


# Summary

- Air pollution is now recognized as a novel risk factor for the development of obesity
- Several xenobiotic chemicals can disrupt the normal development and homeostatic controls over adipogenesis and energy balance
- Exposure to obesogens has been identified to induce obesity.

# Summary

- Obese individuals are also more vulnerable to the harmful effects of air pollutants
- Despite the emerging evidence for the role of air pollutants in obesity, this topic is still in its infancy
- More knowledge needs to be generated by means of dose-response studies on air pollutants and obesity to conclusively establish the link



# 5 to Go!!! Message

- 5: Eat FIVE fruits and veggies a day
- 4: Give and get FOUR compliments a day
- 3: Consume THREE dairy a day
- 2: No more than TWO media hours a day
- 1: At least ONE hour of exercise a day
- 0: No sugar-sweetened drinks, ever

GO: Be well, inside and out!!

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