# Children's Environmental Health

## Overview and General Principals

## Why Children Are Especially Vulnerable to Environmental toxicants

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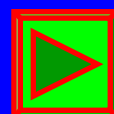

This is a self-learning module. You can proceed at your own pace. For most people, the module takes about 1 hour. If you need to stop before completing the module, click on the right mouse button and then on *end show*. Record the number of the slide where you ended and later resume work at that slide.

**Yellow bold underlined text indicates a question that you should answer before moving to the next slide.**

Advance to the next slide by placing the curser over the green button (arrow box) and left clicking the mouse.

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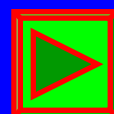

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Produced in conjunction with the Southwest Center for Pediatric Environmental Health, Tyler, Texas

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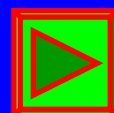

# LEARNING OBJECTIVES

- to understand the dangers our chemical environment poses to children
- to understand why children are especially vulnerable to most environmental toxicants

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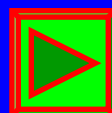

# Overview and General Principals

Understanding the dangers our chemical environment poses to children

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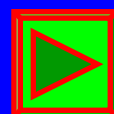
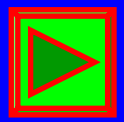
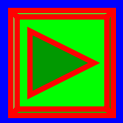


# Which of the following do you think is most frightening?

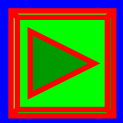
**Click on the green arrow corresponding to your choice**



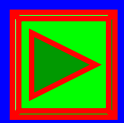
A. A Stephen King novel



B. The threat of chemical terrorism



C. A crop-duster loaded with nerve poison



D. The current proliferation of environmental toxicants and pollutants

Yes, a Stephen King story can be very scary, but not nearly so concerning as the proliferation in the number, diversity and shear volume of chemical pollutants and toxicants in our environment.  It is time to be worried, very worried, about what we are doing to the environment and what the environment will be like for our children in a few decades. We need to worry about what chemicals our children are being exposed to every day, right now.

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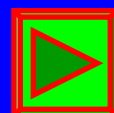

You are worried about the threat of chemical terrorism, and rightly so. Weapons of terror and mass destruction, classified by the ironic acronym B NICE (biologic, nuclear, incendiary, chemical, explosive) are frightening, but we also need to worry about what chemicals we ourselves are exposing our children to every day. The proliferation in the number, diversity and volume of chemical pollutants and toxicants in our environment is frightening. It is time to be worried, very worried, about what we are doing to the environment and what chemicals our children are being exposed to right now.

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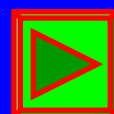

You are worried about a crop duster filled with nerve poison, and rightly so, but do you know what is in those crop dusters right now? They are filled with toxic herbicides and insecticides, many of which are neurotoxicants and some of which are probably carcinogenic as well. We need to worry about what chemicals our children are being exposed to right now. The proliferation in the number, diversity and volume of chemical pollutants and toxicants in our environment is frightening. It is time to be worried, very worried, about what we are doing to the environment and what the environment will be like for our children in a few decades.

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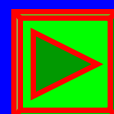

Bingo.  You are right to be worried about the proliferation in the number, diversity and volume of chemical pollutants and toxicants in our environment. It is time to be worried, very worried, about what we are doing to the environment and what the environment will be like for our children in a few decades. A crop duster filled with nerve poison is a disturbing picture, but do you know what is in those crop dusters right now?  They are filled with toxic herbicides and insecticides, many of which are neurotoxic and some of which are probably carcinogenic as well.

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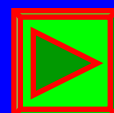

**There are four ways in which environmental issues can present in your practice.**

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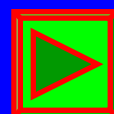

**First**, you might diagnosis an environmentally acquired disease or a disease exacerbated by environmental factors in one of your patients.

**Can you think of one or more diseases clearly *caused* by environmental factors?**

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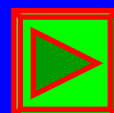

Some examples of environmentally acquired diseases that you might diagnosis in a patient in your practice include lead poisoning and organophosphate insecticide poisoning.

While clinically overt lead poisoning is now relatively uncommon, it does still occur. More frequently, however, practitioners will see “asymptomatic” children with elevated blood lead levels. It is now clear that blood lead levels as low as 5 micrograms/L are associated with neurological, developmental, and cognitive deficiencies.

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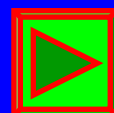

**What do you think is the most common pediatric condition *worsened* by environmental factors?**

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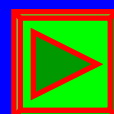

Asthma is the most common pediatric condition clearly *exacerbated* by environmental pollutants (both indoor and outdoor air). Recognition of the role of certain air pollutants such as house dust mite and environmental tobacco smoke in *causing* asthma is evolving.

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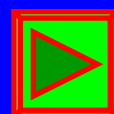

**Second**, a parent might ask a question about environmental health such as, “Is it safe for me to eat fish while pregnant or while nursing?”

Do you currently have the information to answer such a question? In this particular case, the latest Environmental Protection Agency (EPA) recommendation is that women in the childbearing age should limit their fish and shellfish intake to 12 ounces of low mercury items (shrimp, salmon, pollock, canned dark tuna, or catfish) a week.

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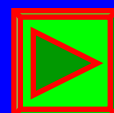

**A third way** in which an environmental issue might present in your practice is that a parent could ask about a child's symptoms:

"My child gets so many infections, do you think his immune system has been affected by the stuff we smell from the chemical plant near where we live?"

This type of question is difficult or impossible to answer in regards to a specific child. However, an understanding of pediatric environmental health issues will enable you to give the family appropriate advice for dealing with their concerns.

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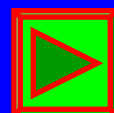

**The fourth way** in which environmental issues come up in practice is when you take an environmental history.

**Can you think of a few environmental questions that you might ask in reference to the child's home environment?**

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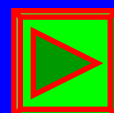

There are many questions that could be asked about the home environment, from accident hazards and prevention to potential toxic exposure.

If there are young children in the home, are stairs and pools adequately fenced or guarded?

Are toxic chemicals such as caustic drain cleaners, cleaning fluids, paints and paint thinners, and pesticides in the home or garage.  If so, how are they stored or locked up?

Is the home close to an industrial facility or a known toxic waste site?

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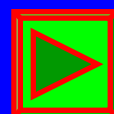


What are the adverse health effects of environmental toxicants?

**In regards to the United States over the past 3 decades, all of the following statements are true EXCEPT (that is, which statement is NOT true?)**

A. There has been a steady increase in the prevalence of asthma

B. There has been a general decline in sperm counts in adult males

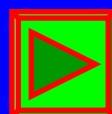
C. There has been an increase in some types of birth defects

D. There has been an increase in the incidence of some types of childhood cancer

E. There has been an increase in the average age of menarche

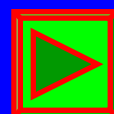
Sorry, wrong answer. All the statements are true except the last, the one about an increase in the average age of menarche. It appears that over the past centuries and recent decades the average age of menarche has *decreased*. This has been referred to as the secular trend in age of menarche. When this trend was first noted it was attributed, at least in part, to better nutrition and general health. The recent changes are possibly the result of various environmental toxicants known as endocrine disruptors.

There has been a steady and impressive increase in the rate of childhood asthma over the past 3 decades. There has been a general decline in sperm counts in adult males throughout North America and Europe over the past few decades. This has been a consistent finding in numerous studies. There has been an increase in certain congenital malformations such as congenital heart defects and obstructive uropathy. There has been an increase in the rate of some childhood cancers such as leukemia and brain cancer.



Bingo! It is the statement about an increase in the average age of menarche that is incorrect. It appears that over the past centuries, and over and recent decades, the average age of menarche has *decreased*. This has been referred to as the secular trend in age of menarche. When this trend was first noted it was attributed, at least in part, to better nutrition and general health. The recent changes are possibly the result of various environmental toxicants that are endocrine disruptors.

The other statements are all true. There has been been an impressive increase in the rate of childhood asthma over the past 3 decades. There has been a general decline in sperm counts in adult males throughout North America and Europe over the past few decades. This has been a consistent finding in numerous studies. There has been an increase in certain congenital malformations such as congenital heart defects and obstructive uropathy. Finally, There has been an increase in the rate of some childhood cancers such as leukemia and brain cancer.



# What evidence is there for adverse health effects of environmental toxicants impacting children?

There has been a significant increase in the prevalence of certain diseases over the past decades. It is highly improbable that these increases are due to changes in the gene pool in this relatively short period of time, therefore it is almost certain that these changes are due to environmental factors, including the increase in environmental toxicants.

For some environmental pollutants the effect is so immediate that the association is clearly evident. For example, studies have documented daily correlations between air pollutants such fine particulate mater and emergency visits and hospitalizations for asthma. Several studies have have demonstrated a correlation between air pollutants and cardiorespiratory deaths.

The prevalence of autism appears to have doubled between 1966 and 1997. While some of this apparent increase could be due to changes in diagnostic criteria or improved case reporting, it is probable that at least some of this increase is real.[1,2]

There has been a substantial increase of congenital cardiac malformations (ventricular septal defects and patent ductus arteriosus)[3] and a 50% increase in congenital obstructive uropathy.[4]

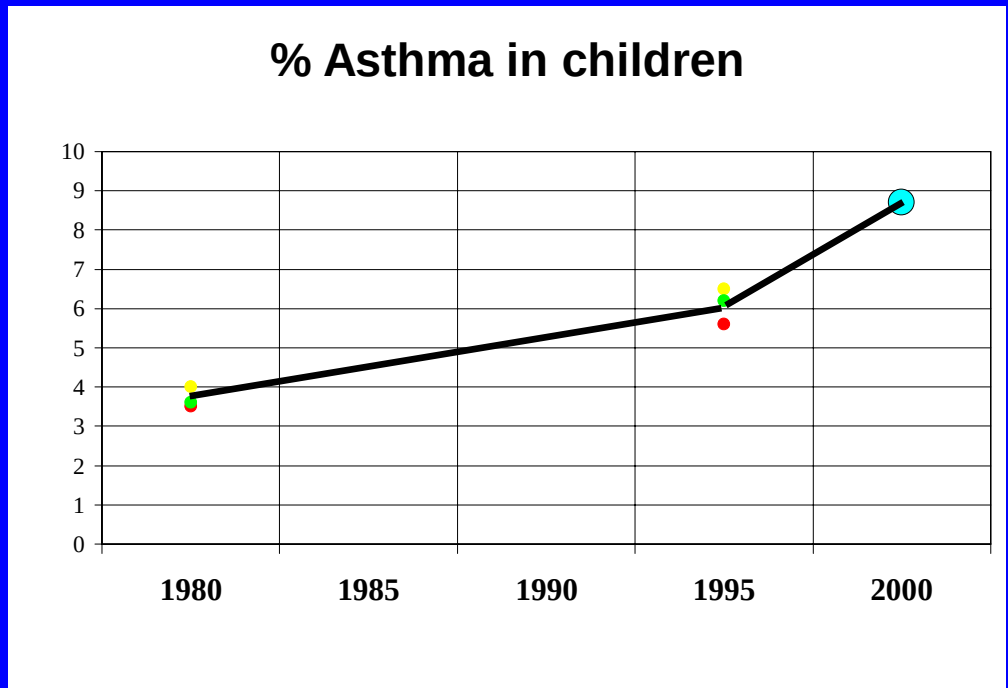
Both the overall incidence of cancer in children and the incidence of certain specific cancers such as leukemia and brain and nervous system cancers have increased over the past few decades.[5]

The prevalence of childhood asthma has risen dramatically over the past two decades. Different studies have shown somewhat different figures, but all confirm a significant increase in frequency:

- from 3.5% to 5.6%
- from 4.0% to 6.9%
- from 3.6% to 6.2%
- latest EPA figures:

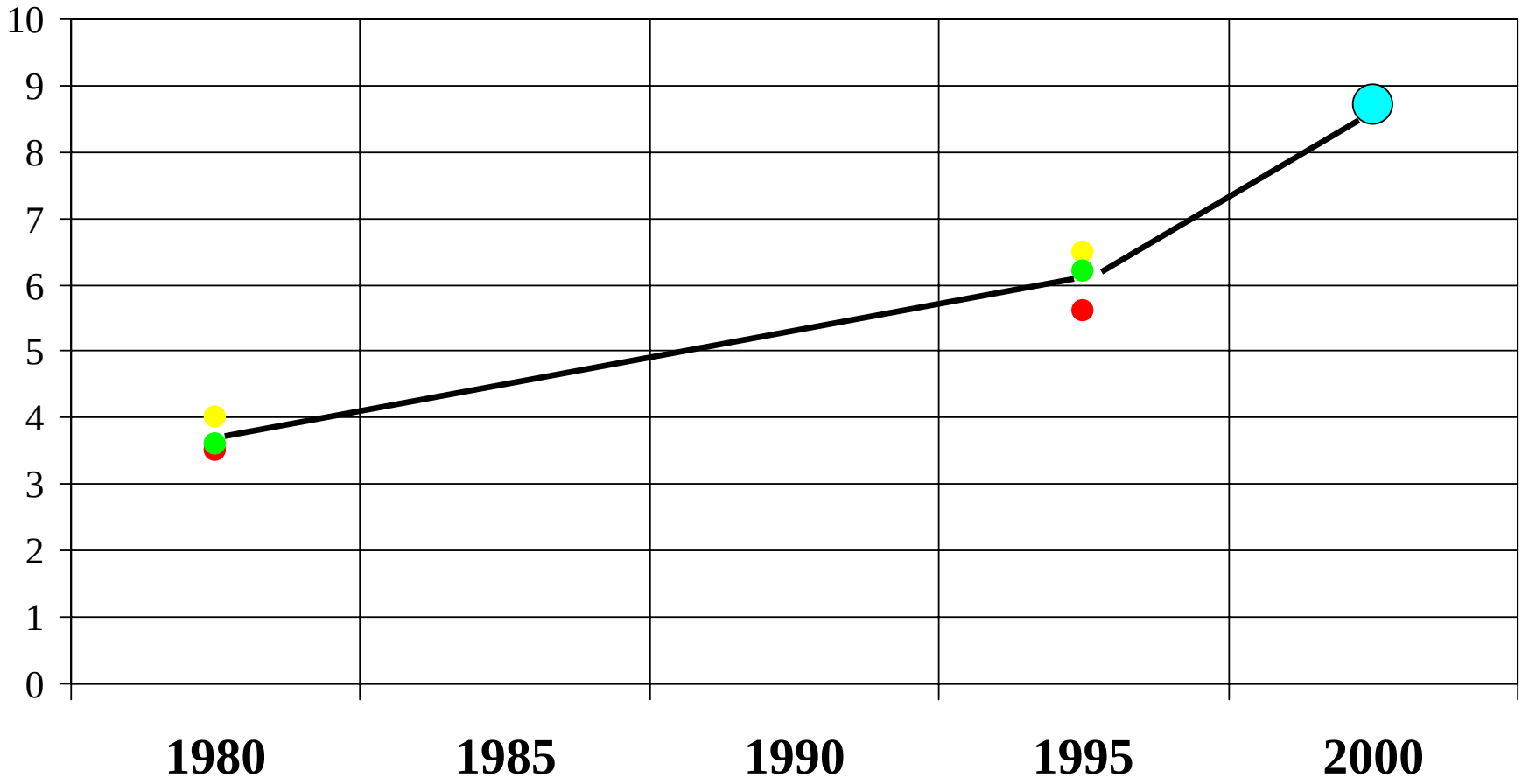
  8.7% in 2001

Asthma deaths doubled from 1979 to 1993




Click on arrow to see close up of graph

# % Asthma in U.S. children




Ref 6.
Ref 7.
Ref 8.
Ref 9.

The National Academy of Science has estimated that 3% of developmental disabilities in children are due to known toxicants (cigarette smoke, drugs, chemicals, etc).

In 1996, all U.S. children lived in counties in which the combined estimated concentrations of hazardous air pollutants exceeded the 1-in-100,000 benchmark for cancer risk. 18% of children lived in counties where the risk exceeded the 1-in-10,000 benchmark.

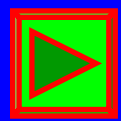
# ENVIRONMENTAL TOXICANTS ARE UBIQUITOUS

- Air (inhalation)
- Water (drinking, bathing, swimming)
- Food
- Other ingestions (pica, accidental ingestions)
- Contact (cutaneous absorption)
- Medications (injection as well as oral)

# TYPES OF TOXICANTS

- Carcinogens
- Mutagens (cause changes in, or damage to, genes)
- Teratogens (cause abnormalities or malformations of the fetus)
- Neurotoxicants and neurodevelopmental toxicants
- Endocrine disruptors
- Irritants and allergens to skin and mucous membranes
- Some chemicals cause specific injury to a variety of organs such as liver, kidney, and retina

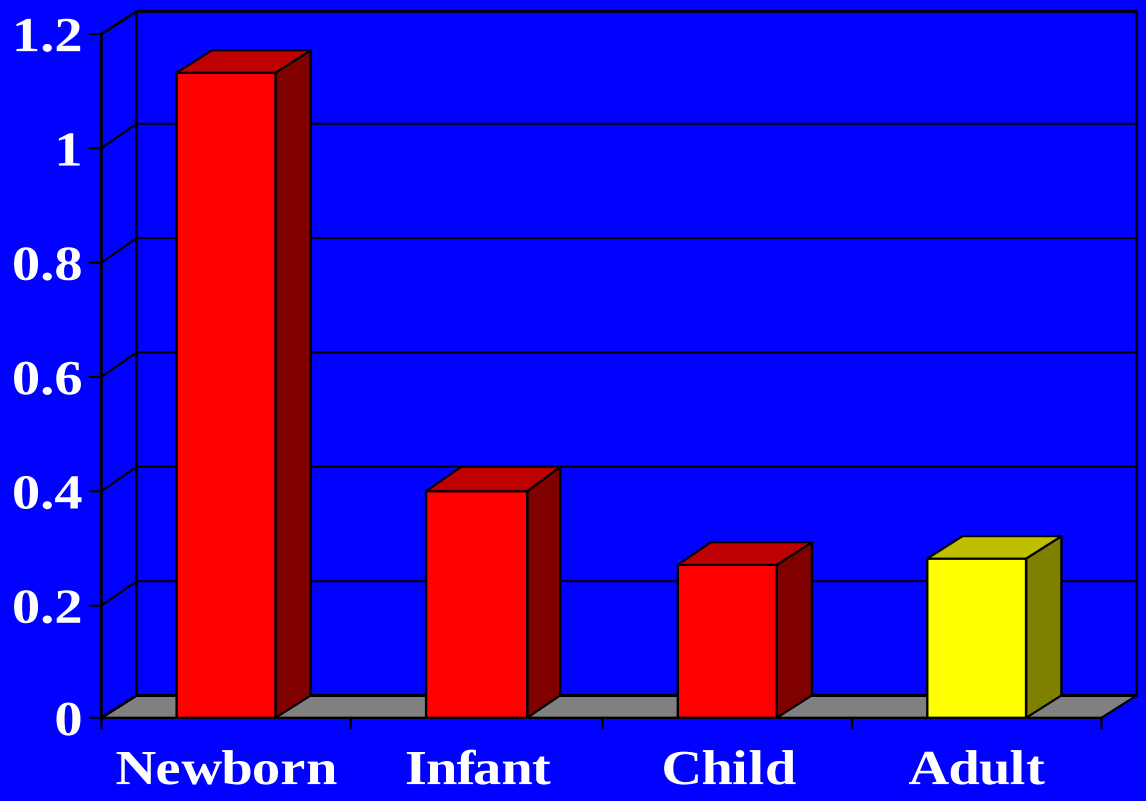
# Why children are more vulnerable than adults to environmental toxicants



# CHILDREN ARE NOT JUST LITTLE PEOPLE

**They are more vulnerable to environmental toxicants than are adults**

- Newborns and infants are more vulnerable to pollutants in the air because they breath more air relative to their weight than do adults
- Infants have a greater minute ventilation per kg body weight than do adults




**Cubic meters Per Kg/ day**

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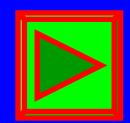
The CDC's Second National Report on Human Exposure to Environmental Chemicals, released in 2003, measured serum concentration of cotinine (a metabolite of nicotine) in 6,000 nonsmoking subjects 3 years and older. **Which group of nonsmokers had the highest levels?**

- A. 3 to 11 year olds
- B. 12 to 19 year olds
- C. 20 years and older

You are absolutely correct, the highest serum cotinine levels among nonsmokers were found in the 3 to 11 year olds. The next highest were among the 12 to 19 year olds. Levels in both these age groups were higher than among nonsmoking adults (20 years and older).

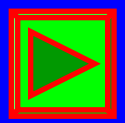


Close, but not quite on target.  Serum cotinine levels in children 12 to 19 year old are higher than in adults (20 years and older), but the highest levels among nonsmokers were in the *3 to 11 year* age group. Levels in both pediatric age groups were higher than among nonsmoking adults.

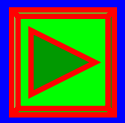
No, the highest levels of serum continine among nonsmokers are not in the adult group but in the *3 to 11 year* old group. The next highest levels were among the 12 to 19 year olds. Both pediatric age groups were higher than the adults.

# CHILDREN ARE NOT JUST LITTLE PEOPLE

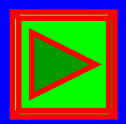
Infants drink more water, juice, milk, and other liquids and eat more food per pound of body weight than do older children or adults. For example, a 12 lb infant drinks 1 to 1.5 quarts a day and ingests about 600 to 800 calories a day. **A comparable amount per day for a 150 lb adult would be**



A. 2 to 3 quarts and 3,000 to 5,000 calories

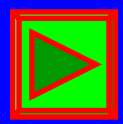


B. 7 to 10 quarts and 7,000 to 10,000 calories

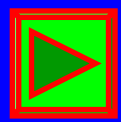


C. 12 to 15 quarts and 12,000 to 15,000 calories

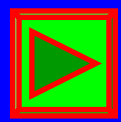
You underestimated the comparison. Infants drink much more water, juice, milk, and other liquids and eat more food per pound of body weight than do older children or adults. For example, a 12 lb infant drinks 1 to 1.5 quarts a day and ingests about 600 to 800 calories a day. *A comparable amount for a 150 lb adult would be 7 to 10 quarts and 7,000 to 10,000 calories per day*, not 2 to 3 quarts and 3,000 to 5,000 calories as you thought.



Exactly right! Infants drink much more water, juice, milk, and other liquids and eat more food per pound of body weight than do older children or adults. For example, a 12 lb infant drinks 1 to 1.5 quarts a day and ingests about 600 to 800 calories a day. As you thought, a comparable amount for a 150 lb adult would be 7 to 10 quarts and 7,000 to 10,000 calories per day.



You were close, but you did overestimate the comparison a bit. Infants drink more water, juice, milk, and other liquids and eat more food per pound of body weight than do older children or adults. For example, a 12 lb infant drinks 1 to 1.5 quarts a day and ingests about 600 to 800 calories a day. *A comparable amount for a 150 lb adult would be 7 to 10 quarts and 7,000 to 10,000 calories per day*, not 12 to 15 quarts and 12,000 to 15,000 calories as you said.



# CHILDREN ARE NOT JUST LITTLE PEOPLE

Newborns and young infants have increased gastrointestinal absorption of calcium, lead and mercury.

**Is this good or bad?** Click on the green button to see.

The increased gastrointestinal absorption of calcium in newborns and young infants, obviously, is good. The increased absorption of lead and mercury is not good. While oral exposure to these toxicants is generally not very likely at this very early age, there is concern about both lead and mercury in human milk.

# CHILDREN ARE NOT JUST LITTLE PEOPLE

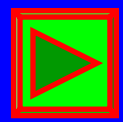
Infants have a greater total surface area of skin for absorption relative to their weight, and at least equally important, the skin of the newborn is more absorptive than that of the older child and adult.

**Is this important?**

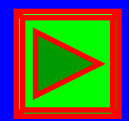
A. No, this is interesting but unimportant

B. Yes, this is important in regard to the use of topical agents such as betadine® and DEET®

Sorry, these facts may seem unimportant, but the greater surface area of skin in the infant, coupled with the fact that the skin of the newborn and young infant is more permeable and absorptive, actually is important in regard to the use of topical agents such as betadine® and DEET®. There have been reports of increased iodine levels in infants secondary to topical betadine® use, and there is concern about the effect of this on thyroid function in infancy, when the function of this hormone is critically important. There is concern about neurotoxicity of DEET in infants and young children. It is generally recommended that agents containing DEET be used for children below the age of 5 years only when necessary to prevent disease (e.g. West Nile) and then applied sparingly, using the lowest effective concentration (usually 10%), never over 30% and washed off as soon as possible.



Congratulations, you are correct. The greater surface area of skin in the infant and the fact that the skin is more permeable and absorptive in the newborn and young infant is important in the use of topical agents such as betadine® and DEET®. There have been reports of increased iodine levels in infants secondary to topical betadine use, and there is concern about the effect of this on thyroid function in infancy, when the function of this hormone is critically important. There is concern about neurotoxicity of DEET in infants and young children. It is generally recommended that agents containing DEET be used for children below the age of 5 years only when necessary to prevent disease (e.g. West Nile) and then applied sparingly, using the lowest effective concentration (usually 10%), never over 30% and washed off as soon as possible.



# CHILDREN ARE NOT JUST LITTLE PEOPLE

Infants have a higher pH of the gastrointestinal tract than older children and adults. This favors bacterial proliferation and conversion of dietary nitrates to nitrites.

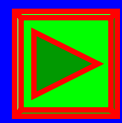
**The result of this is an increased risk of**

- A. food poisoning
- B. seizures
- C. hemolytic uremic syndrome
- D. methhemoglobinemia

Sorry, nitrites and nitrates are not involved in food poisoning, which is due to bacterial toxins formed in stored food.

The higher pH of the gastrointestinal tract of young infants and the resultant bacterial proliferation and conversion of dietary nitrates to nitrites increases the risk of methhemoglobinemia. While both nitrates and nitrites can cause methhemoglobinemia, nitrites are more potent in this regard. In addition, infants have lower levels of methhemoglobin reductase and higher levels of hemoglobin F, making them more susceptible to nitrate or nitrite induced methhemoglobinemia, which is the correct answer.

Hemolytic uremic syndrome is secondary to intestinal infection with certain toxin producing bacteria such as *Shigella* or *E coli* 0157 H7, and is not the result of nitrites or nitrates. Also, nitrites and nitrates are not a cause of seizures.

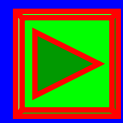


No, nitrites and nitrates do not cause seizures.

The higher pH of the gastrointestinal tract of young infants and the resultant bacterial proliferation and conversion of dietary nitrates to nitrites increases the risk of methhemoglobinemia. While both nitrates and nitrites can cause methhemo-globinemia, nitrites are more potent in this regard. In addition, infants have lower levels of methhemoglobin reductase and higher levels of hemoglobin F, making them more susceptible to nitrate or nitrite induced methhemoglobinemia, which was the right answer.

Hemolytic uremic syndrome is secondary to intestinal infection with certain toxin producing bacteria such as *Shigella* or *E coli* 0157 H7, and is not the result of nitrites or nitrates.

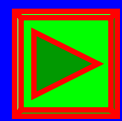
Nitrites and nitrates are not a cause of food poisoning, which is due to toxins produced by bacteria in stored food.



Sorry, hemolytic uremic syndrome is secondary to intestinal infection with certain toxin producing bacteria such as *Shigella* or *E coli* 0157 H7 and is *not* the result of nitrites or nitrates.

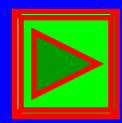
The higher pH of the gastrointestinal tract of young infants and the resultant bacterial proliferation and conversion of dietary nitrates to nitrites increases the risk of methhemoglobinemia. While both nitrates and nitrites can cause methhemo-globinemia, nitrites are more potent in this regard. In addition, infants have lower levels of methhemoglobin reductase and higher levels of hemoglobin F, also making them more susceptible to nitrate or nitrite induced methhemoglobinemia.

Nitrites and nitrates are not a cause of food poisoning, which is due to toxins produced by bacteria in stored food, and neither nitrites nor nitrates cause seizures.



Exactly right. The higher pH of the gastrointestinal tract of young infants and the resultant bacterial proliferation and conversion of dietary nitrates to nitrites increases the risk of methhemoglobinemia. While both nitrates and nitrites can cause methhemo-globinemia, nitrites are more potent in this regard. In addition, infants have lower levels of methhemoglobin reductase and higher levels of hemoglobin F, making them more susceptible to nitrate or nitrite induced methhemoglobinemia.

Nitrites and nitrates are not a cause of food poisoning, which is due to toxins produced by bacteria in stored food. Neither nitrites nor nitrates cause seizures, and hemolytic uremic syndrome is secondary to intestinal infection with certain toxin producing bacteria such as *Shigella* or *E coli* 0157 H7 and *not* the result of nitrites or nitrates..



# CHILDREN ARE NOT JUST LITTLE PEOPLE

It is said that children ingest more than 20 times as much dirt (soil) per kg per day than do adults. **What do you think?**

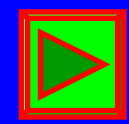
A. The statement is not true. It is a mathematical impossibility since adults do not ingest dirt and therefore the ratio would be infinite

B. The statement is not true because children actually ingest several thousand times more soil than adults

C. The statement is true

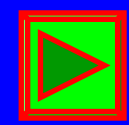
Wrong, adults do ingest dirt, and children ingest more than 20 times as much dirt per kg of body weight per day than do adults.

Several studies have looked at this by measuring the stool content of certain nonabsorbable rare elements found in soil. The studies are technically not very difficult, although aesthetically they may not be very pleasing. Simply collect all stool samples over a period of time and measure the amount of these rare elements in the sample. From this, one can calculate the ingested dose of soil. Sources of soil ingestion by adults include: trace amounts on foods, especially fruits and vegetables; trace amounts in drinking water; soil on the hands from activities such as gardening and golf; small amounts in indoor dust; wind blown dust.



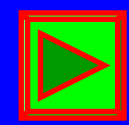
You overestimated the amount of dirt ingested by children versus adults. Children ingest more than 20 times as much soil (dirt) per kg of body weight per day than do adults (not a thousand times more).

Several studies have looked at this by measuring the stool content of certain nonabsorbable rare elements found in soil. The studies are technically not very difficult, although aesthetically they may not be very pleasing. Simply collect all stool samples over a period of time and measure the amount of these rare elements in the sample. From this, one can calculate the ingested dose of soil. Sources of soil ingestion by adults include: trace amounts on foods, especially fruits and vegetables; trace amounts in drinking water; soil on the hands from activities such as gardening and golf; small amounts in indoor dust; wind blown dust.



Bingo. You are exactly right - children ingest more than 20 times as much soil (dirt) per kg of body weight per day than do adults.

Several studies have looked at this by measuring the stool content of certain nonabsorbable rare elements found in soil. The studies are technically not very difficult, although aesthetically they may not be very pleasing. Simply collect all stool samples over a period of time and measure the amount of these rare elements in the sample. From this, one can calculate the ingested dose of soil. Sources of soil ingestion by adults include: trace amounts on foods, especially fruits and vegetables; trace amounts in drinking water; soil on the hands from activities such as gardening and golf; small amounts in indoor dust; wind blown dust.



# CHILDREN ARE NOT JUST LITTLE PEOPLE

Children live close to the X. They play and crawl on the X. Dust, allergens and chemicals settle on the X. Chemical fumes such as mercury and radon are most intense close to the X. Pesticides are often applied to the X. **What is X?**

A. the child's bed

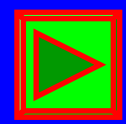
B. the floor

C. the chair by the television

D. the kitchen table

No, X is the floor, not the bed. Children live and play close to the ground. They crawl on the floor. Even when standing, a toddler's nose is twice as close to the ground as an adult's.

Indoors, dust, allergens and chemicals settle on the floor, and chemical fumes such as mercury and radon are most intense close to the floor. Pesticides are often applied to the floor around the baseboards. Additionally, flooring materials like finished wood and new carpets give off toxic volatile organic compounds (VOCs) such as formaldehyde.

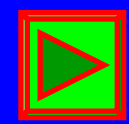


Bravo ! X is the floor.

Indoors, dust, allergens and chemicals settle on the floor, and chemical fumes such as mercury and radon are most intense close to the floor. Pesticides are often applied to the floor around the baseboards. Additionally, flooring materials like finished wood and new carpets give off toxic volatile organic compounds (VOCs) such as formaldehyde.

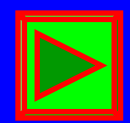
No, X is the floor, not the chair near the television. Children live and play close to the ground. They crawl on the floor. Even when standing, a toddler's nose is twice as close to the ground as an adult's.

Indoors, dust, allergens and chemicals settle on the floor, and chemical fumes such as mercury and radon are most intense close to the floor. Pesticides are often applied to the floor around the baseboards. Additionally, flooring materials like finished wood and new carpets give off toxic volatile organic compounds (VOCs) such as formaldehyde.



No, X is the floor, not kitchen table. Children live and play close to the ground. They crawl on the floor. Even when standing, a toddler's nose is twice as close to the ground as an adult's.

Indoors, dust, allergens and chemicals settle on the floor, and chemical fumes such as mercury and radon are most intense close to the floor. Pesticides are often applied to the floor around the baseboards. Additionally, flooring materials like finished wood and new carpets give off toxic volatile organic compounds (VOCs) such as formaldehyde.



# CHILDREN ARE NOT JUST LITTLE PEOPLE

Children put everything into their mouths

# CHILDREN ARE NOT JUST LITTLE PEOPLE

Children spend more time swimming in lakes, ponds and streams than do adults, and these waters are often polluted by chemicals. They frequently play in wading pools, which are more often contaminated with fecal organisms than regular pools.

# CHILDREN ARE NOT JUST LITTLE PEOPLE

An infant's diet can be very restricted. For the first months it is usually milk only. Milk has a high fat content, and many toxicants such as PCBs (polychlorinated biphenls) and dioxins are stored in fat. PCBs and dioxins are developmental toxicants and may also be carcinogenic.

**Which of the following statements regarding PCBs and dioxins in human breast milk is correct?**

A. human milk is essentially free of PCBs and dioxins

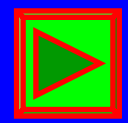
B. human milk has less than one tenth the concentration of PCBs and dioxins than unmodified cow milk

C. human milk has less than one hundredth the concentration of PCBs and dioxins than soy-based formulas

D. human milk has a greater concentration of PCBs and dioxins than cow's milk, milk-based formula, and soy-based formula

Wrong, human milk is *not* free of chemical pollutants such as PCBs and dioxins. Actually, the concentration of these fat-soluble toxicants in human milk far exceeds that in unmodified cow milk, cow milk-based formula, and soy-based formula. Most authorities agree that this is not a reason to abstain from breast feeding. The nutritional, immunological, and bonding benefits of breast feeding are felt to outweigh these disadvantages.

Breast is still best !



Wrong. Unfortunately, breast milk contains relatively large amounts of fat-soluble toxicants such as PCBs and dioxins. The concentration of these toxicants in human milk far exceeds that in unmodified cow milk, cow milk-based formula, and soy-based formula. Most authorities agree that this is not a reason to abstain from breast feeding. The nutritional, immunological, and bonding benefits of breast feeding are felt to outweigh these disadvantages.

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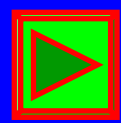

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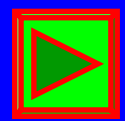
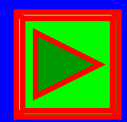
Breast is still best !



You are absolutely correct. Breast milk contains relatively large amounts of fat-soluble toxicants such as PCBs and dioxins. The concentration of these toxicants in human milk far exceeds that in unmodified cow milk, cow milk-based formula, and soy-based formula. Most authorities agree that this is not a reason to abstain from breast feeding. The nutritional, immunological, and bonding benefits of breast feeding are felt to outweigh these disadvantages.

Breast is still best !



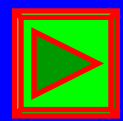
# CHILDREN ARE NOT JUST LITTLE PEOPLE

Children are not only growing, they are developing, and developing organs are uniquely vulnerable to the effects of toxicants such as lead, mercury, PCBs and dioxins. The organ of greatest concern in this regard is the:

- A. Brain
- B. Heart
- C. Kidney
- D. Liver
- E. Lung

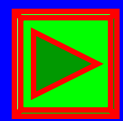
Right. The brain is the target organ of greatest concern in regard to early exposure to toxicants such as lead, mercury, PCB and dioxins.

Numerous studies have documented neurological injury to the fetus at exposure levels that caused no discernable symptoms in the mother. Infants and young children are vulnerable to neurocognitive impairment at blood lead levels that have no apparent effect on adults.



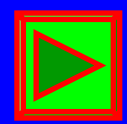
Sorry, the brain, not the heart, is the target organ of greatest concern in regard to early exposure to toxicants such as lead, mercury, PCB and dioxins.

Numerous studies have documented neurological injury to the fetus at exposure levels that caused no discernable symptoms in the mother. Infants and young children are vulnerable to neurocognitive impairment at blood lead levels that have no apparent effect on adults.



Sorry, the kidney may suffer from exposure to toxicants but the brain is the target organ of greatest concern in regard to early exposure to toxicants such as lead, mercury, PCB and dioxins.

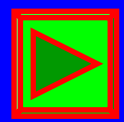
Numerous studies have documented neurological injury to the fetus at exposure levels that caused no discernable symptoms in the mother. Infants and young children are vulnerable to neurocognitive impairment at blood lead levels that have no apparent effect on adults.



Sorry, the brain, not the liver, is the target organ of greatest concern in regard to early exposure to toxicants such as lead, mercury, PCB and dioxins.

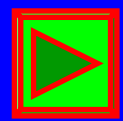
Numerous studies have documented neurological injury to the fetus at exposure levels that caused no discernable symptoms in the mother. Infants and young children are vulnerable to neurocognitive impairment at blood lead levels that have no apparent effect on adults.

While the liver does have a role in metabolizing many toxicants and also stores many toxicants, liver injury is not a major feature of toxicity from lead, mercury, PCBs or dioxins.



Sorry, the brain, not the lung, is the target organ of greatest concern in regard to early exposure to toxicants such as lead, mercury, PCB and dioxins.

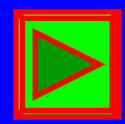
Numerous studies have documented neurological injury to the fetus at exposure levels that caused no discernable symptoms in the mother. Infants and young children are vulnerable to neurocognitive impairment at blood lead levels that have no apparent effect on adults.



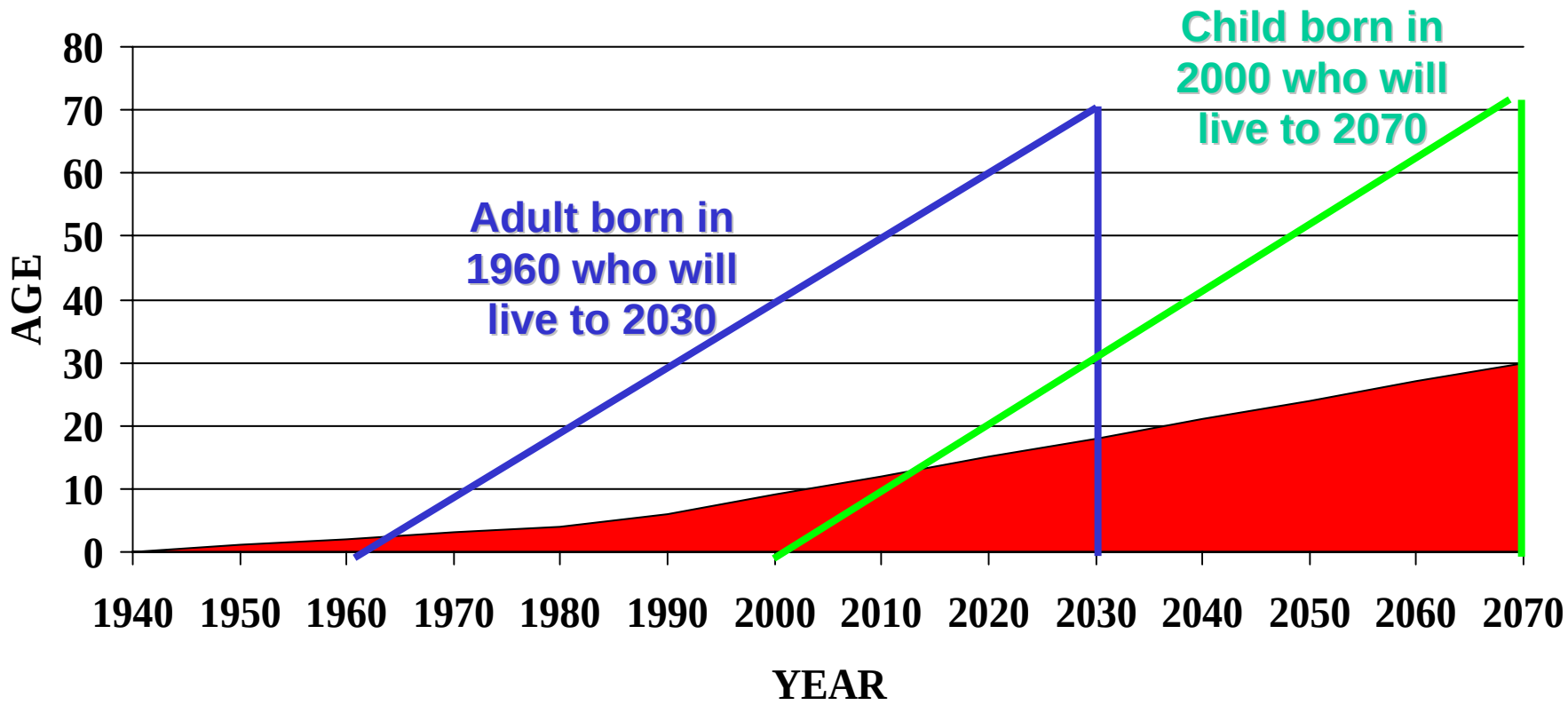
# CHILDREN ARE NOT JUST LITTLE PEOPLE

The production of synthetic chemicals in this country and through out the world has escalated dramatically since the middle of the last century, and this has been accompanied by a parallel increase in the amount of these chemicals in our air, water and food. This means that because they have a longer exposure time from today on, and because the amount of toxicants in the environment is continually increasing, children will have a heavier life-time exposure than their parents or grandparents.

This is shown graphically in the following two slides.

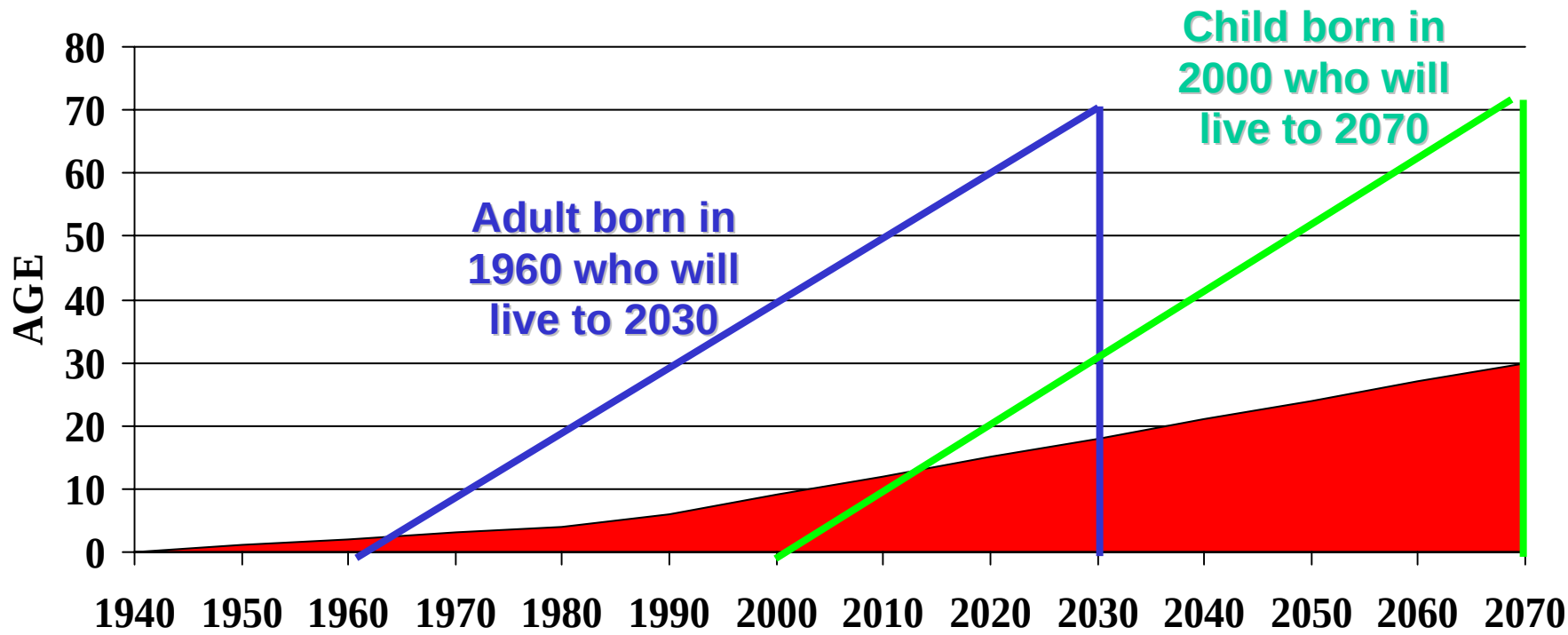


# Lifetime Exposure

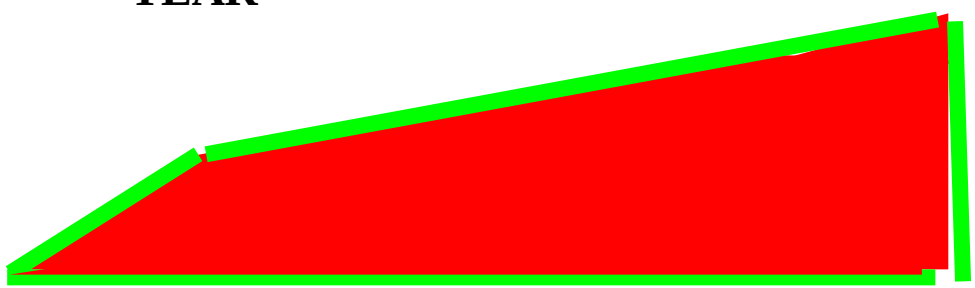



The red area represents the total amount of manmade chemicals (potential toxicants) in the environment

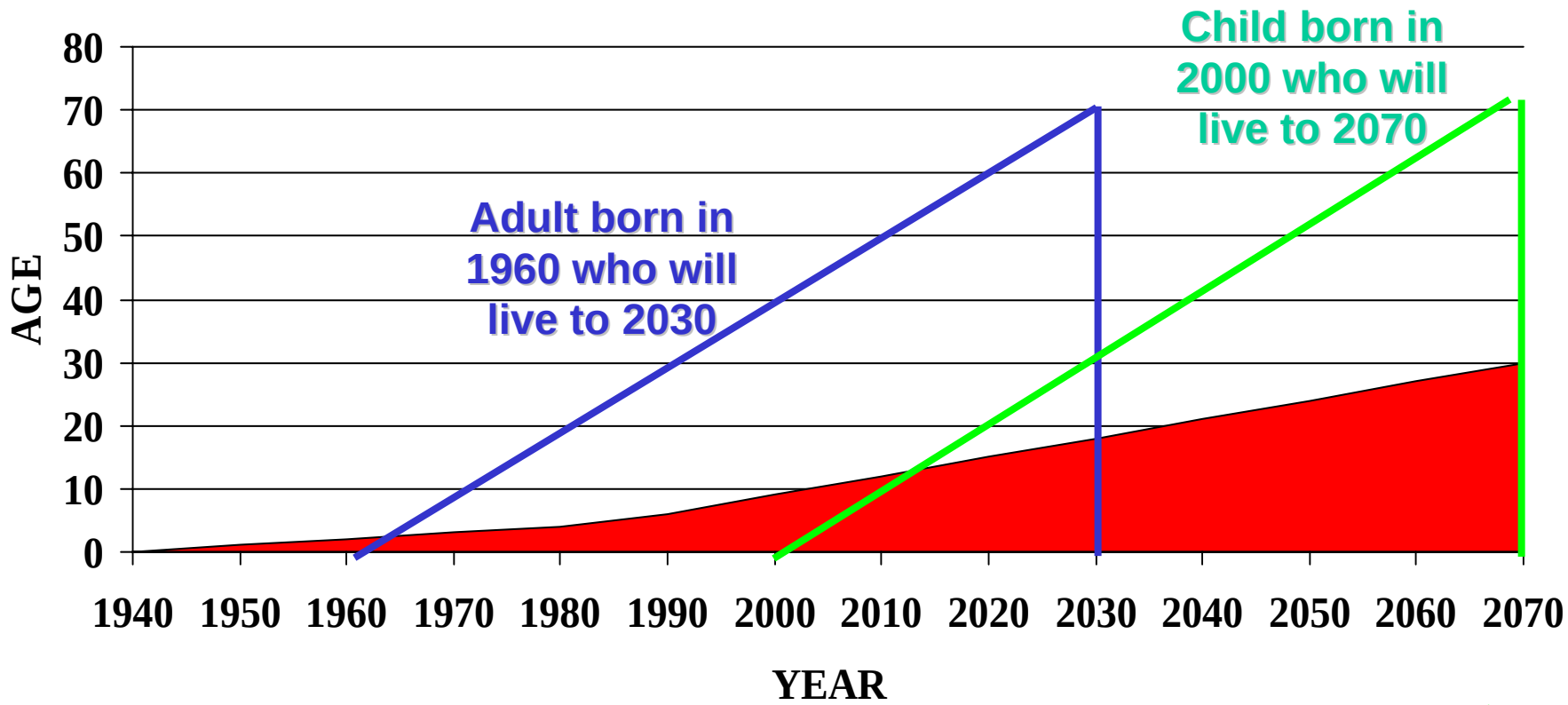
# Lifetime Exposure



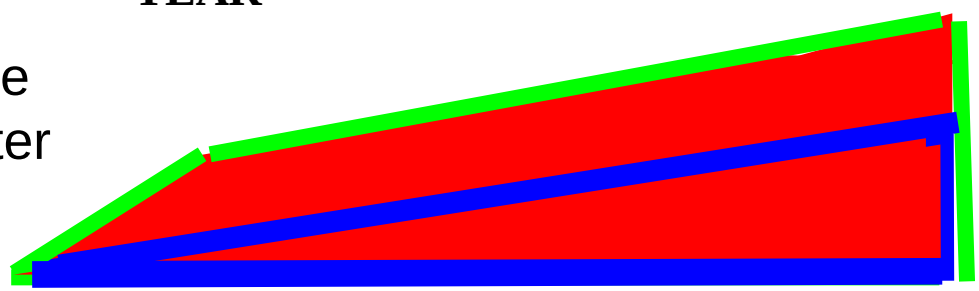

Lifetime exposure:
red area under **green**
represents child's exposure.
Click here ▶ to superimpose
adult exposure in blue



# Lifetime Exposure



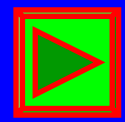

Obviously, the area under the green outline **(child)** is greater than the area under the blue outline (adult)



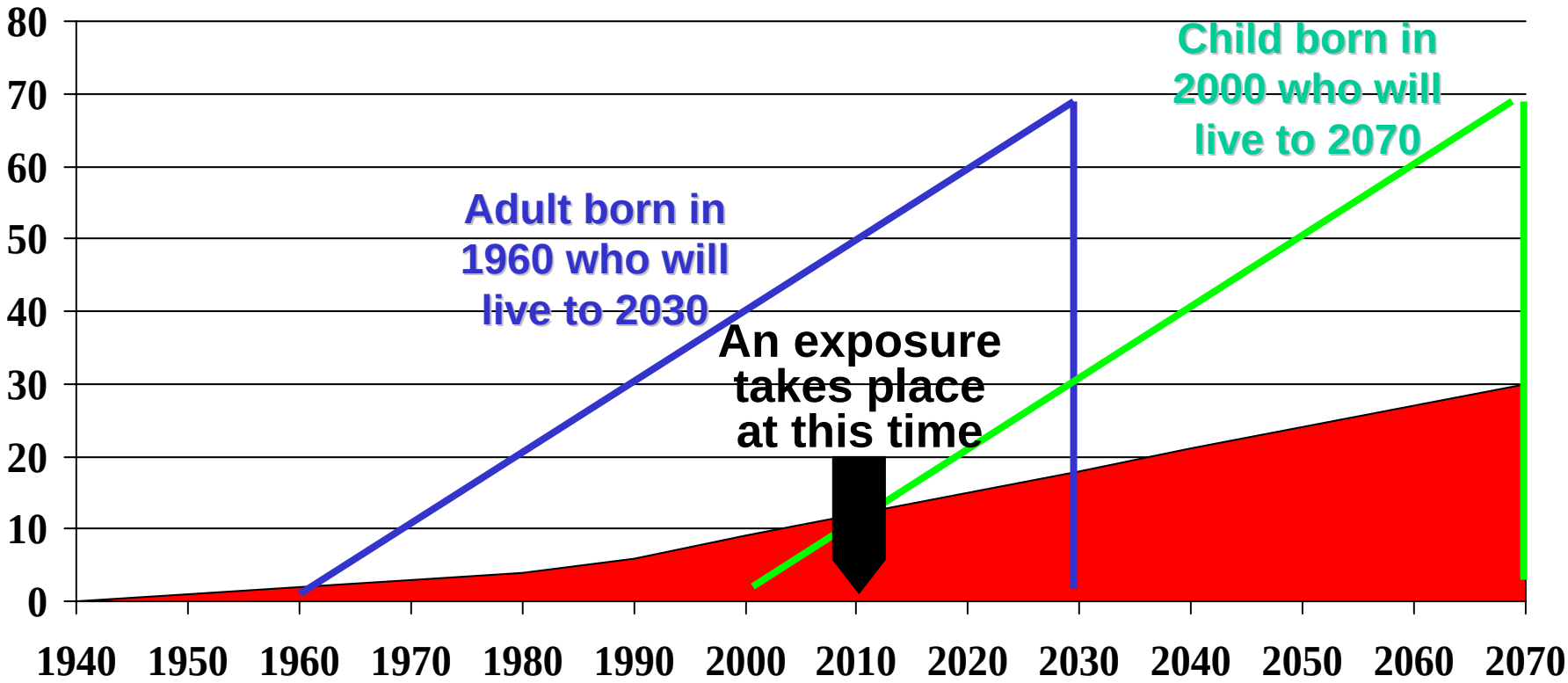
Click here for next slide

# CHILDREN ARE NOT JUST LITTLE PEOPLE

The expression, “children have a longer shelf-life” refers to the fact that children have more years to live and therefore more time after exposure during which to develop diseases with long latency periods, such as cancer.

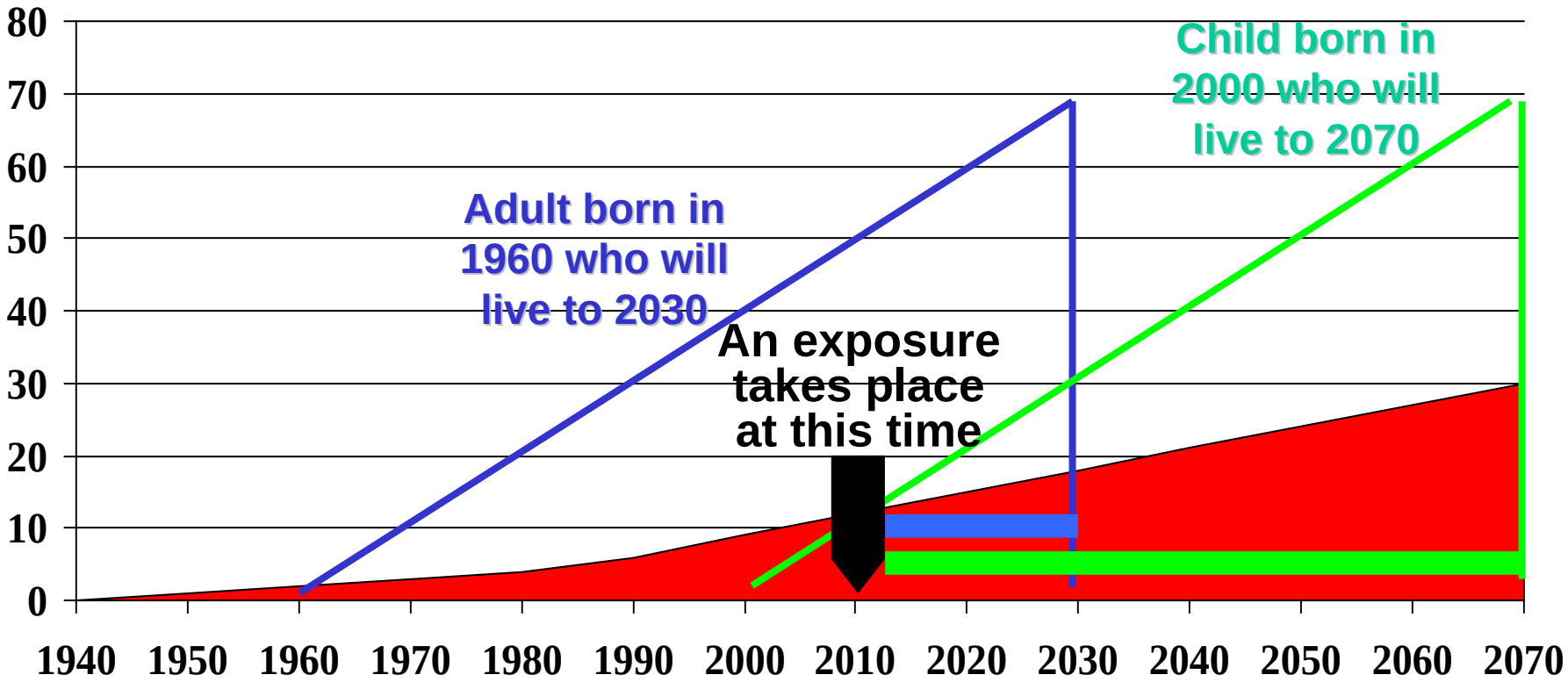


# Latency Time After Exposure




Click here to see latency for adult and for child

# Latency Time After Exposure




Latency for 50 yr old = 20 yrs

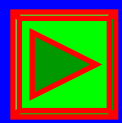
Latency for 10 yr old = 60 yrs

It is apparent that the child (green bar) has a 3X greater period during which he can develop cancer and other diseases with a long latency

**Congratulations. You have completed this basic module about children's environmental health.**

**You now understand the dangers posed to infants and children by environmental chemical pollutants. You also now understand why children are more vulnerable to environmental toxicants than are adults. You can use this understanding when exploring other materials regarding what you can do about these issues in your practice.**

**Let's have a brief review before you leave.**



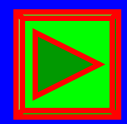
# Summary/Review

- The volume and diversity of chemical toxicants in the environment has been increasing over the past several decades.

- Reported increases in a variety of diseases, from developmental problems to autism and from congenital malformations to cancer are best explained by changes in the environment rather than changes in the gene pool.

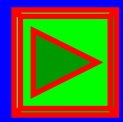
# Summary/Review

- Infants and children are especially vulnerable to environmental toxicants for a number of reasons
  - they breath more air, drink more liquids and eat more foods relative to their weight than do adults
  - their developing bodies, especially their nervous systems, are uniquely susceptible to changes in the chemical milieu
  - they live closer to the ground and floor and put all sorts of objects into their mouths



# THE END

Thank you



# Disclaimer, acknowledgements & fine print

- This presentation represents the views of the authors and does not constitute endorsement of any specific item.
- This presentation was prepared with partial sponsorship from the Association of Occupational and Environmental Clinics under a cooperative agreement (U50/ATU300014 ) with the Agency for Toxic Substances and Disease Registry with additional support from the Environmental Protection Agency.
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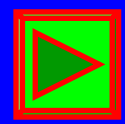
Click here to see references



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End Program