A Story of Childhood Leukemia: Stephen's Story

Genetic and Environmental Risk Factors for Childhood Leukemia

Collaborative on Health and the Environment Partnership Call
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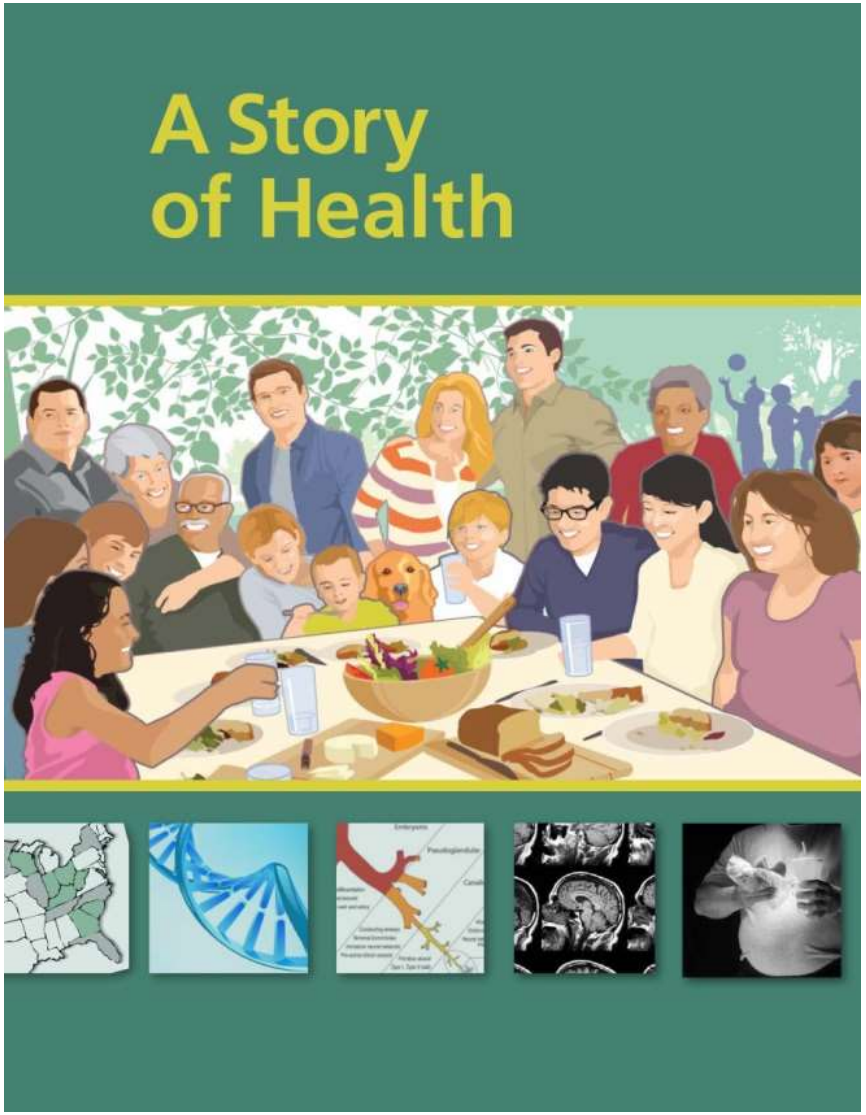
OEHHA

Views do not represent the State of California



A FAMILY REUNION Six Stories

This page is your portal to six stories of health.

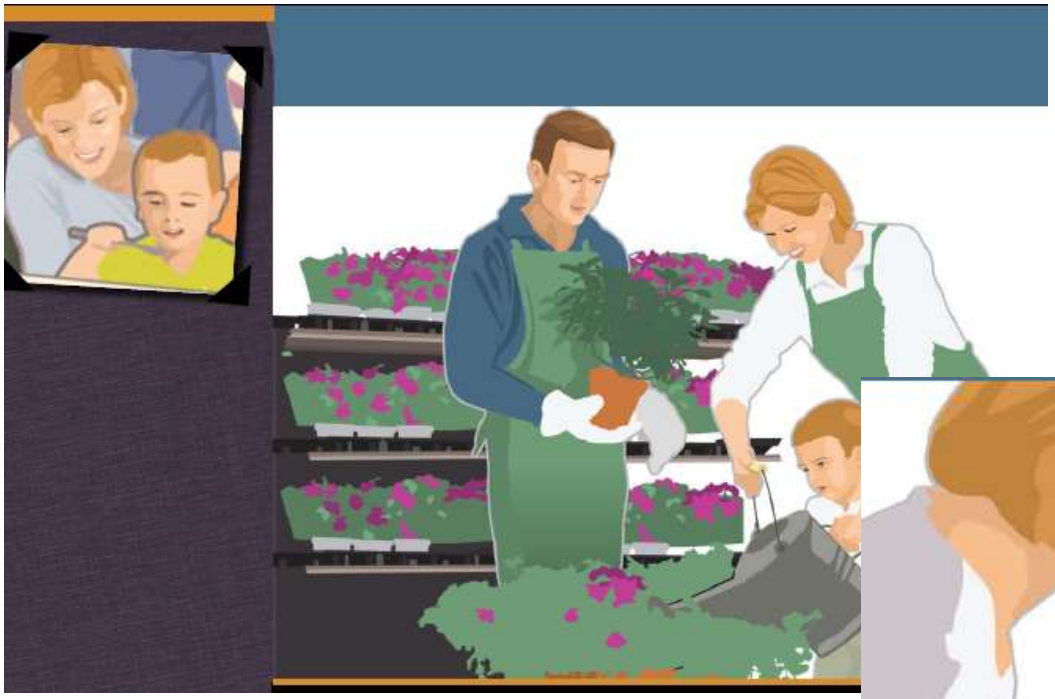
It is recommended that you read through the introduction first and then choose stories in the order you wish.

Health professionals can receive CE credits for completing *A Story of Health*. Click here for more details.

Choose stories in the order you wish. Select a disease term to highlight the affected person. Click the arrow button to read his or her fictional story of health.

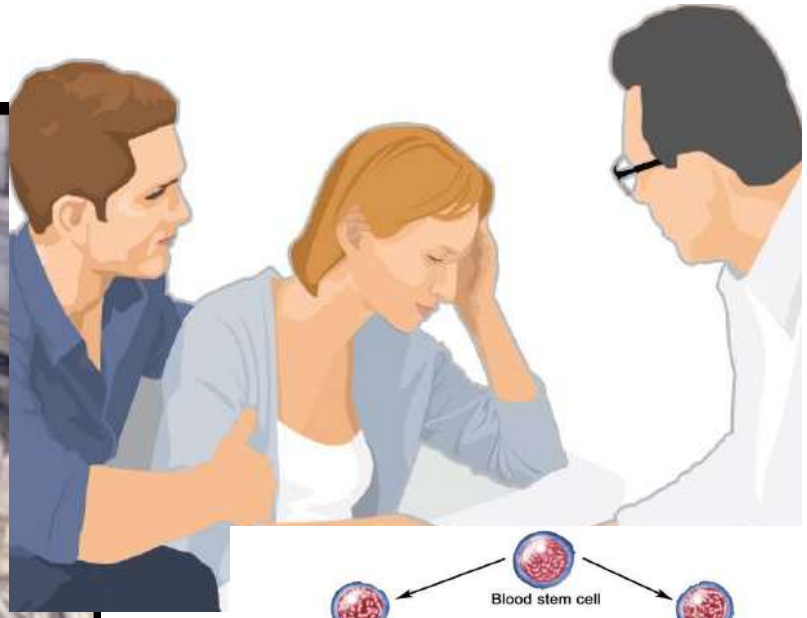
Asthma | Cancer | Learning/ Developmental Disabilities | Diabetes | Infertility | Cognitive Decline

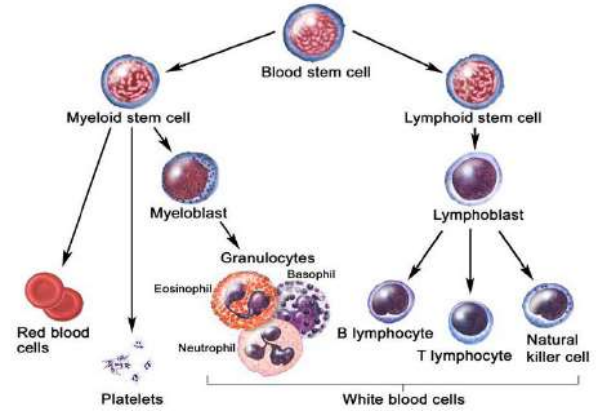
Stephen is a 3 year old who lives with his parents David and Tricia in Connecticut



When he gets ill his pediatrician is Concerned and orders lab tests

A very high white blood count results in referral to specialist/hospitalization





CHILDHOOD LEUKEMIA Stephen's Story

CHILDHOOD LEUKEMIA IS NOT A SINGLE DISEASE

Acute leukemias in childhood comprise a group of related but different diseases. In the United States they represent 31% of malignancies occurring among children under the age of 15.

Eighty percent of acute childhood leukemias, including Stephen's, are acute lymphoblastic leukemia (ALL). Approximately 17% are acute myeloblastic leukemia (AML).

It is important to identify characteristics of the leukemia at its presentation since this information helps to determine the course of treatment as well as prognosis. The types of cells involved in the leukemia (immunophenotype) are used to determine whether a person has ALL or AML.

Factors such as age, initial white blood count at diagnosis, and cytogenetics (the specific differences or changes in DNA) of the leukemic cells at diagnosis are utilized to identify the most appropriate course of treatment.

Types of leukemia vary by age

Early life exposures are important: age-specific incidence chart

More Detail on ALL Subtypes

Watch: Dr. Patricia Buffler discusses leukemia classification (1:59 mins.)

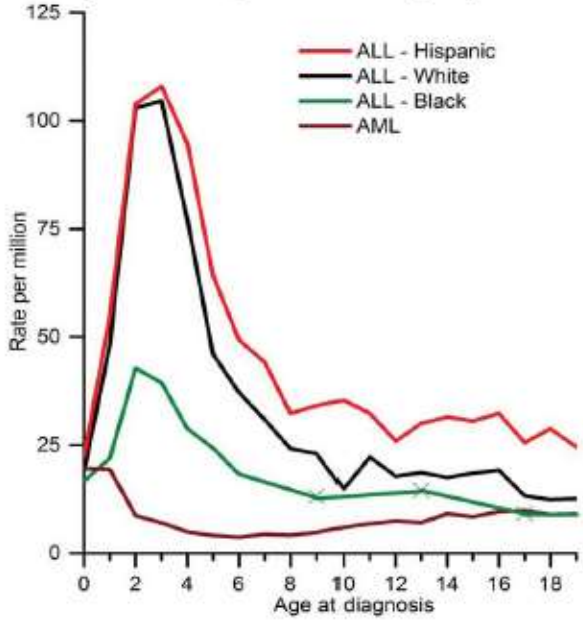
Patricia Buffler PhD MPH, Professor of Epidemiology and Dean Emerita (deceased) of the School of Public Health, University of California-Berkeley

Early Life Exposures are Important

There is a peak of incidence of childhood ALL between the ages of two and five. This has led researchers to think that critical windows of vulnerability to environmental exposures are very important before conception, during pregnancy, and in the early years of life.

In contrast to ALL, the childhood AML rate seems to be more stable across ages, which implies different risk factors, windows of vulnerability, or mechanisms that may lead to AML in contrast to ALL.

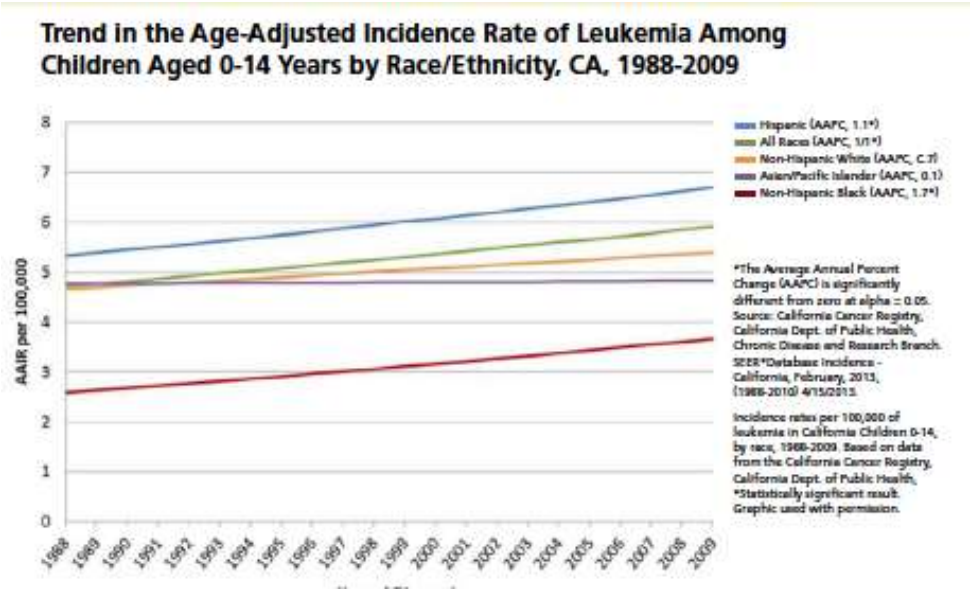
Age-Specific Incidence Rates of Acute Lymphocytic Leukemia (ALL) by Race/ Ethnicity and Acute Myeloid Leukemia (AML) for All Races Combined

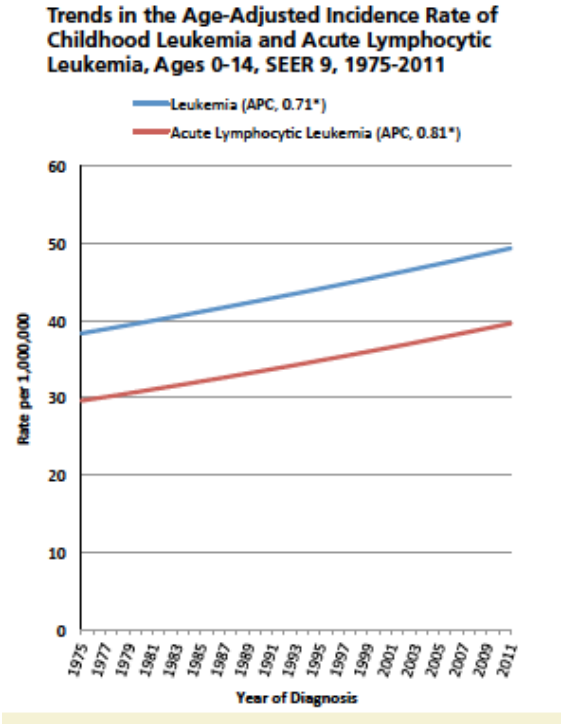


Rates are not shown when based on fewer than 25 cases. Data for whites and blacks exclude Hispanic ethnicity. Due to sparse data for ALL in blacks for some ages, data are shown for combined age groups: 7 to 10 years, 11 to 14 years, and 15 to 19 years as marked by asterisks. Source: Surveillance, Epidemiology, and End Results (SEER) program, 18 SEER Registries, National Cancer Institute.

Ward, et al., 2014. Used with permission.

Childhood Leukemia Trends





Ecological Approach to Disease

Watch: Dr. Gary Dahl discusses the clinic visit (3:08 mins.)

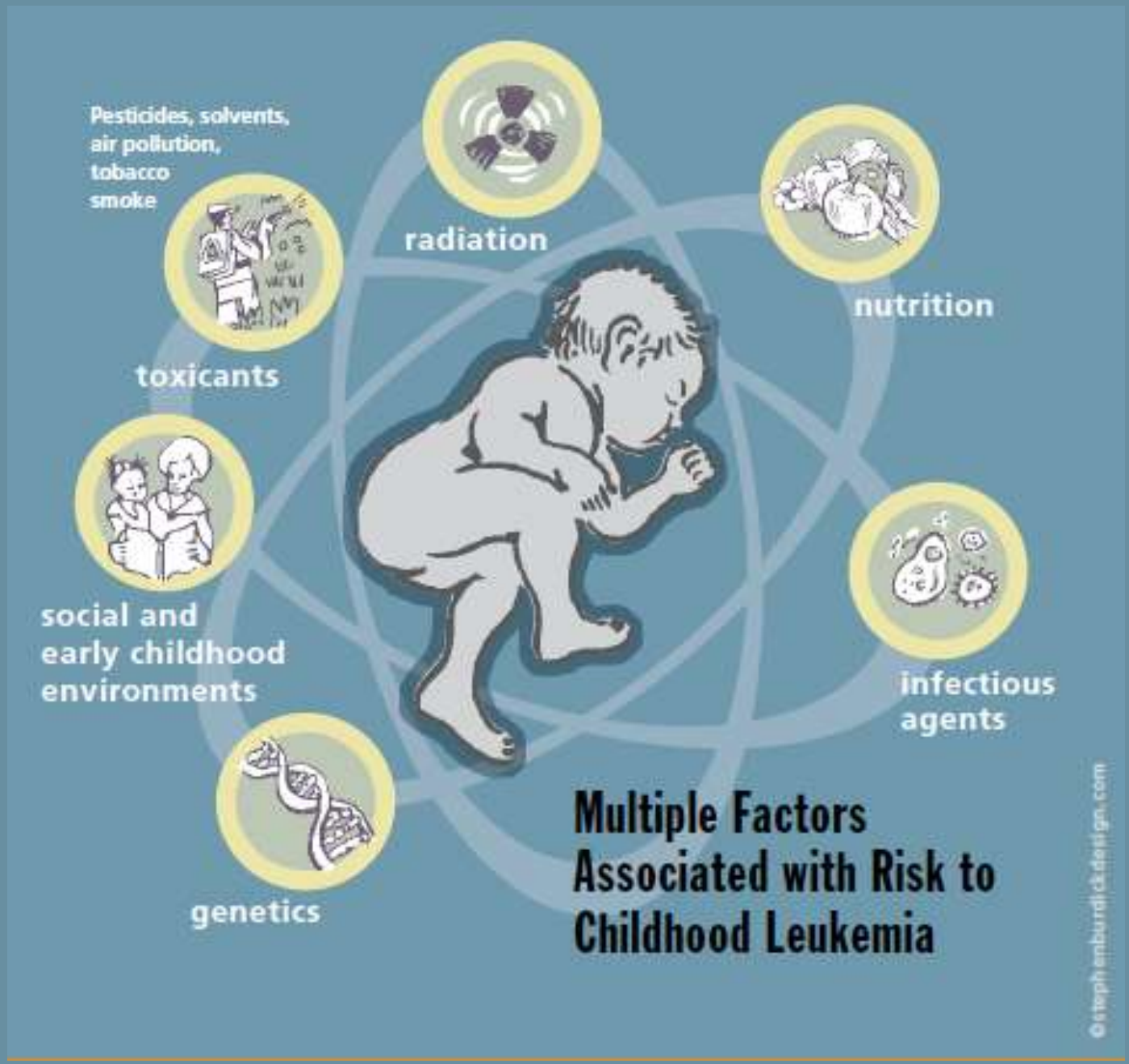
"Playschool."
by Susan Macfarlane,
reproduced with permission.

About this painting, with words of the artist in *italics* >

"Playschool."

A child in the isolation unit is attending playschool. *"A captivating moment seen through the corridor window. A child, Stephanie, in 'isolation' happily paints stencils with the encouragement of her Nan and Sue the 'Playlady'. Much thought and care is given to help children remain creative and busy whenever possible."* Education of the child at whatever age is considered most important and is provided in the specialised treatment units.

close window


Pesticides, solvents, air pollution, tobacco smoke
radiation
nutrition
toxicants
social and early childhood environments
infectious agents
genetics
Multiple Factors Associated with Risk to Childhood Leukemia

CHILDHOOD LEUKEMIA Stephen's Story

PESTICIDES

Tricia mentions to Dr. Baker that other families in the neighborhood have regular pesticide applications to the perimeter of their house and some have lawn service, but they do not.

Tricia thought that Stephen's daycare might occasionally use pesticides to spray for ants and flying insects. Dr. Baker consulted the pediatrician at his regional Pediatric Environmental Health Specialty Unit, who confirmed that many studies from around the world have found statistically significant associations between pesticide exposure and childhood leukemia.

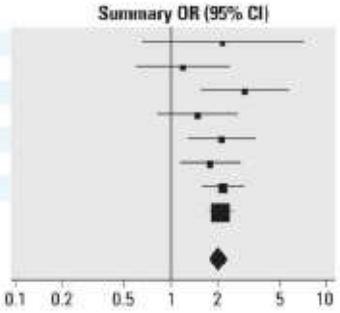
- How to read and interpret the figure at right. What is a meta-analysis?
- Pesticide Regulation
- Find a local Pediatric Environmental Health Specialty Unit (PEHSU): A respected network of experts in children's environmental health.

Watch: Dr. Catherine Metayer discusses insecticides and herbicides (4:15 mins.)

Catherine Metayer MD PhD, Associate Adjunct Professor, Epidemiology/Biostatistics and Epidemiology, University of California-Berkeley, Principal Investigator, Center for Integrative Research on Childhood Leukemia and the Environment

Residential Pesticide Exposures

Study	Weight (%)	OR (95% CI)
Infante-Rivard et al. 1999	1.2	2.17 (0.86–7.09)
Davis 1991	3.4	1.20 (0.60–2.40)
Leiss and Savitz 1995	4.0	3.00 (1.56–5.70)
Steinbuch 1994	4.7	1.49 (0.83–2.68)
Ma et al. 2002	6.6	2.12 (1.29–3.49)
Menegaux et al. 2006	8.4	1.80 (1.16–2.80)
Pombo-de-Oliveira et al. 2006	17.9	2.18 (1.61–2.95)
Rudant et al. 2007	53.8	2.10 (1.76–2.50)
Total	100	2.05 (1.80–2.32)



What is a meta-analysis?

A meta-analysis uses statistical methods to combine the results of different studies in order to identify an overall trend in the data. Generally, studies are grouped by a common measurement, and some studies are excluded on the basis of quality or study design.

Certain studies are given more weight in the meta-analysis. Weighting is usually related to the sample size in the individual studies.

This method can have some limitations. It usually relies on published studies, which may exclude studies that show negative or insufficient results that are less likely to be published. Additional bias can also skew the results if studies are cherry-picked using unsound methodology for selecting studies.

A graphic known as a Forest Plot (shown above) is often used to display the results of a meta-analysis. The size of the square is proportional to the weight assigned to the study.

The horizontal line is the study's confidence interval (a measure of how the results might vary due to chance).

The vertical line at 1 represents "no effect." If the confidence intervals for individual studies overlap with this line, it demonstrates that there is no statistically significant effect observed. The diamond represents the summary measure of all studies combined.

- More information: "5 Key Things to Know about a Meta-Analysis" Scientific American blog post

CHILDHOOD LEUKEMIA Stephen's Story

EARLY PRECONCEPTION AND PRENATAL INTRODUCTION OF VITAMINS AND FOLATE REDUCES RISK OF CHILDHOOD LEUKEMIA

At their next visit, Dr. Baker asks Tricia about her pregnancy with Stephen. Like many other women, she didn't think about taking vitamins before or during the first two months of the pregnancy, especially because she ate a nutritious diet. Otherwise she was very careful to live a healthy lifestyle while pregnant and did not smoke or drink. She started on prenatal vitamins with folate at her first prenatal visit at eight weeks gestation.

Folate supplementation has been associated with reductions in risk for childhood leukemia, at least for those at risk for lower folate consumption. Folate supplementation before conception and early in pregnancy not only appears to be protective in the case of leukemia risk, but also reduces neural tube and other birth defects, and may reduce the risk of developing autism. (Schmidt et al., 2012; Suren et al., 2012)

+ Preconception and Healthy Child Development

+ Prenatal Care and Healthy Child Development

? Folate supplementation recommendations for women

? Studies on Folate and Leukemia

PRENATAL CARE FOR HEALTHY DEVELOPMENT

The fetus can be harmed by environmental exposures including:

- Mom's smoking and second hand smoke,
- Mom's drinking alcohol and her exposure to other solvents like those in certain paints, and in products used in nail salons,
- Mom's exposure to lead, mercury (from some fish and other sources), pesticides, PCBs (banned in the US but still found in the environment) and certain polybrominated diphenyl ethers (PBDEs – a family of chemicals long-used as flame retardants in foam and furniture), among others.

Positive actions to protect the fetus:

- Avoid smoking or drinking,
- Maintain a healthy diet,
- Supplement with prenatal vitamins, including folic acid, iodine, and vitamin D if maternal serum levels are inadequate,
- Avoid toxicants.

More information:

- CDC on pregnancy
- American Congress of Obstetrics and Gynecology (ACOG):
  - Good Health Before Pregnancy (pdf)
  - Prenatal Nutrition
  - Environmental Chemicals
- Royal Congress of OB/GYN:
  - Chemical Exposures During Pregnancy
- UCSF: Program on Reproductive Health and the Environment

Image source: Centers for Disease Control and Prevention, used with permission

SOME FINAL THOUGHTS

COMMON THEMES

Although the fictional narratives in *A Story of Health* describe the lives of people with different diseases, common themes resonate. They include:

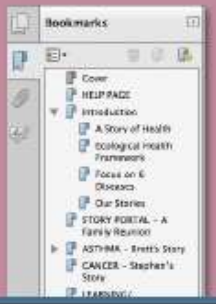
- Important environmental influences come from the natural, chemical, food, built, and social environments.
- Although there are exceptions, most diseases as well as good health are the result of complex interactions among multiple environmental influences and genetics.
- Early-life experiences, particularly during critical windows of development, can have profound beneficial or detrimental lifelong effects, even into elder years.
- Preventing disease and promoting health require actions and commitments from the individual, family, community and society, as they are all interconnected.

- **Common themes in stories**
- **Additional Resources**
- **Register for Continuing Education Credits**

We'd love to hear from you. Give us your feedback on *A Story of Health*. Click here!

Resources

We have linked to many useful resources in each story relevant to a wide range of audiences, including clinicians. To quickly access resources on specific topics in each story, use the **Bookmarks** toolbar on the left (which you can open or close), or return to the **Help page** for more details on other eBook features.



Additional resources to help prevent disease and promote health:

Portal to Science Resources: Hundreds of additional resources on environmental health including organizations, publications, videos and more.

Pediatric Environmental Health Toolkit: Materials for health care providers and patients in English and Spanish.

Out of Harm's Way: Preventing Toxic Threats to Child Development: Fact Sheets in English and Spanish.

Approaches to Healthy Living: A 4-page guide on how to avoid toxicants, eat healthier, reduce stress.

Healthy Aging: The Way Forward: An ecological approach to policy level interventions for healthy aging across the lifespan.

Continuing Education

Register for Continuing Education (CE) credits for *A Story of Health* for a variety of health professions. Free credits are offered by the Centers for Disease Control and Prevention/Agency for Toxic Substances and Disease Registry at this link.

Another free CE course on environmental health offered by the CDC/ATSDR is the **Pediatric Environmental Health Toolkit** online course.

Thank you

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