

Exploring Risk Factors for Childhood Leukemia with A Story of Health

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National Institute of Environmental Health Sciences
Your Environment. Your Health.



The Motivation for *A Story of Health*



Stephen's parents ask Dr. Baker what caused his disease.

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“Epidemiological studies worldwide have provided substantial evidence of the contributions of environmental exposures to the development of childhood leukemia, yet this knowledge has not been integrated into the routine practice of clinicians who care for children with this disease.

-Zachek, Miller *et al.*
In the *J of Pediatric Hematology/Oncology*, 2015.

The Motivation for *A Story of Health*



Art by Stephen Burdick

Zachek, Miller *et al.* surveyed 191 pediatric oncologists, fellows, and nurse practitioners about attitudes and practices around environmental exposures.

- **88%** received questions from families about links between environmental exposure and the cancers they treat,
- **77%** suspected some of the cases they saw had an environmental origin,
- But **93%** were not “very comfortable” discussing environmental sources of exposure with families.

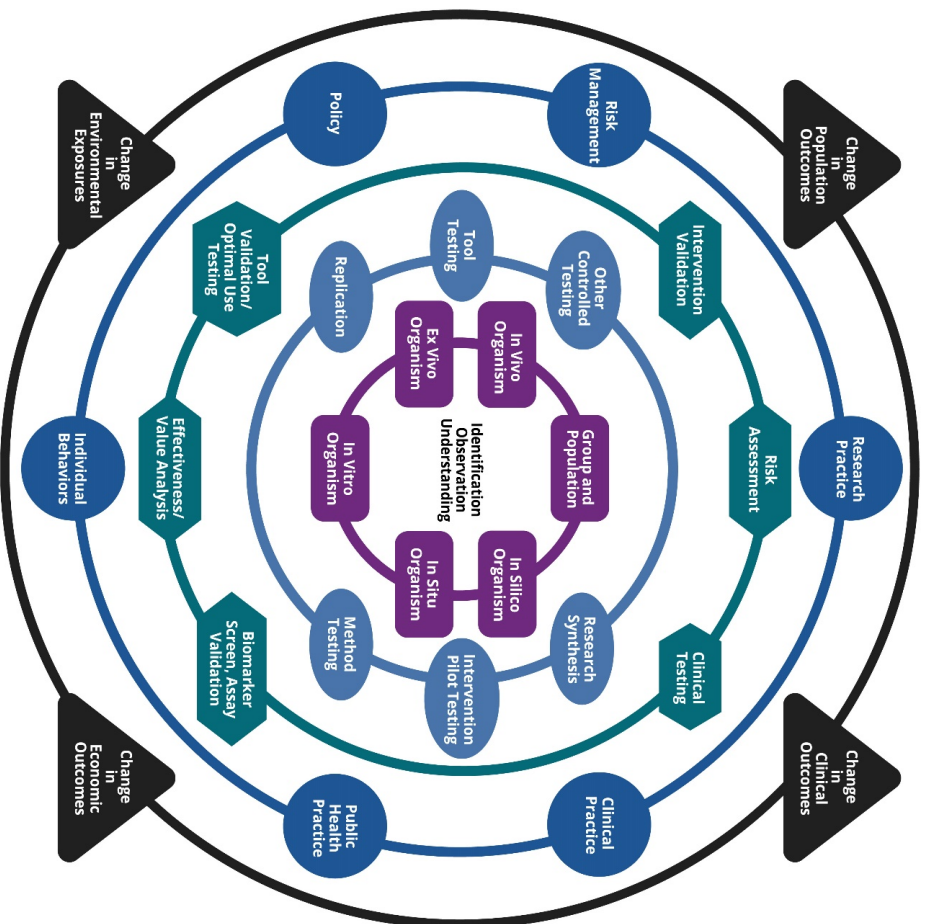
Key Features of *A Story of Health*



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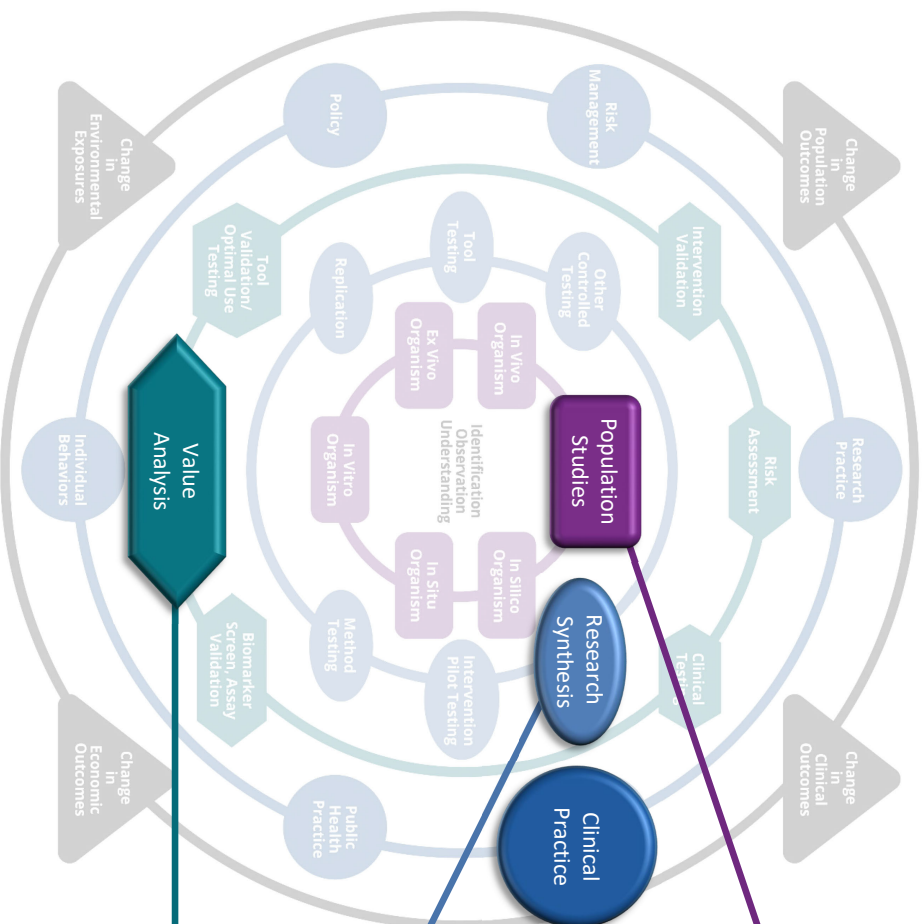
- Engaging
- Multimedia
- Lots of resources
- Colorful design
- Free continuing education credits for health professionals via CDC (ACCME)
- Scientific rigor

Translational Research Framework



- Conceptualized by NIEHS.
- Encourages movement of ideas from basic science to broader societal impact.
- Illustrates CIRCLE's role in creating *A Story of Health*.

Translational Research Framework



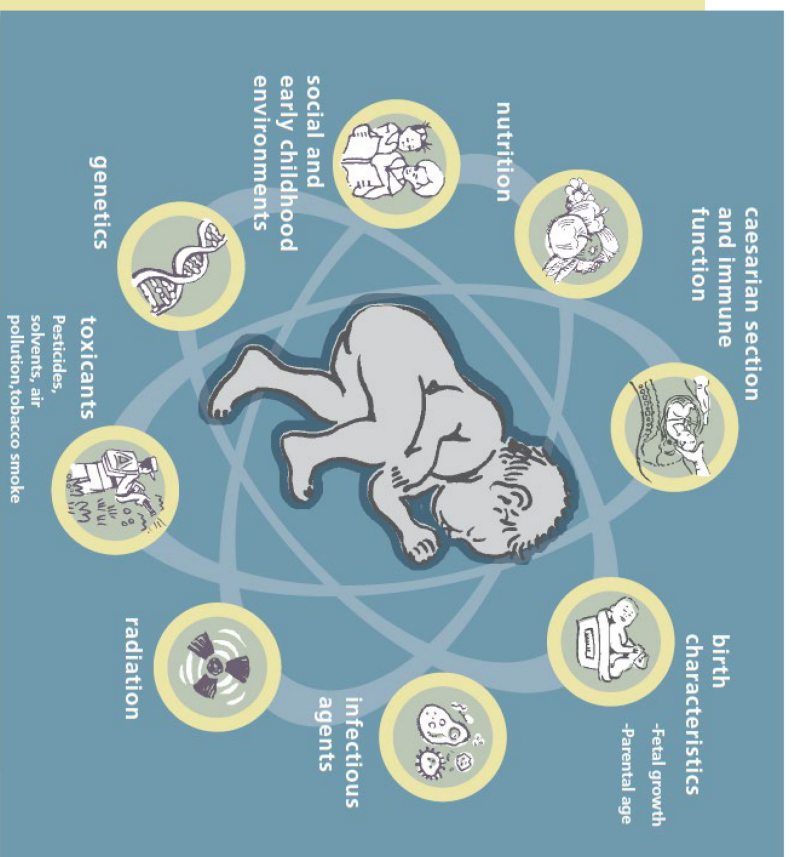
CIRCLE has produced robust evidence that specific environmental exposures *can* increase a child's risk of getting leukemia.

Clinical oncologists are not comfortable discussing risk factors for childhood leukemia with patients.

A *Story of Health* synthesizes the current understanding of childhood leukemia etiology for a clinical audience.

Program effectiveness evaluated by accreditation registration counts, feedback surveys, and testimonials.

Risk Factors for Childhood Leukemia



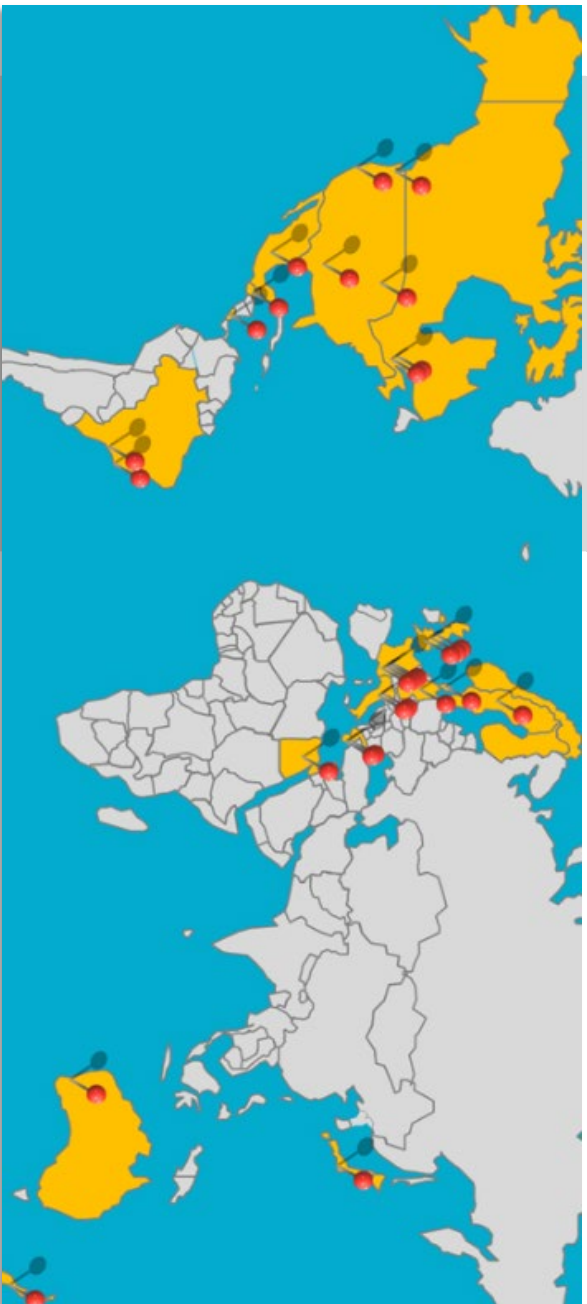
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- Leukemia is a multifactorial disease.
- Complex interactions occur among many variables and across individual, community, and societal levels.
- Rarely is one particular thing responsible for health or disease.

Childhood Leukemia International Consortium



A Map of "CLIC" – from A Story of Health



- Pooled and meta-analysis from CLIC used to support *A Story of Health*
- Represents international consensus
- 33 studies
- 19 countries
- Tens of thousands of leukemia cases

Pesticides and Childhood Leukemia



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- Many studies from around the world have found statistically significant associations between pesticide exposure and childhood leukemia.
- We want to provide these technical findings to health professionals,
- But need to translate the research in a meaningful and useful way.

Pesticides and Childhood Leukemia

Sample page reproduced from *A Story of Health*

Help to understand chart

A Story of Health

CHILDHOOD LEUKEMIA Stephen's Story

PESTICIDES

Other resources

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?

5 Key Things to Know about a Meta-Analysis - Scientific American blog post

Link to EPA website for more information on FRNA

Pesticide Regulation

Find a local Pediatric Environmental Health Specialty Unit (PEHSU): A respected network of experts in children's environmental health.

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



Catherine Meyer, MD PhD, is an Associate Professor of Biostatistics and Epidemiology, Principal Investigator, Center for Childhood Leukemia and the Environment.

Residential Pesticide Exposures

study	cases	OR, (95% CI)	Weight
In the 1-3 months before conception			
Green, 1994	542	1.12 (0.70, 1.82)	10.82
US, 2003	1798	1.42 (1.25, 1.60)	60.20
US, 2003	615	2.00 (1.26, 3.31)	8.01
New Zealand	95	1.36 (1.20, 1.51)	100.00
(I-squared = 20.7%, p = 0.289)			
During pregnancy			
US, 2003	538	1.13 (0.91, 1.43)	15.27
US, 2003	1626	1.21 (1.05, 1.40)	17.24
Canada	787	1.55 (1.26, 1.90)	15.54
New Zealand	97	1.58 (0.82, 2.65)	7.94
France, 2001	238	1.84 (1.31, 2.61)	10.32
France, 2001	430	2.04 (1.74, 2.39)	27.4
Green, 1994	540	2.04 (1.74, 2.39)	27.4
(I-squared = 78.2%, p < 0.0001)			
After birth			
US	792	1.03 (0.90, 1.16)	18.28
US	547	1.24 (0.99, 1.59)	18.68
US, 2003	1745	1.31 (1.11, 1.55)	22.44
US, 2003	36	1.61 (1.12, 2.31)	0.88
US, 2003	30	1.98 (1.27, 2.71)	1.35
France, 2001	237	1.98 (1.37, 2.89)	13.75
(I-squared = 96.2%, p < 0.011)			
Forest plot showing individual odds ratios for home pesticide exposure and childhood acute lymphoblastic leukemia, using random effects models.			

NOTE: Weights are from random effects analysis.

In a meta-analysis by Bailey et al. (2015) that combined data from 12 studies in the Childhood Leukemia International Consortium, residential insecticide use before conception, during pregnancy, or after birth was associated with increases in the risk of childhood acute lymphoblastic leukemia of 40 to 50% (OR=1.39 to 1.51). For acute myeloid leukemia, the associations were somewhat similar for pesticide exposure before conception (OR=1.88) and during pregnancy (OR=1.60), but not after birth (OR=1.10).

Non-technical description and story-telling

Short video with related topic

Technical findings

Brief technical summary

Citation to paper

Graphic used with permission from Bailey et al. 2015. Supplemental Figure 1.

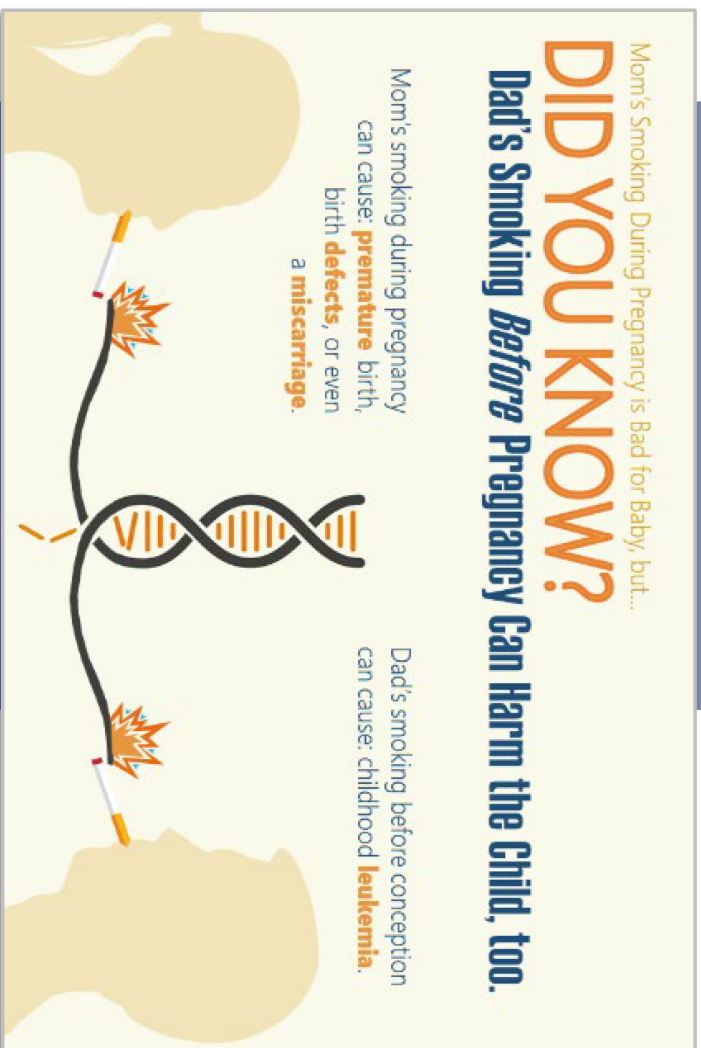
The Role of Nutrition in Childhood Leukemia



- One of a series of infographics on protecting children from leukemia before they are born.
- Vitamin supplementation (protective) and heavy coffee consumption (a risk) during pregnancy linked to leukemia based on a pooled analyses from CLIC.
- Co-benefits of avoiding alcohol during pregnancy.
- Breastfeeding reduces risk, too.

Reproduced from A Story of Health

Parental Smoking and Childhood Leukemia



- Parental smoking (by mom or dad) confers an increased risk, but the story is *complex*.
- CLIC confirmed that paternal smoking before conception is linked to increased risk of ALL.
- Effects are worse if the child is subsequently exposed to secondhand smoke.
- Studies of maternal smoking during pregnancy were initially negative; but recent findings point to specific at-risk populations.
- Certain subtypes of leukemia are uniquely sensitive to smoking.
- Modern techniques of assessing *in utero* smoking damage may reveal more about the risks.

Reproduced from A Story of Health

Paints, Solvents, Traffic – a Common thread?



- CLIC pooled analysis showed *in utero* home paint exposures were associated with increased risk (oil-based paints only).
- In-home solvent use also associated with risk of AML.
- Benzene is a solvent and a leukemogen in adults.
- Home remodeling activities associated with risk.
- Living near traffic associated with risk in CDC meta analysis.

Reproduced from A Story of Health

Cause or Cure?

- Can we be more proactive about preventing cancer?
- Interventions to reduce exposure to risk factors for childhood leukemia.
- Cancer-prevention programs.
- Critical time windows.



Watch: Cause or Cure?
Dr. Bruce P. Lanphear - Is the
relentless pursuit of a cure
hazardous to our health?
(4:28 mins.)

Dr. Bruce P. Lanphear, MD
MPH, Professor, Simon
Fraser University

Impact of *A Story of Health* (by the numbers)



“Weekly Co-Ordinating Meeting”
by Susan Macfarlane, reproduced from *A Story of Health*

- 10,000 continuing education credits completed (750+ for Stephen’s Story).
- **97%** agreed: “*the content and learning materials addressed a need or a gap in my knowledge or skills.*”
- **89%** said: “*I will be able to apply the knowledge gained from this activity to my practice.*”
- **91%** said: “*I will be able to apply the knowledge/skills gained from this activity to develop strategies/provide interventions.*”

Impact of *A Story of Health* (testimonials)



*“Weekly Co-Ordinating Meeting”
by Susan Macfarlane, reproduced from A Story of Health*

- “...one of the BEST online courses I have taken. It was very interactive and teaching through the story was an excellent idea.”
- “I am clinical instructor. I will transfer the knowledge I gained from this course to nursing students in child health practicum course.”
- “I was already able to take some of what I learned and apply it to my current cancer-support class.”

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