CALIFORNIA ENVIRONMENTAL HEALTH TRACKING PROGRAM

Costs of Environmental Health Conditions in California Children

Frequently Asked Questions

Study Backgrounds and Findings

1. What is this report about?

Children are generally more susceptible than adults to environmental hazards, but little is known about the economic burden of illnesses related to these hazards. This report by the California Environmental Health Tracking Program (CEHTP) estimates the cost of four childhood conditions related to the environment in California: asthma, cancer, neurobehavioral disorders, and lead exposures. As part of this study, CEHTP also estimated the proportion of asthma and select childhood cancers in California that is related to preventable environment hazards.

2. What did the study find?

We found that preventable environmental hazards are responsible for a significant health and economic burden on children and families in California. In examining the environmentally-related costs of four childhood health conditions, we found that:

- Preventable environmental hazards cost California **$254 million every year and $10–13 billion over the lifetime** of all children born every year
- Lead exposures had the greatest overall financial impact of the four health conditions, resulting in lost earnings of **$8–11 billion over the lifetime** of children born each year
- Asthma had the greatest financial impact on an annual basis, costing families and the state over **$208 million every year**
- For California specifically, the environment contributes to **30%** of the childhood asthma burden and **15%** of the childhood cancer burden

In conducting the study, we also found that there is a need for:

- **Improved data** on the annual and lifetime costs for a range of childhood health conditions
- **More complete data** on the burden of childhood health conditions, such as birth defects, throughout the state
- **Continued research** on the relationship between the environment and children's health

3. What was the economic impact of these childhood health conditions?

Below are the estimated annual and lifetime costs for each childhood condition studied.

Childhood health condition	Annual costs (in millions)*	Annual costs attributable to the environment (in millions)*	Lifetime costs (in millions)*	Lifetime costs attributable to the environment (in millions)*
Asthma	$693	$208	$21	$6
Cancer	$125	$19	$222	$33
Lead exposures**	Not calculated	Not calculated	$8,300–11,100	$8,300–11,100
Neurobehavioral disorders	$271	$27	$23,000	$2,300
Total	**$1,089**	**$254**	**$31,543–34,343**	**$10,639–13,439**

*Cost figures adjusted to 2013$

**Lead exposures is based on a range of estimates of mean blood lead level in California children

4. What portion of these costs could have been prevented by eliminating preventable environmental hazards?

By eliminating preventable environmental hazards for the four childhood health conditions, California could:

- **Save 23% on annual costs ($254 million)** incurred by families and the state
- **Prevent 34–39% of lost potential earnings and medical costs ($10–13 billion)** over the lifetime for all children born in a single year

Eliminating preventable environmental hazards would significantly impact the health of California's children and could:

- **Reduce** the number of children experiencing asthma and childhood asthma costs by **30%**
- **Reduce** illness and deaths due to childhood cancer and associated costs by **15%**
- **Reduce** the number of children with neurobehavioral disorders and associated costs by **10%**
- **Eliminate** childhood lead exposures and associated costs

5. Why are these costs an underestimate of the true economic burden of the environment on children's health?

The costs presented in this report are limited to four childhood health conditions. These were selected by considering previous analyses on the costs of environmental health conditions in children, the strength of existing research showing an association between the health condition and

environmental hazards, and the availability of data on disease burden and associated costs. For each condition, there are other costs associated with that condition that were not included (e.g., annual costs for lead treatment).

There are many other health conditions potentially related to the environment that were not included in the study, primarily because limited data and research made it difficult to estimate costs, understand environmental associations, and/or calculate environmental attributable fractions. Additionally, for some health conditions, such as birth defects, data on the total health burden in California do not exist and therefore could not be included in the study. Finally, there are adult-onset health conditions that may be related to environmental exposures during childhood, but were not considered in this study.

For these reasons, the costs presented in this report are likely underestimates of the true economic burden of the environment on children's health. Improving environmental health surveillance and availability of data would make it possible to examine a wider spectrum of environmental health conditions.

6. Why was this report developed?

This report was completed as a deliverable to the CDC's National Environmental Public Health Tracking (EPHT) Program, as part of their Economic Burden of Childhood Environmental Illnesses Project. The project was led by CEHTP, with participation from other EPHT-funded programs in Connecticut, Florida, Minnesota, New Hampshire, Oregon, and Utah.

The National EPHT program provides data on environmental hazards, exposures, and health outcomes to better understand how they are related to one another. The objective of this multi-state effort is to provide decision-makers with a better understanding of the impact of the environment on children's health and to consider the economic benefits of pollution prevention in future policies and programs.

7. Who conducted this study?

This study was conducted by the Public Health Institute's California Environmental Health Tracking Program, with funding from the U.S. Centers for Disease Control and Prevention.

Discussion and Future Directions

1. How can the study findings be used?

The findings from this study may be useful for policymakers when considering the costs and benefits of current and future regulations,

activities, or other efforts aimed at reducing environmental hazards. The findings may also be informative to public health professionals who want a better understanding of the environment's impact on health and on economic costs of poor health outcomes in children. Finally, the study findings clearly show that preventable environmental exposures are responsible for significant health and economic burden on children and families in California, which may stimulate further awareness of, research on, and resources for the prevention of these childhood health conditions.

2. Have previous efforts to reduce hazards resulted in cost savings?

There have been a number of state and federal initiatives aimed at reducing environmental hazards, as well as preventing and treating these childhood health conditions. Research has shown that prevention pays for itself. For example:

- The Clean Air Act's central benefits are estimated to outweigh the costs by a factor of 30 to 1[1]
- Federal standards that required the reduction and eventual removal of lead from gasoline have produced an estimated $200 billion in economic benefits each year since 1980[2]
- For each dollar invested in controlling hazards from lead paint, there is a $17-221 return in societal benefits[3]

Investing in efforts to reduce environmental hazards would improve health and have a beneficial economic impact on the lives of all Californians.

3. How might these childhood health conditions impact an individual's future economic and educational opportunities?

The health conditions resulting from exposure to these environmental hazards can have substantial human and economic impacts year after year and can significantly reduce the education and income potential for many of these children.

As the children grow, effects from these health conditions can impact their performance in school and, later on, in the workplace. For example, health conditions outlined in the study can result in absenteeism, reduced IQ, and behavioral problems — all of which can contribute to learning difficulties, limit educational and career opportunities, and negatively impact future job performance.

1 United States Environmental Protection Agency. Second Prospective Study—1990 to 2020. March 2011. Online at www.epa.gov/oar/sect812/prospective2.html, last accessed April 1, 2014.

2 Grosse SD, Matte TD, Schwartz J, Jackson RJ. 2002. *Economic Gains Resulting from the Reduction in Children's Exposure to Lead in the United State*. Environmental Health Perspectives. 110(6):563–569

3 Gould E. 2009. *Childhood Lead Poisoning: Conservative Estimates of the Social and Economic Benefits of Lead Hazard Control*. Environmental Health Perspectives. 117:1162–1167.

As a result, over the course of their lifetime, these children will, on average, have fewer economic opportunities and earn less income compared to children without these conditions. Furthermore, many of the environmental hazards related to the health conditions in this report are often most common in low-income communities and communities of color. The consequences of reduced economic and educational opportunities can extend beyond the individual child to affect their current and future families, resulting in multi-generational impacts that can further disadvantage these communities.

4. How might emerging environmental health concerns impact future health costs?

California has long been a leader in environmental stewardship. However, many environmental challenges remain and will be further impacted by emerging threats such as climate change, which is likely to be the most important environmental health issue of the coming century.

While difficult to predict the exact impact, scientists believe that many environmental hazards will worsen as California's climate changes. For example, climate change is predicted to result in more air pollution (including dust, pollen, and other allergens), greater water contamination and less predictable supplies, and increased pesticide use (in response to greater numbers of disease vectors and other pests) — all of which will impact children's health and have substantial economic costs.

As existing environmental hazards persist and new challenges arise, there will be a need for better data to keep track of these environmental issues and to understand their impact on individual well-being, community health, and California's economy. Data collection systems must evolve to accommodate the changing environment and provide information critical for addressing these issues.

5. Where can I get more information?

See www.phi.org/CEHTPKidsHealthCosts for additional resources on the four childhood health conditions and for other studies that examined the cost of the environment on childhood health.

Methods

1. How did you calculate the costs of health conditions due to the environment?

The study methods are based on seminal work from Landrigan et al. (2002)[4] and Trasande and Liu (2011).[5] Total preventable costs due to the environment were based on the following calculation:

Costs of each condition per individual case	x	Number of cases	x	Proportion of cases attributable to the environment	=	Total costs due to the environment

We estimated costs annually and over the lifetime. California state data sources were used when available, and cost estimates were inflated to match the value of the dollar in 2013.

To determine what proportion of each condition was related to preventable environment hazards, we utilized a concept called the EAF (environmental attributable fraction), which estimates the percentage of the health condition that is related to the environment and preventable.

The paper by Landrigan et al. describes EAFs for various health conditions. For the Landrigan study, an expert panel reviewed scientific literature and engaged in a consensus-based decision-making process to determine a range of EAF values and select the best estimate within these ranges for each health condition.

For this study, we calculated California-specific EAF estimates for asthma and cancer using: (1) the prevalence of the disease among children in California, (2) the risk of having the disease associated with each specific hazard, and (3) the prevalence of each hazard in California. This is the first time California-specific EAFs for asthma and cancer have been calculated. Details are available in Appendix B of the report, online at www.phi.org/CEHTPKidsHealthCosts.

For neurobehavioral disorders, we used the EAF estimate from Landrigan et al. For lead exposures, the EAF is 100% since this condition is related entirely to a preventable environmental hazard.

4 Landrigan PJ. Schechter CB. Lipton JM. Fahs MC. Schwartz J. 2002. *Environmental Pollutants and Disease in American Children: Estimates of Morbidity, Mortality, and Costs for Lead Poisoning, Asthma, Cancer, and Developmental Disabilities.* Environmental Health Perspectives 110: 721–728.

5 Trasande L, Liu Y. 2011. *Reducing the Staggering Costs of Environmental Disease in Children, Estimated at $76.6 Billion in 2008.* Health Affairs. 30(5):863–870.

2. What costs did you include in your calculations?

When available, we included data for direct medical costs, direct non-medical costs (such as special education), indirect costs (such as parental lost earnings), and lost earnings due to death or disability. Not all of the above examples were available or applicable for each health condition. Furthermore, the study did not account for other costs, such as over-the-counter medication. Therefore, findings likely represent an underestimate of the true economic burden of these health conditions.

3. Why didn't you calculate annual costs for lead exposure?

There are annual costs associated with lead exposure, such as treatment for children with high blood lead levels, housing relocation, special education, and crime. However, we limited our methods to those described in the seminal peer-reviewed article by Landrigan et al., which did not calculate annual costs for lead exposure. Therefore, these costs were not included in our study.

4. Why did you study these four childhood health conditions?

While many childhood health conditions have a relationship to the environment, this study focused on four childhood conditions where the scientific research clearly suggests an environmental association and where methods and data from previous research were available to conduct cost calculations. These conditions are asthma, cancer, neurobehavioral disorders, and lead exposures. The environmental and economic burden of these conditions has been assessed in previous studies.

For childhood cancers, we focused on cancers with the most consistent environmental association, which are also the most frequent childhood cancers: leukemia, lymphoma, and brain/central nervous system cancer. For neurobehavioral disorders, we focused on autism spectrum disorder, attention deficit and hyperactivity disorder, and intellectual disability. These are the disorders most commonly associated with the environment and have also been assessed in previous studies.

The study only considered health conditions that begin during childhood. It did not consider adult health conditions that may be related to environmental exposures in early life.

5. What environmental hazards were considered for this study?

For the purposes of this report, environmental hazards are defined as pollutants of human origin in the air, water, soil, and home. We considered hazards that are potentially preventable through public health prevention

and pollution mitigation. Some social factors (e.g., poverty) and individual behaviors (e.g., smoking) are excluded from this definition but have a very substantive impact on the selected environmental health conditions considered in this report.

Environmental hazards associated with children's health vary by each condition, though some hazards may be related to multiple health outcomes. The factors cited below are those most commonly associated with each child health condition, but not inclusive of all environmental hazards related to that condition. When calculating the California-specific EAFs for asthma and cancer, some hazards were excluded because of a lack of data on their exposure prevalence and/or an inability to prevent the exposure through public health efforts.

Asthma Environmental hazards associated with asthma include indoor hazards (secondhand smoke, mold and/or dampness, pests, pet dander, dust mites, chemicals found in consumer products) and outdoor hazards (air pollutants, wood burning, pollen, and extreme weather events). Environmental hazards included in this study's asthma EAF calculation were indoor hazards (secondhand smoke, mold and/or dampness) and outdoor hazards (traffic and ambient air pollutants).

Childhood Cancer Environmental hazards associated with the selected childhood cancers include x-rays, CT scans, radon, solvents, secondhand smoke, non-ionizing radiation, pesticides, traffic pollution, and nitrates in drinking water. Environmental hazards included in this study's cancer EAF calculation were indoor radon, secondhand smoke (in utero), solvents, parental occupational pesticides (in utero or childhood), residential pesticides, traffic pollution, and parental occupational traffic pollution.

Lead Exposure Lead exposures are caused entirely by lead in the environment. Lead in paint, dust, and soil are the leading cause of elevated blood lead levels in U.S. children. Lead can also be found in some imported foods, goods, certain traditional ethnic remedies, and metal jewelry.

Neurobehavioral disorders Most neurobehavioral disorders likely have a complex etiology — beginning in utero and continuing into childhood — which may include genes, the environment, and complex interactions between the two. Environmental factors associated with the selected neurobehavioral disorders include lead, chemicals in household products, pesticides, air pollution, and methylmercury and other metals that may be found in food and water.

6. Where did the data used in this study come from?

Several datasets were used to estimate the cost, number of cases, and environmental attributable fraction of each health condition included in the study. Most of the data used in the study came from existing datasets that were generated by state and federal agencies. Detailed information about the data is provided in the Appendix A of the report, available online at www.phi.org/CEHTPKidsHealthCosts.

7. Where can I get more details about the study methodology?

Details about the study methodology are provided in the report appendices, available online at www.phi.org/CEHTPKidsHealthCosts. The appendices describe methods used in the study to determine health burden, economic costs, and the California-specific environmental attributable fractions for asthma and cancer.

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