

Environmental Pollutants and Disease in New York State's Children: Estimates of Costs for Lead Poisoning, Asthma, Cancer, and Developmental Disabilities

Raphael Falk, Leonardo Trasande, Clyde Schechter, Nathan Graber, Joseph Boscarino, George Dunkel, Jessica Geslani, Evonne Kaplan-Liss, Jacqueline Moline, Richard K. Miller, Katrina Korfmacher, David Carpenter, Sophie Balk; Danielle Laraque, Philip J. Landrigan

Introduction

- **Basic Premise:** The impact of environmental factors, i.e. pollutants/toxins, on the health of children in New York State is significant and is not widely appreciated.
- **Purpose:** To provide accurate and useful data in a format (economic costs) that is applicable across fields in order to facilitate a discussion of how to improve children's health that can involve all necessary participants.

Background: Childhood Diseases of Environmental Origin

- Why childhood?
- Which diseases?
- Environmental origin?
- How to quantify?
 - Environmentally Attributable Fraction (EAF)
 - Delphi process
 - Estimate of fraction of entire disease burden that is due to environmental exposures

Methods: Environmentally Attributable Costs Model (Institute of Medicine)

$$\text{Costs} = \text{Disease Rate} \times \text{EAF} \times \\ \text{Population Size} \times \text{Cost per Case}$$

Data sources:

Incidence/Prevalence: NY DOH, CDC, U.S. Census
Bureau

Costs: CDC, U.S. Bureau of Labor Statistics, EPA, journal
articles

raphael.falk@mssm.edu if interested in specific sources.

Table 1: Estimated costs of pediatric lead poisoning, New York State, 2002.

EAF	=	100%
Main consequence	=	Loss of IQ over lifetime
Mean blood lead level in 2002 among 5-year-old children	=	1.9 µg/dL
A blood lead level of 1µg/dL	=	Mean loss of 0.257 IQ points per child
Therefore, 1.9 µg/dL	=	Mean loss of 0.488 IQ points per child
Loss of 1 IQ point	=	Loss of lifetime earnings of 2.00%
Therefore, loss of 0.488 IQ points	=	Loss of 0.98% of lifetime earnings
Economic consequences		
For boys: loss of 0.98% x \$1,151,933 (lifetime earnings) x 133,153	=	\$1.5 billion
For girls: loss of 0.98% x \$851,915 (lifetime earnings) x 127,097	=	\$1.1 billion
Total costs of pediatric lead poisoning	=	\$2.6 billion

Table 2: Estimated costs of pediatric asthma of environmental origin, New York State, 2002.

Medical and indirect costs	U.S. dollars
Hospital care	
Inpatient	44 million
Emergency room	23 million
Outpatient	12 million
Physicians' services	
Inpatient	4 million
Outpatient	67 million
Medications	178 million
Subtotal: medical costs	328 million
Indirect costs	
School days lost	135 million
Premature deaths	14 million
Subtotal: indirect costs	149 million
Total costs of pediatric asthma	477 million
EAF	30%
Environmentally attributable costs of pediatric asthma	143 million (range 48-167 million)

EAF estimated at 10, 30, and 35%.

Table 3: Estimated costs of pediatric cancer of environmental origin, New York State, 2002.

Costs	U.S. dollars
Medical costs (per primary case)	
Inpatient care	232,885
Outpatient care	25,057
Laboratory	323,287
Physicians' services	44,096
Subtotal: medical costs	625,325
Indirect morbidity costs (per primary case):	
Lost parental wages	16,227
Loss of IQ	72,430
Subtotal: indirect morbidity costs	88,657
Total morbidity costs per primary case	713,982
Morbidity costs of secondary cases^a	53,263
Morbidity costs per case for primary and subsequent secondary cancer	767,246
Total annual morbidity costs of childhood cancer^b	
Medical and indirect morbidity costs	471 million
Costs of premature deaths	99 million
Total morbidity costs	570 million
Costs of environmentally attributable pediatric cancer	29 million
	(range 11-57 million)

EAF estimated at 2, 5, and 10%.

^aPresent value of costs of second cases, 7.46% of above, excluding effects of radiation on IQ in second cancers.

^bBased on 614 new cases of childhood cancer per year.

Table 4: Estimated costs of neurobehavioral disorders of environmental origin, New York, 2002.

Lifetime costs per case of developmental disabilities	Mental retardation	Autism	Cerebral palsy
Physician visits	\$21,034	\$0	\$40,825
Prescription drugs	\$3,862	\$0	\$4,436
Hospitalization	\$33,147	\$5,450	\$21,587
Assistive devices	\$3,384	\$142	\$3,356
Therapy and rehabilitation	\$14,491	\$2,070	\$17,991
Long-term care	\$59,568	\$40,345	\$3,236
Home and auto modifications	\$971	\$701	\$2,297
Special education services	\$67,676	\$88,927	\$63,019
Home care	\$1,114,976	\$1,258,066	\$1,084,502
Productivity losses due to morbidity	\$94,400	\$72,583	\$90,931
Total lifetime costs per case	\$1,413,508	\$1,468,285	\$1,332,180
Annual incident cases	3,123	1,718	781
Annual incident cases not attributable to lead	3,045	1,718	781
Total costs per annual cohort	\$4.3 billion	\$2.5 billion	\$1.0 billion
Adjustment of costs for autism and cerebral palsy to account for co-existing mental retardation	0%	-34%	-15%
Total environmentally attributable costs of neurobehavioral disorders		\$1.7 billion	\$0.9 billion
		\$685 million (range \$0.3 - 1.4 billion)	

EAF estimated at 5, 10, or 20%.

Table 5: Estimated costs (billions) of pediatric disease of environmental origin, New York, 2002.

Disease	Best estimate	Low estimate	High estimate
Lead poisoning	\$2.56	\$2.56	\$2.56
Asthma	\$0.14	\$0.05	\$0.17
Cancer	\$0.03	\$0.01	\$0.06
Neurobehavioral disorders	\$0.69	\$0.34	\$1.37
Total	\$3.41	\$2.96	\$4.15

Discussion

- Weaknesses:
 - Uniformity of Data: Mix of National and State
 - Freshness of Data: Estimate is for 2002 (in 2002\$)
 - Unavoidable Assumptions in Estimate: Always conservative, though; much more likely to have underestimated than overestimated

Policy Implications

- Investment in clinical resources to treat environmental exposures and childhood environmental diseases is likely to be cost-effective.
- Funds have been allocated to establish statewide network of pediatric environmental health clinics ('05-'06, '06-'07, '07-'08, and '08-'09 annual budget allocations of \$40,000, \$200,000, \$500,000, and \$800,000, respectively).