

Calculating Value of Avoided ADHD Cases

From EPA's Economic Analysis for the Final Lead and Copper Rule Improvements, EPA 810-R-24-005

Sections 5.5.3 Concentration-Response Function for Lead and ADHD &

5.5.4 Valuation of Avoided ADHD

https://www.epa.gov/system/files/documents/2024-10/508_lcrl_final_ea_10-21-2024.pdf

Instructions:

1. Use EPA's All Ages Lead Model to Estimate Pre-Rule and Post-Rule Blood Lead Levels for 6 to 11 Year Old Child
2. Enter Pre-Rule and Post-Lead Blood Lead Levels in Yellow Highlighted Cell
3. Enter Population Expected to Benefit from Change in Blood Lead Level in Yellow Highlighted Cell
4. See Low-End and High-End Estimated Changes in Lifetime Earnings in Blue Highlighted Box.



5.5.3 Concentration-Response Function for Lead and ADHD

Variable	Value
Blood Pb _i	0.475 Initial blood lead (µg/dL)
Blood Pb _f	0.4275 Final blood lead (µg/dL)
Population	3,600,000 Number of children in the population of interest
ln(Blood Pb _i)	-0.744
ln(Blood Pb _f)	-0.850
X	0.105 ln(Blood Pb _i)-ln(Blood Pb _f)
p ₀	0.096 Baseline rate of ADHD in the population of interest (assumed to be 9.6% based on Danielson et al (2018).

Equation 11 using Ji et al. (2018) - Low-End Risk and Low-End Value

β ₁	0.223	Beta estimate from study: 0.223 using Ji et al. (2018) or 0.588 using Froelich et al. (2009)
e ^{β₁X}	0.977	
Y	0.979	(1-p ₀) * e ^{-β₁X} * p ₀
z	0.098	p ₀ / ((1-p ₀) * e ^{-β₁X} + p ₀)
y	-0.002	Estimate for one child (7,410.49)
ΔADHD	(7,410)	Change in number of children with ADHD among population of interest with change in blood lead level
Benefits of Avoided ADHD	\$ 128,559	Present value of avoided ADHD cases in 2022 USD at 2% discount rate
Age at ADHD Diagnosis	7	
Societal Benefits	\$ 952,684,950	Per year

Equation 11 using Froelich et al. (2009) - High-End Risk and High-End Value

β ₁	0.558	Beta estimate from study: 0.223 using Ji et al. (2018) or 0.588 using Froelich et al. (2009)
e ^{β₁X}	0.943	
Y	0.948	(1-p ₀) * e ^{-β₁X} * p ₀
z	0.101	p ₀ / ((1-p ₀) * e ^{-β₁X} + p ₀)
y	-0.005	Estimate for one child (18,809.00)
ΔADHD	(18,809)	Change in number of children with ADHD among population of interest with change in blood lead level
Benefits of Avoided ADHD	\$ 184,149	Present value of avoided ADHD cases in 2022 USD at 2% discount rate
Age at ADHD Diagnosis	11	
Societal Benefits	\$ 3,463,659,457	Per year

$$\Delta ADHD = \left[p_0 - \frac{p_0}{(1 - p_0) \times e^{-\beta_1(\ln(\text{Blood Pb}_i) - \ln(\text{Blood Pb}_f))} + p_0} \right] \times pop \quad (\text{Equation 11})$$

Where:

p₀ = Baseline rate of ADHD in the population of interest

β₁ = Beta estimate from study: 0.223 using Ji et al. (2018) or 0.588 using Froelich et al. (2009)

Blood Pb_i = Initial blood lead (µg/dL)

Blood Pb_f = Final blood lead (µg/dL)

pop = Number of children in the population of interest

Exhibit 5-26: Present Value of Avoided ADHD Cases 2022 USD, Per Case

Assumed Persistence of ADHD Into Adulthood	Age at ADHD Diagnosis	2% Discount Rate
90%	11 (High- Froelich)	\$184,149
29.3%	7 (Low- Ji)	\$128,559

Note: The EPA uses of the term "2 percent discount rate" with regard to the calculation of the ADHD high and low estimates is shorthand for a declining discount rate which begins with a 2 percent discount rate for the years 2024-2079, a 1.9 percent discount rate used for the years 2080-2085. This declining rate structure was implemented to comply with updates to OMB Circular A-4 guidance.