Effects of early childhood environmental exposures on elementary school test performance

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Children's Environmental Health Initiative

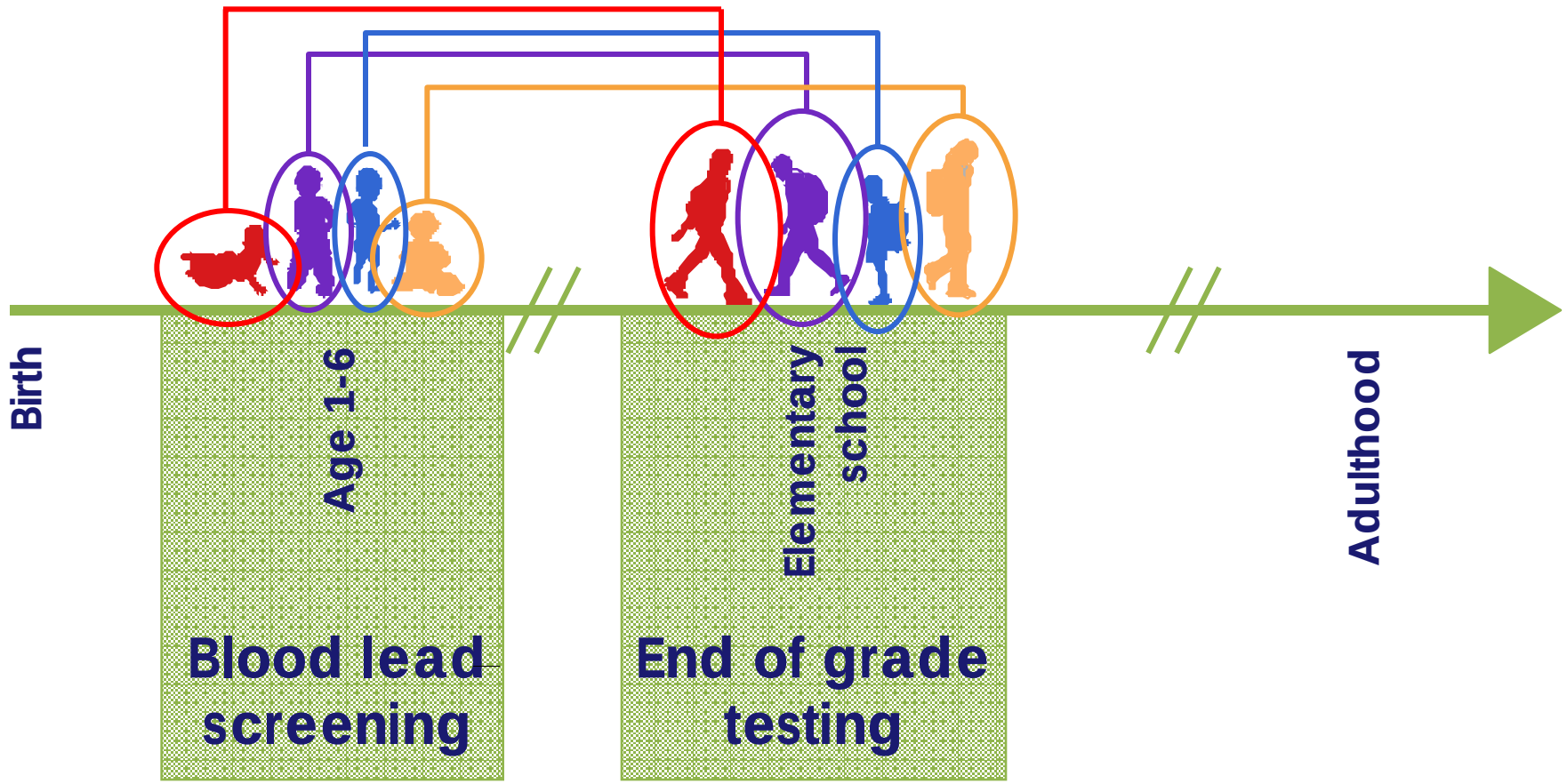
"A research, education, and outreach program committed to fostering environments where all children can proposer"

Research and Policy Questions

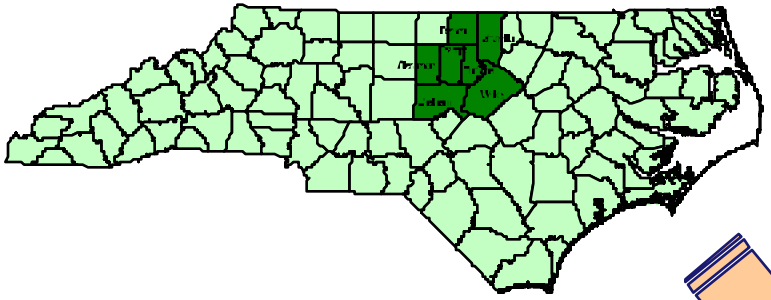
Lead exposure causes a well-documented series of neurological effects

- **Could differential exposure to lead account, in part, for the achievement gap between blacks and whites?**
- **How does the EOG distribution change by exposure to lead?**

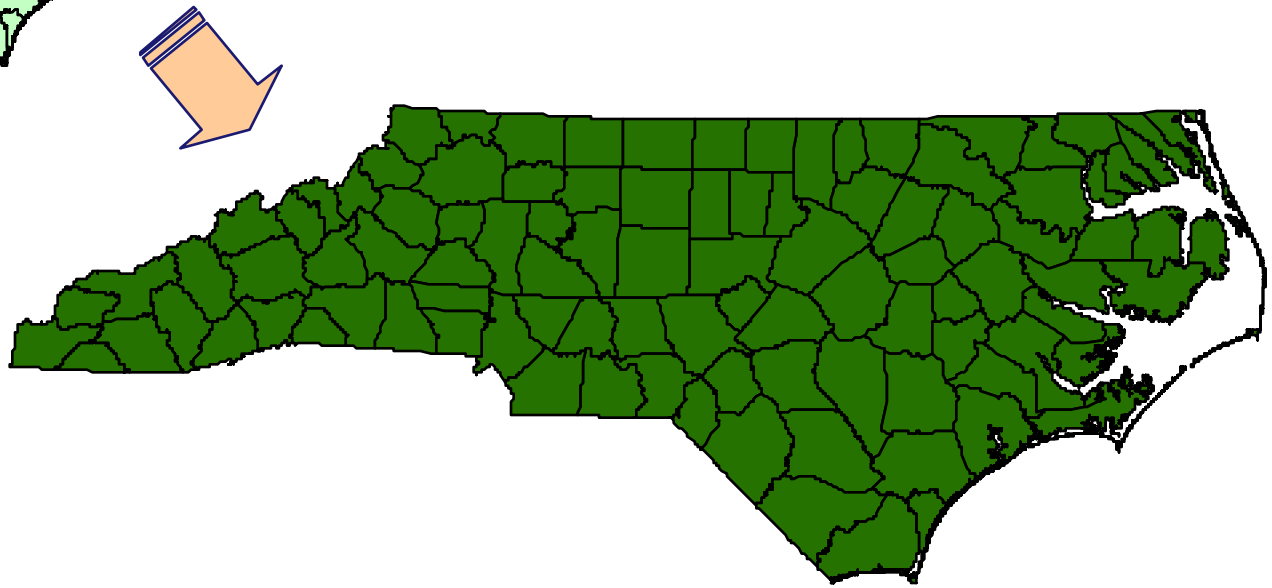
Linking Administrative Datasets



Progress in This Study



Results from 7-county study were published at *EHP* (Miranda et al., 07)

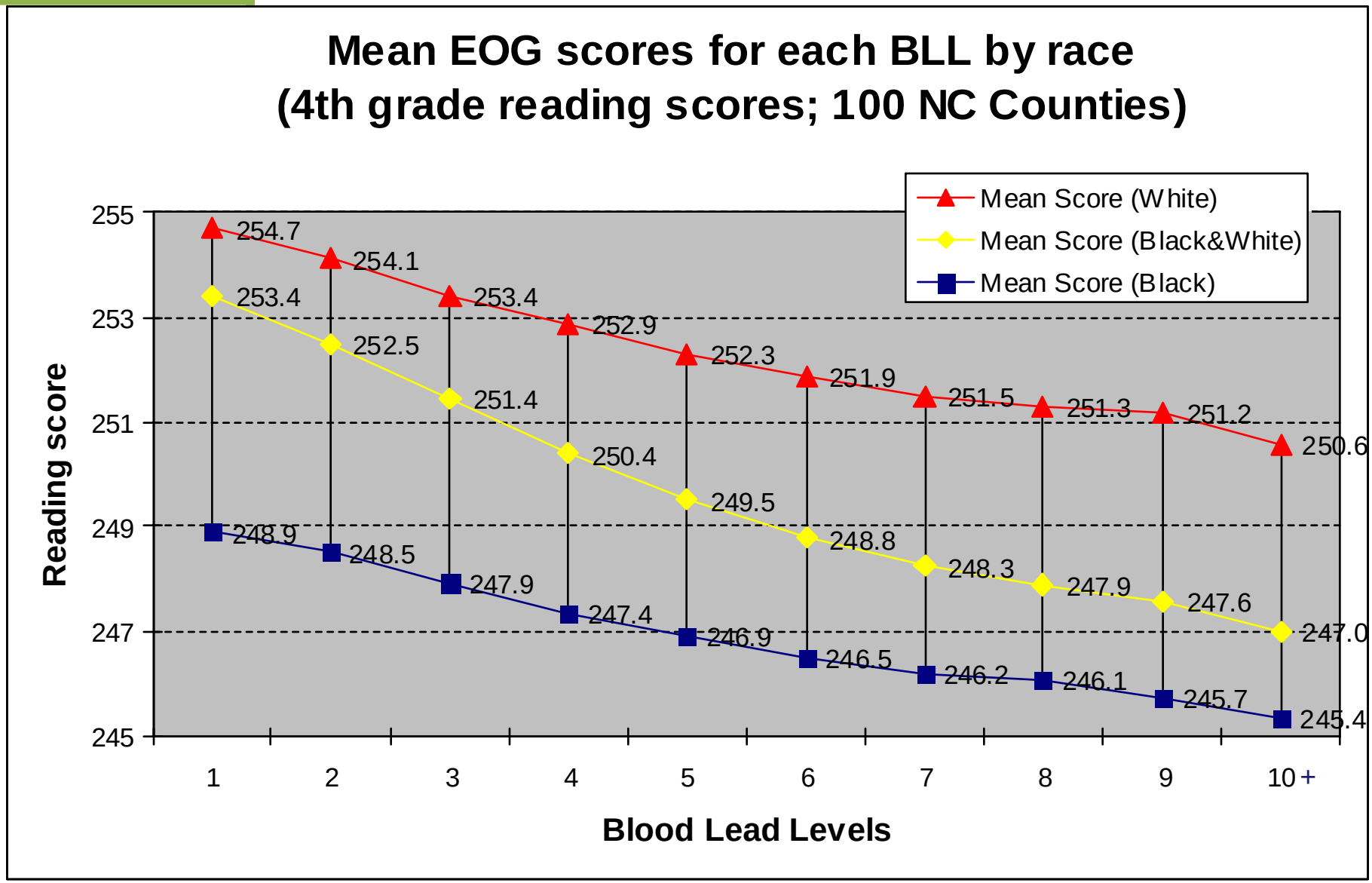


(1) Linking data for all 100 Counties in NC
(2) Further modeling to understand BLL effects better
(3) Handling selectivity bias

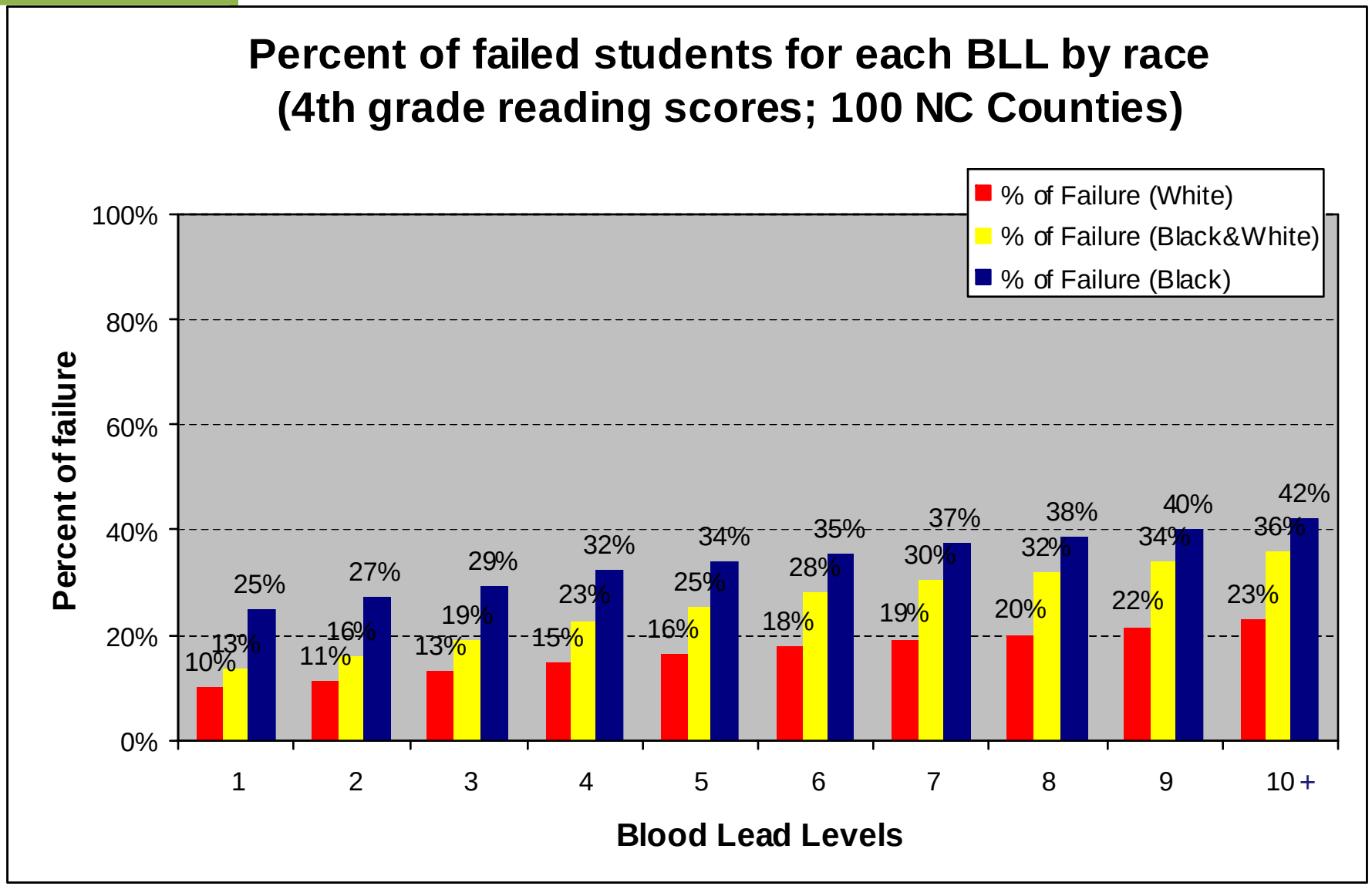
BLL/EOG Exploratory Analysis

BLL	White		Black		Total
1	9,622	77.5	2,789	22.5	12,411
2	17,282	70.8	7,113	29.2	24,395
3	19,703	63.5	11,343	36.5	31,046
4	15,115	55.1	12,315	44.9	27,430
5	9,667	47.8	10,539	52.2	20,206
6	5,802	41.9	8,033	58.1	13,835
7	3,362	38.6	5,341	61.4	8,703
8	1,851	34.5	3,522	65.6	5,373
9	1,181	33.3	2,364	66.7	3,545
10+	2,511	30.9	5,613	69.1	8,124
Total	86,096	55.5%	68,972	44.5%	155,068

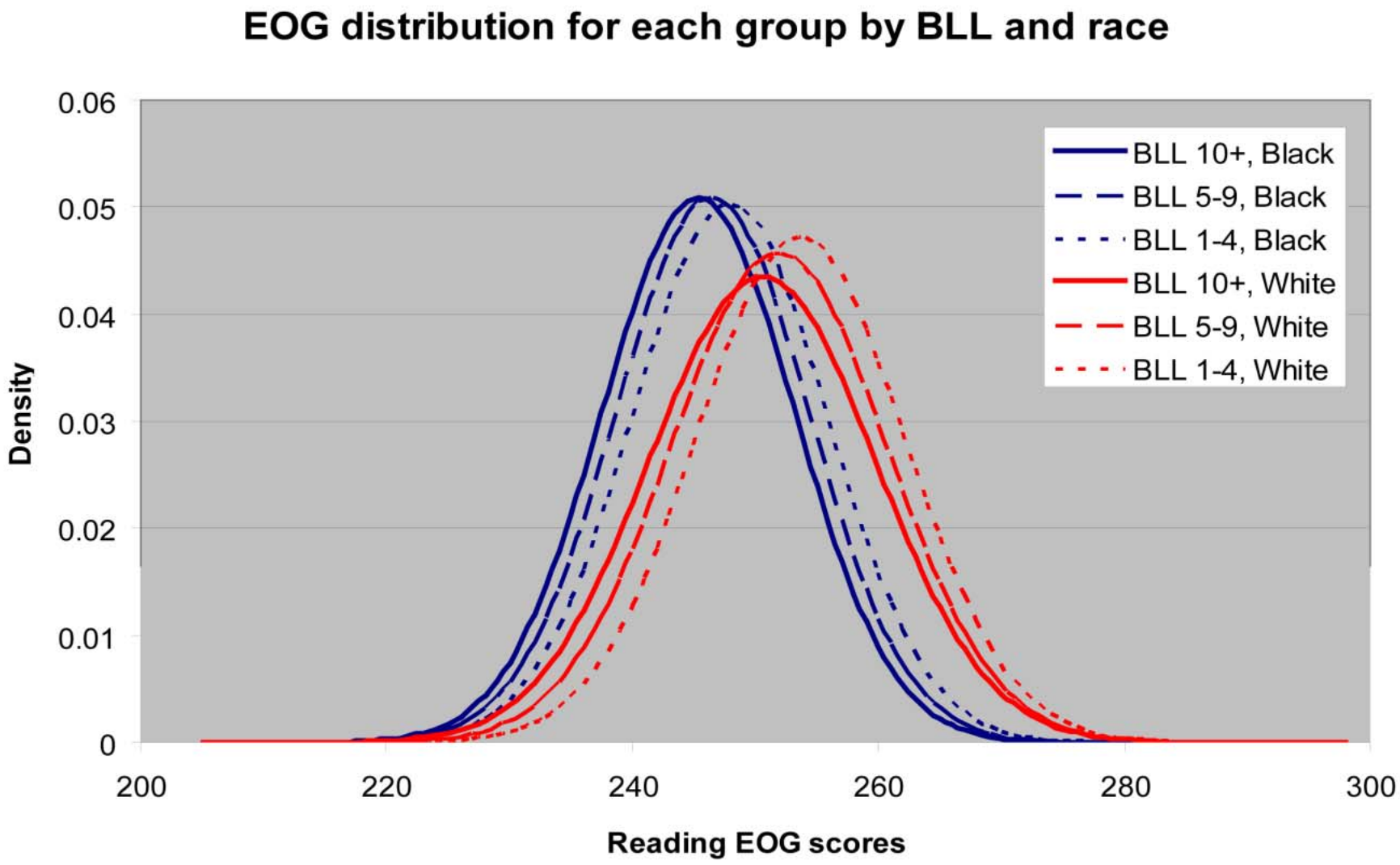
Lead Effect on Mean EOG Scores



Lead Effect on Test Failure Rate



EOG distribution for Race/BLL Groups (Raw Data)



Models

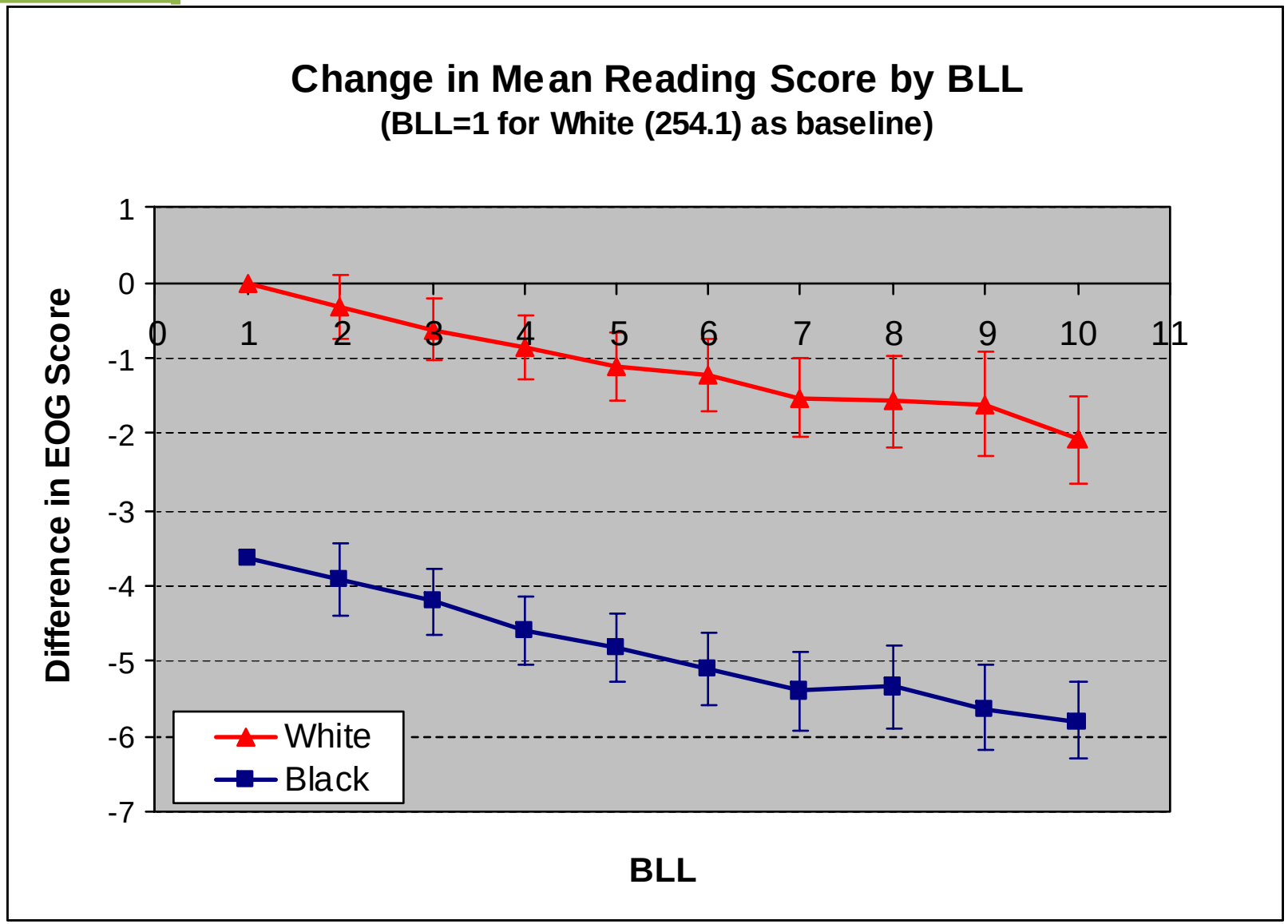
- Dependent variable: Reading subscores for 4th grade students
- BLL variable: indicator for each BLL (2,3,…,9, and 10+, with BLL=1 as referent)
- Covariates: Sex, Race, Enrollment in school lunch program, Parental education, Daily computer use, School systems (all significant with expected signs)
- Interaction between Race and BLL variables

(1) Standard regression model (OLS)

(2) Quantile regression model

- Actual EOG distribution at each BLL without assumption

Change in EOG by BLL (OLS with indicator for each BLL)



EOG distribution for Race/BLL (Predicted)

I will put here EOG distributions for:

- Black, BLL=10+
- Black, BLL=1
- White, BLL=10+
- White, BLL=1

(See my drawing)

Missing Data Issue: Imputation

76% of EOG data are unmatched with screening data

		Matched	Unmatched	Total
Mean reading score		250.5	251.5	251.2
% of free/reduced lunch		54.3%	35.4%	40.0%
% of black		44.5%	30.2%	33.7%
Parental education	Had some high school	11.1%	8.2%	8.9%
	Completed High school	49.1%	41.3%	43.2%
	Had post high school	25.5%	32.4%	30.7%
	Completed college	12.2%	15.4%	14.6%
	Completed grad school	2.1%	2.7%	2.6%
% of charter school		1.7%	1.6%	1.6%
Blood lead level		4.5	?	?

Research and Policy Questions

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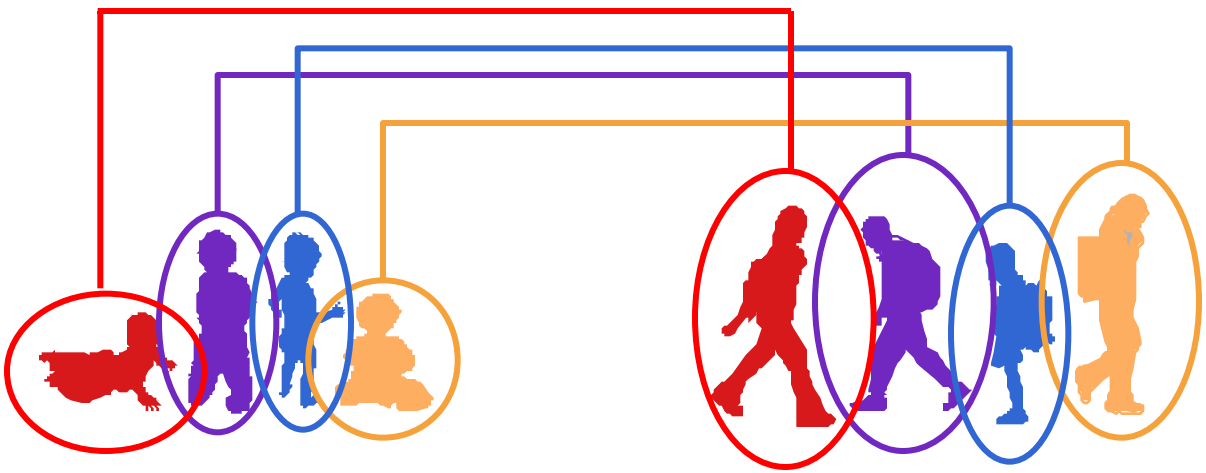
- **Could differential exposure to lead account, in part, for the achievement gap between blacks and whites?** **Yes**
- **Does the EOG distribution change by exposure to lead?**

Black: Shift downward

White: Shift downward + Left-skewed

Policy Implications

- Reduction in CDC blood lead action level
- Early environmental interventions
- Environmental component to educational interventions
- Eligibility criteria for access to special educational resources



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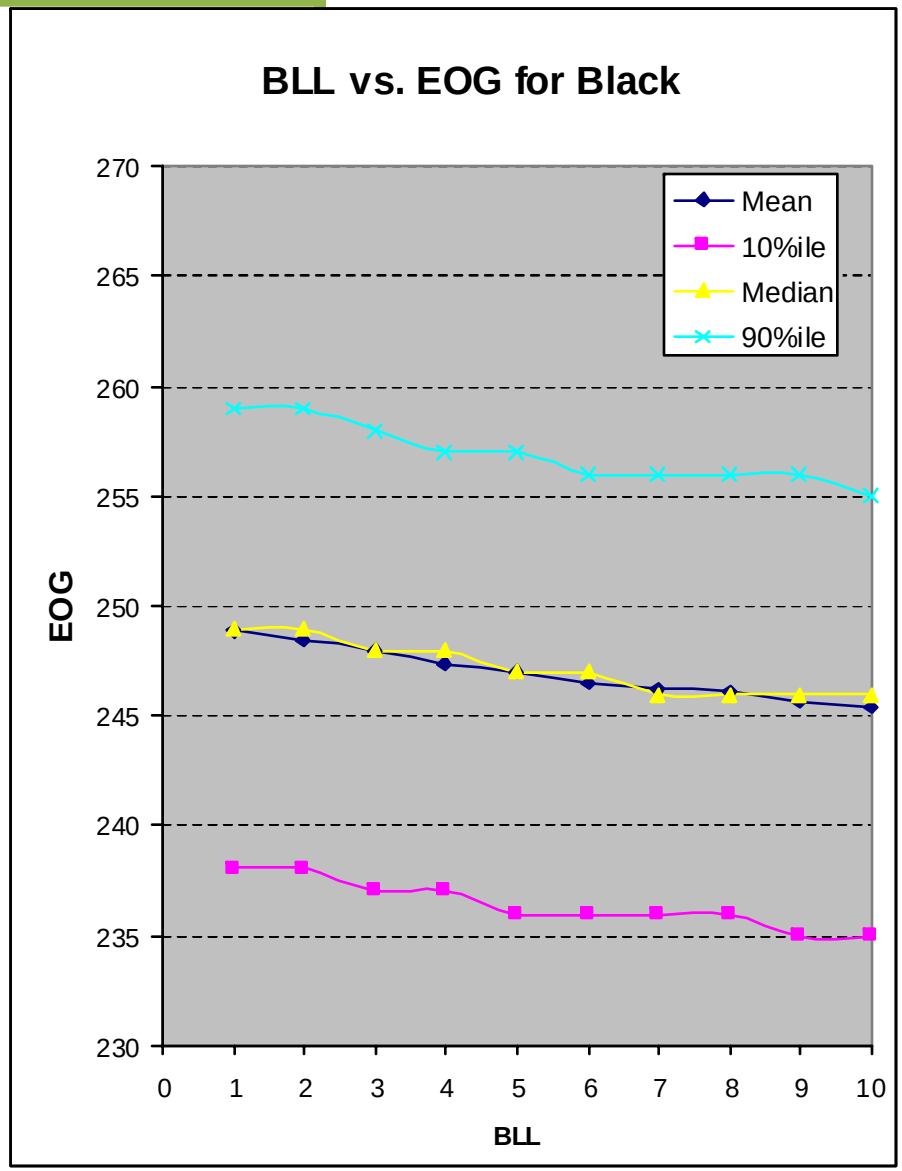
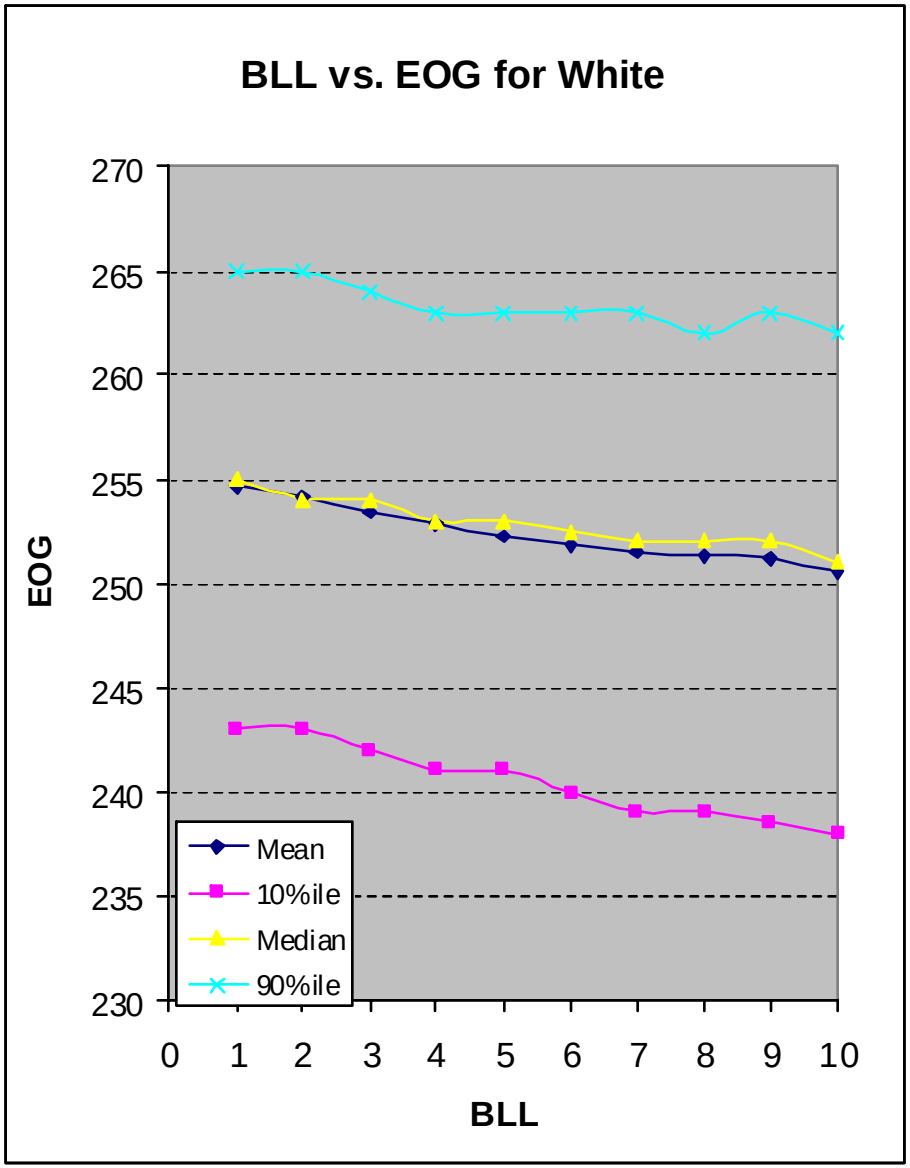
- Office of Research Support, Duke University

http://www.nicholas.duke.edu/cehi/

EOG for each BLL at 10, 50, 90 percentile (Raw Data)





Estimated EOG for Each BLL: Quantile Regression Results