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Comments on 2nd External Review Draft of "Health Risk and Exposure Assessment for Ozone"

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Presentation to CASAC on behalf of UARG

March 26, 2014

Insight in Economics™

Population Inputs to BenMAP-Based Risk Estimates for Urban Areas Seem to Have Large Percent Errors

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	Population (2009, ages 0-99)					
	CBSA			Epi-Study Area		
	Using EPA Shapefile	From BenMAP County Data	% Error	Using EPA Shapefile	From BenMAP County Data	% Error
Atlanta, GA	5,991,005	4,962,417	21%	4,462,663	1,589,914	181%
Baltimore, MD	5,437,691	2,692,803	102%	1,953,317	621,420	214%
Boston, MA	7,553,629	4,519,142	67%	3,609,318	715,296	405%
Cleveland, OH	3,404,546	2,082,741	63%	2,786,348	1,287,137	116%
Denver, CO	3,714,085	2,498,578*	49%	2,737,299	1,578,451	73%
Detroit, MI	5,620,925	4,316,185	30%	4,377,305	1,842,465	138%
Houston, TX	6,437,742	5,823,528	11%	5,769,285	4,017,371	44%
Los Angeles, CA	21,587,310	12,756,236	69%	16,403,420	9,776,644	68%
New York, NY	16,202,260	18,779,755	-14%	13,239,830	9,066,479	46%
Philadelphia, PA	7,904,328	5,936,034	33%	4,737,330	1,513,040	213%
Sacramento, CA	4,770,990	2,127,784	124%	4,341,150	1,405,572	209%
St. Louis, MO	3,369,708	2,769,353	22%	1,855,249	319,302	481%

*Broomfield County, Colorado is missing from the BenMAP county database. 2010 census population is included in lieu.

Used in HREA risk estimates

Correct values (by adding up county populations)

Used in HREA risk estimates

Correct values (by adding up county populations)

Confidential

Any Error in the Population Inputs Affects Many Tables and Figures in the HREA

Preliminary List of Tables and Figures in HREA Affected by Population Errors	
Table 7-7	Figure 7B-4
Figure 7-2	Table 7B-3
Figure 7-3	Table 7B-4
Table 7-9	Table 7B-5
Table 7-10	Table 7B-6
Table 7-11	Table 7B-7
Table 7-12	Table 7C-1
Appendix 7A	Table 7C-2
Table 7B-1	Table 7C-3
Table 7B-2	Table 7C-4
Figure 7B-1	Table 7C-5
Figure 7B-2	Table 7C-6
Figure 7B-3	Table 7C-7

….. And these impacts will carry over into parts of the Policy Assessment document

This Error Might Result from a Bug in EPA's BenMAP Model

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e.g., from EPA's BenMAP Website:

"Under certain circumstances, the program may not aggregate reliably the results from finer to coarser scales, particularly in cases where the coarser-scale grid is irregularly shaped. This error does not affect the total size of the results, but rather the way in which those results are spatially distributed. We have developed an interim fix to this problem, allowing users to generate reliable results when aggregating between the 12km and 36km CMAQ grids and the County, State, and Nation grids in the United States setup."

"BenMAP-CE 1.0.2 Known Issues" (pdf)
http://www.epa.gov/airquality/benmap/models/BenMAP_CE_Known_Issues_1.0.2.pdf

The HREA relied on a beta-test version of BenMAP-CE

Long-Term Respiratory Mortality Risk:
Jerrett *et al.* (2009) Finds a Threshold Model Is a Better Fit than a No-Threshold Model

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Jerrett *et al.*'s Supplemental Appendix, Table 3S reports -2*log likelihood values for alternative models:

Threshold Value (ppb)	With Adjustment for Ecological Covariates
No Ozone	143,797.72
0	143,758.93
45	143,756.73
50	143,756.72
55	143,755.58 (p=0.067)
56*	**143,755.39 (p=0.0600) (β=0.00432, se=0.00121)**
57	143,755.87(p=0.0802)

*: Smallest -2*log likelihood values, indicating the best fit to the data.

Figure 2 illustrates the shape of the relation between exposure to ozone and death from respiratory causes. There was limited evidence that a threshold model specification improved model fit as compared with a nonthreshold linear model (P=0.06) (Table 3S in the Supplementary Appendix).

(p. 1091-1092)

Also from Jerrett *et al.* (p. 1094):

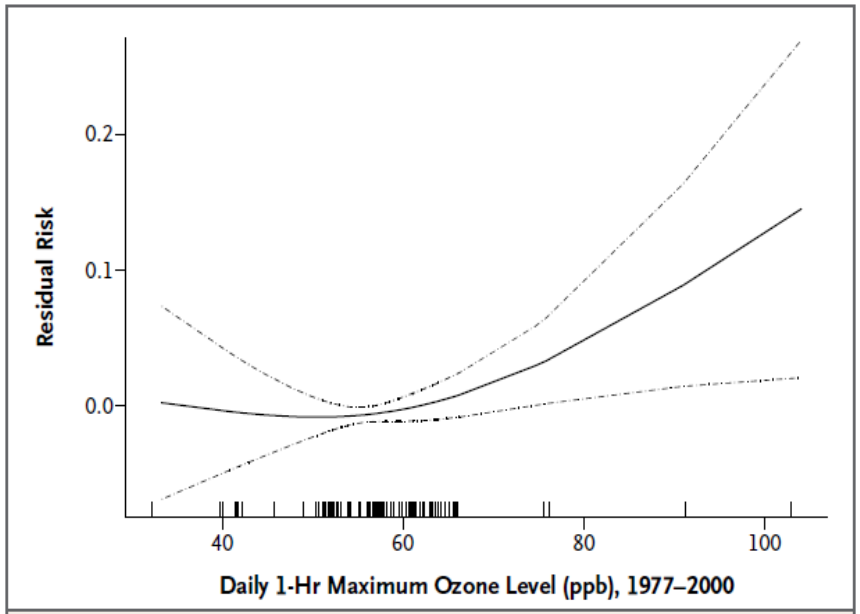

Figure 2. Exposure–Response Curve for the Relation between Exposure to Ozone and the Risk of Death from Respiratory Causes.

Long-Term Respiratory Mortality Risk:

HREA Risk Estimates Are Extremely Sensitive to Alternative Models in Jerrett *et al*.

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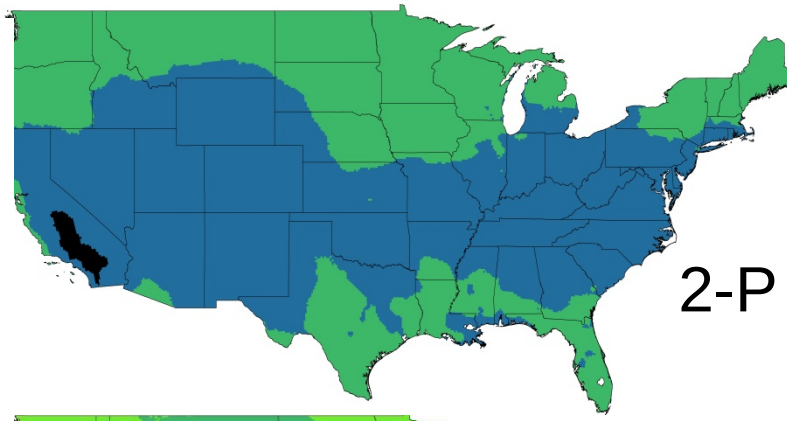
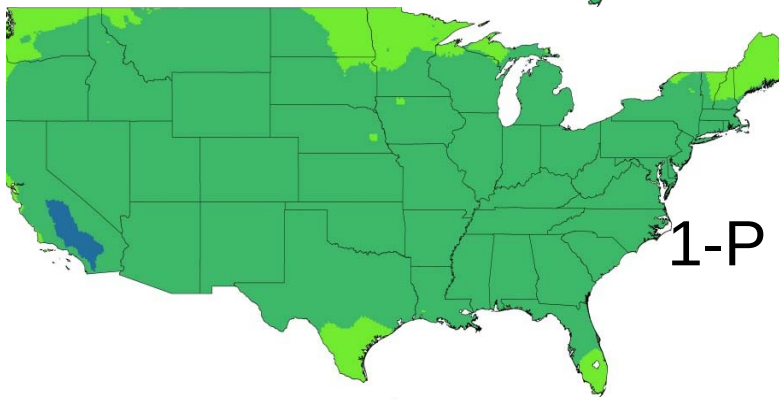
% of Respiratory Mortality Attributed to Ozone (2007)

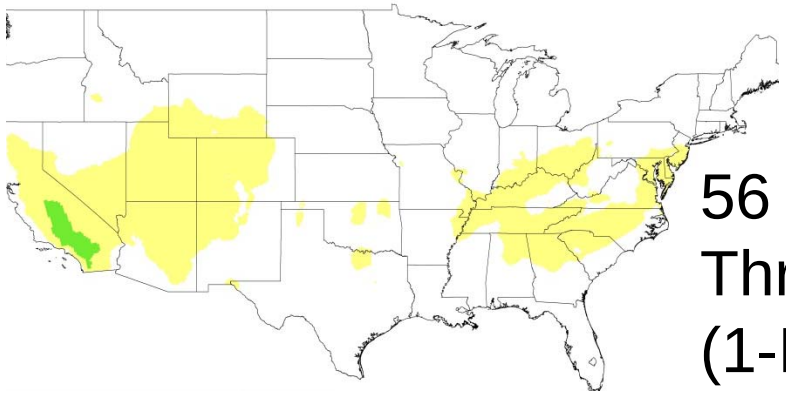


2-P Model

USED IN HREA

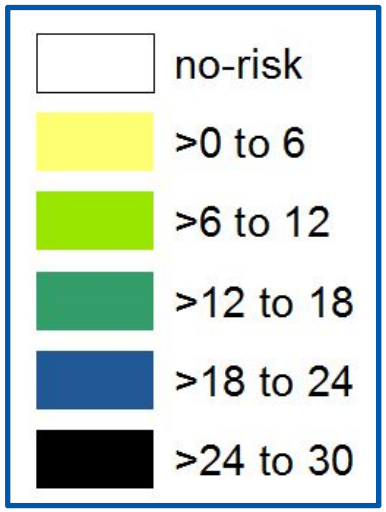


1-P Model



56 ppb Threshold Model (1-P)

BEST FIT of 1-P models



Long-Term Respiratory Mortality Risk:

Evidence on Long-Term Respiratory Mortality Is Too Uncertain to Include in the HREA

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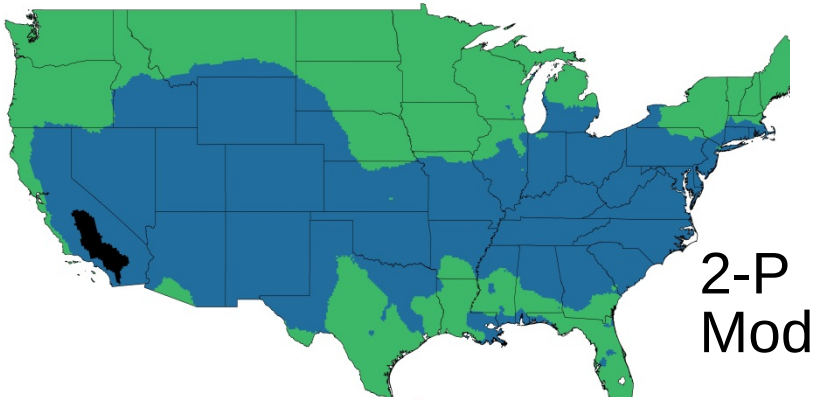
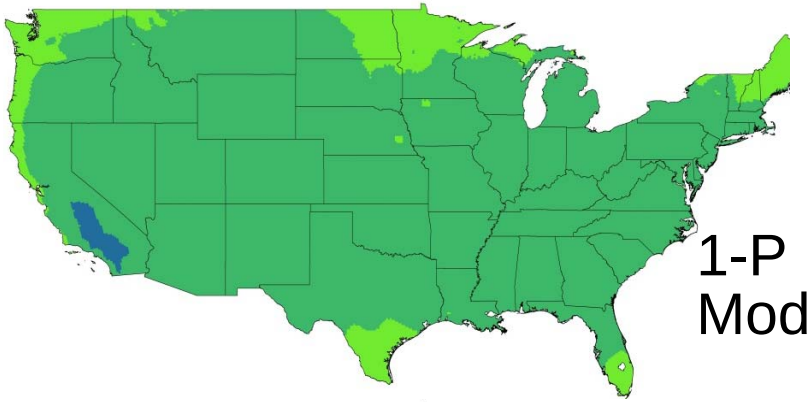
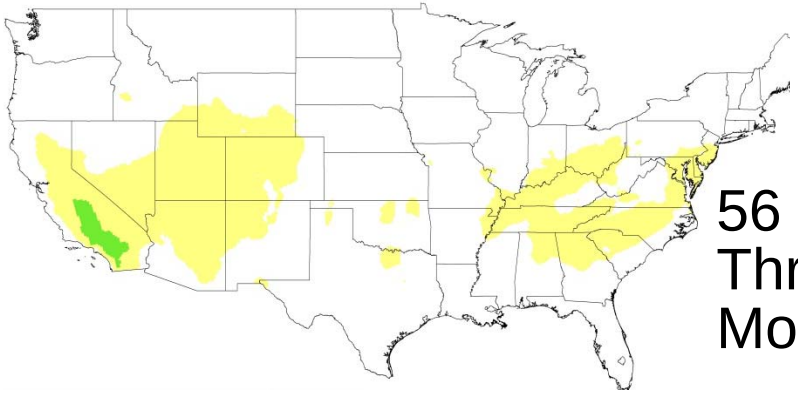


2-P Model



1-P Model

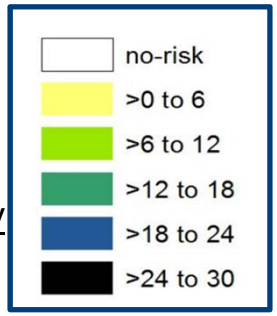


56 ppb Threshold Model (1-P)

The 3 epidemiological models that produce these 3 sets of risk estimates are statistically indistinguishable.

These 3 sets of risk estimates reflect the actual uncertainty about this relationship … <u>not</u> the variance around any one model's risk coefficient.

<u>% of Respiratory Mortality Attributed to Ozone (2007)</u>



Long-Term Respiratory Mortality Risk:

The HREA's Risk Calculation Assumes Higher Base Risk Than Found in Jerrett *et al.*

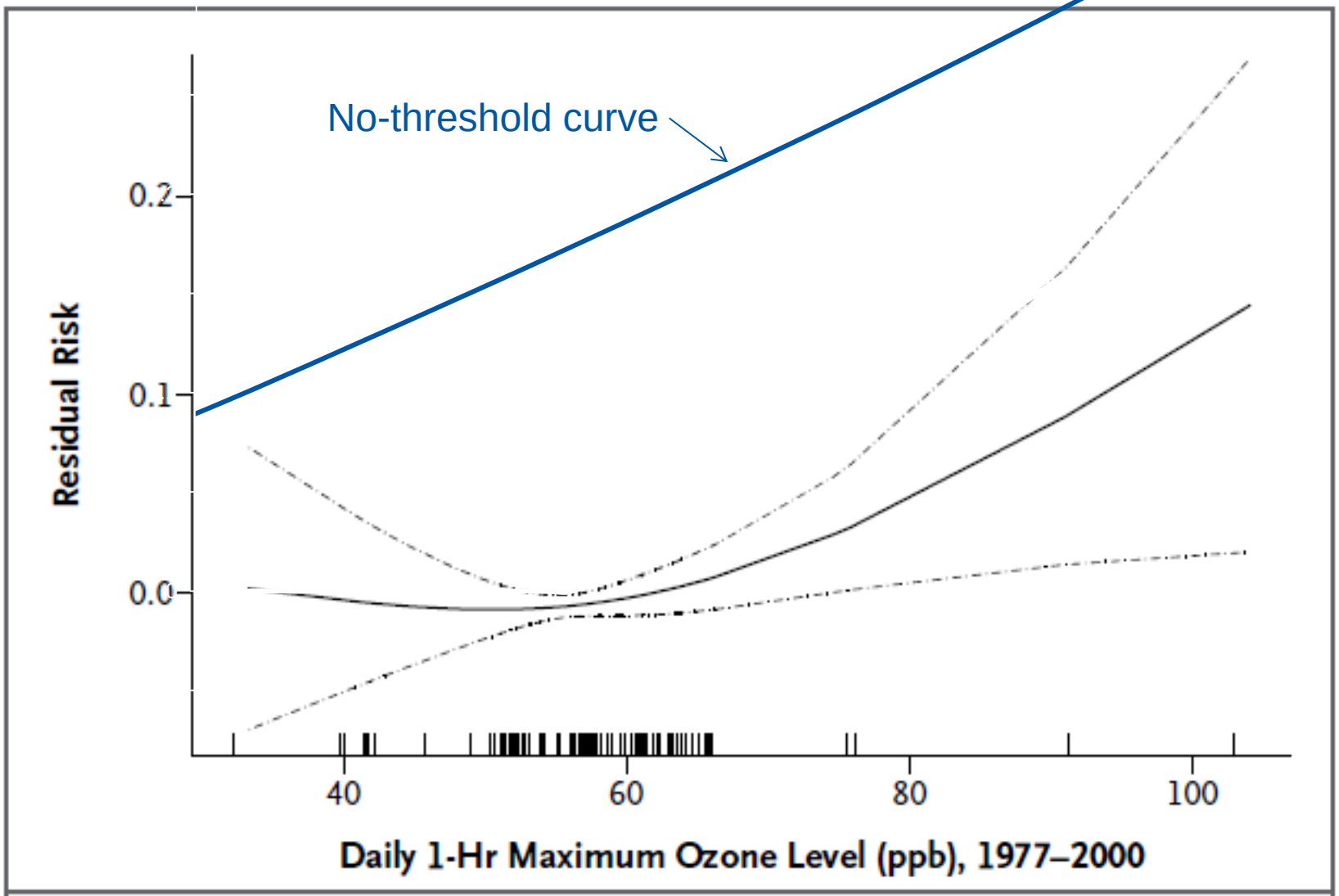


Figure 2. Exposure–Response Curve for the Relation between Exposure to Ozone and the Risk of Death from Respiratory Causes.

Long-Term Respiratory Mortality Risk:

The 56 ppb Threshold Model Matches the Jerrett *et al*. Curve Much Better

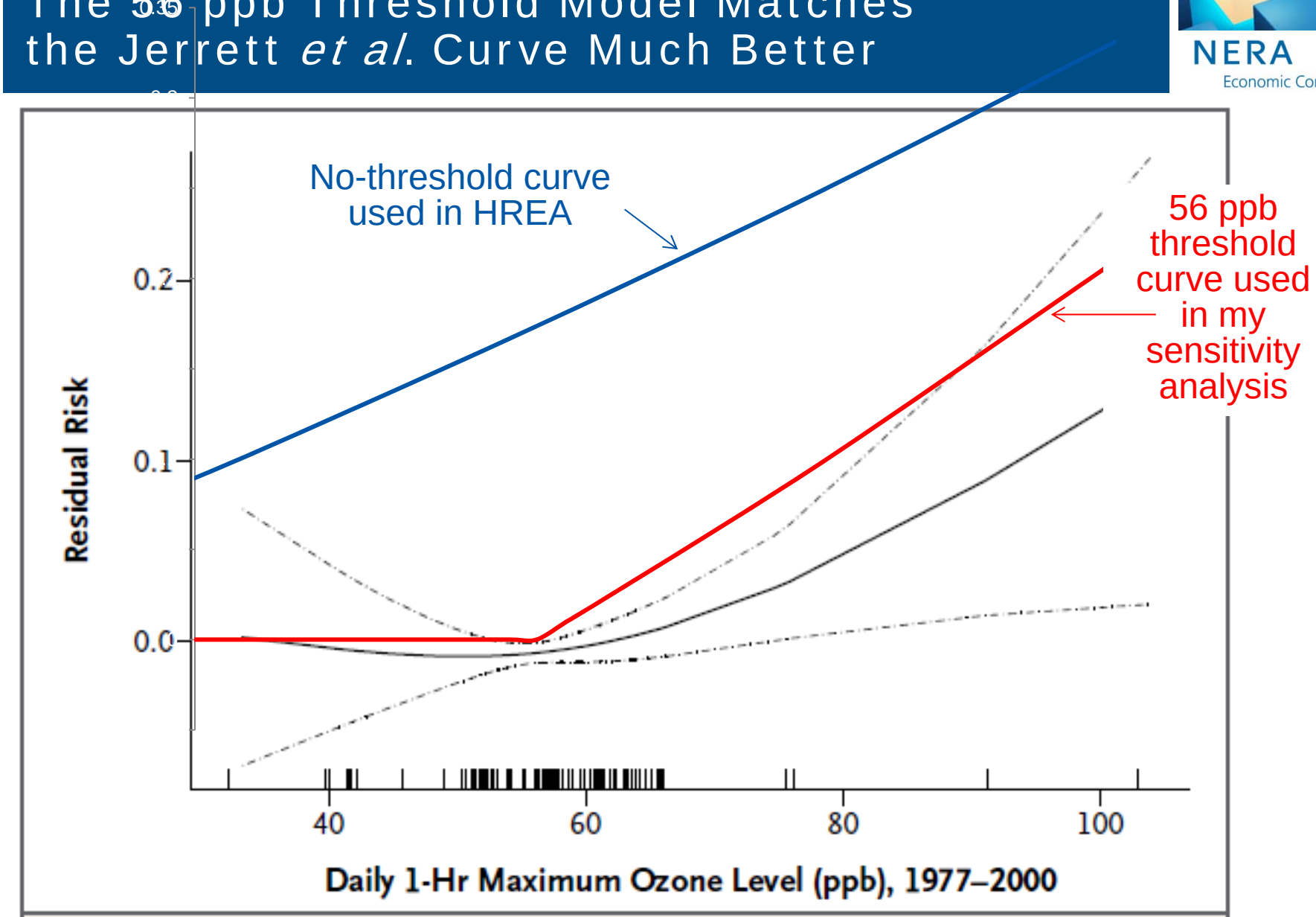
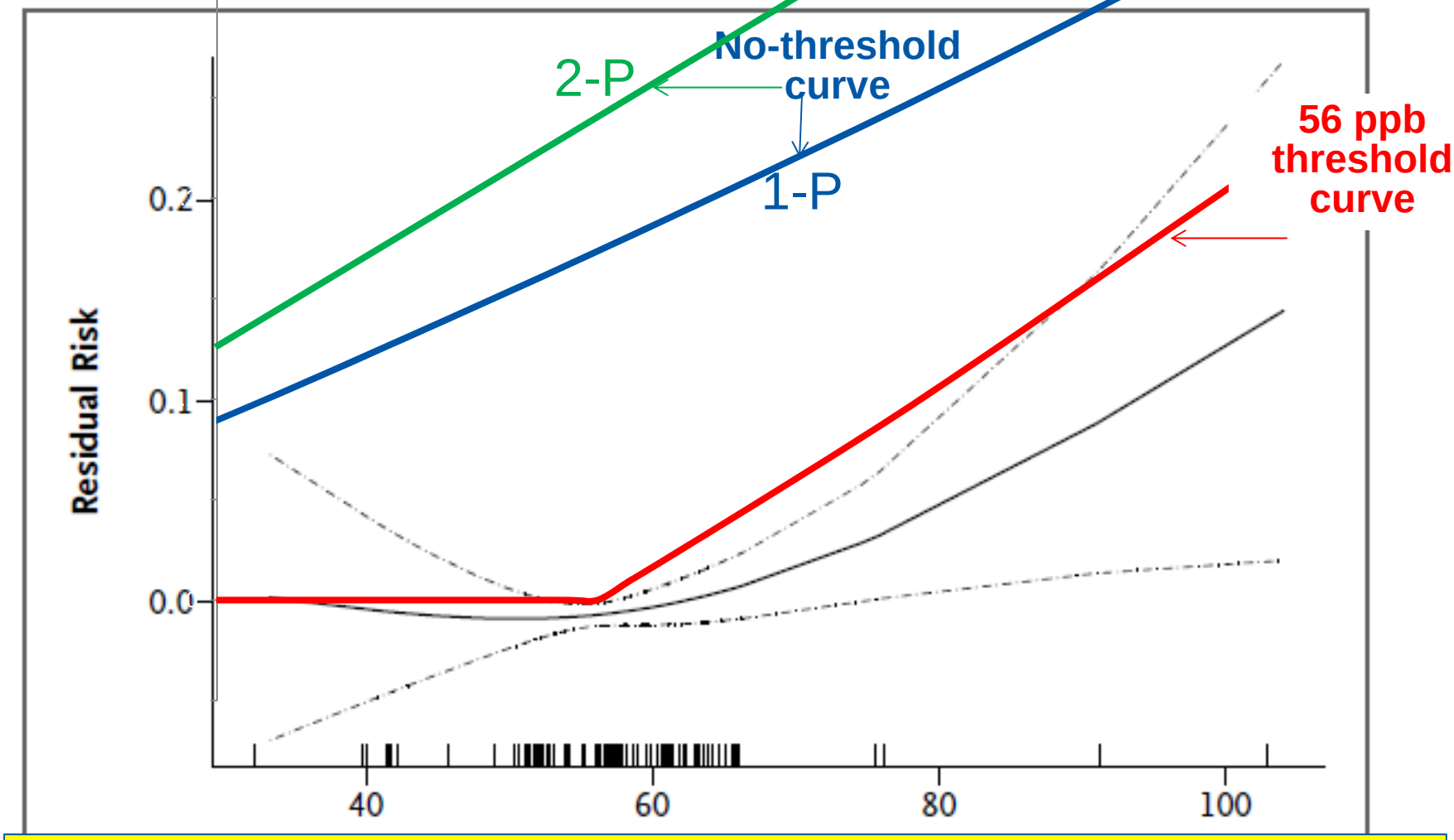


Figure 2. Exposure–Response Curve for the Relation between Exposure to Ozone and the Risk of Death from Respiratory Causes.

Long-Term Respiratory Mortality Risk:

All No-Threshold Models Overstate Residual Risk When Used in a Risk Analysis Calculation



This is why the threshold model should be the core model in a risk analysis, not just a sensitivity analysis

to Ozone and the Risk of Death from Respiratory Causes.

Limits of Domestic Policy Action:

The HREA Should Report Risk Estimates Using Its "US Zero-Out" CMAQ Run Outputs

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Table 2-4 of PA:

All days, CMAQ	ATL	BAL	BOS	CLE	DEN	DET	HOU	LA	NYC	PHI	SAC	STL
Model MDA8 seasonal mean	58.6	55.6	45.2	51.8	57.1	43.5	49.4	54.8	47.7	50.5	51.9	52.6
Model MDA8 seasonal mean from USB emissions	30.0	29.9	28.5	31.6	42.2	31.7	33.0	33.3	29.1	29.4	34.4	32.0
Fractional contribution from background	0.51	0.54	0.63	0.61	0.74	0.73	0.67	0.61	0.61	0.58	0.66	0.61

An additional set of risk estimates can be created using "zero-out" CMAQ run outputs

Short-Term Mortality Risk Estimates in HREA:

CBSA	Base	75 ppb	70 ppb	65 ppb	60 ppb	Irreducible Minimum
Atlanta, GA	300	270	260	250	230	170
Baltimore, MD	470	440	430	420	400	280
Boston, MA	360	350	350	330	320	230
Cleveland, OH	430	430	420	400	370	310
Denver, CO	87	86	84	82	79	70
Detroit, MI	660	660	630	610	590	440
Houston, TX	640	680	680	670	660	580(*)
Los Angeles, CA	1100	1300	1200	1200	1100	880(*)
New York, NY	3000	2800	2700	2200	N/A	2000
Philadelphia, PA	1300	1200	1200	1200	1100	790
Sacramento, CA	380	370	360	350	340	310(*)
St. Louis, MO	460	430	410	390	370	300

(*) Risk for this city is based on January-December, while the only USB estimate currently provided by EPA is for April-October, making it possible that the irreducible risk estimate for this city is inaccurate.

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