United States Environmental Protection Agency

Health Risk and Exposure Assessment for Ozone

Final Report

Chapters 7-9 Appendices

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Health Risk and Exposure Assessment for Ozone

Final Report

Chapters 7-9 Appendices

U.S. Environmental Protection Agency

Office of Air and Radiation

Office of Air Quality Planning and Standards

Health and Environmental Impacts Division

Risk and Benefits Group

Research Triangle Park, North Carolina 27711

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This final document has been prepared by staff from the Risk and Benefits Group, Health and Environmental Impacts Division, Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency. Any findings and conclusions are those of the authors and do not necessarily reflect the views of the Agency.

Questions related to this document should be addressed to Dr. Bryan Hubbell, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, C539-07, Research Triangle Park, North Carolina 27711 (email: hubbell.bryan@epa.gov).

CHAPTERS 7-9 APPENDICES

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APPENDIX 7A

Detailed Information on Effect Estimates, Baseline Incidence and Demographic Data Used in the Epidemiological-Based Risk Assessment

This Appendix contains one table (Table 7A-1) summarizing the effect estimates, baseline incidence, and population data used for the epidemiological-based risk assessment. References are included immediately following the table.

Table 7A-1. Detailed Information on Effect Estimates, Baseline Incidence and Demographic Data Used in the Epidemiological-Based Risk Assessment.

Endpoint	Study	Urban study area	Study area template	Study information (C-R function)								Baseline incidence[b]		Population	
				Air metric	Risk assessment modeling period	Age range	Lag	Additional study details	Statistical Model	Effect estimate (Beta)	SE (effect estimate)[a]	2007	2009	2007	2009
Core Risk - short-term exposure-related all-cause mortality															
Mortality, Non-Accidental	Smith et al., 2009	Atlanta, GA	CBSA	D8HourMax	March-October	0-99	distributed lag 0-6 d	-	log-linear	0.0002411	0.0002919	19,995	20,442	5,033,453	5,205,933
Mortality, Non-Accidental	Smith et al., 2009	Baltimore, MD	CBSA	D8HourMax	April-October	0-99	distributed lag 0-6 d	-	log-linear	0.0004192	0.00033	11,703	11,598	2,664,335	2,692,803
Mortality, Non-Accidental	Smith et al., 2009	Boston, MA	CBSA	D8HourMax	April-September	0-99	distributed lag 0-6 d	-	log-linear	0.0002807	0.0003429	16,688	16,436	4,439,453	4,519,143
Mortality, Non-Accidental	Smith et al., 2009	Cleveland, OH	CBSA	D8HourMax	April-October	0-99	distributed lag 0-6 d	-	log-linear	0.0005654	0.0003149	10,964	10,692	2,093,376	2,082,741
Mortality, Non-Accidental	Smith et al., 2009	Denver, CO	CBSA	D8HourMax	March-September	0-99	distributed lag 0-6 d	-	log-linear	0.0001657	0.0003565	6,750	6,856	2,408,986	2,498,144
Mortality, Non-Accidental	Smith et al., 2009	Detroit, MI	CBSA	D8HourMax	April-September	0-99	distributed lag 0-6 d	-	log-linear	0.0006432	0.0003117	17,169	16,815	4,381,785	4,316,185
Mortality, Non-Accidental	Smith et al., 2009	Houston, TX	CBSA	D8HourMax	January-December	0-99	distributed lag 0-6 d	-	log-linear	0.0004999	0.0002075	30,191	30,927	5,539,894	5,823,529
Mortality, Non-Accidental	Smith et al., 2009	Los Angeles, CA	CBSA	D8HourMax	January-December	0-99	distributed lag 0-6 d	-	log-linear	0.0002179	0.0001571	72,824	72,935	12,615,165	12,756,237
Mortality, Non-Accidental	Smith et al., 2009	New York, NY	CBSA	D8HourMax	April-October	0-99	distributed lag 0-6 d	-	log-linear	0.0010114	0.0002074	78,036	76,645	18,554,574	18,779,754
Mortality, Non-Accidental	Smith et al., 2009	Philadelphia, PA	CBSA	D8HourMax	April-October	0-99	distributed lag 0-6 d	-	log-linear	0.000714	0.0002846	28,177	27,658	5,876,683	5,936,034
Mortality, Non-Accidental	Smith et al., 2009	Sacramento, CA	CBSA	D8HourMax	January-December	0-99	distributed lag 0-6 d	-	log-linear	0.0003016	0.0003145	13,198	13,361	2,077,487	2,127,784
Mortality, Non-Accidental	Smith et al., 2009	St. Louis, MO	CBSA	D8HourMax	April-October	0-99	distributed lag 0-6 d	-	log-linear	0.0005401	0.0003428	13,944	13,686	2,779,558	2,803,333
Core Risk - long-term exposure-related respiratory mortality															
Mortality, Respiratory	Jerrett et al., 2009	Atlanta, GA	CBSA	Seasonal-avg D1hrMax	April-September	30-99	NA	-	log-linear	0.0039221	0.0013249	3,133	3,216	2,833,399	2,954,650
Mortality, Respiratory	Jerrett et al., 2009	Baltimore, MD	CBSA	Seasonal-avg D1hrMax	April-September	30-99	NA	-	log-linear	0.0039221	0.0013249	2,056	2,034	1,587,538	1,609,957
Mortality, Respiratory	Jerrett et al., 2009	Boston, MA	CBSA	Seasonal-avg D1hrMax	April-September	30-99	NA	-	log-linear	0.0039221	0.0013249	3,685	3,622	2,690,981	2,747,634

Endpoint	Study	Urban study area	Study area template	Study information (C-R function)								Baseline incidence[b]		Population	
				Air metric	Risk assessment modeling period	Age range	Lag	Additional study details	Statistical Model	Effect estimate (Beta)	SE (effect estimate)[a]	2007	2009	2007	2009
Mortality, Respiratory	Jerrett et al., 2009	Cleveland, OH	CBSA	Seasonal-avg D1hrMax	April-September	30-99	NA	-	log-linear	0.0039221	0.0013249	1,833	1,783	1,294,458	1,294,845
Mortality, Respiratory	Jerrett et al., 2009	Denver, CO	CBSA	Seasonal-avg D1hrMax	April-September	30-99	NA	-	log-linear	0.0039221	0.0013249	1,549	1,574	1,396,514	1,454,586
Mortality, Respiratory	Jerrett et al., 2009	Detroit, MI	CBSA	Seasonal-avg D1hrMax	April-September	30-99	NA	-	log-linear	0.0039221	0.0013249	3,230	3,153	2,636,935	2,628,339
Mortality, Respiratory	Jerrett et al., 2009	Houston, TX	CBSA	Seasonal-avg D1hrMax	April-September	30-99	NA	-	log-linear	0.0039221	0.0013249	2,790	2,859	3,001,537	3,165,283
Mortality, Respiratory	Jerrett et al., 2009	Los Angeles, CA	CBSA	Seasonal-avg D1hrMax	April-September	30-99	NA	-	log-linear	0.0039221	0.0013249	7,480	7,512	7,072,418	7,236,439
Mortality, Respiratory	Jerrett et al., 2009	New York, NY	CBSA	Seasonal-avg D1hrMax	April-September	30-99	NA	-	log-linear	0.0039221	0.0013249	12,304	12,067	11,118,315	11,303,888
Mortality, Respiratory	Jerrett et al., 2009	Philadelphia, PA	CBSA	Seasonal-avg D1hrMax	April-September	30-99	NA	-	log-linear	0.0039221	0.0013249	4,993	4,891	3,488,101	3,545,106
Mortality, Respiratory	Jerrett et al., 2009	Sacramento, CA	CBSA	Seasonal-avg D1hrMax	April-September	30-99	NA	-	log-linear	0.0039221	0.0013249	1,669	1,690	1,185,990	1,221,735
Mortality, Respiratory	Jerrett et al., 2009	St. Louis, MO	CBSA	Seasonal-avg D1hrMax	April-September	30-99	NA	-	log-linear	0.0039221	0.0013249	2,535	2,485	1,649,209	1,676,509
Core Risk - short-term exposure-related morbidity															
HA, All Respiratory	Katsouyanni et al., 2009	Detroit, MI	CBSA	D1HourMax	June-August	65-99	average of lag 0 and lag 1	penalized splines	log-linear	0.00056	0.000352	6,538	6,694	539,077	557,511
HA, All Respiratory	Katsouyanni et al., 2009	Detroit, MI	CBSA	D1HourMax	June-August	65-99	average of lag 0 and lag 1	natural splines	log-linear	0.00054	0.0003571	6,538	6,694	539,077	557,511
HA, Asthma	Silverman and Ito, 2010	New York, NY	CBSA	D8HourMax	April-October	6-18	average of lag 0 and lag 1	-	log-linear	0.007907	0.0037862	1,697	1,683	3,197,360	3,173,355
HA, Asthma	Silverman and Ito, 2010	New York, NY	CBSA	D8HourMax	April-October	6-18	average of lag 0 and lag 1	PM2.5	log-linear	0.0055553	0.0036926	1,697	1,683	3,197,360	3,173,355
HA, Chronic Lung Disease	Lin et al. (a), 2008	New York, NY	CBSA	D1HourMax	April-October	0-17	Lag 2 d	-	log-linear	0.0007609	0.000163	4,340	4,300	4,388,434	4,344,448
HA, All Respiratory	Linn et al., 2000	Los Angeles, CA	CBSA	D24HourMean	June-August	30-99	Lag 0d	-	log-linear	0.0006	0.0007	19,320	20,259	7,072,418	7,236,439

Endpoint	Study	Urban study area	Study area template	Study information (C-R function)								Baseline incidence[b]		Population	
				Air metric	Risk assessment modeling period	Age range	Lag	Additional study details	Statistical Model	Effect estimate (Beta)	SE (effect estimate)[a]	2007	2009	2007	2009
HA, Chronic Lung Disease (less Asthma)	Medina-Ramon et al, 2006	Atlanta, GA	CBSA	D8HourMean	June-August	65-99	distributed lag 0-1 d	-	logistic	0.00054	0.000199	2,160	2,358	412,999	453,851
HA, Chronic Lung Disease (less Asthma)	Medina-Ramon et al, 2006	Baltimore, MD	CBSA	D8HourMean	June-August	65-99	distributed lag 0-1 d	-	logistic	0.00054	0.000199	1,540	1,593	320,763	334,599
HA, Chronic Lung Disease (less Asthma)	Medina-Ramon et al, 2006	Boston, MA	CBSA	D8HourMean	June-August	65-99	distributed lag 0-1 d	-	logistic	0.00054	0.000199	2,577	2,657	559,310	581,219
HA, Chronic Lung Disease (less Asthma)	Medina-Ramon et al, 2006	Cleveland, OH	CBSA	D8HourMean	June-August	65-99	distributed lag 0-1 d	-	logistic	0.00054	0.000199	1,587	1,612	305,763	312,042
HA, Chronic Lung Disease (less Asthma)	Medina-Ramon et al, 2006	Denver, CO	CBSA	D8HourMean	June-August	65-99	distributed lag 0-1 d	-	logistic	0.00054	0.000199	623	665	227,092	245,643
HA, Chronic Lung Disease (less Asthma)	Medina-Ramon et al, 2006	Detroit, MI	CBSA	D8HourMean	June-August	65-99	distributed lag 0-1 d	-	logistic	0.00054	0.000199	2,870	2,935	539,077	557,511
HA, Chronic Lung Disease (less Asthma)	Medina-Ramon et al, 2006	Houston, TX	CBSA	D8HourMean	June-August	65-99	distributed lag 0-1 d	-	logistic	0.00054	0.000199	2,716	2,922	451,335	489,474
HA, Chronic Lung Disease (less Asthma)	Medina-Ramon et al, 2006	Los Angeles, CA	CBSA	D8HourMean	June-August	65-99	distributed lag 0-1 d	-	logistic	0.00054	0.000199	4,059	4,302	1,309,329	1,372,256
HA, Chronic Lung Disease (less Asthma)	Medina-Ramon et al, 2006	New York, NY	CBSA	D8HourMean	June-August	65-99	distributed lag 0-1 d	-	logistic	0.00054	0.000199	9,026	9,235	2,359,351	2,427,316
HA, Chronic Lung Disease (less Asthma)	Medina-Ramon et al, 2006	Philadelphia, PA	CBSA	D8HourMean	June-August	65-99	distributed lag 0-1 d	-	logistic	0.00054	0.000199	3,825	3,920	755,595	780,220
HA, Chronic Lung Disease (less Asthma)	Medina-Ramon et al, 2006	Sacramento, CA	CBSA	D8HourMean	June-August	65-99	distributed lag 0-1 d	-	logistic	0.00054	0.000199	606	649	235,921	250,905

Endpoint	Study	Urban study area	Study area template	Study information (C-R function)								Baseline incidence[b]		Population	
				Air metric	Risk assessment modeling period	Age range	Lag	Additional study details	Statistical Model	Effect estimate (Beta)	SE (effect estimate)[a]	2007	2009	2007	2009
HA, Chronic Lung Disease (less Asthma)	Medina-Ramon et al, 2006	St. Louis, MO	CBSA	D8HourMean	June-August	65-99	distributed lag 0-1 d	-	logistic	0.00054	0.000199	1,653	1,697	357,309	368,743
Emergency Room Visits, Respiratory	Strickland et al., 2010	Atlanta, GA	Atlanta, GA	D8HourMax	March-October (8)	5-17	distributed lag 0-7 d	-	log-linear	0.0047864	0.0007602	33,322	34,432	963,574	995,654
Emergency Room Visits, Respiratory	Strickland et al., 2010	Atlanta, GA	Atlanta, GA	D8HourMax	March-October (8)	5-17	average of lags 0-2	-	log-linear	0.002699	0.0006456	33,322	34,432	963,574	995,654
Emergency Room Visits, Respiratory	Tolbert et al., 2007	Atlanta, GA	Atlanta, GA	D8HourMax	March-October (8)	0-99	average of lags 0-2	-	log-linear	0.001286	0.0002062	122,122	126,013	5,033,453	5,205,934
Emergency Room Visits, Respiratory	Tolbert et al., 2007	Atlanta, GA	Atlanta, GA	D8HourMax	March-October (8)	0-99	average of lags 0-2	CO	log-linear	0.0011408	0.0002283	122,122	126,013	5,033,453	5,205,934
Emergency Room Visits, Respiratory	Tolbert et al., 2007	Atlanta, GA	Atlanta, GA	D8HourMax	March-October (8)	0-99	average of lags 0-2	NO2	log-linear	0.0010287	0.0002506	122,122	126,013	5,033,453	5,205,934
Emergency Room Visits, Respiratory	Tolbert et al., 2007	Atlanta, GA	Atlanta, GA	D8HourMax	March-October (8)	0-99	average of lags 0-2	PM10	log-linear	0.0008032	0.000267	122,122	126,013	5,033,453	5,205,934
Emergency Room Visits, Respiratory	Tolbert et al., 2007	Atlanta, GA	Atlanta, GA	D8HourMax	March-October (8)	0-99	average of lags 0-2	PM10, NO2	log-linear	0.0007749	0.0002672	122,122	126,013	5,033,453	5,205,934
Emergency Room Visits, Respiratory	Darrow et al., 2011	Atlanta, GA	Atlanta, GA	D8HourMax	March-October (8)	0-99	Lag 1d	-	log-linear	0.0006852	0.0001385	122,122	126,013	5,033,453	5,205,934
Emergency Room Visits, Asthma	Ito et al., 2007	New York, NY	New York, NY	D8HourMax	April-October (7)	0-99	average of lag 0 and lag 1	-	log-linear	0.0052134	0.0009087	52,867	53,243	18,554,574	18,779,754
Emergency Room Visits, Asthma	Ito et al., 2007	New York, NY	New York, NY	D8HourMax	April-October (7)	0-99	average of lag 0 and lag 1	PM2.5	log-linear	0.0039757	0.0009789	52,867	53,243	18,554,574	18,779,754
Emergency Room Visits, Asthma	Ito et al., 2007	New York, NY	New York, NY	D8HourMax	April-October (7)	0-99	average of lag 0 and lag 1	NO2	log-linear	0.0032337	0.0009359	52,867	53,243	18,554,574	18,779,754
Emergency Room Visits, Asthma	Ito et al., 2007	New York, NY	New York, NY	D8HourMax	April-October (7)	0-99	average of lag 0 and lag 1	CO	log-linear	0.0055437	0.0008939	52,867	53,243	18,554,574	18,779,754
Emergency Room Visits, Asthma	Ito et al., 2007	New York, NY	New York, NY	D8HourMax	April-October (7)	0-99	average of lag 0 and lag 1	SO2	log-linear	0.004115	0.0009226	52,867	53,243	18,554,574	18,779,754
Asthma Exacerbation, Chest Tightness	Gent et al., 2003	Boston, MA	Boston, MA	D1HourMax	April-September (6)	0-12	Lag 1d	-	logistic	0.0007609	0.0020002	138,691	138,494	702,975	700,631

Endpoint	Study	Urban study area	Study area template	Study information (C-R function)								Baseline incidence[b]		Population	
				Air metric	Risk assessment modeling period	Age range	Lag	Additional study details	Statistical Model	Effect estimate (Beta)	SE (effect estimate)[a]	2007	2009	2007	2009
Asthma Exacerbation, Chest Tightness	Gent et al., 2003	Boston, MA	Boston, MA	D8HourMax	April-September (6)	0-12	Lag 1d	-	logistic	0.0057036	0.0020217	138,691	138,494	702,975	700,631
Asthma Exacerbation, Chest Tightness	Gent et al., 2003	Boston, MA	Boston, MA	D1HourMax	April-September (6)	0-12	Lag 1d	PM2.5	logistic	0.0077052	0.0022666	138,691	138,494	702,975	700,631
Asthma Exacerbation, Chest Tightness	Gent et al., 2003	Boston, MA	Boston, MA	D1HourMax	April-September (6)	0-12	Lag 1d	PM2.5	logistic	0.0070131	0.0022734	138,691	138,494	702,975	700,631
Asthma Exacerbation, Shortness of Breath	Gent et al., 2003	Boston, MA	Boston, MA	D1HourMax	April-September (6)	0-12	Lag 1d	-	logistic	0.003977	0.0017947	173,364	173,117	702,975	700,631
Asthma Exacerbation, Shortness of Breath	Gent et al., 2003	Boston, MA	Boston, MA	D8HourMax	April-September (6)	0-12	Lag 1d	-	logistic	0.0052473	0.0021808	173,364	173,117	702,975	700,631
Asthma Exacerbation, Wheeze	Gent et al., 2003	Boston, MA	Boston, MA	D1HourMax	April-September (6)	0-12	Lag 0d	PM2.5	logistic	0.0060021	0.0020225	323,613	323,152	702,975	700,631
Sensitivity Analysis - short-term exposure-related all-cause mortality															
Mortality, Non-Accidental	Smith et al., 2009	Atlanta, GA	Epi study based	D8HourMax	March-October	0-99	distributed lag 0-6 d	-	log-linear	0.0002411	0.0002919	SA completed for 2009	6,267	SA completed for 2009	1,589,914
Mortality, Non-Accidental	Smith et al., 2009	Baltimore, MD	Epi study based	D8HourMax	April-October	0-99	distributed lag 0-6 d	-	log-linear	0.0004192	0.00033		3,287		621,421
Mortality, Non-Accidental	Smith et al., 2009	Boston, MA	Epi study based	D8HourMax	April-September	0-99	distributed lag 0-6 d	-	log-linear	0.0002807	0.0003429		2,252		715,296
Mortality, Non-Accidental	Smith et al., 2009	Cleveland, OH	Epi study based	D8HourMax	April-October	0-99	distributed lag 0-6 d	-	log-linear	0.0005654	0.0003149		7,541		1,287,137
Mortality, Non-Accidental	Smith et al., 2009	Denver, CO	Epi study based	D8HourMax	March-September	0-99	distributed lag 0-6 d	-	log-linear	0.0001657	0.0003565		5,140		1,578,451
Mortality, Non-Accidental	Smith et al., 2009	Detroit, MI	Epi study based	D8HourMax	April-September	0-99	distributed lag 0-6 d	-	log-linear	0.0006432	0.0003117		8,174		1,842,465
Mortality, Non-Accidental	Smith et al., 2009	Houston, TX	Epi study based	D8HourMax	January-December	0-99	distributed lag 0-6 d	-	log-linear	0.0004999	0.0002075		19,642		4,017,371
Mortality, Non-Accidental	Smith et al., 2009	Los Angeles, CA	Epi study based	D8HourMax	January-December	0-99	distributed lag 0-6 d	-	log-linear	0.0002179	0.0001571		55,949		9,776,644

Endpoint	Study	Urban study area	Study area template	Study information (C-R function)								Baseline incidence[b]		Population	
				Air metric	Risk assessment modeling period	Age range	Lag	Additional study details	Statistical Model	Effect estimate (Beta)	SE (effect estimate)[a]	2007	2009	2007	2009
Mortality, Non-Accidental	Smith et al., 2009	New York, NY	Epi study based	D8HourMax	April-October	0-99	distributed lag 0-6 d	-	log-linear	0.0010114	0.0002074		33,006		9,066,479
Mortality, Non-Accidental	Smith et al., 2009	Philadelphia, PA	Epi study based	D8HourMax	April-October	0-99	distributed lag 0-6 d	-	log-linear	0.000714	0.0002846		7,835		1,513,040
Mortality, Non-Accidental	Smith et al., 2009	Sacramento, CA	Epi study based	D8HourMax	January-December	0-99	distributed lag 0-6 d	-	log-linear	0.0003016	0.0003145		9,225		1,405,572
Mortality, Non-Accidental	Smith et al., 2009	St. Louis, MO	Epi study based	D8HourMax	April-October	0-99	distributed lag 0-6 d	-	log-linear	0.0005401	0.0003428		1,688		319,302
Mortality, Non-Accidental	Smith et al., 2009	Atlanta, GA	CBSA	D8HourMax	March-October	0-99	distributed lag 0-6 d	Regional Bayes-based	log-linear	0.0002603	0.0002359		20,442		5,205,933
Mortality, Non-Accidental	Smith et al., 2009	Baltimore, MD	CBSA	D8HourMax	April-October	0-99	distributed lag 0-6 d	Regional Bayes-based	log-linear	0.0009399	0.0002829		11,598		2,692,803
Mortality, Non-Accidental	Smith et al., 2009	Boston, MA	CBSA	D8HourMax	April-September	0-99	distributed lag 0-6 d	Regional Bayes-based	log-linear	0.0008827	0.0003004		16,436		4,519,143
Mortality, Non-Accidental	Smith et al., 2009	Cleveland, OH	CBSA	D8HourMax	April-October	0-99	distributed lag 0-6 d	Regional Bayes-based	log-linear	0.0006789	0.0002637		10,692		2,082,741
Mortality, Non-Accidental	Smith et al., 2009	Denver, CO	CBSA	D8HourMax	March-September	0-99	distributed lag 0-6 d	Regional Bayes-based	log-linear	0.0000293	0.0003502	SA completed for 2009	6,856	SA completed for 2009	2,498,144
Mortality, Non-Accidental	Smith et al., 2009	Detroit, MI	CBSA	D8HourMax	April-September	0-99	distributed lag 0-6 d	Regional Bayes-based	log-linear	0.0007159	0.0002622		16,815		4,316,185
Mortality, Non-Accidental	Smith et al., 2009	Houston, TX	CBSA	D8HourMax	January-December	0-99	distributed lag 0-6 d	Regional Bayes-based	log-linear	0.000423	0.0001825		30,927		5,823,529
Mortality, Non-Accidental	Smith et al., 2009	Los Angeles, CA	CBSA	D8HourMax	January-December	0-99	distributed lag 0-6 d	Regional Bayes-based	log-linear	0.0001988	0.000151		72,935		12,756,237
Mortality, Non-Accidental	Smith et al., 2009	New York, NY	CBSA	D8HourMax	April-October	0-99	distributed lag 0-6 d	Regional Bayes-based	log-linear	0.0011223	0.0001808		76,645		18,779,754

				Study information (C-R function)								Baseline incidence[b]		Population	
Endpoint	Study	Urban study area	Study area template	Air metric	Risk assessment modeling period	Age range	Lag	Additional study details	Statistical Model	Effect estimate (Beta)	SE (effect estimate)[a]	2007	2009	2007	2009
Mortality, Non-Accidental	Smith et al., 2009	Philadelphia, PA	CBSA	D8HourMax	April-October	0-99	distributed lag 0-6 d	Regional Bayes-based	log-linear	0.001026	0.0002395		27,658		5,936,034
Mortality, Non-Accidental	Smith et al., 2009	Sacramento, CA	CBSA	D8HourMax	January-December	0-99	distributed lag 0-6 d	Regional Bayes-based	log-linear	0.000107	0.000323		13,361		2,127,784
Mortality, Non-Accidental	Smith et al., 2009	St. Louis, MO	CBSA	D8HourMax	April-October	0-99	distributed lag 0-6 d	Regional Bayes-based	log-linear	0.0006754	0.00028		13,686		2,803,333
Mortality, Non-Accidental	Smith et al., 2009	Atlanta, GA	CBSA	D8HourMax	March-October	0-99	distributed lag 0-6 d	PM10	log-linear	0.0001183	0.0005456	SA completed for 2009	20,442	SA completed for 2009	5,205,933
Mortality, Non-Accidental	Smith et al., 2009	Baltimore, MD	CBSA	D8HourMax	April-October	0-99	distributed lag 0-6 d	PM10	log-linear	0.0004727	0.000531		11,598		2,692,803
Mortality, Non-Accidental	Smith et al., 2009	Boston, MA	CBSA	D8HourMax	April-September	0-99	distributed lag 0-6 d	PM10	log-linear	0.0001591	0.0005752		16,436		4,519,143
Mortality, Non-Accidental	Smith et al., 2009	Cleveland, OH	CBSA	D8HourMax	April-October	0-99	distributed lag 0-6 d	PM10	log-linear	0.0004626	0.0004335		10,692		2,082,741
Mortality, Non-Accidental	Smith et al., 2009	Denver, CO	CBSA	D8HourMax	March-September	0-99	distributed lag 0-6 d	PM10	log-linear	-0.0000383	0.0005263		6,856		2,498,144
Mortality, Non-Accidental	Smith et al., 2009	Detroit, MI	CBSA	D8HourMax	April-September	0-99	distributed lag 0-6 d	PM10	log-linear	0.000286	0.0004066		16,815		4,316,185
Mortality, Non-Accidental	Smith et al., 2009	Houston, TX	CBSA	D8HourMax	January-December	0-99	distributed lag 0-6 d	PM10	log-linear	0.000631	0.0003623		30,927		5,823,529
Mortality, Non-Accidental	Smith et al., 2009	Los Angeles, CA	CBSA	D8HourMax	January-December	0-99	distributed lag 0-6 d	PM10	log-linear	0.0000524	0.0003473		72,935		12,756,237
Mortality, Non-Accidental	Smith et al., 2009	New York, NY	CBSA	D8HourMax	April-October	0-99	distributed lag 0-6 d	PM10	log-linear	0.0004407	0.0003904		76,645		18,779,754
Mortality, Non-Accidental	Smith et al., 2009	Philadelphia, PA	CBSA	D8HourMax	April-October	0-99	distributed lag 0-6 d	PM10	log-linear	0.0005445	0.0005186		27,658		5,936,034
Mortality, Non-Accidental	Smith et al., 2009	Sacramento, CA	CBSA	D8HourMax	January-December	0-99	distributed lag 0-6 d	PM10	log-linear	0.0002805	0.0005434		13,361		2,127,784
Mortality, Non-Accidental	Smith et al., 2009	St. Louis, MO	CBSA	D8HourMax	April-October	0-99	distributed lag 0-6 d	PM10	log-linear	0.0003602	0.0005813		13,686		2,803,333

Endpoint	Study	Urban study area	Study area template	Study information (C-R function)								Baseline incidence[b]		Population	
				Air metric	Risk assessment modeling period	Age range	Lag	Additional study details	Statistical Model	Effect estimate (Beta)	SE (effect estimate)[a]	2007	2009	2007	2009
Mortality, All Cause	Zanobetti & Schwartz (b), 2008	Atlanta, GA	CBSA	D8HourMean	June-August	0-99	distributed lag 0-3 d	-	log-linear	0.0002954	0.0002886	SA completed for 2009	8,448	SA completed for 2009	5,205,933
Mortality, All Cause	Zanobetti & Schwartz (b), 2008	Baltimore, MD	CBSA	D8HourMean	June-August	0-99	distributed lag 0-3 d	-	log-linear	0.000515	0.000314		5,327		2,692,803
Mortality, All Cause	Zanobetti & Schwartz (b), 2008	Boston, MA	CBSA	D8HourMean	June-August	0-99	distributed lag 0-3 d	-	log-linear	0.0006816	0.0003284		8,726		4,519,143
Mortality, All Cause	Zanobetti & Schwartz (b), 2008	Cleveland, OH	CBSA	D8HourMean	June-August	0-99	distributed lag 0-3 d	-	log-linear	0.0005962	0.0003546		4,838		2,082,741
Mortality, All Cause	Zanobetti & Schwartz (b), 2008	Denver, CO	CBSA	D8HourMean	June-August	0-99	distributed lag 0-3 d	-	log-linear	0.0003518	0.0004088		3,351		2,498,144
Mortality, All Cause	Zanobetti & Schwartz (b), 2008	Detroit, MI	CBSA	D8HourMean	June-August	0-99	distributed lag 0-3 d	-	log-linear	0.0010459	0.0003441		8,977		4,316,185
Mortality, All Cause	Zanobetti & Schwartz (b), 2008	Houston, TX	CBSA	D8HourMean	June-August	0-99	distributed lag 0-3 d	-	log-linear	0.0001629	0.0002628		8,712		5,823,529
Mortality, All Cause	Zanobetti & Schwartz (b), 2008	Los Angeles, CA	CBSA	D8HourMean	June-August	0-99	distributed lag 0-3 d	-	log-linear	0.0002737	0.0002134		19,665		12,756,237
Mortality, All Cause	Zanobetti & Schwartz (b), 2008	New York, NY	CBSA	D8HourMean	June-August	0-99	distributed lag 0-3 d	-	log-linear	0.0010925	0.0002357		34,611		18,779,754
Mortality, All Cause	Zanobetti & Schwartz (b), 2008	Philadelphia, PA	CBSA	D8HourMean	June-August	0-99	distributed lag 0-3 d	-	log-linear	0.0006246	0.0003146		12,678		5,936,034
Mortality, All Cause	Zanobetti & Schwartz (b), 2008	Sacramento, CA	CBSA	D8HourMean	June-August	0-99	distributed lag 0-3 d	-	log-linear	0.0005691	0.0003885		3,657		2,127,784
Mortality, All Cause	Zanobetti & Schwartz (b), 2008	St. Louis, MO	CBSA	D8HourMean	June-August	0-99	distributed lag 0-3 d	-	log-linear	0.0005444	0.0003334		6,359		2,803,333
Sensitivity Analysis - long-term exposure-related respiratory mortality[c]															
Mortality, Respiratory	Jerrett et al., 2009	Atlanta, GA	CBSA	Seasonal-avg D1hrMax	April-September	30-99	NA	Regional	log-linear	0.0113329	0.0031929		3,216		2,954,650

Endpoint	Study	Urban study area	Study area template	Study information (C-R function)								Baseline incidence[b]		Population	
				Air metric	Risk assessment modeling period	Age range	Lag	Additional study details	Statistical Model	Effect estimate (Beta)	SE (effect estimate)[a]	2007	2009	2007	2009
Mortality, Respiratory	Jerrett et al., 2009	Baltimore, MD	CBSA	Seasonal-avg D1hrMax	April-September	30-99	NA	Regional	log-linear	-0.001005	0.0038531		2,034		1,609,957
Mortality, Respiratory	Jerrett et al., 2009	Boston, MA	CBSA	Seasonal-avg D1hrMax	April-September	30-99	NA	Regional	log-linear	-0.001005	0.0038531		3,622		2,747,634
Mortality, Respiratory	Jerrett et al., 2009	Cleveland, OH	CBSA	Seasonal-avg D1hrMax	April-September	30-99	NA	Regional	log-linear	0	0.0046043		1,783		1,294,845
Mortality, Respiratory	Jerrett et al., 2009	Denver, CO	CBSA	Seasonal-avg D1hrMax	April-September	30-99	NA	Regional	log-linear	0.0058269	0.0031178		1,574		1,454,586
Mortality, Respiratory	Jerrett et al., 2009	Detroit, MI	CBSA	Seasonal-avg D1hrMax	April-September	30-99	NA	Regional	log-linear	0	0.0046043		3,153		2,628,339
Mortality, Respiratory	Jerrett et al., 2009	Houston, TX	CBSA	Seasonal-avg D1hrMax	April-September	30-99	NA	Regional	log-linear	0.0113329	0.0031929	SA completed for 2009	2,859	SA completed for 2009	3,165,283
Mortality, Respiratory	Jerrett et al., 2009	Los Angeles, CA	CBSA	Seasonal-avg D1hrMax	April-September	30-99	NA	Regional	log-linear	0.000995	0.0027674		7,512		7,236,439
Mortality, Respiratory	Jerrett et al., 2009	New York, NY	CBSA	Seasonal-avg D1hrMax	April-September	30-99	NA	Regional	log-linear	-0.001005	0.0038531		12,067		11,303,888
Mortality, Respiratory	Jerrett et al., 2009	Philadelphia, PA	CBSA	Seasonal-avg D1hrMax	April-September	30-99	NA	Regional	log-linear	-0.001005	0.0038531		4,891		3,545,106
Mortality, Respiratory	Jerrett et al., 2009	Sacramento, CA	CBSA	Seasonal-avg D1hrMax	April-September	30-99	NA	Regional	log-linear	0.0058269	0.0031178		1,690		1,221,735
Mortality, Respiratory	Jerrett et al., 2009	St. Louis, MO	CBSA	Seasonal-avg D1hrMax	April-September	30-99	NA	Regional	log-linear	0	0.0046043		2,485		1,676,509
Mortality, Respiratory	Jerrett et al., 2009	Atlanta, GA	CBSA	Seasonal-avg D1hrMax	April-September	30-99	NA	ozone-only	log-linear	0.0026642	0.0009693		3,216		2,954,650
Mortality, Respiratory	Jerrett et al., 2009	Baltimore, MD	CBSA	Seasonal-avg D1hrMax	April-September	30-99	NA	ozone-only	log-linear	0.0026642	0.0009693		2,034		1,609,957
Mortality, Respiratory	Jerrett et al., 2009	Boston, MA	CBSA	Seasonal-avg D1hrMax	April-September	30-99	NA	ozone-only	log-linear	0.0026642	0.0009693	SA completed for 2009	3,622	SA completed for 2009	2,747,634
Mortality, Respiratory	Jerrett et al., 2009	Cleveland, OH	CBSA	Seasonal-avg D1hrMax	April-September	30-99	NA	ozone-only	log-linear	0.0026642	0.0009693		1,783		1,294,845
Mortality, Respiratory	Jerrett et al., 2009	Denver, CO	CBSA	Seasonal-avg D1hrMax	April-September	30-99	NA	ozone-only	log-linear	0.0026642	0.0009693		1,574		1,454,586
Mortality, Respiratory	Jerrett et al., 2009	Detroit, MI	CBSA	Seasonal-avg D1hrMax	April-September	30-99	NA	ozone-only	log-linear	0.0026642	0.0009693		3,153		2,628,339

Endpoint	Study	Urban study area	Study area template	Study information (C-R function)								Baseline incidence[b]		Population	
				Air metric	Risk assessment modeling period	Age range	Lag	Additional study details	Statistical Model	Effect estimate (Beta)	SE (effect estimate)[a]	2007	2009	2007	2009
Mortality, Respiratory	Jerrett et al., 2009	Houston, TX	CBSA	Seasonal-avg D1hrMax	April-September	30-99	NA	ozone-only	log-linear	0.0026642	0.0009693		2,859		3,165,283
Mortality, Respiratory	Jerrett et al., 2009	Los Angeles, CA	CBSA	Seasonal-avg D1hrMax	April-September	30-99	NA	ozone-only	log-linear	0.0026642	0.0009693		7,512		7,236,439
Mortality, Respiratory	Jerrett et al., 2009	New York, NY	CBSA	Seasonal-avg D1hrMax	April-September	30-99	NA	ozone-only	log-linear	0.0026642	0.0009693		12,067		11,303,888
Mortality, Respiratory	Jerrett et al., 2009	Philadelphia, PA	CBSA	Seasonal-avg D1hrMax	April-September	30-99	NA	ozone-only	log-linear	0.0026642	0.0009693		4,891		3,545,106
Mortality, Respiratory	Jerrett et al., 2009	Sacramento, CA	CBSA	Seasonal-avg D1hrMax	April-September	30-99	NA	ozone-only	log-linear	0.0026642	0.0009693		1,690		1,221,735
Mortality, Respiratory	Jerrett et al., 2009	St. Louis, MO	CBSA	Seasonal-avg D1hrMax	April-September	30-99	NA	ozone-only	log-linear	0.0026642	0.0009693		2,485		1,676,509

[a] all Beta distributions assumed to be normal.

[b] Gent et al., 2003 also uses the following prevalence rates: 0.028 (wheeze), 0.015 (shortness of breath), 0.012 (chest tightness) (from study).

[c] Threshold models were considered as sensitivity analyses for long-term exposure-related respiratory mortality (see section HREA 7.3.2). Given that the same threshold-specific effect estimate was used for all 12 study areas, they are not presented here to avoid repetition (see Sasser, 2014 for a listing of the coefficients and standard errors). Other model inputs used in modeling thresholds for this effect endpoint are the same as for other applications of Jerrett et al., 2009 (see table entries).

REFERENCES

Darrow, L.A.; M. Klein; J.A. Sarnat; J.A. Mulholland; M.J. Strickland; S.E. Sarnat, et al. 2011. The use of alternative pollutant metrics in time-series studies of ambient air pollution and respiratory emergency department visits. *Journal of Exposure Science and Environmental Epidemiology*. 21:10-19.

Gent, J.F.; E.W. Triche; T.R. Holford; K. Belanger; M.B. Bracken; W.S. Beckett, et al. 2003. Association of low-level ozone and fine particles with respiratory symptoms in children with asthma. *Journal of the American Medical Association.* 290(14):1859-1867.

Ito, K.; G.D. Thurston and R.A. Silverman. 2007. Characterization of $PM_{2.5}$, gaseous pollutants, and meteorological interactions in the context of time-series health effects models. *Journal of Exposure Science and Environmental Epidemiology*. 17(S2):S45-60.

Katsouyanni, K.; J.M. Samet; H.R. Anderson; R. Atkinson; A.L. Tertre; S. Medina, et al. 2009. *Air Pollution and Health: A European and North American Approach (APHENA)*. Health Effects Institute.

Lin, S; X. Liu; L.H. Le; S.A. Hwang. 2008. Chronic exposure to ambient ozone and asthma hospital admissions among children. *Environmental Health Perspective*. 116:1725-1730.

Linn, W.S.; Y. Szlachcic; H. Gong, Jr.; P.L. Kinney and K.T. Berhane. 2000. Air pollution and daily hospital admissions in metropolitan Los Angeles. *Environmental Health Perspective*. 108(5):427-434.

Jerrett, M.; R.T. Burnett; C.A. Pope, III; K. Ito; G. Thurston; D. Krewski; Y. Shi; E. Calle; and M. Thun. 2009. Long-term ozone exposure and mortality." *New England Journal of Medicine*. 360:1085-1095.

Medina-Ramon, M.; A. Zanobetti and J. Schwartz. 2006. The effect of ozone and PM_{10} on hospital admissions for pneumonia and chronic obstructive pulmonary disease: a national multicity study. *American Journal of Epidemiology*. 163(6):579-588.

Sasser, E. 2014. *Response to Comments Regarding the Potential Use of a Threshold Model in Estimating the Mortality Risks from Long-term Exposure to Ozone in the Health Risk and Exposure Assessment for Ozone, Second External Review Draft*. Memorandum to Holly Stallworth, Designated Federal Officer, Clean Air Scientific Advisory Committee from EPA/OAQPS Health and Environmental Impacts Division.

Silverman, R.A.; and K. Ito. 2010. Age-related association of fine particles and ozone with severe acute asthma in New York City. *Journal of Allergy Clinical Immunology*. 125(2):367-373.

Smith, R.L.; B. Xu and P. Switzer. 2009. Reassessing the relationship between ozone and short-term mortality in U.S. urban communities. *Inhalation Toxicology*. 21:37-61.

Strickland, M.J.; L.A. Darrow; M. Klein; W.D. Flanders; J.A. Sarnat; L.A. Waller, et al. 2010. Short-term associations between ambient air pollutants and pediatric asthma emergency department visits. *American Journal of Respiratory Critical Care Medicine*. 182:307-316.

Tolbert, P.E.; M. Klein; J.L. Peel; S.E. Sarnat and J.A. Sarnat. 2007. Multipollutant modeling issues in a study of ambient air quality and emergency department visits in Atlanta. *Journal of Exposure Science and Environmental Epidemiology*. 17(S2):S29-35.

Zanobetti, A; J. Schwartz. 2008. Mortality displacement in the association of ozone with mortality: an analysis of 48 cities in the United States. *American Journal of Respiratory and Critical Care Medicine.* 177:184-189.

APPENDIX 7B

Detailed Summary Tables and Figures of Core Risk Estimates

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Table 7B-1. Core Short-Term Ozone-Attributable Mortality (2007) (incidence, percent of baseline mortality, incidence per 100,000) (Smith et al., 2009).

	Air Quality Scenario								
	Absolute Ozone-Attributable Incidence					Change in Ozone-Attributable Incidence			
Study Area	Base	75ppb	70ppb	65ppb	60ppb	Base-75	75-70	75-65	75-60
Atlanta, GA	250	220	210	200	190	31	10	18	28
	(-350 - 840)	(-310 - 740)	(-300 - 710)	(-280 - 680)	(-270 - 650)	(-42 - 100)	(-13 - 32)	(-24 - 60)	(-39 - 95)
Baltimore, MD	240	230	220	210	210	12	7	14	23
	(-130 - 600)	(-130 - 570)	(-120 - 560)	(-120 - 540)	(-110 - 520)	(-6 - 30)	(-4 - 17)	(-8 - 35)	(-13 - 59)
Boston, MA	210	200	200	190	180	3	4	11	18
	(-290 - 680)	(-290 - 670)	(-280 - 660)	(-270 - 640)	(-260 - 620)	(-5 - 11)	(-6 - 14)	(-16 - 39)	(-25 - 62)
Cleveland, OH	270	270	260	250	230	0	8	20	40
	(-25 - 550)	(-25 - 550)	(-24 - 540)	(-23 - 510)	(-21 - 470)	(0 - -1)	(-1 - 18)	(-2 - 41)	(-4 - 83)
Denver, CO	59	58	57	55	53	1	1	3	5
	(-190 - 300)	(-190 - 300)	(-190 - 290)	(-180 - 280)	(-170 - 270)	(-2 - 3)	(-4 - 7)	(-10 - 15)	(-17 - 27)
Detroit, MI	520	520	500	480	460	2	18	33	54
	(26 - 990)	(26 - 990)	(25 - 960)	(25 - 930)	(24 - 890)	(0 - 4)	(1 - 35)	(2 - 64)	(3 - 110)
Houston, TX	540	580	580	570	560	-39	4	9	20
	(100 - 970)	(110 - 1000)	(110 - 1000)	(110 - 1000)	(110 - 1000)	(-7 - -71)	(1 - 8)	(2 - 17)	(4 - 37)
Los Angeles, CA	640	750	730	700	660	-110	26	52	96
	(-270 - 1500)	(-310 - 1800)	(-300 - 1700)	(-290 - 1700)	(-270 - 1600)	(46 - -270)	(-11 - 62)	(-22 - 130)	(-40 - 230)
New York, NY	3400	3200	3100	2500	NA	170	150	740	NA
	(2000 - 4700)	(1900 - 4500)	(1900 - 4300)	(1500 - 3500)		(100 - 240)	(92 - 220)	(440 - 1000)	
Philadelphia, PA	960	920	890	860	830	47	26	56	86
	(210 - 1700)	(200 - 1600)	(200 - 1600)	(190 - 1500)	(180 - 1500)	(10 - 84)	(6 - 46)	(12 - 100)	(19 - 150)
Sacramento, CA	170	160	160	160	150	5	3	6	10
	(-180 - 500)	(-170 - 480)	(-170 - 470)	(-160 - 470)	(-160 - 450)	(-5 - 15)	(-3 - 9)	(-6 - 17)	(-11 - 31)
St. Louis, MO	370	350	330	320	300	22	15	31	49
	(-92 - 810)	(-86 - 770)	(-83 - 740)	(-79 - 700)	(-74 - 660)	(-6 - 50)	(-4 - 33)	(-8 - 70)	(-12 - 110)

	Air Quality Scenario								
	Percent of Baseline Incidence Attributable to Ozone					Change in O_3-Attributable Risk			
Study Area	Base	75ppb	70ppb	65ppb	60ppb	Base-75	75-70	75-65	75-60
Atlanta, GA	1.2	1.1	1.1	1.0	1.0	12	4	8	13
Baltimore, MD	2.0	1.9	1.9	1.8	1.7	5	3	6	10
Boston, MA	1.2	1.2	1.2	1.1	1.1	2	2	5	9
Cleveland, OH	2.4	2.4	2.4	2.3	2.1	-0.1	3	7	14
Denver, CO	0.9	0.8	0.8	0.8	0.8	1	2	5	9
Detroit, MI	3.0	3.0	2.9	2.8	2.7	0.3	3	6	10
Houston, TX	1.8	1.9	1.9	1.9	1.9	-7	1	2	3
Los Angeles, CA	0.9	1.0	1.0	1.0	0.9	-17	3	7	13
New York, NY	4.3	4.1	3.9	3.2	NA	5	5	22	NA
Philadelphia, PA	3.4	3.2	3.2	3.1	3.0	5	3	6	9
Sacramento, CA	1.2	1.2	1.2	1.2	1.1	3	2	3	6
St. Louis, MO	2.6	2.5	2.4	2.3	2.1	6	4	9	14

	Air Quality Scenario								
	Ozone-Attributable Deaths per 100,000					Change in Ozone-Attributable Deaths per 100,000			
Study Area	Base	75ppb	70ppb	65ppb	60ppb	Base-75	75-70	75-65	75-60
Atlanta, GA	5.0	4.4	4.2	4.1	3.8	0.61	0.19	0.35	0.56
Baltimore, MD	9.0	8.6	8.3	8.1	7.7	0.44	0.25	0.52	0.87
Boston, MA	4.6	4.5	4.5	4.3	4.1	0.074	0.092	0.26	0.41
Cleveland, OH	13	13	12	12	11	-0.011	0.40	0.95	1.9
Denver, CO	2.4	2.4	2.4	2.3	2.2	0.023	0.054	0.12	0.22
Detroit, MI	12	12	11	11	11	0.049	0.41	0.75	1.2
Houston, TX	9.8	10	10	10	10	-0.70	0.075	0.17	0.36
Los Angeles, CA	5.1	6.0	5.8	5.6	5.2	-0.88	0.20	0.41	0.76
New York, NY	18	17	17	14	NA	0.93	0.83	4.0	NA
Philadelphia, PA	16	16	15	15	14	0.81	0.44	0.96	1.5
Sacramento, CA	8.0	7.7	7.6	7.5	7.3	0.23	0.14	0.27	0.49
St. Louis, MO	13	13	12	11	11	0.81	0.53	1.1	1.7

NA: for NYC, the model-based adjustment methodology was unable to estimate ozone distributions which would meet the alternative standard level of 60 ppb.
"0" incidence values denote non-zero estimates that round to zero.

Table 7B-2. Core Short-Term Ozone-Attributable Mortality (2009) (incidence, percent of baseline mortality, incidence per 100,000) (Smith et al., 2009).

Study Area	Air Quality Scenario								
	Absolute Ozone-Attributable Incidence					Change in Ozone-Attributable Incidence			
	Base	75ppb	70ppb	65ppb	60ppb	Base-75	75-70	75-65	75-60
Atlanta, GA	200	200	190	190	180	4	7	13	19
	(-280 - 680)	(-280 - 670)	(-270 - 650)	(-260 - 620)	(-250 - 610)	(-5 - 13)	(-10 - 24)	(-18 - 45)	(-26 - 64)
Baltimore, MD	210	210	200	200	190	3	4	9	14
	(-120 - 530)	(-110 - 520)	(-110 - 510)	(-110 - 500)	(-110 - 480)	(-2 - 7)	(-2 - 10)	(-5 - 23)	(-8 - 37)
Boston, MA	180	180	180	180	180	-1	-1	3	8
	(-260 - 610)	(-260 - 610)	(-260 - 620)	(-260 - 600)	(-250 - 590)	(2 - -4)	(1 - -2)	(-4 - 10)	(-11 - 27)
Cleveland, OH	250	250	240	230	220	-3	7	18	31
	(-23 - 510)	(-23 - 510)	(-22 - 500)	(-21 - 480)	(-20 - 450)	(0 - -6)	(-1 - 15)	(-2 - 37)	(-3 - 64)
Denver, CO	56	56	56	55	51	0	0	1	5
	(-180 - 290)	(-180 - 290)	(-180 - 290)	(-180 - 280)	(-170 - 260)	(1 - -1)	(-1 - 1)	(-4 - 7)	(-15 - 25)
Detroit, MI	460	460	470	460	440	NA	-17	-5	12
	(23 - 880)	(23 - 880)	(24 - 910)	(23 - 890)	(23 - 850)		(-1 - -33)	(0 - -10)	(1 - 23)
Houston, TX	550	600	600	590	580	-47	-1	3	12
	(100 - 990)	(110 - 1100)	(110 - 1100)	(110 - 1100)	(110 - 1000)	(-9 - -85)	(0 - -1)	(1 - 6)	(2 - 22)
Los Angeles, CA	670	770	750	720	670	-99	25	53	98
	(-280 - 1600)	(-320 - 1800)	(-310 - 1800)	(-300 - 1700)	(-280 - 1600)	(41 - -240)	(-10 - 60)	(-22 - 130)	(-41 - 240)
New York, NY	2900	3000	2900	2500	NA	-89	96	500	NA
	(1800 - 4100)	(1800 - 4200)	(1800 - 4100)	(1500 - 3500)		(-53 - -120)	(57 - 130)	(300 - 700)	
Philadelphia, PA	820	820	810	790	770	-4	14	33	51
	(180 - 1400)	(180 - 1400)	(180 - 1400)	(170 - 1400)	(170 - 1400)	(-1 - -8)	(3 - 25)	(7 - 58)	(11 - 90)
Sacramento, CA	170	160	160	160	150	5	3	5	9
	(-180 - 500)	(-170 - 490)	(-170 - 480)	(-170 - 470)	(-160 - 460)	(-5 - 14)	(-3 - 8)	(-6 - 17)	(-10 - 28)
St. Louis, MO	310	310	300	290	280	1	7	17	30
	(-77 - 690)	(-77 - 690)	(-75 - 670)	(-73 - 650)	(-69 - 620)	(0 - 3)	(-2 - 15)	(-4 - 37)	(-7 - 67)

Study Area	Air Quality Scenario								
	Percent of Baseline Incidence Attributable to Ozone					Change in O_3-Attributable Risk			
	Base	75ppb	70ppb	65ppb	60ppb	Base-75	75-70	75-65	75-60
Atlanta, GA	1.0	1.0	0.9	0.9	0.9	2	3	7	9
Baltimore, MD	1.8	1.8	1.7	1.7	1.7	1	2	4	7
Boston, MA	1.1	1.1	1.1	1.1	1.1	-1	-0.3	2	4
Cleveland, OH	2.3	2.3	2.3	2.2	2.0	-1	3	7	12
Denver, CO	0.8	0.8	0.8	0.8	0.7	-0.4	0.3	2	8
Detroit, MI	2.7	2.7	2.8	2.7	2.6	NA	-4	-1	3
Houston, TX	1.8	1.9	1.9	1.9	1.9	-8	-0.1	0.5	2
Los Angeles, CA	0.9	1.1	1.0	1.0	0.9	-15	3	7	13
New York, NY	3.8	4.0	3.8	3.3	NA	-3	3	16	NA
Philadelphia, PA	2.9	3.0	2.9	2.9	2.8	-1	2	4	6
Sacramento, CA	1.2	1.2	1.2	1.2	1.1	3	2	3	6
St. Louis, MO	2.3	2.3	2.2	2.1	2.0	0.4	2	5	9

Study Area	Air Quality Scenario								
	Ozone-Attributable Deaths per 100,000					Change in Ozone-Attributable Deaths per 100,000			
	Base	75ppb	70ppb	65ppb	60ppb	Base-75	75-70	75-65	75-60
Atlanta, GA	3.9	3.9	3.7	3.6	3.5	0.071	0.14	0.26	0.37
Baltimore, MD	7.8	7.7	7.6	7.4	7.2	0.11	0.14	0.33	0.54
Boston, MA	4.0	4.1	4.1	4.0	3.9	-0.028	-0.013	0.064	0.18
Cleveland, OH	12	12	12	11	11	-0.14	0.35	0.86	1.5
Denver, CO	2.2	2.2	2.2	2.2	2.1	-0.0098	0.0081	0.054	0.19
Detroit, MI	11	11	11	11	10	NA	-0.39	-0.11	0.28
Houston, TX	9.4	10	10	10	10	-0.80	-0.010	0.054	0.21
Los Angeles, CA	5.3	6.0	5.8	5.6	5.3	-0.77	0.19	0.42	0.77
New York, NY	16	16	16	14	NA	-0.47	0.51	2.7	NA
Philadelphia, PA	14	14	14	13	13	-0.070	0.24	0.55	0.85
Sacramento, CA	7.8	7.6	7.5	7.4	7.2	0.21	0.13	0.26	0.44
St. Louis, MO	11	11	11	10	10	0.041	0.24	0.60	1.1

NA: for NYC, the model-based adjustment methodology was unable to estimate ozone distributions which would meet the alternative standard level of 60 ppb. For Detroit, already meeting existing standard
"0" incidence values denote non-zero estimates that round to zero.

Figure 7B-1. Core Short-Term Ozone-Attributable Mortality (2007) (heat map tables – absolute ozone-attributable incidence) (Smith et al., 2009).

Recent conditions

Study area	Daily 8hr Max Ozone Level (ppb)																Total
	0-5	5-10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50	50-55	55-60	60-65	65-70	70-75	>75	
Atlanta, GA	0	0	0	1	2	4	10	13	17	24	34	47	29	30	20	19	252
Baltimore, MD	0	0	0	1	4	10	10	25	20	28	30	29	18	33	20	13	240
Boston, MA	0	0	0	0	5	10	27	24	36	22	17	18	14	10	5	17	205
Cleveland, OH	0	0	0	2	5	14	28	30	45	34	33	25	23	15	6	7	268
Denver, CO	0	0	0	0	0	0	2	3	4	6	9	12	12	6	3	1	59
Detroit, MI	0	0	1	0	5	23	31	48	76	96	50	30	41	20	29	68	518
Houston, TX	0	1	6	20	41	58	74	71	61	49	51	28	25	27	26	3	542
Los Angeles, CA	0	0	3	14	33	38	69	58	96	84	81	79	35	20	15	17	643
New York, NY	0	0	0	47	93	169	339	549	326	446	306	228	222	266	205	197	3,391
Philadelphia, PA	0	0	1	5	15	39	63	70	118	97	112	117	69	93	86	76	961
Sacramento, CA	0	0	0	2	7	10	17	25	19	21	20	19	10	7	5	3	165
St. Louis, MO	0	0	1	1	2	9	17	34	49	33	58	48	32	25	23	36	369

Current Standard (75)

Study area	Daily 8hr Max Ozone Level (ppb)																Total
	0-5	5-10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50	50-55	55-60	60-65	65-70	70-75	>75	
Atlanta, GA	0	0	0	0	2	4	15	20	34	43	52	31	12	5	3	0	222
Baltimore, MD	0	0	0	0	1	6	11	22	43	37	36	38	23	6	5	2	228
Boston, MA	0	0	0	0	2	11	26	29	33	33	20	12	17	5	7	6	202
Cleveland, OH	0	0	0	1	3	9	25	41	55	50	27	25	19	8	6	0	268
Denver, CO	0	0	0	0	0	0	1	3	4	9	12	15	10	3	1	0	58
Detroit, MI	0	0	0	0	1	5	33	56	97	116	59	41	44	16	34	14	516
Houston, TX	0	0	0	0	14	42	107	124	126	81	42	42	2	0	0	0	580
Los Angeles, CA	0	0	0	0	0	0	0	10	204	268	233	27	8	3	0	0	753
New York, NY	0	0	0	0	24	113	341	625	851	545	418	268	45	0	0	0	3,230
Philadelphia, PA	0	0	0	2	0	25	46	115	157	175	155	122	75	31	7	7	916
Sacramento, CA	0	0	0	0	1	8	23	43	29	29	17	9	2	1	0	0	161
St. Louis, MO	0	0	0	1	2	6	15	52	53	61	60	38	24	23	10	3	348

Alternative Standard 70

Study area	Daily 8hr Max Ozone Level (ppb)																Total
	0-5	5-10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50	50-55	55-60	60-65	65-70	70-75	>75	
Atlanta, GA	0	0	0	0	2	7	16	23	43	53	43	17	6	3	0	0	212
Baltimore, MD	0	0	0	0	1	6	7	28	49	44	43	26	11	5	2	0	222
Boston, MA	0	0	0	0	2	11	27	35	31	31	21	16	8	7	4	4	198
Cleveland, OH	0	0	0	1	2	10	26	45	67	47	24	21	14	4	0	0	260
Denver, CO	0	0	0	0	0	0	0	3	5	11	17	15	4	2	0	0	57
Detroit, MI	0	0	0	0	0	5	33	65	119	113	50	55	23	24	13	0	499
Houston, TX	0	0	0	0	8	41	108	141	139	81	45	11	0	0	0	0	576
Los Angeles, CA	0	0	0	0	0	0	0	17	240	362	98	5	5	0	0	0	727
New York, NY	0	0	0	0	15	156	392	749	930	597	224	20	0	0	0	0	3,083
Philadelphia, PA	0	0	0	0	2	23	45	133	202	167	160	89	57	6	7	0	891
Sacramento, CA	0	0	0	0	0	7	24	47	35	30	9	6	0	1	0	0	158
St. Louis, MO	0	0	0	1	2	7	20	61	61	68	47	34	24	9	0	0	333

Alternative Standard 65

Study area	Daily 8hr Max Ozone Level (ppb)																Total
	0-5	5-10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50	50-55	55-60	60-65	65-70	70-75	>75	
Atlanta, GA	0	0	0	0	1	8	20	24	54	55	31	8	4	0	0	0	204
Baltimore, MD	0	0	0	0	1	5	11	34	51	44	43	19	6	2	0	0	215
Boston, MA	0	0	0	0	1	11	31	36	37	31	21	12	6	3	2	0	191
Cleveland, OH	0	0	0	0	2	11	34	57	65	42	22	11	4	0	0	0	249
Denver, CO	0	0	0	0	0	0	0	2	7	14	21	10	2	0	0	0	55
Detroit, MI	0	0	0	0	0	3	33	74	144	96	56	37	29	12	0	0	484
Houston, TX	0	0	0	0	4	36	119	155	149	69	38	0	0	0	0	0	571
Los Angeles, CA	0	0	0	0	0	0	0	63	312	288	29	7	3	0	0	0	701
New York, NY	0	0	0	0	43	694	710	1,057	15	0	0	0	0	0	0	0	2,519
Philadelphia, PA	0	0	0	0	2	23	45	143	228	197	148	63	6	6	0	0	862
Sacramento, CA	0	0	0	0	0	5	28	50	41	22	7	2	1	0	0	0	155
St. Louis, MO	0	0	0	0	2	7	29	62	69	75	38	28	6	0	0	0	317

Alternative Standard 60

Study area	Daily 8hr Max Ozone Level (ppb)																Total
	0-5	5-10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50	50-55	55-60	60-65	65-70	70-75	>75	
Atlanta, GA	0	0	0	0	2	10	21	41	53	48	16	2	0	0	0	0	194
Baltimore, MD	0	0	0	0	1	5	12	45	56	56	25	7	0	0	0	0	206
Boston, MA	0	0	0	0	1	12	39	29	53	26	12	7	3	2	0	0	184
Cleveland, OH	0	0	0	0	3	15	51	66	70	15	10	0	0	0	0	0	229
Denver, CO	0	0	0	0	0	0	0	2	9	21	18	3	0	0	0	0	53
Detroit, MI	0	0	0	0	0	2	39	106	139	101	47	31	0	0	0	0	463
Houston, TX	0	0	0	0	0	28	136	192	152	48	4	0	0	0	0	0	560
Los Angeles, CA	0	0	0	0	0	0	7	225	264	151	11	0	0	0	0	0	658
New York, NY									NA								
Philadelphia, PA	0	0	0	0	2	21	61	161	263	218	97	5	6	0	0	0	834
Sacramento, CA	0	0	0	0	0	4	33	59	38	13	4	1	0	0	0	0	151
St. Louis, MO	0	0	0	0	2	8	45	73	92	46	29	4	0	0	0	0	300

NA: for NYC, the model-based adjustment methodology was unable to estimate ozone distributions which would meet the alternative standard level of 60 ppb.

Figure 7B-2. Core Short-Term Ozone-Attributable Mortality (2007) (heat map tables – change in absolute ozone-attributable incidence) (Smith et al., 2009). Note: negative values are risk increases, positive values are risk reductions.

Decrease recent conditions to 75

Study area	Daily 8hr Max Ozone Level (ppb)																Total	Change in risk	
	0-5	5-10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50	50-55	55-60	60-65	65-70	70-75	>75		Inc.	Dec.
Atlanta, GA	0	0	0	0	0	0	0	0	1	2	4	6	5	5	4	4	31	0	31
Baltimore, MD	0	0	0	0	-1	-1	-1	-1	0	1	2	2	2	4	3	2	12	-6	18
Boston, MA	0	0	0	0	-1	0	-1	0	0	0	1	1	1	1	0	1	3	-4	6
Cleveland, OH	0	0	0	-1	-1	-2	-2	-1	-1	1	1	1	1	1	1	0	0	-8	7
Denver, CO	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	1
Detroit, MI	0	0	-1	0	-2	-4	-4	-4	-3	1	1	2	3	2	3	9	2	-19	22
Houston, TX	0	-2	-6	-11	-14	-15	-10	-6	0	3	5	3	4	4	5	1	-39	-65	26
Los Angeles, CA	0	0	-7	-18	-28	-22	-26	-14	-14	-5	1	7	5	4	3	4	-111	-134	25
New York, NY	0	0	0	-18	-30	-31	-43	-25	7	44	39	38	38	56	48	49	172	-169	341
Philadelphia, PA	0	0	-1	-3	-3	-9	-9	-5	0	3	10	12	9	14	14	15	47	-36	82
Sacramento, CA	0	0	0	-1	-2	-2	-1	0	1	2	2	3	2	1	1	1	5	-7	13
St. Louis, MO	0	0	0	0	0	-1	-1	0	2	2	4	4	3	3	3	5	22	-3	27

Decrease 75 to 70

Study area	Daily 8hr Max Ozone Level (ppb)																Total	Change in risk	
	0-5	5-10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50	50-55	55-60	60-65	65-70	70-75	>75		Inc.	Dec.
Atlanta, GA	0	0	0	0	0	0	0	0	1	2	3	2	1	0	0	0	10	0	10
Baltimore, MD	0	0	0	0	0	0	0	0	1	1	1	2	1	0	0	0	7	0	6
Boston, MA	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	0	4	0	3
Cleveland, OH	0	0	0	0	0	0	0	0	1	2	1	2	1	1	0	0	8	0	10
Denver, CO	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	1
Detroit, MI	0	0	0	0	0	0	0	0	2	4	3	2	3	1	3	1	18	0	19
Houston, TX	0	0	0	0	-1	-1	-1	0	2	2	2	2	0	0	0	0	4	-3	8
Los Angeles, CA	0	0	0	0	0	0	0	0	4	10	10	1	0	0	0	0	26	0	25
New York, NY	0	0	0	0	-1	-2	0	14	31	37	41	29	6	0	0	0	154	-13	167
Philadelphia, PA	0	0	0	0	0	-1	0	0	2	5	6	6	4	2	0	1	26	-2	27
Sacramento, CA	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	3	0	4
St. Louis, MO	0	0	0	0	0	0	0	1	2	3	3	2	2	2	1	0	15	0	16

Decrease 75 to 65

Study area	Daily 8hr Max Ozone Level (ppb)																Total	Change in risk	
	0-5	5-10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50	50-55	55-60	60-65	65-70	70-75	>75		Inc.	Dec.
Atlanta, GA	0	0	0	0	0	0	1	1	2	4	5	3	1	1	0	0	18	0	18
Baltimore, MD	0	0	0	0	0	0	0	0	2	2	3	4	2	1	1	0	14	0	15
Boston, MA	0	0	0	0	0	0	0	1	1	2	2	1	2	1	1	1	11	0	12
Cleveland, OH	0	0	0	0	0	0	0	1	4	4	3	3	3	1	1	0	20	-1	20
Denver, CO	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	3	0	3
Detroit, MI	0	0	0	0	0	0	-1	0	3	7	5	4	5	2	5	2	33	-2	35
Houston, TX	0	0	0	0	-2	-2	-3	0	4	4	3	4	0	0	0	0	9	-8	16
Los Angeles, CA	0	0	0	0	0	0	0	0	8	20	21	2	1	0	0	0	52	0	52
New York, NY	0	0	0	0	-1	2	27	98	172	156	156	103	22	0	0	0	735	-7	742
Philadelphia, PA	0	0	0	0	0	-1	-1	0	5	11	13	14	9	4	1	1	56	-4	60
Sacramento, CA	0	0	0	0	0	0	-1	1	1	2	1	1	0	0	0	0	6	-1	6
St. Louis, MO	0	0	0	0	0	0	0	2	4	6	6	5	3	3	2	0	31	0	31

Decrease 75 to 60

Study area	Daily 8hr Max Ozone Level (ppb)																Total	Change in risk	
	0-5	5-10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50	50-55	55-60	60-65	65-70	70-75	>75		Inc.	Dec.
Atlanta, GA	0	0	0	0	0	0	1	2	4	6	7	5	2	1	1	0	28	0	29
Baltimore, MD	0	0	0	0	0	0	0	0	3	4	5	6	4	1	1	0	23	0	25
Boston, MA	0	0	0	0	0	0	0	1	2	3	3	2	3	1	2	1	18	0	19
Cleveland, OH	0	0	0	0	0	0	0	3	7	9	6	6	5	2	2	0	40	-2	41
Denver, CO	0	0	0	0	0	0	0	0	0	0	1	2	2	1	0	0	5	0	6
Detroit, MI	0	0	0	0	0	0	-1	1	6	11	8	7	8	4	7	3	54	-2	57
Houston, TX	0	0	0	0	-2	-4	-4	1	7	8	6	7	1	0	0	0	20	-11	31
Los Angeles, CA	0	0	0	0	0	0	0	1	24	35	29	4	1	1	0	0	96	0	95
New York, NY										NA									
Philadelphia, PA	0	0	0	0	0	-1	-1	1	8	17	19	20	13	6	1	2	86	-4	89
Sacramento, CA	0	0	0	0	0	-1	-1	2	3	3	2	1	0	0	0	0	10	-2	11
St. Louis, MO	0	0	0	0	0	0	0	4	6	9	10	7	5	5	2	1	49	0	49

NA: for NYC, the model-based adjustment methodology was unable to estimate ozone distributions which would meet the alternative standard level of 60 ppb.

Figure 7B-3. Core Short-Term Ozone-Attributable Mortality (2009) (heat map tables – absolute ozone-attributable incidence) (Smith et al., 2009).

Recent conditions

Study area	Daily 8hr Max Ozone Level (ppb)																Total
	0-5	5-10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50	50-55	55-60	60-65	65-70	70-75	>75	
Atlanta, GA	0	0	1	3	6	16	13	20	36	32	26	23	18	8	1	0	204
Baltimore, MD	0	0	1	1	6	12	20	20	20	29	40	33	15	7	5	0	210
Boston, MA	0	0	0	0	6	19	21	32	29	31	25	6	2	3	5	2	182
Cleveland, OH	0	0	0	4	8	17	20	31	50	33	35	24	7	15	2	0	246
Denver, CO	0	0	0	0	0	1	1	2	7	11	13	13	6	1	1	0	56
Detroit, MI	0	0	1	7	5	21	36	53	89	116	30	40	36	0	17	5	456
Houston, TX	0	1	7	18	34	68	80	85	60	55	53	41	21	14	6	7	549
Los Angeles, CA	0	1	4	12	23	40	68	51	63	109	98	75	67	41	12	10	672
New York, NY	0	0	5	93	165	248	322	373	466	367	370	240	153	116	25	0	2,944
Philadelphia, PA	0	0	4	10	22	56	88	67	116	110	114	124	68	30	7	0	817
Sacramento, CA	0	0	2	3	7	12	17	15	22	21	19	13	10	15	9	3	166
St. Louis, MO	0	0	1	5	4	15	21	47	38	55	60	39	17	9	0	0	311

Current Standard (75)

Study area	Daily 8hr Max Ozone Level (ppb)																Total
	0-5	5-10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50	50-55	55-60	60-65	65-70	70-75	>75	
Atlanta, GA	0	0	1	2	7	13	15	28	41	37	24	25	8	1	0	0	201
Baltimore, MD	0	0	0	0	2	7	21	36	33	47	33	23	6	0	0	0	207
Boston, MA	0	0	0	0	7	14	26	33	29	31	27	4	2	3	5	2	183
Cleveland, OH	0	0	0	0	3	16	28	42	46	50	35	17	7	4	0	0	249
Denver, CO	0	0	0	0	0	1	2	3	6	12	15	13	4	1	0	0	56
Detroit, MI	0	0	1	7	5	21	36	53	89	116	30	40	36	0	17	5	456
Houston, TX	0	0	0	5	24	43	105	107	96	77	72	31	23	6	3	3	595
Los Angeles, CA	0	0	0	0	0	0	1	10	168	196	297	91	5	0	0	0	770
New York, NY	0	0	0	7	41	246	489	407	724	538	314	201	64	0	0	0	3,031
Philadelphia, PA	0	0	0	2	12	38	118	93	162	130	151	67	50	0	0	0	822
Sacramento, CA	0	0	0	0	1	10	28	30	32	24	18	14	3	0	0	0	162
St. Louis, MO	0	0	1	5	5	14	22	44	42	63	53	43	11	7	0	0	310

Alternative Standard 70

Study area	Daily 8hr Max Ozone Level (ppb)																Total
	0-5	5-10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50	50-55	55-60	60-65	65-70	70-75	>75	
Atlanta, GA	0	0	0	1	8	14	18	38	48	27	24	16	1	0	0	0	194
Baltimore, MD	0	0	0	0	2	7	20	40	42	46	37	10	0	0	0	0	203
Boston, MA	0	0	0	0	1	17	23	37	34	33	25	3	0	5	5	0	184
Cleveland, OH	0	0	0	0	1	16	35	47	53	49	31	5	5	0	0	0	242
Denver, CO	0	0	0	0	0	0	2	2	7	11	20	11	2	1	0	0	56
Detroit, MI	0	0	0	0	9	10	33	58	82	137	66	50	7	15	4	0	472
Houston, TX	0	0	0	2	21	41	104	124	99	97	70	22	10	3	3	0	596
Los Angeles, CA	0	0	0	0	0	0	1	24	198	301	185	36	0	0	0	0	745
New York, NY	0	0	0	0	42	203	548	609	847	434	256	0	0	0	0	0	2,940
Philadelphia, PA	0	0	0	0	13	33	109	127	152	180	127	62	5	0	0	0	808
Sacramento, CA	0	0	0	0	1	7	34	35	35	21	22	6	0	0	0	0	159
St. Louis, MO	0	0	0	3	8	12	28	51	58	58	52	25	8	0	0	0	304

Alternative Standard 65

Study area	Daily 8hr Max Ozone Level (ppb)																Total
	0-5	5-10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50	50-55	55-60	60-65	65-70	70-75	>75	
Atlanta, GA	0	0	0	1	7	10	27	44	53	21	23	1	0	0	0	0	187
Baltimore, MD	0	0	0	0	1	6	22	44	56	38	29	2	0	0	0	0	198
Boston, MA	0	0	0	0	1	17	27	37	40	33	14	1	5	5	0	0	181
Cleveland, OH	0	0	0	0	1	15	50	51	57	43	10	5	0	0	0	0	231
Denver, CO	0	0	0	0	0	0	1	3	7	16	21	5	1	0	0	0	55
Detroit, MI	0	0	0	0	8	8	31	68	115	135	52	26	14	4	0	0	461
Houston, TX	0	0	0	0	10	38	118	142	115	109	41	12	5	3	0	0	592
Los Angeles, CA	0	0	0	0	0	0	1	55	241	319	96	5	0	0	0	0	717
New York, NY	0	0	0	0	43	540	827	1,080	58	0	0	0	0	0	0	0	2,547
Philadelphia, PA	0	0	0	0	11	31	102	171	193	172	85	25	0	0	0	0	791
Sacramento, CA	0	0	0	0	0	6	36	43	34	19	18	1	0	0	0	0	156
St. Louis, MO	0	0	0	1	10	10	33	61	70	52	46	12	0	0	0	0	294

Alternative Standard 60

Study area	Daily 8hr Max Ozone Level (ppb)																Total
	0-5	5-10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50	50-55	55-60	60-65	65-70	70-75	>75	
Atlanta, GA	0	0	0	0	7	12	35	47	47	25	8	0	0	0	0	0	182
Baltimore, MD	0	0	0	0	1	5	27	54	55	37	14	0	0	0	0	0	193
Boston, MA	0	0	0	0	1	19	34	37	45	26	5	4	5	0	0	0	176
Cleveland, OH	0	0	0	0	1	17	68	50	58	21	4	0	0	0	0	0	219
Denver, CO	0	0	0	0	0	0	0	5	12	29	5	0	0	0	0	0	51
Detroit, MI	0	0	0	0	4	13	31	95	129	123	36	10	3	0	0	0	444
Houston, TX	0	0	0	0	4	32	117	177	155	79	17	2	0	0	0	0	583
Los Angeles, CA	0	0	0	0	0	0	4	199	216	242	11	0	0	0	0	0	673
New York, NY									NA								
Philadelphia, PA	0	0	0	0	5	23	109	214	220	142	61	0	0	0	0	0	773
Sacramento, CA	0	0	0	0	0	4	38	52	31	25	2	0	0	0	0	0	153
St. Louis, MO	0	0	0	0	10	11	47	76	64	58	16	0	0	0	0	0	281

NA: for NYC, the model-based adjustment methodology was unable to estimate ozone distributions which would meet the alternative standard level of 60 ppb.

Figure 7B-4. Core Short-Term Ozone-Attributable Mortality (2009) (heat map tables – change in absolute ozone-attributable incidence) (Smith et al., 2009) Note: negative values are risk increases, positive values are risk reductions.

Decrease recent conditinos to 75

Study area	Daily 8hr Max Ozone Level (ppb)																Total	Change in risk	
	0-5	5-10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50	50-55	55-60	60-65	65-70	70-75	>75		Inc.	Dec.
Atlanta, GA	0	0	0	0	0	-1	0	0	1	1	1	1	1	1	0	0	4	-1	6
Baltimore, MD	0	0	-1	0	-2	-2	-2	-1	0	2	3	3	2	1	1	0	3	-9	13
Boston, MA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-1	0	0
Cleveland, OH	0	0	0	-2	-2	-2	-2	-1	0	1	2	1	1	1	0	0	-3	-10	7
Denver, CO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Detroit, MI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Houston, TX	0	-1	-4	-7	-9	-12	-10	-8	-3	-1	1	2	1	1	1	1	-47	-55	7
Los Angeles, CA	0	-2	-9	-15	-19	-23	-26	-13	-10	-8	1	5	7	7	2	3	-99	-126	26
New York, NY	0	0	-3	-34	-47	-42	-27	-18	-4	10	23	20	16	13	3	0	-89	-198	109
Philadelphia, PA	0	0	-2	-4	-6	-9	-7	-4	1	3	5	9	5	3	1	0	-4	-36	32
Sacramento, CA	0	0	-1	-1	-2	-2	-1	0	1	2	2	2	2	3	2	1	5	-7	15
St. Louis, MO	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	0	2

Decrease 75 to 70

Study area	Daily 8hr Max Ozone Level (ppb)																Total	Change in risk	
	0-5	5-10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50	50-55	55-60	60-65	65-70	70-75	>75		Inc.	Dec.
Atlanta, GA	0	0	0	0	0	0	0	1	1	2	2	2	1	0	0	0	7	0	9
Baltimore, MD	0	0	0	0	0	0	0	0	1	1	1	1	0	0	0	0	4	0	4
Boston, MA	0	0	0	0	-1	0	-1	0	0	0	0	0	0	0	0	0	-1	-3	2
Cleveland, OH	0	0	0	0	0	0	0	1	1	2	2	1	0	0	0	0	7	0	7
Denver, CO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Detroit, MI	0	0	-1	-2	-1	-4	-4	-4	-4	-1	0	1	2	0	1	0	-17	-22	5
Houston, TX	0	0	0	-1	-2	-2	-3	-1	1	1	2	1	1	0	0	0	-1	-9	6
Los Angeles, CA	0	0	0	0	0	0	0	0	3	6	12	4	0	0	0	0	25	0	25
New York, NY	0	0	0	-1	-4	-16	-9	9	26	36	26	21	7	0	0	0	96	-44	139
Philadelphia, PA	0	0	0	0	-1	-2	-2	-1	3	4	6	3	3	0	0	0	14	-6	21
Sacramento, CA	0	0	0	0	0	0	0	0	1	1	1	1	0	0	0	0	3	0	4
St. Louis, MO	0	0	0	-1	0	-1	0	0	1	2	2	2	1	0	0	0	7	-2	9

Decrease 75 to 65

Study area	Daily 8hr Max Ozone Level (ppb)																Total	Change in risk	
	0-5	5-10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50	50-55	55-60	60-65	65-70	70-75	>75		Inc.	Dec.
Atlanta, GA	0	0	0	0	-1	-1	0	1	3	4	3	3	1	0	0	0	13	-2	15
Baltimore, MD	0	0	0	0	0	0	0	0	1	3	2	2	1	0	0	0	9	-1	11
Boston, MA	0	0	0	0	-1	-1	-1	0	1	1	2	0	0	0	1	0	3	-4	6
Cleveland, OH	0	0	0	0	0	-1	0	2	3	5	4	3	1	1	0	0	18	-1	21
Denver, CO	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	1
Detroit, MI	0	0	-1	-3	-1	-5	-4	-3	-2	3	1	4	4	0	2	1	-5	-21	16
Houston, TX	0	0	0	-1	-4	-4	-5	-1	2	3	5	3	3	1	1	0	3	-15	19
Los Angeles, CA	0	0	0	0	0	0	0	0	6	14	25	8	0	0	0	0	53	0	53
New York, NY	0	0	0	-1	-5	-19	18	60	122	138	93	72	24	0	0	0	500	-48	550
Philadelphia, PA	0	0	0	0	-2	-3	-3	-1	8	8	13	7	6	0	0	0	33	-11	44
Sacramento, CA	0	0	0	0	0	-1	0	1	2	2	1	1	0	0	0	0	5	-2	7
St. Louis, MO	0	0	0	-1	-1	-1	0	1	2	5	5	5	1	1	0	0	17	-4	22

Decrease 75 to 60

Study area	Daily 8hr Max Ozone Level (ppb)																Total	Change in risk	
	0-5	5-10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50	50-55	55-60	60-65	65-70	70-75	>75		Inc.	Dec.
Atlanta, GA	0	0	0	0	-1	-1	0	2	4	5	4	4	2	0	0	0	19	-2	21
Baltimore, MD	0	0	0	0	0	-1	0	1	2	5	4	3	1	0	0	0	14	-2	16
Boston, MA	0	0	0	0	-1	-1	-1	1	1	3	3	1	0	0	1	0	8	-4	11
Cleveland, OH	0	0	0	0	0	0	1	4	5	8	7	4	2	1	0	0	31	-1	33
Denver, CO	0	0	0	0	0	0	0	0	0	0	1	2	1	0	0	0	5	0	5
Detroit, MI	0	0	-1	-4	-2	-6	-4	-2	1	8	3	6	6	0	4	1	12	-22	32
Houston, TX	0	0	0	-2	-6	-6	-6	0	4	7	9	5	5	1	1	1	12	-22	35
Los Angeles, CA	0	0	0	0	0	0	0	1	19	26	37	13	1	0	0	0	98	0	97
New York, NY										NA									
Philadelphia, PA	0	0	0	-1	-2	-4	-3	0	12	12	19	10	8	0	0	0	51	-14	65
Sacramento, CA	0	0	0	0	0	-1	-1	1	3	3	2	2	0	0	0	0	9	-2	11
St. Louis, MO	0	0	-1	-2	-1	-1	0	3	4	8	8	7	2	1	0	0	30	-6	34

NA: for NYC, the model-based adjustment methodology was unable to estimate ozone distributions which would meet the alternative standard level of 60 ppb.

Table 7B-3a. Core Short-Term Ozone-Attributable Morbidity – Hospital Admissions (2007).

Endpoint/Study Area/Descriptor	Air Quality Scenario								
	Absolute Ozone-Attributable Incidence					Change in Ozone-Attributable Incidence			
	Base	**75ppb**	**70ppb**	**65ppb**	**60ppb**	**Base-75**	**75-70**	**75-65**	**75-60**
2007 Simulation Year									
HA (respiratory); Detroit (Katsouyanni et al., 2009)									
1hr max, penalized splines	200	190	180	170	160	14	10	18	29
	(-47 - 430)	(-44 - 410)	(-41 - 380)	(-40 - 370)	(-37 - 340)	(-3.2 - 31)	(-2.4 - 23)	(-4.3 - 41)	(-6.8 - 65)
1hr max, natural splines	190	180	170	160	150	13	9.8	18	28
	(-58 - 430)	(-54 - 400)	(-51 - 380)	(-49 - 360)	(-45 - 340)	(-4.0 - 31)	(-2.9 - 22)	(-5.3 - 40)	(-8.4 - 65)
HA (respiratory); NYC (Silverman and Ito, 2010; Lin et al., 2008)									
HA Chronic Lung Disease (Lin)	160	140	140	110	NA	14	7.9	34	NA
	(92 - 220)	(84 - 200)	(80 - 190)	(65 - 160)		(8.0 - 19)	(4.6 - 11)	(20 - 48)	
HA Asthma (Silverman)	520	490	460	380		58	33	140	
	(39 - 860)	(35 - 810)	(33 - 780)	(26 - 660)		(3.8 - 110)	(2.1 - 63)	(8.9 - 250)	
HA Asthma, PM2.5 (Silverman)	390	360	340	280		42	23	98	
	(-140 - 760)	(-130 - 710)	(-120 - 680)	(-94 - 570)		(-13 - 91)	(-7.2 - 53)	(-31 - 210)	
HA (respiratory); LA (Linn et al., 2000)									
1hr max penalized splines	370	480	460	450	440	-110	11	23	36
	(-480 - 1,200)	(-630 - 1,500)	(-610 - 1,500)	(-600 - 1,500)	(-580 - 1,400)	(140 - -370)	(-15 - 37)	(-29 - 74)	(-47 - 120)
HA (COPD less asthma); all 12 study areas (Medina-Ramon, et al., 2006)									
Atlanta, GA	64	55	52	50	47	10	3	5	8
	(18 - 110)	(15 - 93)	(15 - 89)	(14 - 85)	(13 - 80)	(3 - 17)	(1 - 5)	(1 - 9)	(2 - 14)
Baltimore, MD	43	40	38	37	35	3	1	3	5
	(12 - 73)	(11 - 68)	(11 - 66)	(10 - 63)	(10 - 60)	(1 - 6)	(0 - 3)	(1 - 5)	(1 - 8)
Boston, MA	59	58	57	54	52	2	1	3	6
	(17 - 100)	(16 - 99)	(16 - 97)	(15 - 93)	(15 - 90)	(0 - 3)	(0 - 2)	(1 - 6)	(2 - 9)
Cleveland, OH	38	37	36	34	31	1	1	3	6
	(11 - 65)	(11 - 64)	(10 - 62)	(10 - 59)	(9 - 53)	(0 - 1)	(0 - 2)	(1 - 6)	(2 - 11)
Denver, CO	18	18	18	17	16	0	1	1	2
	(5 - 32)	(5 - 31)	(5 - 30)	(5 - 29)	(5 - 27)	(0 - 1)	(0 - 1)	(0 - 2)	(1 - 4)
Detroit, MI	72	71	69	67	64	0	2	4	7
	(20 - 120)	(20 - 120)	(19 - 120)	(19 - 110)	(18 - 110)	(0 - 1)	(1 - 4)	(1 - 8)	(2 - 13)
Houston, TX	55	57	56	55	54	-2	1	2	3
	(15 - 94)	(16 - 97)	(16 - 96)	(15 - 94)	(15 - 92)	(-1 - -4)	(0 - 1)	(0 - 3)	(1 - 6)
Los Angeles, CA	110	110	110	100	96	2	5	10	15
	(31 - 190)	(31 - 190)	(30 - 180)	(28 - 170)	(27 - 160)	(0 - 3)	(1 - 9)	(3 - 17)	(4 - 26)
New York, NY	220	200	190	150	NA	21	13	57	NA
	(63 - 380)	(57 - 350)	(53 - 330)	(41 - 250)		(6 - 37)	(4 - 22)	(16 - 98)	
Philadelphia, PA	110	97	93	90	86	9	3	7	11
	(30 - 180)	(27 - 160)	(26 - 160)	(25 - 150)	(24 - 150)	(2 - 15)	(1 - 6)	(2 - 12)	(3 - 18)
Sacramento, CA	17	15	14	14	13	2	1	1	2
	(5 - 29)	(4 - 25)	(4 - 25)	(4 - 24)	(4 - 23)	(1 - 3)	(0 - 1)	(0 - 2)	(0 - 3)
St. Louis, MO	46	43	41	38	36	4	2	4	7
	(13 - 79)	(12 - 73)	(11 - 69)	(11 - 66)	(10 - 62)	(1 - 6)	(1 - 4)	(1 - 8)	(2 - 12)

NA: for NYC, the model-based adjustment methodology was unable to estimate ozone distributions which would meet the alternative standard level of 60 ppb.
“0” incidence values denote non-zero estimates that round to zero.

Table 7B-3b. Core Short-Term Ozone-Attributable Morbidity – Hospital Admissions (2009).

Endpoint/Study Area/Descriptor	Air Quality Scenario								
	Absolute Ozone-Attributable Incidence					Change in Ozone-Attributable Incidence			
	Base	75ppb	70ppb	65ppb	60ppb	Base-75	75-70	75-65	75-60
2009 Simulation Year									
HA (respiratory); Detroit (Katsouyanni et al., 2009)									
1hr max, penalized splines	170	170	170	160	150	NA	2.8	10	20
	(-40 - 380)	(-40 - 380)	(-40 - 370)	(-38 - 350)	(-36 - 330)		(-0.65 - 6.2)	(-2.4 - 23)	(-4.6 - 44)
1hr max, natural splines	160	160	160	160	150		2.7	9.8	19
	(-50 - 370)	(-50 - 370)	(-49 - 370)	(-47 - 350)	(-44 - 330)		(-0.80 - 6.2)	(-2.9 - 22)	(-5.6 - 43)
HA (respiratory); NYC (Silverman and Ito, 2010; Lin et al., 2008)									
HA Chronic Lung Disease (Lin)	140	140	130	110	NA	0.053	5.9	25	NA
	(80 - 190)	(80 - 190)	(77 - 190)	(66 - 160)		(0.038 - 0.056)	(3.4 - 8.4)	(14 - 35)	
HA Asthma (Silverman)	480	470	450	390		9.4	28	110	
	(35 - 800)	(34 - 790)	(32 - 770)	(27 - 670)		(0.62 - 17)	(1.8 - 54)	(7.2 - 200)	
HA Asthma, PM2.5 (Silverman)	350	350	330	280		6.8	20	79	
	(-130 - 700)	(-120 - 700)	(-120 - 670)	(-97 - 580)		(-2.2 - 14)	(-6.2 - 45)	(-25 - 170)	
HA (respiratory); LA (Linn et al., 2000)									
1hr max penalized splines	390	500	490	480	460	-120	11	23	37
	(-510 - 1,200)	(-660 - 1,600)	(-650 - 1,600)	(-630 - 1,500)	(-610 - 1,500)	(150 - -390)	(-14 - 35)	(-30 - 76)	(-48 - 120)
HA (COPD less asthma); all 12 study areas (Medina-Ramon, et al., 2006)									
Atlanta, GA	53	52	50	48	46	2	3	4	6
	(15 - 91)	(15 - 89)	(14 - 85)	(13 - 82)	(13 - 79)	(0 - 3)	(1 - 4)	(1 - 8)	(2 - 11)
Baltimore, MD	38	37	36	35	34	1	1	2	3
	(11 - 65)	(10 - 62)	(10 - 61)	(10 - 59)	(9 - 57)	(0 - 3)	(0 - 1)	(1 - 3)	(1 - 5)
Boston, MA	53	53	53	52	51	0	0	1	2
	(15 - 90)	(15 - 91)	(15 - 91)	(15 - 89)	(14 - 87)	(0 - -1)	(0 - 0)	(0 - 1)	(1 - 4)
Cleveland, OH	36	36	35	33	31	0	1	3	5
	(10 - 61)	(10 - 61)	(10 - 59)	(9 - 56)	(9 - 53)	(0 - 0)	(0 - 2)	(1 - 5)	(1 - 9)
Denver, CO	18	18	18	17	16	0	0	1	2
	(5 - 30)	(5 - 30)	(5 - 30)	(5 - 29)	(4 - 27)	(0 - 0)	(0 - 0)	(0 - 1)	(1 - 4)
Detroit, MI	64	64	66	65	63	NA	-3	-1	1
	(18 - 110)	(18 - 110)	(19 - 110)	(18 - 110)	(18 - 110)		(-1 - -4)	(0 - -2)	(0 - 2)
Houston, TX	60	63	63	62	60	-3	0	1	3
	(17 - 100)	(18 - 110)	(18 - 110)	(17 - 110)	(17 - 100)	(-1 - -5)	(0 - 1)	(0 - 2)	(1 - 6)
Los Angeles, CA	120	120	110	110	100	3	5	10	16
	(33 - 200)	(33 - 200)	(31 - 190)	(30 - 180)	(28 - 170)	(1 - 5)	(1 - 8)	(3 - 17)	(4 - 27)
New York, NY	190	190	190	160	NA	-1	8	40	NA
	(54 - 330)	(55 - 330)	(52 - 320)	(43 - 270)		(0 - -1)	(2 - 14)	(11 - 69)	
Philadelphia, PA	90	88	87	84	82	1	2	4	6
	(25 - 150)	(25 - 150)	(24 - 150)	(24 - 140)	(23 - 140)	(0 - 2)	(0 - 3)	(1 - 7)	(2 - 11)
Sacramento, CA	18	16	15	15	14	2	1	1	2
	(5 - 31)	(5 - 27)	(4 - 26)	(4 - 25)	(4 - 24)	(1 - 4)	(0 - 1)	(0 - 2)	(1 - 3)
St. Louis, MO	41	41	39	38	36	0	2	3	5
	(12 - 70)	(11 - 69)	(11 - 67)	(11 - 64)	(10 - 61)	(0 - 1)	(0 - 3)	(1 - 5)	(1 - 9)

NA: for NYC, the model-based adjustment methodology was unable to estimate ozone distributions which would meet the alternative standard level of 60 ppb. For Detroit, already meeting existing standard.

"0" incidence values denote non-zero estimates that round to zero.

Table 7B-4a. Core Short-Term Ozone-Attributable Morbidity – Emergency Room Visits (2007).

Endpoint/Study Area/Descriptor	Air Quality Scenario								
	Absolute Ozone-Attributable Incidence					Change in Ozone-Attributable Incidence			
	Base	75ppb	70ppb	65ppb	60ppb	Base-75	75-70	75-65	75-60
2007 Simulation Year									
ER Visits (repiratory); Atlanta (Strickland et al., 2007)									
Distributed lag 0-7 days	7,400	6,600	6,300	6,000	5,700	1,100	350	650	1,000
	(5,300 - 9,400)	(4,700 - 8,300)	(4,500 - 8,000)	(4,300 - 7,700)	(4,100 - 7,300)	(790 - 1,500)	(240 - 460)	(450 - 850)	(710 - 1,300)
Average day lag 0-2	4,400	3,900	3,700	3,600	3,400	650	200	370	580
	(2,400 - 6,300)	(2,100 - 5,500)	(2,000 - 5,300)	(1,900 - 5,100)	(1,800 - 4,800)	(350 - 950)	(110 - 290)	(200 - 540)	(310 - 850)
ER-visits (respiratory); Atlanta (Tolbert et al., 2007, Darrow et al., 2011)									
Tolbert	8,000	7,000	6,700	6,500	6,200	1,000	310	580	920
	(5,500 - 10,000)	(4,900 - 9,200)	(4,700 - 8,800)	(4,500 - 8,500)	(4,300 - 8,000)	(680 - 1,300)	(220 - 410)	(400 - 760)	(630 - 1,200)
Tolbert-CO	7,100	6,300	6,000	5,800	5,500	880	280	510	810
	(4,400 - 9,800)	(3,800 - 8,600)	(3,700 - 8,300)	(3,500 - 8,000)	(3,400 - 7,600)	(540 - 1,200)	(170 - 390)	(310 - 710)	(490 - 1,100)
Tolbert-NO2	6,400	5,700	5,400	5,200	5,000	800	250	460	730
	(3,400 - 9,400)	(3,000 - 8,300)	(2,900 - 7,900)	(2,800 - 7,600)	(2,600 - 7,300)	(420 - 1,200)	(130 - 370)	(240 - 680)	(380 - 1,100)
Tolbert-PM10	5,000	4,400	4,300	4,100	3,900	620	200	360	570
	(1,800 - 8,200)	(1,600 - 7,300)	(1,500 - 7,000)	(1,400 - 6,700)	(1,400 - 6,400)	(220 - 1,000)	(68 - 320)	(130 - 600)	(200 - 940)
Tolbert-PM10, NO2	4,900	4,300	4,100	4,000	3,800	600	190	350	550
	(1,600 - 8,000)	(1,400 - 7,100)	(1,300 - 6,800)	(1,300 - 6,600)	(1,200 - 6,200)	(200 - 1,000)	(61 - 320)	(110 - 580)	(180 - 920)
Darrow	4,300	3,800	3,600	3,500	3,300	530	170	310	490
	(2,600 - 6,000)	(2,300 - 5,300)	(2,200 - 5,100)	(2,100 - 4,900)	(2,000 - 4,600)	(320 - 740)	(100 - 230)	(190 - 430)	(300 - 680)
ER-visits (asthma); NYC (Ito et al, 2007)									
single pollutant model	11,000	11,000	10,000	8,200	NA	920	620	2,700	NA
	(7,700 - 14,000)	(7,200 - 14,000)	(6,900 - 13,000)	(5,600 - 11,000)		(610 - 1,200)	(410 - 830)	(1,800 - 3,600)	
PM2.5	8,800	8,300	7,900	6,400		710	480	2,100	
	(4,800 - 12,000)	(4,500 - 12,000)	(4,200 - 11,000)	(3,400 - 9,200)		(370 - 1,000)	(250 - 700)	(1,100 - 3,100)	
NO2	7,300	6,800	6,500	5,300		580	390	1,700	
	(3,300 - 11,000)	(3,100 - 10,000)	(2,900 - 9,800)	(2,400 - 8,000)		(260 - 890)	(170 - 610)	(760 - 2,700)	
CO	12,000	11,000	11,000	8,700		970	660	2,900	
	(8,500 - 15,000)	(7,900 - 14,000)	(7,500 - 13,000)	(6,100 - 11,000)		(680 - 1,300)	(460 - 870)	(2,000 - 3,800)	
SO2	9,100	8,500	8,100	6,600		730	490	2,200	
	(5,300 - 13,000)	(5,000 - 12,000)	(4,700 - 11,000)	(3,800 - 9,200)		(420 - 1,000)	(280 - 710)	(1,200 - 3,100)	

NA: for NYC, the model-based adjustment methodology was unable to estimate ozone distributions which would meet the alternative standard level of 60 ppb.

Table 7B-4b. Core Short-Term Ozone-Attributable Morbidity – Emergency Room Visits (2009).

Endpoint/Study Area/Descriptor	Air Quality Scenario								
	Absolute Ozone-Attributable Incidence					Change in Ozone-Attributable Incidence			
	Base	75ppb	70ppb	65ppb	60ppb	Base-75	75-70	75-65	75-60
2009 Simulation Year									
ER Visits (repiratory); Atlanta (Strickland et al., 2007)									
Distributed lag 0-7 days	6,100	5,900	5,700	5,500	5,400	150	270	490	700
	(4,300 - 7,700)	(4,200 - 7,600)	(4,100 - 7,300)	(3,900 - 7,100)	(3,800 - 6,900)	(100 - 200)	(190 - 350)	(340 - 640)	(480 - 910)
Average day lag 0-2	3,600	3,500	3,400	3,300	3,100	86	150	280	400
	(2,000 - 5,100)	(1,900 - 5,000)	(1,800 - 4,800)	(1,800 - 4,700)	(1,700 - 4,500)	(46 - 130)	(81 - 220)	(150 - 410)	(210 - 580)
ER-visits (respiratory); Atlanta (Tolbert et al., 2007, Darrow et al., 2011)									
Tolbert	6,600	6,400	6,200	6,000	5,900	120	230	440	620
	(4,500 - 8,500)	(4,500 - 8,400)	(4,300 - 8,100)	(4,200 - 7,900)	(4,000 - 7,600)	(84 - 160)	(160 - 300)	(300 - 570)	(430 - 820)
Tolbert-CO	5,800	5,700	5,500	5,400	5,200	110	200	390	550
	(3,600 - 8,000)	(3,500 - 7,900)	(3,400 - 7,600)	(3,300 - 7,400)	(3,200 - 7,200)	(66 - 150)	(120 - 290)	(240 - 540)	(340 - 770)
Tolbert-NO2	5,300	5,200	5,000	4,900	4,700	97	180	350	500
	(2,800 - 7,700)	(2,700 - 7,600)	(2,600 - 7,300)	(2,600 - 7,100)	(2,500 - 6,900)	(51 - 140)	(97 - 270)	(180 - 520)	(260 - 740)
Tolbert-PM10	4,100	4,100	3,900	3,800	3,700	76	140	270	390
	(1,500 - 6,800)	(1,400 - 6,600)	(1,400 - 6,400)	(1,300 - 6,200)	(1,300 - 6,000)	(27 - 130)	(50 - 240)	(95 - 450)	(140 - 640)
Tolbert-PM10, NO2	4,000	3,900	3,800	3,700	3,600	73	140	260	380
	(1,300 - 6,600)	(1,300 - 6,500)	(1,200 - 6,300)	(1,200 - 6,100)	(1,200 - 5,900)	(24 - 120)	(45 - 230)	(86 - 440)	(120 - 630)
Darrow	3,500	3,500	3,400	3,300	3,200	65	120	230	330
	(2,200 - 4,900)	(2,100 - 4,800)	(2,000 - 4,700)	(2,000 - 4,500)	(1,900 - 4,400)	(39 - 91)	(74 - 170)	(140 - 320)	(200 - 470)
ER-visits (asthma); NYC (Ito et al, 2007)									
single pollutant model	10,000	10,000	9,900	8,500	NA	-84	470	2,100	NA
	(7,000 - 13,000)	(7,000 - 13,000)	(6,800 - 13,000)	(5,800 - 11,000)		(-52 - -120)	(310 - 630)	(1,400 - 2,800)	
PM2.5	8,000	8,100	7,800	6,700		-62	360	1,600	
	(4,300 - 11,000)	(4,300 - 11,000)	(4,200 - 11,000)	(3,600 - 9,600)		(-30 - -97)	(190 - 530)	(840 - 2,300)	
NO2	6,600	6,700	6,400	5,500		-49	290	1,300	
	(3,000 - 9,900)	(3,000 - 10,000)	(2,900 - 9,700)	(2,400 - 8,300)		(-20 - -81)	(130 - 460)	(570 - 2,000)	
CO	11,000	11,000	10,000	9,000		-90	500	2,200	
	(7,600 - 14,000)	(7,700 - 14,000)	(7,400 - 13,000)	(6,400 - 12,000)		(-59 - -130)	(340 - 660)	(1,500 - 2,900)	
SO2	8,200	8,300	8,000	6,900		-64	370	1,700	
	(4,800 - 11,000)	(4,800 - 12,000)	(4,700 - 11,000)	(4,000 - 9,600)		(-34 - -98)	(210 - 530)	(940 - 2,400)	

NA: for NYC, the model-based adjustment methodology was unable to estimate ozone distributions which would meet the alternative standard level of 60 ppb.

Table 7B-5a. Core Short-Term Ozone-Attributable Morbidity – Asthma Exacerbations (2007).

Endpoint/Study Area/Descriptor	Air Quality Scenario								
	Absolute Ozone-Attributable Incidence					Change in Ozone-Attributable Incidence			
	Base	75ppb	70ppb	65ppb	60ppb	Base-75	75-70	75-65	75-60
2007 Simulation Year									
Asthma exacerbation (wheeze); Boston (Gent et al., 2003, 2004)									
Chest Tightness (1hr max)	41,000	40,000	40,000	38,000	37,000	1,500	1,200	3,300	5,100
	(22,000 - 57,000)	(21,000 - 56,000)	(21,000 - 55,000)	(20,000 - 53,000)	(19,000 - 52,000)	(720 - 2,200)	(600 - 1,800)	(1,600 - 4,900)	(2,500 - 7,500)
Chest Tightness (8hr max)	30,000	30,000	29,000	28,000	28,000	530	680	1,900	3,000
	(10,000 - 47,000)	(9,900 - 47,000)	(9,800 - 46,000)	(9,400 - 45,000)	(9,100 - 43,000)	(170 - 870)	(210 - 1,100)	(580 - 3,100)	(920 - 4,900)
Chest Tightness (1hr max, PM2.5)[a]	42,000	41,000	40,000	39,000	37,000	1,500	1,200	3,300	5,100
	(20,000 - 59,000)	(19,000 - 58,000)	(19,000 - 57,000)	(18,000 - 56,000)	(17,000 - 54,000)	(640 - 2,300)	(530 - 1,900)	(1,400 - 5,100)	(2,200 - 7,900)
Chest Tightness (1hr max, PM2.5)[b]	39,000	38,000	37,000	36,000	34,000	1,400	1,100	3,000	4,700
	(16,000 - 57,000)	(15,000 - 56,000)	(15,000 - 55,000)	(14,000 - 53,000)	(14,000 - 52,000)	(500 - 2,200)	(420 - 1,800)	(1,100 - 4,900)	(1,800 - 7,500)
Shortness of Breath (1hr max)	29,000	29,000	28,000	27,000	26,000	970	800	2,200	3,400
	(3,700 - 51,000)	(3,600 - 50,000)	(3,500 - 49,000)	(3,400 - 47,000)	(3,200 - 45,000)	(110 - 1,800)	(93 - 1,500)	(250 - 4,000)	(400 - 6,200)
Shortness of Breath (8hr max)	35,000	35,000	34,000	33,000	32,000	610	780	2,100	3,400
	(7,200 - 58,000)	(7,000 - 57,000)	(6,900 - 56,000)	(6,700 - 55,000)	(6,400 - 53,000)	(120 - 1,100)	(150 - 1,400)	(400 - 3,800)	(640 - 6,000)
Wheeze (PM2.5)	78,000	76,000	75,000	72,000	69,000	2,700	2,200	6,000	9,300
	(29,000 - 120,000)	(28,000 - 120,000)	(28,000 - 110,000)	(26,000 - 110,000)	(25,000 - 110,000)	(930 - 4,400)	(760 - 3,700)	(2,100 - 9,800)	(3,200 - 15,000)

[a] previous day; [b] same day.

Table 7B-5b. Core Short-Term Ozone-Attributable Morbidity – Asthma Exacerbations (2009).

Endpoint/Study Area/Descriptor	Air Quality Scenario								
	Absolute Ozone-Attributable Incidence					Change in Ozone-Attributable Incidence			
	Base	75ppb	70ppb	65ppb	60ppb	Base-75	75-70	75-65	75-60
2009 Simulation Year									
Asthma exacerbation (wheeze); Boston (Gent et al., 2003, 2004)									
Chest Tightness (1hr max)	38,000	38,000	38,000	37,000	36,000	-92	290	1,400	2,800
	(20,000 - 53,000)	(20,000 - 53,000)	(20,000 - 53,000)	(19,000 - 52,000)	(19,000 - 50,000)	(-44 - -140)	(140 - 430)	(690 - 2,100)	(1,400 - 4,200)
Chest Tightness (8hr max)	28,000	28,000	28,000	27,000	27,000	-220	-110	470	1,300
	(9,100 - 43,000)	(9,200 - 44,000)	(9,200 - 44,000)	(9,100 - 43,000)	(8,800 - 42,000)	(-66 - -370)	(-32 - -190)	(150 - 780)	(410 - 2,200)
Chest Tightness (1hr max, PM2.5)[a]	38,000	38,000	38,000	37,000	36,000	-93	300	1,400	2,900
	(18,000 - 55,000)	(18,000 - 55,000)	(18,000 - 55,000)	(17,000 - 54,000)	(17,000 - 52,000)	(-39 - -150)	(130 - 460)	(610 - 2,200)	(1,200 - 4,400)
Chest Tightness (1hr max, PM2.5)[b]	35,000	35,000	35,000	34,000	33,000	-84	270	1,300	2,600
	(14,000 - 52,000)	(14,000 - 53,000)	(14,000 - 52,000)	(14,000 - 51,000)	(13,000 - 50,000)	(-30 - -140)	(100 - 430)	(480 - 2,100)	(980 - 4,200)
Shortness of Breath (1hr max)	26,000	27,000	26,000	26,000	25,000	-59	190	930	1,900
	(3,300 - 46,000)	(3,300 - 46,000)	(3,300 - 46,000)	(3,200 - 45,000)	(3,100 - 44,000)	(-6.8 - -110)	(23 - 360)	(110 - 1,700)	(220 - 3,500)
Shortness of Breath (8hr max)	32,000	32,000	32,000	32,000	31,000	-250	-120	540	1,500
	(6,500 - 53,000)	(6,500 - 54,000)	(6,500 - 54,000)	(6,400 - 53,000)	(6,200 - 52,000)	(-46 - -450)	(-22 - -230)	(100 - 960)	(280 - 2,600)
Wheeze (PM2.5)	71,000	71,000	71,000	69,000	67,000	-170	530	2,600	5,200
	(26,000 - 110,000)	(26,000 - 110,000)	(26,000 - 110,000)	(25,000 - 110,000)	(25,000 - 100,000)	(-56 - -280)	(190 - 870)	(880 - 4,200)	(1,800 - 8,500)

[a] previous day; [b] same day.

Table 7B-6. Core Long-Term Ozone-Attributable Respiratory Mortality (2007) (incidence, percent of baseline mortality, incidence per 100,000) (Jerrett et al., 2009).

	Air Quality Scenario								
	Absolute Incidence					Change in Incidence			
Study Area	Base	75ppb	70ppb	65ppb	60ppb	base-75	75-70	75-65	75-60
Atlanta, GA	690	590	560	530	500	120	35	64	100
	(250 - 1100)	(210 - 920)	(200 - 870)	(190 - 840)	(180 - 790)	(42 - 200)	(12 - 59)	(22 - 110)	(34 - 160)
Baltimore, MD	420	390	380	360	340	41	17	35	57
	(150 - 650)	(140 - 610)	(140 - 590)	(130 - 560)	(120 - 540)	(14 - 67)	(6 - 29)	(12 - 57)	(19 - 93)
Boston, MA	660	640	620	590	570	24	20	53	82
	(240 - 1000)	(230 - 1000)	(220 - 980)	(210 - 930)	(200 - 900)	(8 - 39)	(7 - 33)	(18 - 88)	(28 - 140)
Cleveland, OH	340	330	310	300	270	13	16	35	64
	(120 - 530)	(120 - 510)	(110 - 490)	(110 - 470)	(97 - 430)	(4 - 21)	(6 - 27)	(12 - 58)	(22 - 100)
Denver, CO	340	330	320	300	290	16	13	26	43
	(120 - 520)	(120 - 500)	(110 - 490)	(110 - 470)	(100 - 450)	(5 - 26)	(4 - 21)	(9 - 44)	(15 - 71)
Detroit, MI	620	600	580	560	540	24	28	50	78
	(220 - 960)	(220 - 940)	(210 - 900)	(200 - 880)	(190 - 840)	(8 - 40)	(10 - 46)	(17 - 82)	(27 - 130)
Houston, TX	470	460	450	450	440	18	8.0	16	27
	(170 - 740)	(160 - 720)	(160 - 710)	(160 - 700)	(160 - 690)	(6 - 30)	(3 - 13)	(5 - 26)	(9 - 44)
Los Angeles, CA	1,600	1,500	1,500	1,400	1,300	57	82	160	240
	(580 - 2500)	(560 - 2400)	(540 - 2300)	(510 - 2200)	(490 - 2100)	(19 - 95)	(28 - 140)	(54 - 260)	(83 - 400)
New York, NY	2,400	2,100	2,000	1,600	NA	320	140	550	NA
	(860 - 3700)	(750 - 3300)	(710 - 3100)	(570 - 2600)		(110 - 530)	(47 - 230)	(190 - 900)	
Philadelphia, PA	1,000	930	890	850	820	120	42	87	130
	(370 - 1600)	(330 - 1400)	(320 - 1400)	(310 - 1300)	(290 - 1300)	(42 - 200)	(14 - 69)	(30 - 140)	(44 - 210)
Sacramento, CA	350	300	290	280	260	56	14	26	44
	(130 - 530)	(110 - 470)	(100 - 450)	(100 - 440)	(94 - 410)	(19 - 92)	(5 - 22)	(9 - 43)	(15 - 73)
St. Louis, MO	520	480	460	430	410	48	27	56	84
	(190 - 800)	(170 - 750)	(170 - 710)	(160 - 680)	(150 - 640)	(16 - 80)	(9 - 45)	(19 - 92)	(29 - 140)

	Air Quality Scenario								
	Percent of Baseline Incidence					Change in O_3-Attributable Risk			
Study Area	Base	75ppb	70ppb	65ppb	60ppb	Base-75	75-70	75-65	75-60
Atlanta, GA	21.7	18.6	17.7	16.9	16.0	14	5	9	14
Baltimore, MD	20.3	18.8	18.1	17.4	16.5	8	4	7	12
Boston, MA	17.7	17.2	16.7	16.0	15.3	3	3	7	11
Cleveland, OH	18.2	17.7	16.9	16.1	14.8	3	4	9	16
Denver, CO	21.6	20.8	20.1	19.4	18.6	4	3	6	11
Detroit, MI	19.0	18.4	17.7	17.2	16.4	3	4	7	11
Houston, TX	16.9	16.3	16.1	15.9	15.5	3	1	3	5
Los Angeles, CA	21.0	20.4	19.6	18.8	17.8	3	4	8	13
New York, NY	19.0	16.9	15.9	13.1	NA	11	6	23	NA
Philadelphia, PA	20.4	18.4	17.7	17.0	16.3	10	4	8	12
Sacramento, CA	20.5	17.8	17.1	16.5	15.6	13	4	7	12
St. Louis, MO	20.3	18.8	17.9	17.0	16.0	7	5	10	15

	Air Quality Scenario								
	Ozone-Attributable Deaths per 100,000					Change in Ozone-Attributable Deaths per 100,000			
Study Area	Base	75ppb	70ppb	65ppb	60ppb	Base-75	75-70	75-65	75-60
Atlanta, GA	24	21	20	19	18	4.4	1.3	2.3	3.5
Baltimore, MD	27	25	24	23	22	2.6	1.1	2.2	3.6
Boston, MA	24	24	23	22	21	0.88	0.74	2.0	3.1
Cleveland, OH	26	25	24	23	21	1.00	1.2	2.7	4.9
Denver, CO	24	23	23	22	21	1.1	0.91	1.9	3.1
Detroit, MI	24	23	22	21	20	0.91	1.1	1.9	3.0
Houston, TX	16	15	15	15	15	0.61	0.27	0.52	0.89
Los Angeles, CA	23	22	21	20	19	0.81	1.2	2.2	3.4
New York, NY	21	19	18	15	NA	2.9	1.3	4.9	NA
Philadelphia, PA	29	27	26	24	23	3.5	1.2	2.5	3.7
Sacramento, CA	29	25	24	23	22	4.7	1.1	2.2	3.7
St. Louis, MO	32	29	28	26	25	2.9	1.6	3.4	5.1

NA: for NYC, the model-based adjustment methodology was unable to estimate ozone distributions which would meet the alternative standard level of 60 ppb.

Table 7B-7. Core Long-Term Ozone-Attributable Respiratory Mortality (2009) (incidence, percent of baseline mortality, incidence per 100,000) (Jerrett et al., 2009).

	Air Quality Scenario								
	Absolute Incidence					Change in Incidence			
Study Area	**Base**	**75ppb**	**70ppb**	**65ppb**	**60ppb**	**base-75**	**75-70**	**75-65**	**75-60**
Atlanta, GA	570	550	520	500	480	26	32	59	82
	(210 - 890)	(200 - 860)	(190 - 820)	(180 - 790)	(170 - 760)	(9 - 43)	(11 - 53)	(20 - 98)	(28 - 140)
Baltimore, MD	380	360	350	340	320	25	12	27	41
	(140 - 590)	(130 - 560)	(120 - 540)	(120 - 530)	(120 - 510)	(8 - 41)	(4 - 20)	(9 - 44)	(14 - 68)
Boston, MA	580	580	580	560	540	-1.1	3.7	23	47
	(210 - 910)	(210 - 920)	(210 - 910)	(200 - 890)	(190 - 860)	(0 - -2)	(1 - 6)	(8 - 38)	(16 - 77)
Cleveland, OH	310	300	290	280	260	9.4	14	32	50
	(110 - 490)	(110 - 470)	(100 - 460)	(98 - 430)	(92 - 410)	(3 - 16)	(5 - 24)	(11 - 53)	(17 - 82)
Denver, CO	320	320	310	300	280	0.49	5.8	18	45
	(120 - 490)	(120 - 490)	(110 - 490)	(110 - 470)	(100 - 440)	(0 - 1)	(2 - 10)	(6 - 30)	(16 - 75)
Detroit, MI	540	540	550	530	510	NA	-6.7	14	38
	(190 - 850)	(190 - 850)	(200 - 850)	(190 - 830)	(180 - 800)		(-2 - -11)	(5 - 23)	(13 - 64)
Houston, TX	490	490	480	470	460	-3.9	11	24	40
	(170 - 760)	(180 - 770)	(170 - 750)	(170 - 740)	(160 - 720)	(-1 - -7)	(4 - 18)	(8 - 40)	(14 - 66)
Los Angeles, CA	1,600	1,600	1,500	1,400	1,400	63	77	160	250
	(590 - 2500)	(570 - 2400)	(550 - 2300)	(520 - 2200)	(500 - 2100)	(21 - 100)	(26 - 130)	(54 - 260)	(84 - 400)
New York, NY	2,100	2,000	1,900	1,700	NA	61	120	420	NA
	(750 - 3300)	(730 - 3200)	(690 - 3000)	(590 - 2700)		(21 - 100)	(40 - 200)	(140 - 690)	
Philadelphia, PA	880	850	820	790	770	40	31	66	97
	(320 - 1400)	(310 - 1300)	(300 - 1300)	(280 - 1200)	(270 - 1200)	(13 - 66)	(11 - 52)	(23 - 110)	(33 - 160)
Sacramento, CA	360	310	300	280	270	61	14	28	44
	(130 - 550)	(110 - 480)	(110 - 460)	(100 - 450)	(96 - 420)	(21 - 100)	(5 - 24)	(9 - 46)	(15 - 73)
St. Louis, MO	450	440	430	410	390	5.6	19	41	66
	(160 - 700)	(160 - 690)	(150 - 670)	(150 - 650)	(140 - 610)	(2 - 9)	(6 - 31)	(14 - 67)	(23 - 110)

	Air Quality Scenario								
	Percent of Baseline Incidence					Change in O_3-Attributable Risk			
Study Area	**Base**	**75ppb**	**70ppb**	**65ppb**	**60ppb**	**Base-75**	**75-70**	**75-65**	**75-60**
Atlanta, GA	17.6	17.0	16.2	15.4	14.8	4	5	9	13
Baltimore, MD	18.4	17.4	16.9	16.3	15.7	5	3	6	10
Boston, MA	15.9	16.0	15.9	15.4	14.9	-0.2	1	3	7
Cleveland, OH	17.2	16.8	16.1	15.3	14.5	2	4	9	14
Denver, CO	20.1	20.0	19.8	19.1	17.7	0.1	1	5	12
Detroit, MI	17.0	17.0	17.2	16.6	16.0	NA	-1	2	6
Houston, TX	16.8	16.9	16.6	16.3	15.8	-1	2	4	7
Los Angeles, CA	21.4	20.7	19.9	19.1	18.1	3	4	8	13
New York, NY	17.1	16.7	15.9	13.8	NA	2	5	18	NA
Philadelphia, PA	17.9	17.2	16.7	16.1	15.5	4	3	6	10
Sacramento, CA	20.9	18.0	17.3	16.7	15.8	14	4	7	12
St. Louis, MO	17.9	17.7	17.1	16.4	15.5	1	3	8	12

	Air Quality Scenario								
	Ozone-Attributable Deaths per 100,000					Change in Ozone-Attributable Deaths per 100,000			
Study Area	**Base**	**75ppb**	**70ppb**	**65ppb**	**60ppb**	**Base-75**	**75-70**	**75-65**	**75-60**
Atlanta, GA	19	19	18	17	16	0.88	1.1	2.0	2.8
Baltimore, MD	23	22	22	21	20	1.5	0.75	1.7	2.6
Boston, MA	21	21	21	21	20	-0.041	0.13	0.82	1.7
Cleveland, OH	24	23	22	21	20	0.73	1.1	2.5	3.8
Denver, CO	22	22	22	21	19	0.034	0.40	1.3	3.1
Detroit, MI	21	21	21	20	19	NA	-0.25	0.52	1.5
Houston, TX	15	15	15	15	14	-0.12	0.35	0.76	1.3
Los Angeles, CA	22	22	21	20	19	0.87	1.1	2.2	3.4
New York, NY	18	18	17	15	NA	0.54	1.0	3.7	NA
Philadelphia, PA	25	24	23	22	22	1.1	0.88	1.9	2.7
Sacramento, CA	29	25	24	23	22	5.0	1.2	2.3	3.6
St. Louis, MO	27	27	26	25	23	0.34	1.1	2.4	3.9

NA: for NYC, the model-based adjustment methodology was unable to estimate ozone distributions which would meet the alternative standard level of 60 ppb. For Detroit, already meeting existing standard.
"0" counts denote non-zero estimates that round to zero.

APPENDIX 7C

Detailed Summary Tables and Figures of Sensitivity Analysis Results

List of Tables

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Table 7C-1. Sensitivity Analysis – ST Mortality: Smaller Smith et al., 2009-based study area (2009) (incidence, percent of baseline mortality, incidence per 100,000 - compare with Core Results in Appendix B, Table 7B-2).

	Air Quality Scenario								
	Absolute Ozone-Attributable Incidence					Change in Ozone-Attributable Incidence			
Study Area	Base	75ppb	70ppb	65ppb	60ppb	Base-75	75-70	75-65	75-60
Atlanta, GA	64	64	64	62	61	-1	1	2	4
	(-89 - 210)	(-90 - 210)	(-89 - 210)	(-86 - 210)	(-84 - 200)	(1 - -2)	(-1 - 3)	(-3 - 8)	(-6 - 13)
Baltimore, MD	55	58	58	57	56	-3	0	1	2
	(-30 - 140)	(-32 - 150)	(-32 - 140)	(-31 - 140)	(-31 - 140)	(2 - -8)	(0 - 1)	(-1 - 3)	(-1 - 6)
Boston, MA	24	25	26	26	26	-1	-1	-1	-1
	(-34 - 82)	(-35 - 84)	(-37 - 87)	(-37 - 87)	(-36 - 86)	(1 - -2)	(2 - -4)	(1 - -3)	(1 - -2)
Cleveland, OH	170	180	170	170	160	-8	4	10	18
	(-16 - 350)	(-16 - 360)	(-16 - 360)	(-15 - 340)	(-15 - 330)	(1 - -17)	(0 - 8)	(-1 - 21)	(-2 - 38)
Denver, CO	41	42	42	42	40	0	-1	0	2
	(-130 - 210)	(-140 - 210)	(-140 - 220)	(-140 - 210)	(-130 - 200)	(2 - -3)	(2 - -3)	(0 - 0)	(-7 - 11)
Detroit, MI	220	220	230	220	220	NA	-11	-7	0
	(11 - 420)	(11 - 420)	(12 - 440)	(11 - 430)	(11 - 420)		(-1 - -22)	(0 - -14)	(0 - 0)
Houston, TX	350	380	380	380	380	-36	-2	-1	3
	(65 - 620)	(72 - 690)	(72 - 690)	(72 - 690)	(71 - 680)	(-7 - -66)	(0 - -3)	(0 - -2)	(1 - 6)
Los Angeles, CA	520	600	580	560	520	-83	21	44	81
	(-220 - 1200)	(-250 - 1400)	(-240 - 1400)	(-230 - 1300)	(-220 - 1200)	(34 - -200)	(-9 - 50)	(-18 - 110)	(-33 - 190)
New York, NY	1200	1400	1400	1200	NA	-170	5	140	NA
	(730 - 1700)	(830 - 1900)	(830 - 1900)	(750 - 1700)		(-100 - -240)	(3 - 6)	(84 - 200)	
Philadelphia, PA	210	220	220	220	220	-15	1	3	5
	(46 - 370)	(49 - 390)	(49 - 390)	(49 - 390)	(48 - 380)	(-3 - -27)	(0 - 1)	(1 - 5)	(1 - 9)
Sacramento, CA	110	110	110	110	110	1	2	4	7
	(-120 - 340)	(-120 - 340)	(-120 - 340)	(-120 - 330)	(-110 - 320)	(-1 - 2)	(-2 - 6)	(-4 - 11)	(-7 - 20)
St. Louis, MO	36	37	39	39	39	-1	-2	-3	-2
	(-9 - 80)	(-9 - 81)	(-10 - 86)	(-10 - 87)	(-10 - 86)	(0 - -2)	(1 - -5)	(1 - -6)	(1 - -5)

	Air Quality Scenario								
	Percent of Baseline Incidence Attributable to Ozone					Change in O_3-Attributable Risk			
Study Area	Base	75ppb	70ppb	65ppb	60ppb	Base-75	75-70	75-65	75-60
Atlanta, GA	1.0	1.0	1.0	1.0	1.0	-1	1	4	6
Baltimore, MD	1.7	1.8	1.7	1.7	1.7	-6	1	2	4
Boston, MA	1.1	1.1	1.1	1.1	1.1	-2	-4	-4	-2
Cleveland, OH	2.2	2.3	2.3	2.2	2.1	-5	2	5	10
Denver, CO	0.8	0.8	0.8	0.8	0.8	-1	-1	-0.2	5
Detroit, MI	2.6	2.6	2.8	2.7	2.6	NA	-5	-3	0.03
Houston, TX	1.8	1.9	2.0	1.9	1.9	-10	-1	-0.3	1
Los Angeles, CA	0.9	1.1	1.0	1.0	0.9	-16	3	7	13
New York, NY	3.7	4.2	4.1	3.8	NA	-14	0.3	10	NA
Philadelphia, PA	2.6	2.8	2.8	2.8	2.8	-7	0.2	1	2
Sacramento, CA	1.2	1.2	1.2	1.2	1.2	1	2	3	6
St. Louis, MO	2.1	2.2	2.3	2.3	2.3	-2	-6	-7	-6

	Air Quality Scenario								
	Ozone-Attributable Deaths per 100,000					Change in Ozone-Attributable Deaths per 100,000			
Study Area	Base	75ppb	70ppb	65ppb	60ppb	Base-75	75-70	75-65	75-60
Atlanta, GA	4.0	4.1	4.0	3.9	3.8	-0.041	0.050	0.15	0.25
Baltimore, MD	8.8	9.3	9.3	9.1	9.0	-0.52	0.073	0.21	0.38
Boston, MA	3.4	3.5	3.6	3.6	3.6	-0.084	-0.16	-0.14	-0.087
Cleveland, OH	13	14	13	13	12	-0.63	0.28	0.77	1.4
Denver, CO	2.6	2.6	2.7	2.6	2.5	-0.030	-0.036	-0.0040	0.13
Detroit, MI	12	12	12	12	12	NA	-0.62	-0.38	0.011
Houston, TX	8.6	9.5	9.6	9.5	9.4	-0.91	-0.047	-0.022	0.081
Los Angeles, CA	5.3	6.1	5.9	5.7	5.3	-0.85	0.21	0.45	0.83
New York, NY	13	15	15	14	NA	-1.9	0.050	1.5	NA
Philadelphia, PA	14	15	15	15	14	-1.0	0.039	0.18	0.34
Sacramento, CA	8.2	8.1	8.0	7.8	7.6	0.060	0.13	0.26	0.46
St. Louis, MO	11	12	12	12	12	-0.27	-0.66	-0.82	-0.69

NA: for NYC, the model-based adjustment methodology was unable to estimate ozone distributions which would meet the alternative standard level of 60 ppb.
"0" incidence values denote non-zero estimates that round to zero.

Figure 7C-1. Sensitivity Analysis – ST Mortality: Smaller Smith et al., 2009-based study area (2009) (heat maps for just meeting existing standard and risk reductions from just meeting alternative standards) (see Key at bottom of figure).

Current Standard (75)

Study area	Daily 8hr Max Ozone Level (ppb)																Total
	0-5	5-10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50	50-55	55-60	60-65	65-70	70-75	>75	
Atlanta, GA	0	0	0	0	2	4	5	8	12	11	7	8	2	0	0	0	61
Baltimore, MD	0	0	0	0	0	2	6	11	10	14	10	7	2	0	0	0	63
Boston, MA	0	0	0	0	1	2	4	5	4	4	4	1	0	0	1	0	25
Cleveland, OH	0	0	0	0	2	11	20	30	33	35	25	12	5	3	0	0	176
Denver, CO	0	0	0	0	0	0	1	2	5	9	11	10	3	1	0	0	42
Detroit, MI	0	0	0	3	3	10	18	26	43	56	15	19	18	0	8	2	221
Houston, TX	0	0	0	3	15	28	66	68	61	49	46	19	15	4	2	2	378
Los Angeles, CA	0	0	0	0	0	0	1	8	129	151	228	70	4	0	0	0	590
New York, NY	0	0	0	3	18	106	211	175	312	232	135	86	28	0	0	0	1,305
Philadelphia, PA	0	0	0	1	3	11	33	26	46	37	43	19	14	0	0	0	234
Sacramento, CA	0	0	0	0	1	7	19	21	22	17	13	10	2	0	0	0	112
St. Louis, MO	0	0	0	1	1	2	3	5	5	8	7	5	1	1	0	0	38

Decrease 75 to 70

Study area	Daily 8hr Max Ozone Level (ppb)																Total	Change in risk	
	0-5	5-10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50	50-55	55-60	60-65	65-70	70-75	>75		Inc.	Dec.
Atlanta, GA	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	2	0	2
Baltimore, MD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Boston, MA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cleveland, OH	0	0	0	0	0	0	0	1	1	2	1	1	0	0	0	0	5	0	6
Denver, CO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Detroit, MI	0	0	0	-1	-1	-2	-2	-2	-2	-1	0	1	1	0	1	0	-8	-11	3
Houston, TX	0	0	0	0	-1	-1	-2	-1	0	1	2	1	1	0	0	0	0	-5	5
Los Angeles, CA	0	0	0	0	0	0	0	0	2	5	9	3	0	0	0	0	19	0	19
New York, NY	0	0	0	0	-2	-7	-4	4	11	15	11	9	3	0	0	0	41	-19	59
Philadelphia, PA	0	0	0	0	0	-1	-1	0	1	1	2	1	1	0	0	0	4	-2	6
Sacramento, CA	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	2	0	3
St. Louis, MO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0

Decrease 75 to 65

Study area	Daily 8hr Max Ozone Level (ppb)																Total	Change in risk	
	0-5	5-10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50	50-55	55-60	60-65	65-70	70-75	>75		Inc.	Dec.
Atlanta, GA	0	0	0	0	0	0	0	0	1	1	1	1	0	0	0	0	4	0	4
Baltimore, MD	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	3	0	3
Boston, MA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cleveland, OH	0	0	0	0	0	0	0	2	2	4	3	2	1	0	0	0	13	-1	14
Denver, CO	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	1
Detroit, MI	0	0	0	-1	-1	-2	-2	-2	-1	1	1	2	2	0	1	0	-2	-9	9
Houston, TX	0	0	0	-1	-2	-3	-3	0	1	2	3	2	2	0	0	0	2	-10	10
Los Angeles, CA	0	0	0	0	0	0	0	0	4	10	19	6	0	0	0	0	41	0	39
New York, NY	0	0	0	-1	-2	-8	8	26	53	59	40	31	10	0	0	0	215	-21	236
Philadelphia, PA	0	0	0	0	0	-1	-1	0	2	2	4	2	2	0	0	0	9	-3	12
Sacramento, CA	0	0	0	0	0	-1	0	1	1	1	1	1	0	0	0	0	4	-1	5
St. Louis, MO	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	2	0	3

Decrease 75 to 60

Study area	Daily 8hr Max Ozone Level (ppb)																Total	Change in risk	
	0-5	5-10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50	50-55	55-60	60-65	65-70	70-75	>75		Inc.	Dec.
Atlanta, GA	0	0	0	0	0	0	0	1	1	2	1	1	1	0	0	0	6	0	7
Baltimore, MD	0	0	0	0	0	0	0	0	1	2	1	1	0	0	0	0	4	0	5
Boston, MA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Cleveland, OH	0	0	0	0	0	0	0	3	4	6	5	3	1	1	0	0	22	-1	24
Denver, CO	0	0	0	0	0	0	0	0	0	0	1	2	1	0	0	0	4	0	4
Detroit, MI	0	0	0	-2	-1	-3	-2	-1	1	4	2	3	3	0	2	1	6	-10	17
Houston, TX	0	0	0	-1	-4	-4	-4	0	3	4	6	3	3	1	1	0	8	-14	22
Los Angeles, CA	0	0	0	0	0	0	0	1	15	20	29	10	1	0	0	0	75	0	76
New York, NY	NA																		
Philadelphia, PA	0	0	0	0	-1	-1	-1	0	3	4	5	3	2	0	0	0	14	-4	18
Sacramento, CA	0	0	0	0	0	-1	0	1	2	2	2	2	0	0	0	0	6	-2	9
St. Louis, MO	0	0	0	0	0	0	0	0	1	1	1	1	0	0	0	0	4	0	4

NA: for NYC, the model-based adjustment methodology was unable to estimate ozone distributions which would meet the alternative standard level of 60 ppb.

Key: For *current standard (75)* which is an absolute risk metric, color gradient ranges from blue (smallest ozone-related mortality count) to red (highest ozone-related mortality count). For *Decrease results*, color gradient ranges from red (increase in risk – negative cell values) to blue (reduction in risk – positive cell values).

Table 7C-2. Sensitivity Analysis – ST Mortality: Alternate method for simulating standards (2009) (incidence, percent of baseline mortality, incidence per 100,000 - compare with Core Results in Table 7B-2).

Study Area	Air Quality Scenario								
	Absolute Ozone-Attributable Incidence					Change in Ozone-Attributable Incidence			
	Base	75ppb	70ppb	65ppb	60ppb	Base-75	75-70	75-65	75-60
Denver, CO	56	57	57	56	52	-1	0	1	5
	(-180 - 290)	(-190 - 290)	(-190 - 290)	(-180 - 290)	(-170 - 270)	(3 - -5)	(0 - -1)	(-3 - 6)	(-16 - 25)
Detroit, MI	460	460	460	450	430	NA	-9	4	24
	(23 - 880)	(23 - 880)	(24 - 890)	(23 - 870)	(22 - 830)		(0 - -18)	(0 - 7)	(1 - 46)
Houston, TX	550	580	580	580	560	-31	-2	2	18
	(100 - 990)	(110 - 1000)	(110 - 1000)	(110 - 1000)	(110 - 1000)	(-6 - -57)	(0 - -3)	(0 - 3)	(3 - 32)
Los Angeles, CA	670	690	680	660	640	-19	15	32	48
	(-280 - 1600)	(-290 - 1700)	(-280 - 1600)	(-270 - 1600)	(-270 - 1500)	(8 - -46)	(-6 - 36)	(-13 - 77)	(-20 - 120)
New York, NY	2900	2900	2900	2700	NA	-3	24	290	NA
	(1800 - 4100)	(1800 - 4100)	(1800 - 4100)	(1600 - 3700)		(-2 - -4)	(14 - 33)	(170 - 400)	
Philadelphia, PA	820	810	790	780	750	9	16	35	58
	(180 - 1400)	(180 - 1400)	(180 - 1400)	(170 - 1400)	(170 - 1300)	(2 - 16)	(4 - 28)	(8 - 61)	(13 - 100)
Sacramento, CA	170	160	160	150	150	7	3	6	10
	(-180 - 500)	(-170 - 480)	(-170 - 470)	(-160 - 460)	(-160 - 450)	(-7 - 20)	(-3 - 10)	(-6 - 18)	(-10 - 30)

Study Area	Air Quality Scenario								
	Percent of Baseline Incidence Attributable to Ozone					Change in O_3-Attributable Risk			
	Base	75ppb	70ppb	65ppb	60ppb	Base-75	75-70	75-65	75-60
Denver, CO	0.8	0.8	0.8	0.8	0.7	-2	-0.2	2	8
Detroit, MI	2.7	2.7	2.8	2.7	2.6	NA	-2	1	5
Houston, TX	1.8	1.9	1.9	1.9	1.8	-6	-0.3	0.2	3
Los Angeles, CA	0.9	0.9	0.9	0.9	0.9	-3	2	5	7
New York, NY	3.8	3.8	3.8	3.5	NA	-0.1	1	9	NA
Philadelphia, PA	2.9	2.9	2.9	2.8	2.7	1	2	4	7
Sacramento, CA	1.2	1.2	1.2	1.1	1.1	4	2	4	6

Study Area	Air Quality Scenario								
	Ozone-Attributable Deaths per 100,000					Change in Ozone-Attributable Deaths per 100,000			
	Base	75ppb	70ppb	65ppb	60ppb	Base-75	75-70	75-65	75-60
Denver, CO	2.2	2.3	2.3	2.2	2.1	-0.039	-0.0044	0.042	0.19
Detroit, MI	11	11	11	10	10	NA	-0.21	0.086	0.54
Houston, TX	9.4	10.0	10.0	9.9	9.7	-0.54	-0.026	0.028	0.30
Los Angeles, CA	5.3	5.4	5.3	5.2	5.0	-0.15	0.12	0.25	0.38
New York, NY	16	16	16	14	NA	-0.014	0.13	1.5	NA
Philadelphia, PA	14	14	13	13	13	0.15	0.27	0.58	0.99
Sacramento, CA	7.8	7.5	7.4	7.2	7.1	0.30	0.15	0.28	0.46

NA: for NYC, the model-based adjustment methodology was unable to estimate ozone distributions which would meet the alternative standard level of 60 ppb.
"0" incidence values denote non-zero estimates that round to zero.

Table 7C-3. Sensitivity Analysis – ST Mortality: Regional Bayes Adjustment (2009) (incidence, percent of baseline mortality, incidence per 100,000 - compare with Core Results in Table 7B-2).

	Air Quality Scenario								
	Absolute Ozone-Attributable Incidence					Change in Ozone-Attributable Incidence			
Study Area	Base	75ppb	70ppb	65ppb	60ppb	Base-75	75-70	75-65	75-60
Atlanta, GA	220	220	210	200	200	4	8	14	21
	(-170 - 610)	(-170 - 590)	(-160 - 570)	(-160 - 560)	(-150 - 540)	(-3 - 11)	(-6 - 21)	(-11 - 40)	(-16 - 57)
Baltimore, MD	460	460	450	440	430	7	9	20	32
	(190 - 730)	(190 - 720)	(190 - 710)	(180 - 690)	(180 - 670)	(3 - 10)	(4 - 13)	(8 - 32)	(13 - 51)
Boston, MA	570	570	570	560	550	-4	-2	9	25
	(190 - 930)	(190 - 940)	(190 - 940)	(190 - 920)	(180 - 900)	(-1 - -7)	(-1 - -3)	(3 - 15)	(8 - 41)
Cleveland, OH	290	300	290	280	260	-4	9	21	37
	(71 - 510)	(72 - 520)	(70 - 500)	(67 - 480)	(63 - 460)	(-1 - -6)	(2 - 15)	(5 - 38)	(9 - 65)
Denver, CO	10	10	10	10	9	0	0	0	1
	(-230 - 240)	(-230 - 240)	(-230 - 240)	(-220 - 230)	(-210 - 220)	(1 - -1)	(-1 - 1)	(-5 - 6)	(-19 - 21)
Detroit, MI	510	510	520	510	490	NA	-19	-5	13
	(140 - 860)	(140 - 860)	(150 - 890)	(150 - 870)	(140 - 840)		(-5 - -32)	(-2 - -9)	(4 - 23)
Houston, TX	470	500	500	500	490	-40	-1	3	10
	(72 - 850)	(78 - 920)	(79 - 930)	(78 - 920)	(77 - 910)	(-6 - -73)	(0 - -1)	(0 - 5)	(2 - 19)
Los Angeles, CA	610	700	680	650	610	-90	23	49	90
	(-300 - 1500)	(-350 - 1700)	(-330 - 1700)	(-320 - 1600)	(-300 - 1500)	(44 - -220)	(-11 - 56)	(-24 - 120)	(-44 - 220)
New York, NY	3300	3400	3300	2800	NA	-98	110	550	NA
	(2200 - 4300)	(2300 - 4400)	(2200 - 4300)	(1900 - 3700)		(-67 - -130)	(73 - 140)	(380 - 730)	
Philadelphia, PA	1200	1200	1200	1100	1100	-6	20	47	73
	(640 - 1700)	(640 - 1700)	(630 - 1700)	(620 - 1600)	(600 - 1600)	(-3 - -9)	(11 - 29)	(25 - 68)	(40 - 110)
Sacramento, CA	59	58	57	56	54	2	1	2	3
	(-300 - 400)	(-290 - 390)	(-280 - 390)	(-280 - 380)	(-270 - 370)	(-8 - 11)	(-5 - 7)	(-10 - 13)	(-16 - 23)
St. Louis, MO	390	390	380	370	350	1	8	21	37
	(74 - 690)	(73 - 690)	(72 - 680)	(69 - 660)	(66 - 630)	(0 - 3)	(2 - 15)	(4 - 38)	(7 - 68)

	Air Quality Scenario								
	Percent of Baseline Incidence Attributable to Ozone					Change in O_3-Attributable Risk			
Study Area	Base	75ppb	70ppb	65ppb	60ppb	Base-75	75-70	75-65	75-60
Atlanta, GA	1.1	1.1	1.0	1.0	1.0	2	3	7	9
Baltimore, MD	4.0	3.9	3.9	3.8	3.7	1	2	4	7
Boston, MA	3.4	3.5	3.5	3.4	3.3	-1	-0.3	1	4
Cleveland, OH	2.7	2.8	2.7	2.6	2.4	-1	3	7	12
Denver, CO	0.1	0.1	0.1	0.1	0.1	-0.4	0.2	2	7
Detroit, MI	3.0	3.0	3.1	3.0	2.9	NA	-4	-1	3
Houston, TX	1.5	1.6	1.6	1.6	1.6	-8	-0.1	0.5	2
Los Angeles, CA	0.8	1.0	0.9	0.9	0.8	-15	3	7	13
New York, NY	4.2	4.4	4.2	3.7	NA	-3	3	16	NA
Philadelphia, PA	4.2	4.2	4.2	4.1	4.0	-1	2	4	6
Sacramento, CA	0.4	0.4	0.4	0.4	0.4	2	2	3	6
St. Louis, MO	2.8	2.8	2.8	2.7	2.6	0.4	2	5	9

	Air Quality Scenario								
	Ozone-Attributable Deaths per 100,000					Change in Ozone-Attributable Deaths per 100,000			
Study Area	Base	75ppb	70ppb	65ppb	60ppb	Base-75	75-70	75-65	75-60
Atlanta, GA	4.2	4.2	4.0	3.9	3.8	0.077	0.15	0.28	0.40
Baltimore, MD	17	17	17	16	16	0.24	0.32	0.74	1.2
Boston, MA	13	13	13	12	12	-0.088	-0.043	0.20	0.55
Cleveland, OH	14	14	14	13	13	-0.17	0.42	1.0	1.8
Denver, CO	0.40	0.40	0.40	0.39	0.36	-0.0017	0.0014	0.0095	0.034
Detroit, MI	12	12	12	12	11	NA	-0.43	-0.12	0.31
Houston, TX	8.0	8.7	8.7	8.6	8.5	-0.68	-0.0085	0.045	0.18
Los Angeles, CA	4.8	5.5	5.3	5.1	4.8	-0.70	0.18	0.38	0.70
New York, NY	17	18	17	15	NA	-0.52	0.57	3.0	NA
Philadelphia, PA	20	20	19	19	19	-0.10	0.34	0.79	1.2
Sacramento, CA	2.8	2.7	2.7	2.6	2.6	0.076	0.046	0.091	0.16
St. Louis, MO	14	14	13	13	12	0.052	0.30	0.74	1.3

NA: for NYC, the model-based adjustment methodology was unable to estimate ozone distributions which would meet the alternative standard level of 60 ppb.
"0" incidence values denote non-zero estimates that round to zero.

Table 7C-4. Sensitivity Analysis – ST Mortality: Copollutant model (PM10) (2009) (incidence, percent of baseline mortality, incidence per 100,000 - compare with Core Results in Table 7B-2).

Study Area	Air Quality Scenario								
	Absolute Ozone-Attributable Incidence					Change in Ozone-Attributable Incidence			
	Base	75ppb	70ppb	65ppb	60ppb	Base-75	75-70	75-65	75-60
Atlanta, GA	100	99	95	92	89	2	4	7	9
	(-830 - 980)	(-810 - 970)	(-780 - 940)	(-760 - 910)	(-730 - 880)	(-15 - 18)	(-28 - 35)	(-53 - 65)	(-76 - 94)
Baltimore, MD	240	230	230	220	220	3	4	10	16
	(-290 - 740)	(-290 - 730)	(-280 - 720)	(-270 - 700)	(-270 - 680)	(-4 - 10)	(-5 - 14)	(-12 - 32)	(-20 - 52)
Boston, MA	100	100	100	100	100	-1	0	2	5
	(-650 - 820)	(-650 - 820)	(-650 - 830)	(-640 - 810)	(-620 - 790)	(4 - -6)	(2 - -3)	(-10 - 13)	(-28 - 36)
Cleveland, OH	200	200	200	190	180	-3	6	15	25
	(-170 - 560)	(-170 - 570)	(-170 - 550)	(-160 - 530)	(-150 - 500)	(2 - -7)	(-5 - 17)	(-12 - 41)	(-21 - 71)
Denver, CO	-13	-13	-13	-13	-12	0	0	0	-1
	(-370 - 330)	(-370 - 330)	(-370 - 330)	(-360 - 320)	(-340 - 300)	(2 - -2)	(-1 - 1)	(-9 - 8)	(-31 - 28)
Detroit, MI	200	200	210	210	200	NA	-7	-2	5
	(-370 - 760)	(-370 - 760)	(-380 - 790)	(-380 - 770)	(-360 - 740)		(13 - -28)	(4 - -8)	(-10 - 20)
Houston, TX	690	750	750	750	730	-59	-1	4	16
	(-88 - 1400)	(-95 - 1600)	(-95 - 1600)	(-95 - 1600)	(-93 - 1500)	(7 - -130)	(0 - -2)	(-1 - 8)	(-2 - 33)
Los Angeles, CA	160	190	180	170	160	-24	6	13	24
	(-2000 - 2200)	(-2300 - 2600)	(-2200 - 2500)	(-2100 - 2400)	(-2000 - 2200)	(280 - -330)	(-72 - 83)	(-150 - 180)	(-280 - 330)
New York, NY	1300	1300	1300	1100	NA	-38	42	220	NA
	(-970 - 3500)	(-1000 - 3600)	(-970 - 3500)	(-840 - 3000)		(28 - -110)	(-31 - 110)	(-160 - 600)	
Philadelphia, PA	630	630	620	610	590	-3	11	25	39
	(-560 - 1800)	(-560 - 1800)	(-550 - 1700)	(-540 - 1700)	(-520 - 1700)	(3 - -9)	(-9 - 31)	(-22 - 71)	(-34 - 110)
Sacramento, CA	150	150	150	150	140	4	3	5	9
	(-440 - 720)	(-430 - 710)	(-420 - 690)	(-420 - 680)	(-410 - 670)	(-12 - 20)	(-7 - 12)	(-14 - 24)	(-24 - 41)
St. Louis, MO	210	210	200	200	190	1	4	11	20
	(-460 - 840)	(-460 - 840)	(-450 - 830)	(-440 - 800)	(-420 - 760)	(-2 - 3)	(-10 - 18)	(-24 - 46)	(-43 - 83)

Study Area	Air Quality Scenario								
	Percent of Baseline Incidence Attributable to Ozone					Change in O_3-Attributable Risk			
	Base	75ppb	70ppb	65ppb	60ppb	Base-75	75-70	75-65	75-60
Atlanta, GA	0.5	0.5	0.4	0.4	0.4	2	3	6	9
Baltimore, MD	2.0	2.0	2.0	1.9	1.9	1	2	4	7
Boston, MA	0.6	0.6	0.6	0.6	0.6	-1	-0.4	1	4
Cleveland, OH	1.9	1.9	1.8	1.8	1.7	-1	3	7	12
Denver, CO	-0.2	-0.2	-0.2	-0.2	-0.2	-0.5	1	3	10
Detroit, MI	1.2	1.2	1.2	1.2	1.2	NA	-4	-1	3
Houston, TX	2.2	2.4	2.4	2.4	2.4	-8	-0.1	0.5	2
Los Angeles, CA	0.2	0.2	0.2	0.2	0.2	-14	3	7	12
New York, NY	1.7	1.7	1.7	1.5	NA	-3	3	16	NA
Philadelphia, PA	2.2	2.3	2.2	2.2	2.1	-1	2	4	6
Sacramento, CA	1.1	1.1	1.1	1.1	1.0	2	2	3	6
St. Louis, MO	1.5	1.5	1.5	1.4	1.3	0.3	2	5	9

Study Area	Air Quality Scenario								
	Ozone-Attributable Deaths per 100,000					Change in Ozone-Attributable Deaths per 100,000			
	Base	75ppb	70ppb	65ppb	60ppb	Base-75	75-70	75-65	75-60
Atlanta, GA	1.9	1.9	1.8	1.8	1.7	0.035	0.066	0.13	0.18
Baltimore, MD	8.8	8.7	8.5	8.3	8.1	0.12	0.16	0.37	0.61
Boston, MA	2.3	2.3	2.3	2.3	2.2	-0.016	-0.0076	0.036	0.100
Cleveland, OH	9.7	9.8	9.5	9.1	8.6	-0.12	0.28	0.70	1.2
Denver, CO	-0.52	-0.52	-0.52	-0.51	-0.48	0.0023	-0.0019	-0.012	-0.044
Detroit, MI	4.7	4.7	4.9	4.8	4.6	NA	-0.17	-0.049	0.12
Houston, TX	12	13	13	13	13	-1.0	-0.013	0.068	0.27
Los Angeles, CA	1.3	1.5	1.4	1.4	1.3	-0.19	0.047	0.10	0.19
New York, NY	6.9	7.1	6.9	6.0	NA	-0.20	0.22	1.2	NA
Philadelphia, PA	11	11	10	10	10.0	-0.053	0.18	0.42	0.65
Sacramento, CA	7.3	7.1	7.0	6.8	6.7	0.20	0.12	0.24	0.41
St. Louis, MO	7.4	7.4	7.2	7.0	6.7	0.028	0.16	0.40	0.71

NA: for NYC, the model-based adjustment methodology was unable to estimate ozone distributions which would meet the alternative standard level of 60 ppb.
"0" incidence values denote non-zero estimates that round to zero.

Table 7C-5. Sensitivity Analysis – ST Mortality: Alternate risk model (Zanobetti and Schwartz, 2008) (2009) (incidence, percent of baseline mortality, incidence per 100,000 - compare with Core Results in Table 7B-2).

	Air Quality Scenario								
	Absolute Ozone-Attributable Incidence					Change in Ozone-Attributable Incidence			
Study Area	Base	75ppb	70ppb	65ppb	60ppb	Base-75	75-70	75-65	75-60
Atlanta, GA	120	110	100	96	91	6	8	14	19
	(-110 - 330)	(-100 - 320)	(-94 - 290)	(-89 - 280)	(-84 - 260)	(-6 - 18)	(-8 - 24)	(-13 - 41)	(-18 - 56)
Baltimore, MD	130	120	120	110	110	13	4	10	15
	(-26 - 290)	(-24 - 260)	(-23 - 250)	(-22 - 240)	(-21 - 230)	(-3 - 29)	(-1 - 10)	(-2 - 21)	(-3 - 32)
Boston, MA	220	220	210	210	200	1	6	11	19
	(12 - 420)	(12 - 420)	(12 - 410)	(12 - 400)	(11 - 390)	(0 - 2)	(0 - 11)	(1 - 22)	(1 - 37)
Cleveland, OH	120	110	110	100	95	5	5	12	20
	(-20 - 260)	(-19 - 240)	(-18 - 230)	(-17 - 220)	(-16 - 200)	(-1 - 11)	(-1 - 11)	(-2 - 27)	(-3 - 44)
Denver, CO	62	62	60	57	51	0	2	4	10
	(-81 - 200)	(-80 - 200)	(-78 - 190)	(-75 - 180)	(-67 - 170)	(0 - 1)	(-2 - 6)	(-6 - 14)	(-13 - 33)
Detroit, MI	370	370	380	370	350	NA	-6	5	21
	(130 - 600)	(130 - 600)	(140 - 610)	(130 - 600)	(130 - 570)		(-2 - -10)	(2 - 8)	(8 - 35)
Houston, TX	52	56	56	55	54	-4	0	1	3
	(-110 - 220)	(-120 - 230)	(-120 - 230)	(-120 - 230)	(-120 - 220)	(8 - -15)	(0 - 1)	(-2 - 4)	(-6 - 10)
Los Angeles, CA	270	270	260	240	230	6	13	27	40
	(-150 - 690)	(-140 - 670)	(-140 - 640)	(-130 - 600)	(-120 - 570)	(-3 - 16)	(-7 - 32)	(-14 - 69)	(-21 - 100)
New York, NY	1500	1500	1400	1000	NA	96	110	420	NA
	(900 - 2200)	(850 - 2100)	(790 - 1900)	(610 - 1500)		(56 - 140)	(64 - 160)	(240 - 600)	
Philadelphia, PA	360	340	320	310	300	24	12	26	38
	(5 - 700)	(4 - 660)	(4 - 640)	(4 - 610)	(4 - 590)	(0 - 47)	(0 - 24)	(0 - 51)	(1 - 76)
Sacramento, CA	110	93	89	86	82	15	4	7	12
	(-37 - 250)	(-32 - 210)	(-31 - 210)	(-30 - 200)	(-28 - 190)	(-5 - 36)	(-1 - 9)	(-2 - 17)	(-4 - 27)
St. Louis, MO	160	150	150	140	130	2	8	15	24
	(-32 - 340)	(-31 - 330)	(-30 - 320)	(-28 - 300)	(-26 - 280)	(0 - 5)	(-2 - 17)	(-3 - 34)	(-5 - 53)

	Air Quality Scenario								
	Percent of Baseline Incidence Attributable to Ozone					Change in O_3-Attributable Risk			
Study Area	Base	75ppb	70ppb	65ppb	60ppb	Base-75	75-70	75-65	75-60
Atlanta, GA	1.4	1.3	1.2	1.1	1.1	5	7	13	17
Baltimore, MD	2.5	2.2	2.2	2.1	2.0	10	4	8	12
Boston, MA	2.5	2.5	2.4	2.4	2.3	0.3	2	5	8
Cleveland, OH	2.5	2.4	2.3	2.1	2.0	4	4	10	17
Denver, CO	1.8	1.8	1.8	1.7	1.5	1	3	7	16
Detroit, MI	4.1	4.1	4.2	4.1	3.9	NA	-2	1	5
Houston, TX	0.6	0.6	0.6	0.6	0.6	-7	0.3	2	4
Los Angeles, CA	1.4	1.4	1.3	1.2	1.2	2	5	10	15
New York, NY	4.5	4.2	3.9	3.0	NA	6	7	28	NA
Philadelphia, PA	2.8	2.6	2.6	2.4	2.4	6	3	7	11
Sacramento, CA	2.9	2.5	2.4	2.3	2.2	14	4	7	12
St. Louis, MO	2.4	2.4	2.3	2.2	2.0	1	5	10	15

	Air Quality Scenario								
	Ozone-Attributable Deaths per 100,000					Change in Ozone-Attributable Deaths per 100,000			
Study Area	Base	75ppb	70ppb	65ppb	60ppb	Base-75	75-70	75-65	75-60
Atlanta, GA	2.2	2.1	2.0	1.8	1.7	0.12	0.16	0.27	0.37
Baltimore, MD	4.9	4.4	4.3	4.1	3.9	0.49	0.16	0.35	0.55
Boston, MA	4.9	4.8	4.7	4.6	4.4	0.017	0.13	0.25	0.42
Cleveland, OH	5.7	5.5	5.3	4.9	4.6	0.25	0.25	0.59	0.97
Denver, CO	2.5	2.5	2.4	2.3	2.1	0.014	0.077	0.17	0.41
Detroit, MI	8.6	8.6	8.8	8.5	8.2	NA	-0.14	0.12	0.50
Houston, TX	0.90	0.96	0.96	0.95	0.92	-0.062	0.0029	0.016	0.043
Los Angeles, CA	2.2	2.1	2.0	1.9	1.8	0.050	0.10	0.21	0.31
New York, NY	8.2	7.8	7.2	5.6	NA	0.51	0.59	2.2	NA
Philadelphia, PA	6.1	5.7	5.5	5.2	5.0	0.40	0.20	0.43	0.64
Sacramento, CA	5.1	4.4	4.2	4.0	3.8	0.72	0.17	0.34	0.55
St. Louis, MO	5.5	5.5	5.2	4.9	4.6	0.075	0.28	0.55	0.86

NA: for NYC, the model-based adjustment methodology was unable to estimate ozone distributions which would meet the alternative standard level of 60 ppb.
"0" incidence values denote non-zero estimates that round to zero.

Table 7C-6. Sensitivity Analysis – LT Mortality: Alternate risk model (regional effect estimates) (2009) (incidence, percent of baseline mortality, incidence per 100,000 - compare with Core Results in Table 7B-7).

Study Area	Air Quality Scenario								
	Absolute Ozone-Attributable Incidence					Change in Ozone-Attributable Incidence			
	Base	75ppb	70ppb	65ppb	60ppb	Base-75	75-70	75-65	75-60
Atlanta, GA	1,400	1,300	1,300	1,200	1,200	75	92	170	230
	(720 - 1900)	(690 - 1800)	(660 - 1800)	(630 - 1700)	(610 - 1700)	(34 - 110)	(42 - 140)	(77 - 260)	(110 - 350)
Baltimore, MD	-110	-100	-100	-96	-92	-6.4	-3.1	-6.9	-11
	(-1200 - 590)	(-1100 - 560)	(-1000 - 550)	(-980 - 530)	(-930 - 510)	(-55 - 41)	(-27 - 20)	(-59 - 44)	(-93 - 68)
Boston, MA		-170	-170	-160	-150	0.29	-0.95	-5.8	-12
	(-1700 - 920)	(-1700 - 920)	(-1700 - 920)	(-1600 - 890)	(-1500 - 860)	(3 - -2)	(-8 - 6)	(-50 - 38)	(-100 - 77)
Cleveland, OH	0	0	0	0	0	0	0	0	0
	(-990 - 630)	(-950 - 620)	(-900 - 600)	(-840 - 570)	(-780 - 540)	(-22 - 22)	(-34 - 33)	(-76 - 73)	(-120 - 110)
Denver, CO	450	450	440	430	400	0.73	8.6	27	67
	(-26 - 780)	(-26 - 780)	(-26 - 770)	(-25 - 760)	(-23 - 710)	(0 - 2)	(0 - 18)	(-1 - 55)	(-3 - 130)
Detroit, MI	0	0	0	0	0	NA	0	0	0
	(-1700 - 1100)	(-1700 - 1100)	(-1700 - 1100)	(-1700 - 1100)	(-1600 - 1000)		(15 - -15)	(-31 - 31)	(-90 - 88)
Houston, TX	1,200	1,200	1,200	1,200	1,100	-11	32	69	110
	(610 - 1600)	(620 - 1600)	(610 - 1600)	(590 - 1600)	(580 - 1500)	(-5 - -18)	(14 - 49)	(31 - 110)	(51 - 170)
Los Angeles, CA	450	440	420	400	380	16	19	41	63
	(-2400 - 2500)	(-2300 - 2400)	(-2200 - 2300)	(-2100 - 2200)	(-1900 - 2100)	(-72 - 100)	(-87 - 120)	(-180 - 260)	(-290 - 400)
New York, NY	-600	-580	-550	-470	NA	-16	-31	-110	NA
	(-6200 - 3300)	(-6000 - 3200)	(-5600 - 3100)	(-4600 - 2700)		(-130 - 100)	(-260 - 200)	(-960 - 690)	
Philadelphia, PA	-260	-240	-240	-230	-220	-10	-8.0	-17	-25
	(-2700 - 1400)	(-2500 - 1300)	(-2400 - 1300)	(-2300 - 1300)	(-2200 - 1200)	(-88 - 66)	(-69 - 52)	(-150 - 110)	(-220 - 160)
Sacramento, CA	500	440	420	400	380	90	21	41	65
	(-29 - 870)	(-25 - 770)	(-24 - 750)	(-23 - 720)	(-21 - 690)	(-5 - 180)	(-1 - 43)	(-2 - 82)	(-3 - 130)
St. Louis, MO	0	0	0	0	0	0	0	0	0
	(-1400 - 910)	(-1400 - 910)	(-1400 - 880)	(-1300 - 850)	(-1200 - 810)	(-13 - 13)	(-44 - 43)	(-96 - 92)	(-160 - 150)

Study Area	Air Quality Scenario								
	Percent of Baseline Incidence Attributable to Ozone					Change in O_3-Attributable Risk			
	Base	75ppb	70ppb	65ppb	60ppb	Base-75	75-70	75-65	75-60
Atlanta, GA	42.6	41.3	39.6	38.1	36.9	3.1	4.0	7.6	10.7
Baltimore, MD	-7.4	-6.9	-6.6	-6.3	-5.9	7.7	4.0	8.7	13.4
Boston, MA	-6.1	-6.1	-6.0	-5.8	-5.5	-0.2	0.7	4.5	9.2
Cleveland, OH	0	0	0	0	0	0	0	0	0
Denver, CO	27.5	27.5	27.1	26.3	24.5	0.1	1.3	4.2	10.7
Detroit, MI	0	0	0	0	0	NA	0	0	0
Houston, TX	41.0	41.2	40.6	39.8	38.9	-0.5	1.5	3.4	5.7
Los Angeles, CA	4.7	4.6	4.4	4.3	4.1	2.4	3.1	6.7	10.6
New York, NY	-6.7	-6.5	-6.0	-5.0	NA	3.4	6.8	23.5	NA
Philadelphia, PA	-7.1	-6.7	-6.5	-6.1	-5.9	5.3	4.3	9.1	13.3
Sacramento, CA	28.5	24.9	24.0	23.2	22.1	12.8	3.6	6.9	11.2
St. Louis, MO	0	0	0	0	0	0	0	0	0

Study Area	Air Quality Scenario								
	Ozone-Attributable Deaths per 100,000					Change in Ozone-Attributable Deaths per 100,000			
	Base	75ppb	70ppb	65ppb	60ppb	Base-75	75-70	75-65	75-60
Atlanta, GA	47	46	44	42	41	2.5	3.1	5.7	7.9
Baltimore, MD	-6.8	-6.4	-6.2	-6.0	-5.7	-0.40	-0.19	-0.43	-0.66
Boston, MA	-6.1	-6.1	-6.0	-5.8	-5.6	0.011	-0.034	-0.21	-0.44
Cleveland, OH	0	0	0	0	0	0	0	0	0
Denver, CO	31	31	30	30	27	0.050	0.59	1.9	4.6
Detroit, MI	0	0	0	0	0	NA	0	0	0
Houston, TX	38	38	37	37	36	-0.36	1.00	2.2	3.6
Los Angeles, CA	6.2	6.0	5.8	5.5	5.2	0.22	0.27	0.56	0.87
New York, NY	-5.3	-5.2	-4.9	-4.2	NA	-0.14	-0.27	-0.97	NA
Philadelphia, PA	-7.2	-6.9	-6.7	-6.4	-6.2	-0.29	-0.23	-0.48	-0.71
Sacramento, CA	41	36	34	33	32	7.4	1.7	3.3	5.3
St. Louis, MO	0	0	0	0	0	0	0	0	0

NA: for NYC, the model-based adjustment methodology was unable to estimate ozone distributions which would meet the alternative standard level of 60 ppb.

Table 7C-7. Sensitivity Analysis – *LT Mortality: Alternate risk model (ozone-only effect estimate)* (2009) (incidence, percent of baseline mortality, incidence per 100,000) - compare with Core Results in Table 7B-7).

Study Area	Air Quality Scenario								
	Absolute Incidence					Change in Incidence			
	Base	75ppb	70ppb	65ppb	60ppb	base-75	75-70	75-65	75-60
Atlanta, GA	400	390	370	350	340	18	22	40	56
	(120 - 660)	(120 - 630)	(110 - 600)	(100 - 580)	(100 - 550)	(5 - 30)	(6 - 37)	(12 - 69)	(16 - 96)
Baltimore, MD	260	250	240	230	230	17	8.2	18	28
	(80 - 430)	(75 - 410)	(73 - 400)	(70 - 380)	(67 - 370)	(5 - 29)	(2 - 14)	(5 - 31)	(8 - 48)
Boston, MA	410	410	400	390	380	-0.77	2.5	15	32
	(120 - 670)	(120 - 670)	(120 - 670)	(120 - 650)	(110 - 620)	(0 - -1)	(1 - 4)	(4 - 26)	(9 - 54)
Cleveland, OH	220	210	200	190	180	6.4	9.9	22	34
	(65 - 360)	(63 - 350)	(61 - 330)	(57 - 320)	(54 - 300)	(2 - 11)	(3 - 17)	(6 - 37)	(10 - 58)
Denver, CO	220	220	220	210	200	0.34	3.9	12	31
	(68 - 370)	(68 - 360)	(67 - 360)	(65 - 350)	(59 - 320)	(0 - 1)	(1 - 7)	(4 - 21)	(9 - 53)
Detroit, MI	380	380	380	370	350	NA	-4.5	9.2	26
	(110 - 620)	(110 - 620)	(110 - 630)	(110 - 610)	(110 - 580)		(-1 - -8)	(3 - 16)	(8 - 45)
Houston, TX	340	340	340	330	320	-2.7	7.5	16	27
	(100 - 560)	(100 - 560)	(100 - 550)	(98 - 540)	(95 - 520)	(-1 - -5)	(2 - 13)	(5 - 28)	(8 - 46)
Los Angeles, CA	1,100	1,100	1,100	1,000	960	43	52	110	170
	(350 - 1900)	(340 - 1800)	(320 - 1700)	(310 - 1700)	(290 - 1600)	(12 - 73)	(15 - 89)	(31 - 180)	(49 - 290)
New York, NY	1,500	1,400	1,300	1,200	NA	42	81	290	NA
	(440 - 2400)	(430 - 2300)	(400 - 2200)	(350 - 1900)		(12 - 71)	(23 - 140)	(83 - 490)	
Philadelphia, PA	620	590	580	550	530	27	21	45	66
	(190 - 1000)	(180 - 970)	(170 - 940)	(170 - 910)	(160 - 880)	(8 - 46)	(6 - 36)	(13 - 77)	(19 - 110)
Sacramento, CA	250	220	210	200	190	42	9.8	19	30
	(76 - 410)	(65 - 350)	(62 - 340)	(60 - 330)	(56 - 310)	(12 - 71)	(3 - 17)	(5 - 32)	(9 - 51)
St. Louis, MO	320	310	300	290	270	3.8	13	28	45
	(95 - 520)	(94 - 510)	(90 - 490)	(86 - 470)	(81 - 450)	(1 - 7)	(4 - 22)	(8 - 47)	(13 - 77)

Study Area	Air Quality Scenario								
	Percent of Baseline Incidence					Change in O_3-Attributable Risk			
	Base	75ppb	70ppb	65ppb	60ppb	Base-75	75-70	75-65	75-60
Atlanta, GA	12.4	11.9	11.3	10.8	10.4	4	5	9	13
Baltimore, MD	12.9	12.2	11.9	11.4	11.0	6	3	6	10
Boston, MA	11.1	11.2	11.1	10.8	10.4	-0.2	1	3	7
Cleveland, OH	12.1	11.8	11.3	10.7	10.1	3	4	9	14
Denver, CO	14.1	14.1	13.9	13.5	12.4	0.1	1	5	12
Detroit, MI	11.9	11.9	12.0	11.7	11.2	NA	-1	2	6
Houston, TX	11.8	11.9	11.6	11.4	11.0	-1	2	4	7
Los Angeles, CA	15.1	14.6	14.1	13.4	12.7	3	4	8	13
New York, NY	12.0	11.7	11.1	9.6	NA	3	5	18	NA
Philadelphia, PA	12.5	12.1	11.7	11.2	10.9	4	3	7	10
Sacramento, CA	14.7	12.6	12.1	11.7	11.1	14	4	8	12
St. Louis, MO	12.6	12.4	12.0	11.5	10.9	1	4	8	13

Study Area	Air Quality Scenario								
	Ozone-Attributable Deaths per 100,000					Change in Ozone-Attributable Deaths per 100,000			
	Base	75ppb	70ppb	65ppb	60ppb	Base-75	75-70	75-65	75-60
Atlanta, GA	14	13	12	12	11	0.60	0.74	1.4	1.9
Baltimore, MD	16	16	15	15	14	1.0	0.51	1.1	1.7
Boston, MA	15	15	15	14	14	-0.028	0.091	0.56	1.2
Cleveland, OH	17	16	16	15	14	0.49	0.76	1.7	2.6
Denver, CO	15	15	15	15	14	0.023	0.27	0.85	2.1
Detroit, MI	14	14	15	14	14	NA	-0.17	0.35	1.00
Houston, TX	11	11	11	10	10	-0.084	0.24	0.51	0.86
Los Angeles, CA	16	15	15	14	13	0.59	0.72	1.5	2.3
New York, NY	13	13	12	10	NA	0.37	0.71	2.5	NA
Philadelphia, PA	17	17	16	16	15	0.76	0.60	1.3	1.9
Sacramento, CA	21	18	17	16	15	3.4	0.80	1.5	2.5
St. Louis, MO	19	19	18	17	16	0.23	0.76	1.6	2.7

NA: for NYC, the model-based adjustment methodology was unable to estimate ozone distributions which would meet the lower alternative standard level of 60 ppb.
"0" incidence values denote non-zero estimates that round to zero.

Table 7C-8. Sensitivity Analysis – *LT Mortality: Threshold models (ozone-only effect estimate)* (2009 Baseline) (ozone-attributable deaths, percent of baseline mortality, incidence per 100,000 - compare with Core Results in Table 7B-7).

Ozone-Attributable Deaths

Study Area	Type of Ozone Model							
	Non-Threshold*		Threshold					
	86 city model	96 city model	40ppb	45ppb	50ppb	55ppb	56ppb	60ppb
Atlanta, GA	400	430	99	54	-	-	-	-
	(120 - 660)	(160 - 670)	(40 - 160)	(22 - 84)	(- - -)	(- - -)	(- - -)	(- - -)
Baltimore, MD	260	280	77	50	17	-	-	-
	(80 - 430)	(110 - 440)	(31 - 120)	(21 - 78)	(7 - 27)	(- - -)	(- - -)	(- - -)
Boston, MA	410	430	52	-	-	-	-	-
	(120 - 670)	(160 - 690)	(21 - 83)	(- - -)	(- - -)	(- - -)	(- - -)	(- - -)
Cleveland, OH	220	230	48	22	-	-	-	-
	(65 - 360)	(86 - 370)	(19 - 76)	(9 - 35)	(- - -)	(- - -)	(- - -)	(- - -)
Denver, CO	220	240	85	66	43	18	12	-
	(68 - 370)	(90 - 370)	(34 - 130)	(28 - 100)	(18 - 68)	(8 - 28)	(6 - 19)	(- - -)
Detroit, MI	380	400	77	31	-	-	-	-
	(110 - 620)	(150 - 640)	(31 - 120)	(13 - 49)	(- - -)	(- - -)	(- - -)	(- - -)
Houston, TX	340	360	66	24	-	-	-	-
	(100 - 560)	(130 - 570)	(26 - 100)	(10 - 37)	(- - -)	(- - -)	(- - -)	(- - -)
Los Angeles, CA	1100	1200	500	420	320	220	200	65
	(350 - 1900)	(460 - 1900)	(200 - 790)	(180 - 660)	(130 - 500)	(99 - 340)	(89 - 300)	(22 - 110)
New York, NY	1500	1600	310	140	-	-	-	-
	(440 - 2400)	(580 - 2500)	(120 - 490)	(56 - 210)	(- - -)	(- - -)	(- - -)	(- - -)
Philadelphia, PA	620	660	160	93	12	-	-	-
	(190 - 1000)	(240 - 1000)	(64 - 250)	(39 - 150)	(5 - 19)	(- - -)	(- - -)	(- - -)
Sacramento, CA	250	270	100	86	62	38	33	3
	(76 - 410)	(100 - 420)	(42 - 160)	(36 - 130)	(26 - 97)	(17 - 59)	(15 - 50)	(1 - 6)
St. Louis, MO	320	340	83	49	8	-	-	-
	(95 - 520)	(120 - 530)	(33 - 130)	(20 - 77)	(3 - 12)	(- - -)	(- - -)	(- - -)

Percent of Baseline Incidence Attributable to Ozone

Study Area	Type of Ozone Model							
	Non-Threshold*		Threshold					
	86 city model	96 city model	40ppb	45ppb	50ppb	55ppb	56ppb	60ppb
Atlanta, GA	12.4	13.2	3.1	1.7	-	-	-	-
Baltimore, MD	12.9	13.8	3.8	2.5	0.8	-	-	-
Boston, MA	11.1	11.9	1.4	-	-	-	-	-
Cleveland, OH	12.1	12.9	2.7	1.3	-	-	-	-
Denver, CO	14.1	15.1	5.4	4.2	2.7	1.2	0.8	-
Detroit, MI	11.9	12.7	2.5	1.0	-	-	-	-
Houston, TX	11.8	12.6	2.3	0.8	-	-	-	-
Los Angeles, CA	15.1	16.2	6.7	5.6	4.2	2.9	2.6	0.9
New York, NY	12.0	12.8	2.6	1.1	-	-	-	-
Philadelphia, PA	12.5	13.4	3.3	1.9	0.2	-	-	-
Sacramento, CA	14.7	15.8	6.2	5.1	3.7	2.3	1.9	0.2
St. Louis, MO	12.6	13.5	3.3	2.0	0.3	-	-	-

Ozone-Attributable Deaths per 100,000 Population

Study Area	Type of Ozone Model							
	Non-Threshold*		Threshold					
	86 city model	96 city model	40ppb	45ppb	50ppb	55ppb	56ppb	60ppb
Atlanta, GA	14	15	3.3	1.8	-	-	-	-
Baltimore, MD	16	18	4.8	3.1	1.1	-	-	-
Boston, MA	15	16	1.9	-	-	-	-	-
Cleveland, OH	17	18	3.7	1.7	-	-	-	-
Denver, CO	15	16	5.8	4.6	3.0	1.3	0.84	-
Detroit, MI	14	15	2.9	1.2	-	-	-	-
Houston, TX	11	11	2.1	0.75	-	-	-	-
Los Angeles, CA	16	17	6.9	5.8	4.4	3.0	2.7	0.89
New York, NY	13	14	2.7	1.2	-	-	-	-
Philadelphia, PA	17	19	4.5	2.6	0.34	-	-	-
Sacramento, CA	21	22	8.6	7.0	5.1	3.1	2.7	0.28
St. Louis, MO	19	20	5.0	2.9	0.47	-	-	-

* The 86 city model is the ozone-only long-term mortality model used for a sensitivity analysis in the Ozone HREA (see Table 7C-7). All other models (including threshold models) presented in this table were generated using the 96 city dataset rather than the 86 city dataset (Jerrett et al., 2014).

Table 7C-9. Sensitivity Analysis – LT Mortality: Threshold models (ozone-only effect estimate) (2009 Current Standard 75ppb) (ozone-attributable deaths, percent of baseline mortality, incidence per 100,000 - compare with Core Results in Table 7B-7).

Ozone-Attributable Deaths

Study Area	Type of Ozone Model							
	Non-Threshold*		Threshold					
	86 city model	96 city model	40ppb	45ppb	50ppb	55ppb	56ppb	60ppb
Atlanta, GA	390	410	79	32	-	-	-	-
	(120 - 630)	(150 - 650)	(31 - 130)	(13 - 50)	(- - -)	(- - -)	(- - -)	(- - -)
Baltimore, MD	250	270	58	29	-	-	-	-
	(75 - 410)	(99 - 420)	(23 - 92)	(12 - 46)	(- - -)	(- - -)	(- - -)	(- - -)
Boston, MA	410	440	53	-	-	-	-	-
	(120 - 670)	(160 - 690)	(21 - 85)	(- - -)	(- - -)	(- - -)	(- - -)	(- - -)
Cleveland, OH	210	230	41	14	-	-	-	-
	(63 - 350)	(84 - 360)	(16 - 65)	(6 - 23)	(- - -)	(- - -)	(- - -)	(- - -)
Denver, CO	220	240	85	66	43	18	12	-
	(68 - 360)	(89 - 370)	(34 - 130)	(28 - 100)	(18 - 67)	(8 - 28)	(5 - 18)	(- - -)
Detroit, MI	380	400	77	31	-	-	-	-
	(110 - 620)	(150 - 640)	(31 - 120)	(13 - 49)	(- - -)	(- - -)	(- - -)	(- - -)
Houston, TX	340	370	69	27	-	-	-	-
	(100 - 560)	(140 - 580)	(28 - 110)	(11 - 43)	(- - -)	(- - -)	(- - -)	(- - -)
Los Angeles, CA	1100	1200	450	370	260	160	130	-
	(340 - 1800)	(440 - 1800)	(180 - 720)	(160 - 580)	(110 - 410)	(69 - 240)	(58 - 200)	(- - -)
New York, NY	1400	1500	260	83	-	-	-	-
	(430 - 2300)	(560 - 2400)	(100 - 420)	(35 - 130)	(- - -)	(- - -)	(- - -)	(- - -)
Philadelphia, PA	590	630	130	59	-	-	-	-
	(180 - 970)	(240 - 1000)	(52 - 210)	(25 - 93)	(- - -)	(- - -)	(- - -)	(- - -)
Sacramento, CA	220	230	58	34	7	-	-	-
	(65 - 350)	(85 - 360)	(23 - 91)	(14 - 54)	(3 - 11)	(- - -)	(- - -)	(- - -)
St. Louis, MO	310	330	79	44	3	-	-	-
	(94 - 510)	(120 - 520)	(32 - 120)	(18 - 69)	(1 - 4)	(- - -)	(- - -)	(- - -)

Percent of Baseline Incidence Attributable to Ozone

Study Area	Type of Ozone Model							
	Non-Threshold*		Threshold					
	86 city model	96 city model	40ppb	45ppb	50ppb	55ppb	56ppb	60ppb
Atlanta, GA	11.9	12.7	2.4	1.0	-	-	-	-
Baltimore, MD	12.2	13.1	2.8	1.4	-	-	-	-
Boston, MA	11.2	11.9	1.5	-	-	-	-	-
Cleveland, OH	11.8	12.6	2.3	0.8	-	-	-	-
Denver, CO	14.1	15.1	5.4	4.2	2.7	1.1	0.7	-
Detroit, MI	11.9	12.7	2.5	1.0	-	-	-	-
Houston, TX	11.9	12.7	2.4	0.9	-	-	-	-
Los Angeles, CA	14.6	15.6	6.0	4.9	3.5	2.1	1.7	-
New York, NY	11.7	12.5	2.2	0.7	-	-	-	-
Philadelphia, PA	12.1	12.9	2.6	1.2	-	-	-	-
Sacramento, CA	12.6	13.5	3.4	2.0	0.4	-	-	-
St. Louis, MO	12.4	13.3	3.2	1.8	0.1	-	-	-

Ozone-Attributable Deaths per 100,000 Population

Study Area	Type of Ozone Model							
	Non-Threshold*		Threshold					
	86 city model	96 city model	40ppb	45ppb	50ppb	55ppb	56ppb	60ppb
Atlanta, GA	13	14	2.7	1.1	-	-	-	-
Baltimore, MD	16	17	3.6	1.8	-	-	-	-
Boston, MA	15	16	1.9	-	-	-	-	-
Cleveland, OH	16	17	3.1	1.1	-	-	-	-
Denver, CO	15	16	5.8	4.5	2.9	1.2	0.80	-
Detroit, MI	14	15	2.9	1.2	-	-	-	-
Houston, TX	11	12	2.2	0.85	-	-	-	-
Los Angeles, CA	15	16	6.3	5.1	3.6	2.1	1.8	-
New York, NY	13	13	2.3	0.73	-	-	-	-
Philadelphia, PA	17	18	3.7	1.7	-	-	-	-
Sacramento, CA	18	19	4.7	2.8	0.55	-	-	-
St. Louis, MO	19	20	4.7	2.6	0.16	-	-	-

* The 86 city model is the ozone-only long-term mortality model used for a sensitivity analysis in the Ozone HREA (see Table 7C-7). All other models (including threshold models) presented in this table were generated using the 96 city dataset rather than the 86 city dataset (Jerrett et al., 2014).

Table 7C-10. Sensitivity Analysis – *LT Mortality: Threshold models (ozone-only effect estimate)* (2009 Current Standard 70ppb) (ozone-attributable deaths, percent of baseline mortality, incidence per 100,000 - compare with Core Results in Table 7B-7).

Ozone-Attributable Deaths

	Type of Ozone Model							
	Non-Threshold*		Threshold					
Study Area	86 city model	96 city model	40ppb	45ppb	50ppb	55ppb	56ppb	60ppb
Atlanta, GA	370	390	53	4	-	-	-	-
	(110 - 600)	(140 - 620)	(21 - 85)	(2 - 6)	(- - -)	(- - -)	(- - -)	(- - -)
Baltimore, MD	240	260	49	19	-	-	-	-
	(73 - 400)	(96 - 410)	(19 - 77)	(8 - 30)	(- - -)	(- - -)	(- - -)	(- - -)
Boston, MA	400	430	50	-	-	-	-	-
	(120 - 670)	(160 - 680)	(20 - 80)	(- - -)	(- - -)	(- - -)	(- - -)	(- - -)
Cleveland, OH	200	220	29	2	-	-	-	-
	(61 - 330)	(80 - 340)	(12 - 47)	(1 - 3)	(- - -)	(- - -)	(- - -)	(- - -)
Denver, CO	220	240	80	61	38	12	5	-
	(67 - 360)	(88 - 370)	(32 - 130)	(26 - 96)	(16 - 59)	(5 - 18)	(2 - 8)	(- - -)
Detroit, MI	380	410	83	37	-	-	-	-
	(110 - 630)	(150 - 640)	(33 - 130)	(15 - 58)	(- - -)	(- - -)	(- - -)	(- - -)
Houston, TX	340	360	60	18	-	-	-	-
	(100 - 550)	(130 - 570)	(24 - 96)	(7 - 28)	(- - -)	(- - -)	(- - -)	(- - -)
Los Angeles, CA	1100	1100	400	310	200	74	45	-
	(320 - 1700)	(420 - 1800)	(160 - 630)	(130 - 480)	(82 - 310)	(33 - 120)	(20 - 70)	(- - -)
New York, NY	1300	1400	170	-	-	-	-	-
	(400 - 2200)	(530 - 2300)	(68 - 270)	(- - -)	(- - -)	(- - -)	(- - -)	(- - -)
Philadelphia, PA	580	610	110	32	-	-	-	-
	(170 - 940)	(230 - 970)	(42 - 170)	(14 - 51)	(- - -)	(- - -)	(- - -)	(- - -)
Sacramento, CA	210	220	46	22	-	-	-	-
	(62 - 340)	(82 - 350)	(19 - 74)	(9 - 35)	(- - -)	(- - -)	(- - -)	(- - -)
St. Louis, MO	300	320	64	28	-	-	-	-
	(90 - 490)	(120 - 510)	(26 - 100)	(12 - 44)	(- - -)	(- - -)	(- - -)	(- - -)

Percent of Baseline Incidence Attributable to Ozone

	Type of Ozone Model							
	Non-Threshold*		Threshold					
Study Area	86 city model	96 city model	40ppb	45ppb	50ppb	55ppb	56ppb	60ppb
Atlanta, GA	11.3	12.1	1.7	0.1	-	-	-	-
Baltimore, MD	11.9	12.7	2.4	0.9	-	-	-	-
Boston, MA	11.1	11.9	1.4	-	-	-	-	-
Cleveland, OH	11.3	12.1	1.6	0.1	-	-	-	-
Denver, CO	13.9	14.9	5.1	3.9	2.4	0.7	0.3	-
Detroit, MI	12.0	12.9	2.6	1.2	-	-	-	-
Houston, TX	11.6	12.5	2.1	0.6	-	-	-	-
Los Angeles, CA	14.1	15.0	5.3	4.1	2.6	1.0	0.6	-
New York, NY	11.1	11.9	1.4	-	-	-	-	-
Philadelphia, PA	11.7	12.5	2.2	0.7	-	-	-	-
Sacramento, CA	12.1	13.0	2.7	1.3	-	-	-	-
St. Louis, MO	12.0	12.8	2.6	1.1	-	-	-	-

Ozone-Attributable Deaths per 100,000 Population

	Type of Ozone Model							
	Non-Threshold*		Threshold					
Study Area	86 city model	96 city model	40ppb	45ppb	50ppb	55ppb	56ppb	60ppb
Atlanta, GA	12	13	1.8	0.14	-	-	-	-
Baltimore, MD	15	16	3.0	1.2	-	-	-	-
Boston, MA	15	16	1.8	-	-	-	-	-
Cleveland, OH	16	17	2.3	0.15	-	-	-	-
Denver, CO	15	16	5.5	4.2	2.6	0.80	0.36	-
Detroit, MI	15	16	3.1	1.4	-	-	-	-
Houston, TX	11	11	1.9	0.56	-	-	-	-
Los Angeles, CA	15	16	5.5	4.2	2.7	1.0	0.62	-
New York, NY	12	13	1.5	-	-	-	-	-
Philadelphia, PA	16	17	3.0	0.91	-	-	-	-
Sacramento, CA	17	18	3.8	1.8	-	-	-	-
St. Louis, MO	18	19	3.8	1.7	-	-	-	-

* The 86 city model is the ozone-only long-term mortality model used for a sensitivity analysis in the Ozone HREA (see Table 7C-7). All other models (including threshold models) presented in this table were generated using the 96 city dataset rather than the 86 city dataset (Jerrett et al., 2014).

Table 7C-11. Sensitivity Analysis – LT Mortality: Threshold models (ozone-only effect estimate) (2009 Current Standard 65ppb) (ozone-attributable deaths, percent of baseline mortality, incidence per 100,000 - compare with Core Results in Table 7B-7).

Ozone-Attributable Deaths

Study Area	Type of Ozone Model							
	Non-Threshold*		Threshold					
	86 city model	96 city model	40ppb	45ppb	50ppb	55ppb	56ppb	60ppb
Atlanta, GA	350	370	32	-	-	-	-	-
	(100 - 580)	(140 - 590)	(13 - 51)	(- - -)	(- - -)	(- - -)	(- - -)	(- - -)
Baltimore, MD	230	250	37	6	-	-	-	-
	(70 - 380)	(92 - 400)	(15 - 59)	(3 - 10)	(- - -)	(- - -)	(- - -)	(- - -)
Boston, MA	390	420	35	-	-	-	-	-
	(120 - 650)	(150 - 670)	(14 - 56)	(- - -)	(- - -)	(- - -)	(- - -)	(- - -)
Cleveland, OH	190	210	15	-	-	-	-	-
	(57 - 320)	(76 - 330)	(6 - 25)	(- - -)	(- - -)	(- - -)	(- - -)	(- - -)
Denver, CO	210	230	71	51	26	-	-	-
	(65 - 350)	(85 - 360)	(28 - 110)	(21 - 80)	(11 - 42)	(- - -)	(- - -)	(- - -)
Detroit, MI	370	400	67	20	-	-	-	-
	(110 - 610)	(150 - 620)	(27 - 110)	(8 - 31)	(- - -)	(- - -)	(- - -)	(- - -)
Houston, TX	330	350	50	7	-	-	-	-
	(98 - 540)	(130 - 550)	(20 - 80)	(3 - 10)	(- - -)	(- - -)	(- - -)	(- - -)
Los Angeles, CA	1000	1100	330	240	120	-	-	-
	(310 - 1700)	(400 - 1700)	(130 - 530)	(100 - 370)	(50 - 190)	(- - -)	(- - -)	(- - -)
New York, NY	1200	1200	-	-	-	-	-	-
	(350 - 1900)	(460 - 2000)	(- - -)	(- - -)	(- - -)	(- - -)	(- - -)	(- - -)
Philadelphia, PA	550	590	78	2	-	-	-	-
	(170 - 910)	(220 - 940)	(31 - 120)	(1 - 3)	(- - -)	(- - -)	(- - -)	(- - -)
Sacramento, CA	200	210	36	11	-	-	-	-
	(60 - 330)	(79 - 330)	(14 - 58)	(5 - 17)	(- - -)	(- - -)	(- - -)	(- - -)
St. Louis, MO	290	310	47	9	-	-	-	-
	(86 - 470)	(110 - 480)	(19 - 75)	(4 - 15)	(- - -)	(- - -)	(- - -)	(- - -)

Percent of Baseline Incidence Attributable to Ozone

Study Area	Type of Ozone Model							
	Non-Threshold*		Threshold					
	86 city model	96 city model	40ppb	45ppb	50ppb	55ppb	56ppb	60ppb
Atlanta, GA	10.8	11.5	1.0	-	-	-	-	-
Baltimore, MD	11.4	12.2	1.8	0.3	-	-	-	-
Boston, MA	10.8	11.5	1.0	-	-	-	-	-
Cleveland, OH	10.7	11.5	0.9	-	-	-	-	-
Denver, CO	13.5	14.4	4.5	3.2	1.7	-	-	-
Detroit, MI	11.7	12.5	2.1	0.6	-	-	-	-
Houston, TX	11.4	12.2	1.8	0.2	-	-	-	-
Los Angeles, CA	13.4	14.3	4.4	3.2	1.6	-	-	-
New York, NY	9.6	10.3	-	-	-	-	-	-
Philadelphia, PA	11.2	12.0	1.6	0.0	-	-	-	-
Sacramento, CA	11.7	12.5	2.1	0.6	-	-	-	-
St. Louis, MO	11.5	12.3	1.9	0.4	-	-	-	-

Ozone-Attributable Deaths per 100,000 Population

Study Area	Type of Ozone Model							
	Non-Threshold*		Threshold					
	86 city model	96 city model	40ppb	45ppb	50ppb	55ppb	56ppb	60ppb
Atlanta, GA	12	13	1.1	-	-	-	-	-
Baltimore, MD	15	16	2.3	0.39	-	-	-	-
Boston, MA	14	15	1.3	-	-	-	-	-
Cleveland, OH	15	16	1.2	-	-	-	-	-
Denver, CO	15	16	4.9	3.5	1.8	-	-	-
Detroit, MI	14	15	2.5	0.75	-	-	-	-
Houston, TX	10	11	1.6	0.21	-	-	-	-
Los Angeles, CA	14	15	4.6	3.3	1.7	-	-	-
New York, NY	10	11	-	-	-	-	-	-
Philadelphia, PA	16	17	2.2	0.060	-	-	-	-
Sacramento, CA	16	17	3.0	0.89	-	-	-	-
St. Louis, MO	17	18	2.8	0.55	-	-	-	-

* The 86 city model is the ozone-only long-term mortality model used for a sensitivity analysis in the Ozone HREA (see Table 7C-7). All other models (including threshold models) presented in this table were generated using the 96 city dataset rather than the 86 city dataset (Jerrett et al., 2014).

Table 7C-12. Sensitivity Analysis – LT Mortality: Threshold models (ozone-only effect estimate) (2009 Current Standard 60ppb) (ozone-attributable deaths, percent of baseline mortality, incidence per 100,000 - compare with Core Results in Table 7B-7).

Ozone-Attributable Deaths

Study Area	Type of Ozone Model							
	Non-Threshold*		Threshold					
	86 city model	96 city model	40ppb	45ppb	50ppb	55ppb	56ppb	60ppb
Atlanta, GA	340	360	13	-	-	-	-	-
	(100 - 550)	(130 - 570)	(5 - 21)	(- - -)	(- - -)	(- - -)	(- - -)	(- - -)
Baltimore, MD	230	240	26	-	-	-	-	-
	(67 - 370)	(89 - 380)	(10 - 41)	(- - -)	(- - -)	(- - -)	(- - -)	(- - -)
Boston, MA	380	400	16	-	-	-	-	-
	(110 - 620)	(150 - 640)	(7 - 26)	(- - -)	(- - -)	(- - -)	(- - -)	(- - -)
Cleveland, OH	180	190	1	-	-	-	-	-
	(54 - 300)	(71 - 310)	(0 - 2)	(- - -)	(- - -)	(- - -)	(- - -)	(- - -)
Denver, CO	200	210	50	28	1	-	-	-
	(59 - 320)	(78 - 330)	(20 - 79)	(12 - 43)	(1 - 2)	(- - -)	(- - -)	(- - -)
Detroit, MI	350	380	47	-	-	-	-	-
	(110 - 580)	(140 - 600)	(19 - 75)	(- - -)	(- - -)	(- - -)	(- - -)	(- - -)
Houston, TX	320	340	38	-	-	-	-	-
	(95 - 520)	(130 - 540)	(15 - 60)	(- - -)	(- - -)	(- - -)	(- - -)	(- - -)
Los Angeles, CA	960	1000	260	160	40	-	-	-
	(290 - 1600)	(380 - 1600)	(110 - 420)	(68 - 260)	(17 - 63)	(- - -)	(- - -)	(- - -)
New York, NY	NA							
Philadelphia, PA	530	570	53	-	-	-	-	-
	(160 - 880)	(210 - 910)	(21 - 84)	(- - -)	(- - -)	(- - -)	(- - -)	(- - -)
Sacramento, CA	190	200	23	-	-	-	-	-
	(56 - 310)	(74 - 320)	(9 - 36)	(- - -)	(- - -)	(- - -)	(- - -)	(- - -)
St. Louis, MO	270	290	26	-	-	-	-	-
	(81 - 450)	(110 - 460)	(11 - 42)	(- - -)	(- - -)	(- - -)	(- - -)	(- - -)

Percent of Baseline Incidence Attributable to Ozone

Study Area	Type of Ozone Model							
	Non-Threshold*		Threshold					
	86 city model	96 city model	40ppb	45ppb	50ppb	55ppb	56ppb	60ppb
Atlanta, GA	10.4	11.1	0.4	-	-	-	-	-
Baltimore, MD	11.0	11.8	1.3	-	-	-	-	-
Boston, MA	10.4	11.1	0.4	-	-	-	-	-
Cleveland, OH	10.1	10.8	0.1	-	-	-	-	-
Denver, CO	12.4	13.3	3.1	1.7	0.1	-	-	-
Detroit, MI	11.2	12.0	1.5	-	-	-	-	-
Houston, TX	11.0	11.8	1.3	-	-	-	-	-
Los Angeles, CA	12.7	13.6	3.5	2.2	0.5	-	-	-
New York, NY	NA							
Philadelphia, PA	10.9	11.6	1.1	-	-	-	-	-
Sacramento, CA	11.1	11.8	1.3	-	-	-	-	-
St. Louis, MO	10.9	11.6	1.1	-	-	-	-	-

Ozone-Attributable Deaths per 100,000 Population

Study Area	Type of Ozone Model							
	Non-Threshold*		Threshold					
	86 city model	96 city model	40ppb	45ppb	50ppb	55ppb	56ppb	60ppb
Atlanta, GA	11	12	0.44	-	-	-	-	-
Baltimore, MD	14	15	1.6	-	-	-	-	-
Boston, MA	14	15	0.59	-	-	-	-	-
Cleveland, OH	14	15	0.073	-	-	-	-	-
Denver, CO	14	14	3.4	1.9	0.096	-	-	-
Detroit, MI	14	14	1.8	-	-	-	-	-
Houston, TX	10	11	1.2	-	-	-	-	-
Los Angeles, CA	13	14	3.7	2.2	0.55	-	-	-
New York, NY	NA							
Philadelphia, PA	15	16	1.5	-	-	-	-	-
Sacramento, CA	15	16	1.9	-	-	-	-	-
St. Louis, MO	16	17	1.6	-	-	-	-	-

* The 86 city model is the ozone-only long-term mortality model used for a sensitivity analysis in the Ozone HREA (see Table 7C-7). All other models (including threshold models) presented in this table were generated using the 96 city dataset rather than the 86 city dataset (Jerrett et al., 2014).

NA: for NYC, the model-based adjustment methodology was unable to adjust O_3 distributions such that they would meet the alternative standard level of 60 ppb.

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APPENDIX 8A

City-Specific Ozone-Mortality Effect Estimates

This Appendix contains two tables specifying the effect estimates from Smith et al. (2009) (Table 8A-1) and Zanobetti and Schwartz (2008) (Table 8A-2) studies that were used in the national-scale epidemiological-based risk assessment. References are included immediately following the tables.

Table 8A-1. Smith et al. (2009) city-specific and regional non-accidental mortality effect estimates for 8-hr daily maximum ozone, using April-October (many just May-September) ozone observations from 1987-2000, based on 98 U.S. urban communities.

	National prior		Regional prior	
Location	**Beta**	**Std**	**Beta**	**Std**
Akron, OH	0.000305	0.000332	0.000502	0.000279
Albuquerque, NM	0.000292	0.000349	-5E-05	0.000351
Arlington, VA	0.000341	0.000353	0.00091	0.000297
Atlanta, GA	0.000256	0.000283	0.000222	0.000229
Austin, TX	0.000309	0.000313	-1.6E-05	0.000326
Bakersfield, CA	0.000342	0.00033	4.41E-05	0.000282
Baltimore, MD	0.000313	0.000322	0.000863	0.000286
Baton Rouge, LA	0.000383	0.00031	0.000281	0.000244
Biddeford, ME	0.000321	0.000349	0.000897	0.000297
Birmingham, AL	0.000212	0.000318	0.000197	0.00025
Boston, MA	0.000156	0.000343	0.000803	0.00031
Buffalo, NY	0.000349	0.000324	0.00052	0.000274
Cedar Rapids, IA	0.000338	0.000338	-0.00017	0.000482
Charlotte, NC	0.000236	0.000328	0.000208	0.000254
Chicago, IL	0.000498	0.000247	0.000568	0.000224
Cincinnati, OH	0.000513	0.000329	0.000597	0.000277
Cleveland, OH	0.000488	0.000308	0.00058	0.000264
Colorado Springs, CO	0.000389	0.000347	0.000257	0.000377
Columbus, GA	0.000405	0.000321	0.000289	0.000249
Columbus, OH	0.000309	0.000323	0.000501	0.000274
Corpus Christi, TX	0.000375	0.000322	8.6E-06	0.000335
Coventry, RI	0.000251	0.000335	0.000847	0.000297
Dallas/Ft Worth, TX	0.000538	0.000238	0.000392	0.000213
Dayton, OH	0.000314	0.000334	0.000507	0.00028
Denver, CO	0.000182	0.000345	0.000163	0.000372
Des Moines, IA	0.000188	0.000342	-0.00024	0.00048
Detroit, MI	0.000439	0.000299	0.000554	0.000259
El Paso, TX	0.000173	0.000347	-9.7E-05	0.000347
Evansville	0.000275	0.000326	0.000486	0.000277
Ft Wayne, IN	0.000319	0.00034	0.000512	0.000283
Fresno, CA	0.000188	0.000334	-2.6E-05	0.000283
Grand Rapids, MI	0.000377	0.000335	0.000537	0.00028
Greensboro, NC	0.000291	0.000346	0.000231	0.000262
Honolulu, HI	0.000451	0.000358	6.17E-05	0.000236
Houston, TX	0.000403	0.000215	0.00032	0.000189
Huntsville, AL	0.000548	0.000357	0.000349	0.000271

	National prior		Regional prior	
Location	Beta	Std	Beta	Std
Indianapolis, IN	0.000246	0.000331	0.000474	0.00028
Industrial Midwest	N/A	N/A	0.000521	0.00018
Jackson, MS	0.000269	0.000327	0.000223	0.000253
Jacksonville, FL	0.000201	0.000322	0.000192	0.000252
Jersey City, NJ	0.000117	0.000336	0.000769	0.000314
Johnston, PA	0.000329	0.000334	0.000884	0.00029
Kansas City, KS	0.000146	0.000339	-0.00025	0.000473
Kansas City, MO	0.000395	0.000321	-0.00013	0.000467
Kingston, NY	0.000452	0.000342	0.000944	0.000287
Knoxville, TN	0.000471	0.000339	0.000316	0.00026
Lafayette, LA	0.000236	0.000315	0.000209	0.000247
Lake Charles, LA	0.000263	0.000312	0.000222	0.000245
Las Vegas, NV	0.00014	0.000348	-0.00011	0.000346
Lexington, KY	0.000172	0.000345	0.000443	0.00029
Lincoln, NE	0.000426	0.000349	0.000941	0.000292
Little Rock, AR	0.000217	0.000339	0.000198	0.000261
Los Angeles, CA	0.000148	0.000165	5.24E-05	0.000161
Louisville, KY	0.000351	0.000322	0.000521	0.000273
Madison, WI	0.000456	0.000355	0.000577	0.000292
Memphis, TN	0.000391	0.000312	0.000284	0.000245
Miami, FL	0.000233	0.000277	0.000211	0.000226
Milwaukee, WI	0.00029	0.000315	0.000488	0.00027
Mobile, AL	0.000359	0.000323	0.000266	0.00025
Modesto, CA	0.000322	0.000341	0.000227	0.000372
Muskegon, MI	0.000305	0.000346	0.000508	0.000287
Nashville, TN	0.000347	0.000329	0.00026	0.000253
National Average	0.000322	8.42E-05	N/A	N/A
New Orleans, LA	0.000252	0.000321	0.000216	0.00025
New York, NY	0.000917	0.00023	0.001055	0.000195
Newark, NJ	0.000549	0.000333	0.000972	0.000276
North East	N/A	N/A	0.000908	0.000192
North West	N/A	N/A	0.000224	0.000308
Oakland, CA	0.000214	0.000334	0.000179	0.000366
Oklahoma City, OK	0.000358	0.000317	4.62E-06	0.000331
Omaha, NE	0.000377	0.000345	0.000917	0.000292
Orlando, FL	-3.3E-05	0.000358	7.91E-05	0.000286
Philadelphia, PA	0.000574	0.000296	0.000948	0.000253
Phoenix, AZ	0.00034	0.000301	7.84E-06	0.00032
Pittsburgh, PA	0.000155	0.000306	0.000412	0.000272

	National prior		Regional prior	
Location	Beta	Std	Beta	Std
Portland, OR	0.00037	0.000335	0.00025	0.000369
Providence, RI	0.000418	0.000333	0.000922	0.000284
Raleigh, NC	0.000271	0.000337	0.000223	0.000258
Riverside, CA	0.000206	0.000295	2.3E-06	0.000257
Rochester, NY	0.000406	0.000339	0.000923	0.000287
Sacramento, CA	0.000306	0.000313	0.000225	0.000351
Salt Lake City, UT	0.000296	0.000345	0.000215	0.000375
San Antonio, TX	7.15E-05	0.000307	-0.00012	0.000313
San Bernardino, CA	0.00034	0.000283	7.61E-05	0.000254
San Diego, CA	0.000118	0.000289	-3.6E-05	0.000252
San Jose, CA	0.000351	0.000323	0.000244	0.00036
Santa Ana/Anaheim, CA	0.0002	0.000279	8.65E-06	0.000246
Seattle, WA	0.000283	0.000325	0.000212	0.00036
Shreveport, LA	0.000366	0.00032	0.00027	0.000248
South East	N/A	N/A	0.000242	0.000135
South West	N/A	N/A	-4.4E-05	0.000273
Southern California	N/A	N/A	1.73E-05	0.000189
Spokane, WA	0.000327	0.000353	0.000227	0.000381
St. Louis, MO	0.000476	0.000336	0.000581	0.000281
St Petersburg, FL	0.000147	0.000288	0.000166	0.000235
Stockton, CA	0.00036	0.000343	0.000244	0.000374
Syracuse, NY	0.00053	0.000357	0.000985	0.000292
Tacoma, WA	0.00036	0.000342	0.000245	0.000373
Tampa, FL	0.000223	0.000299	0.000204	0.000239
Toledo, OH	0.000414	0.000333	0.000553	0.000279
Tucson, AZ	0.000333	0.000334	-2.1E-05	0.000342
Tulsa, OK	0.000382	0.000325	0.000277	0.000251
Upper Midwest	N/A	N/A	-0.0002	0.000445
Washington, DC	0.000239	0.000321	0.000823	0.000294
Wichita, KS	0.000249	0.000345	-0.00022	0.000486
Worcester, MA	0.000467	0.000337	0.000946	0.000283

Table 8A-2. Zanobetti and Schwartz (2008) city-specific all-cause mortality effect estimates for June-August 8-hr daily mean (10am-6pm) ozone from 1989-2000, using a 0-3 day lag, based on 48 U.S. cities.

Location	Beta	Std
All cities (48)	0.00053	0.000125
Albuquerque, NM	0.000528	0.000416
Atlanta, GA	0.000295	0.000289
Austin, TX	0.00045	0.000393
Baltimore, MD	0.000515	0.000314
Birmingham, AL	0.000293	0.000356
Boston, MA	0.000682	0.000328
Boulder, CO	0.000602	0.000419
Broward, FL	0.000593	0.000382
Canton, OH	0.000489	0.000401
Charlotte, NC	0.000571	0.000381
Chicago, IL	0.000479	0.000299
Cincinnati, OH	0.000509	0.000361
Cleveland, OH	0.000596	0.000355
Colorado Springs, CO	0.000497	0.000418
Columbus, OH	0.000739	0.000368
Dallas, TX	0.000578	0.000317
Denver, CO	0.000352	0.000409
Detroit, MI	0.001046	0.000344
Greensboro, NC	0.000478	0.000397
Honolulu, HI	0.000486	0.00042
Houston, TX	0.000163	0.000263
Jersey city, NJ	0.000354	0.00038
Kansas City, KS	0.000922	0.000387
Los Angeles, CA	0.000274	0.000213
Miami, FL	0.000607	0.000373
Milwaukee, WI	0.000659	0.000382
Nashville, TN	0.00046	0.000383
New Haven, CT	0.000647	0.000364
New Orleans, LA	0.000218	0.000375
New York, NY	0.001092	0.000236
Oklahoma City, OK	0.00062	0.00038
Orlando, FL	0.000487	0.000377
Philadelphia, PA	0.000625	0.000315
Phoenix, AZ	0.00071	0.000374
Pittsburgh, PA	0.00028	0.000328
Provo/Orem, UT	0.000527	0.00042

Location	Beta	Std
Sacramento, CA	0.000569	0.000389
Salt Lake City, UT	0.000478	0.000407
San Diego, CA	0.000448	0.000373
San Francisco, CA	0.000566	0.000416
Seattle, WA	0.000491	0.00038
Spokane, WA	0.00059	0.000415
St. Louis, MO	0.000544	0.000333
Tampa, FL	0.000123	0.000366
Terra Haute, IN	0.000659	0.00042
Tulsa, OK	0.000871	0.000391
Washington, DC	9.56E-05	0.00036
Youngstown, OH	0.000448	0.000394

REFERENCES

Smith R.L.; B. Xu and P. Switzer. 2009. Reassessing the relationship between ozone and short-term mortality in U.S. urban communities. *Inhalation Toxicology*. 21:37-61.

Zanobetti, A. and J. Schwartz. 2011. Ozone and survival in four cohorts with potentially predisposing diseases. *American Journal of Respiratory and Critical Care Medicine*. 194:836-841.

APPENDIX 8B

Supplement to the Representativeness Analysis of the 12 Urban Study Areas

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List of Figures

Following the analysis discussed in the main body of the HREA Section 8.2, this Appendix provides graphical comparisons of the empirical distributions of components of the risk function, and additional variables that have been identified as potentially influencing the risk associated with ozone exposures. In each graph, the blue line represents the cumulative distribution function (CDF) for the complete set of data available for the variable. In some cases, this many encompass all counties in the U.S., while in others it may be based on a subset of the U.S., usually for large urban areas. The black squares at the bottom of each graph represent the specific value of the variable for one of the case study locations, with the line showing where that value intersect the CDF of the nationwide data.

8B-1. ELEMENTS OF THE RISK EQUATION

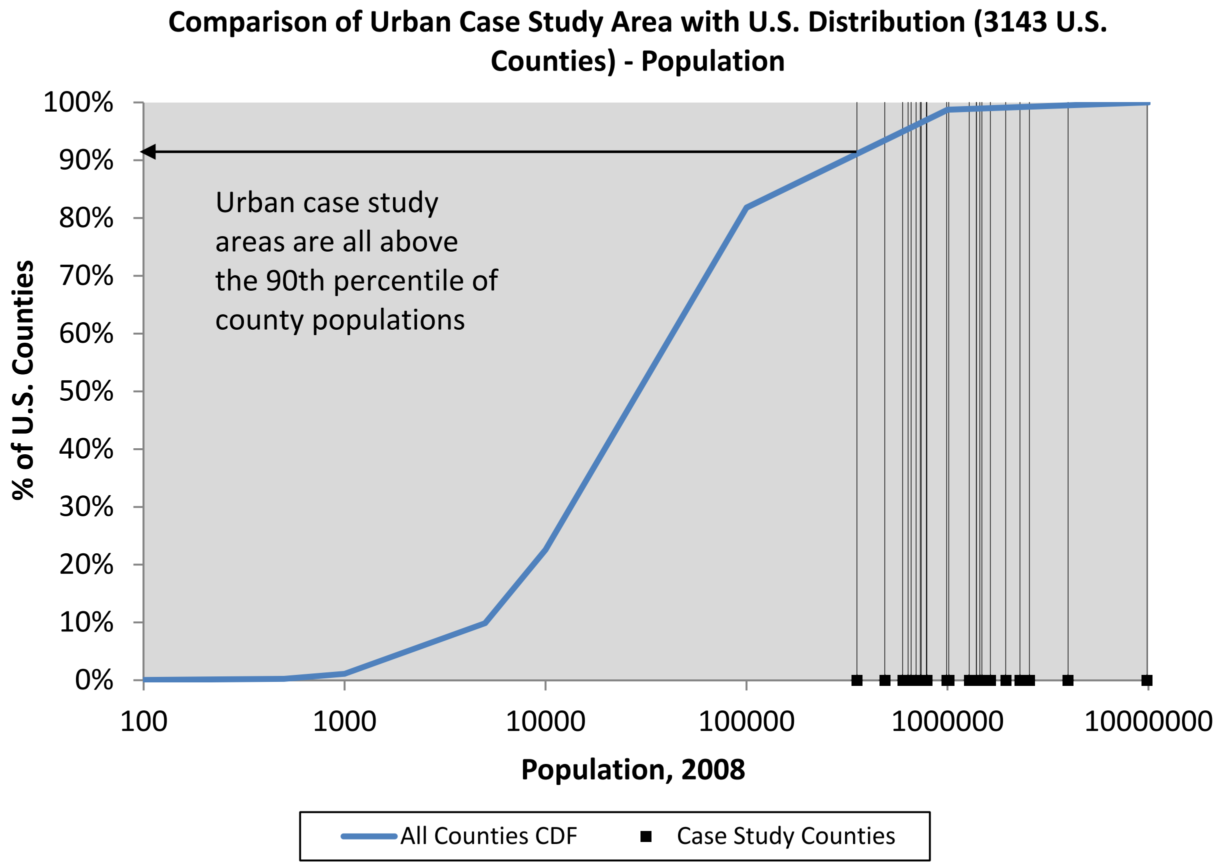

Figure 8B-1. Comparison of distributions for key elements of the risk equation: Total population.

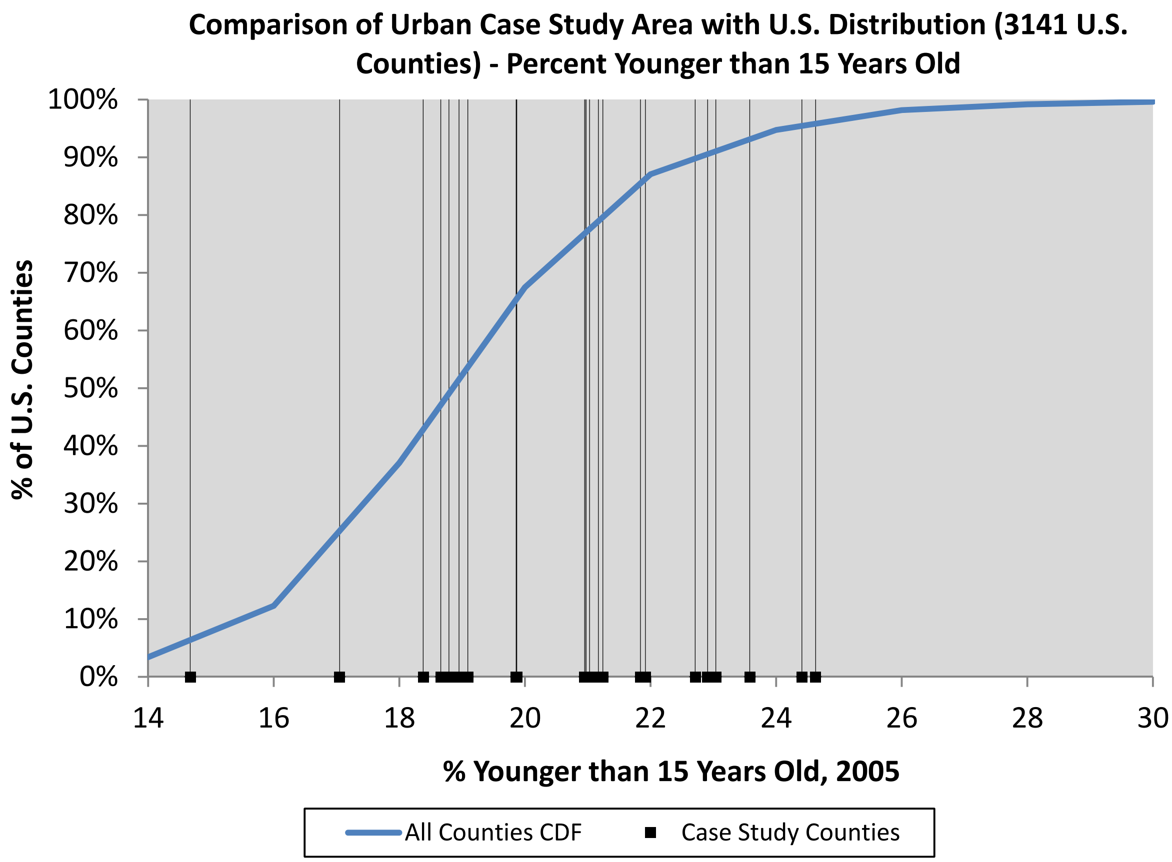

Figure 8B-2. Comparison of distributions for key elements of the risk equation: Percent of population younger than 15 years old.

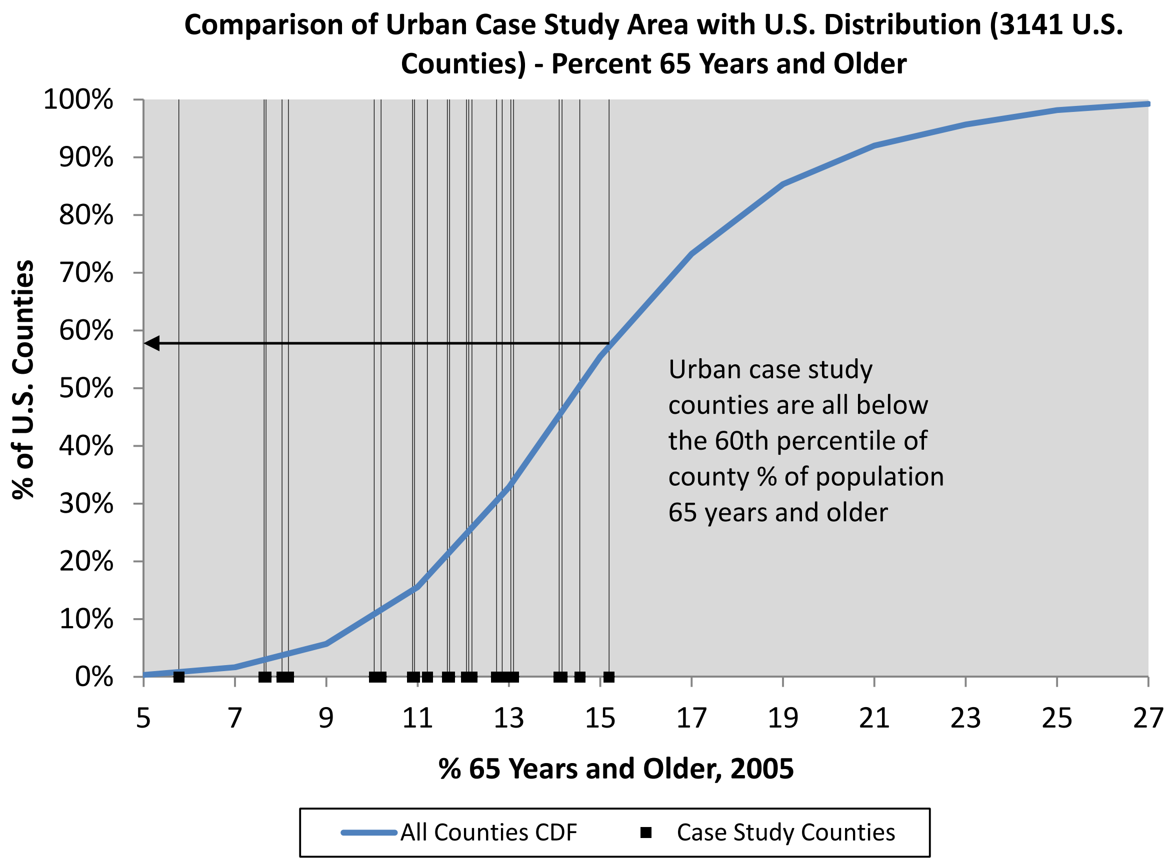

Figure 8B-3. Comparison of distributions for key elements of the risk equation: Percent of population 65 and older.

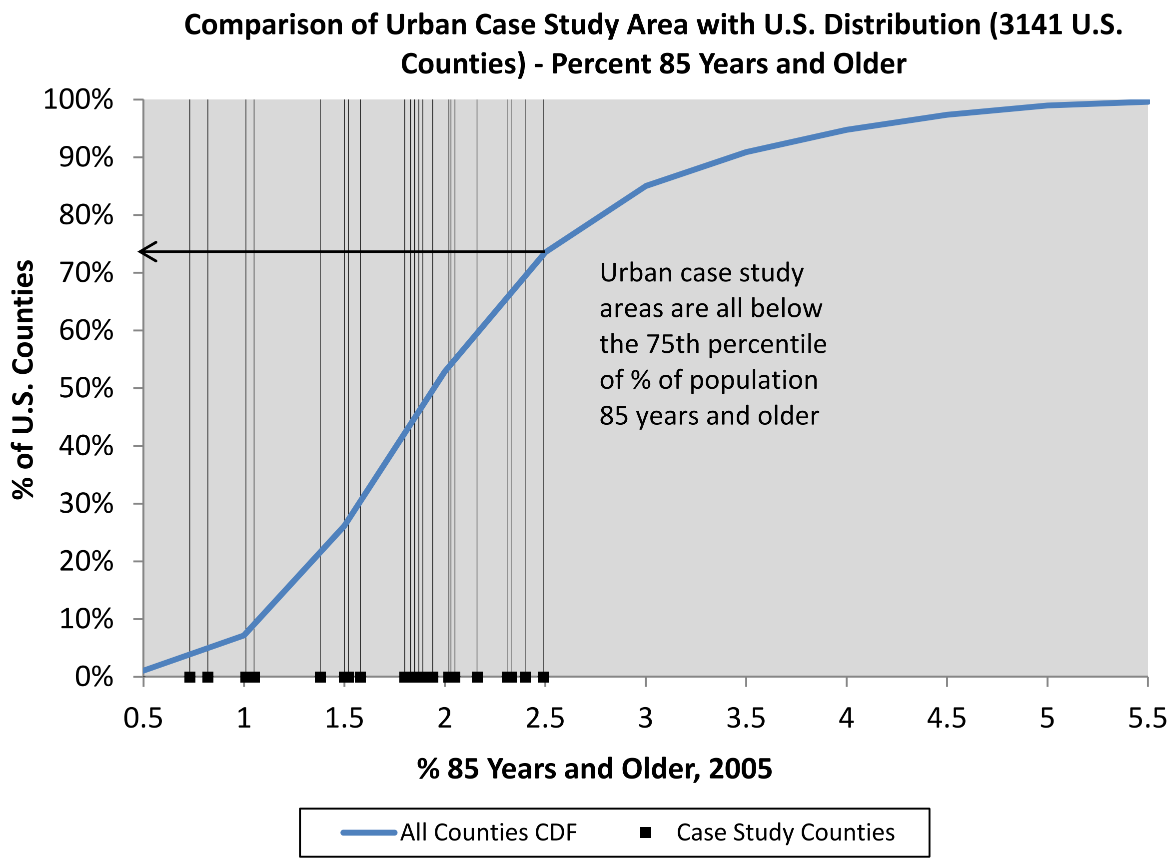

Figure 8B-4. Comparison of distributions for key elements of the risk equation: Percent of population 85 and older.

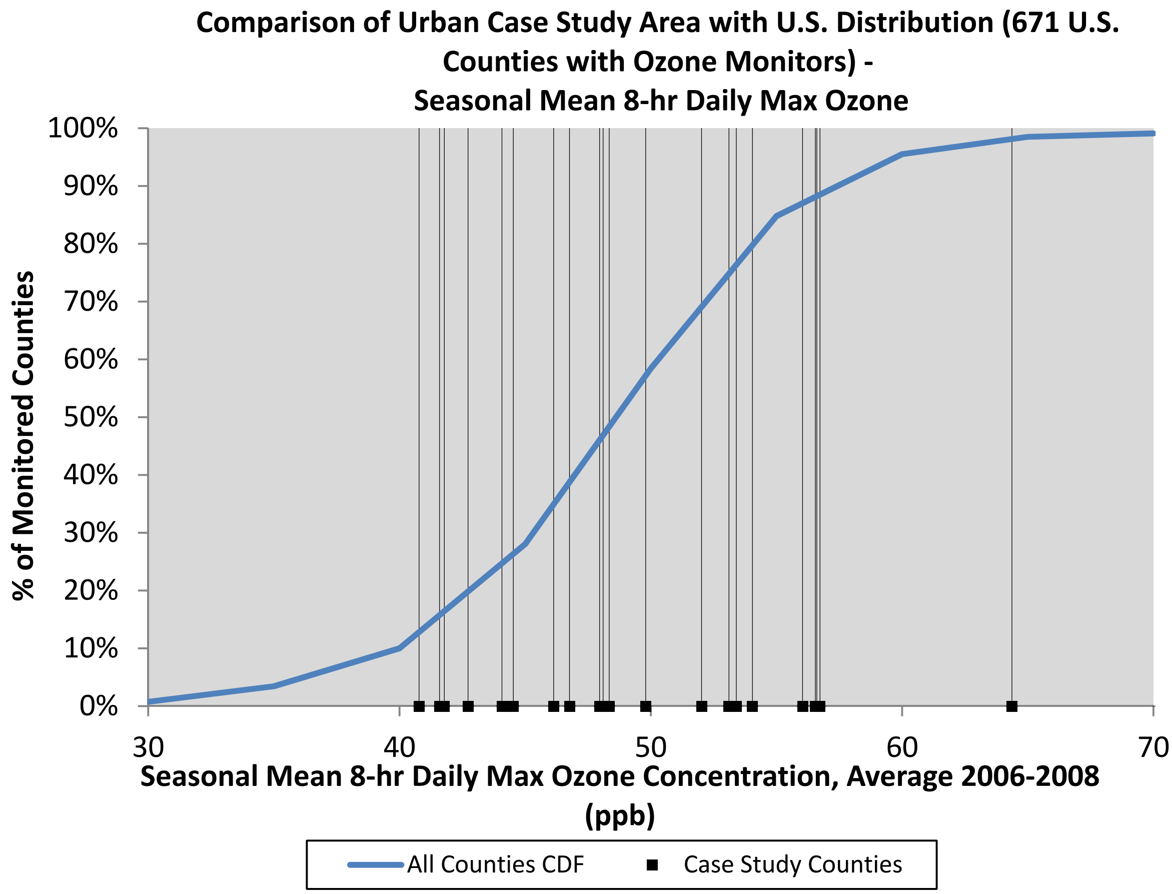

Figure 8B-5 Comparison of distributions for key elements of the risk equation: Seasonal mean 8-hr daily maximum ozone concentration.

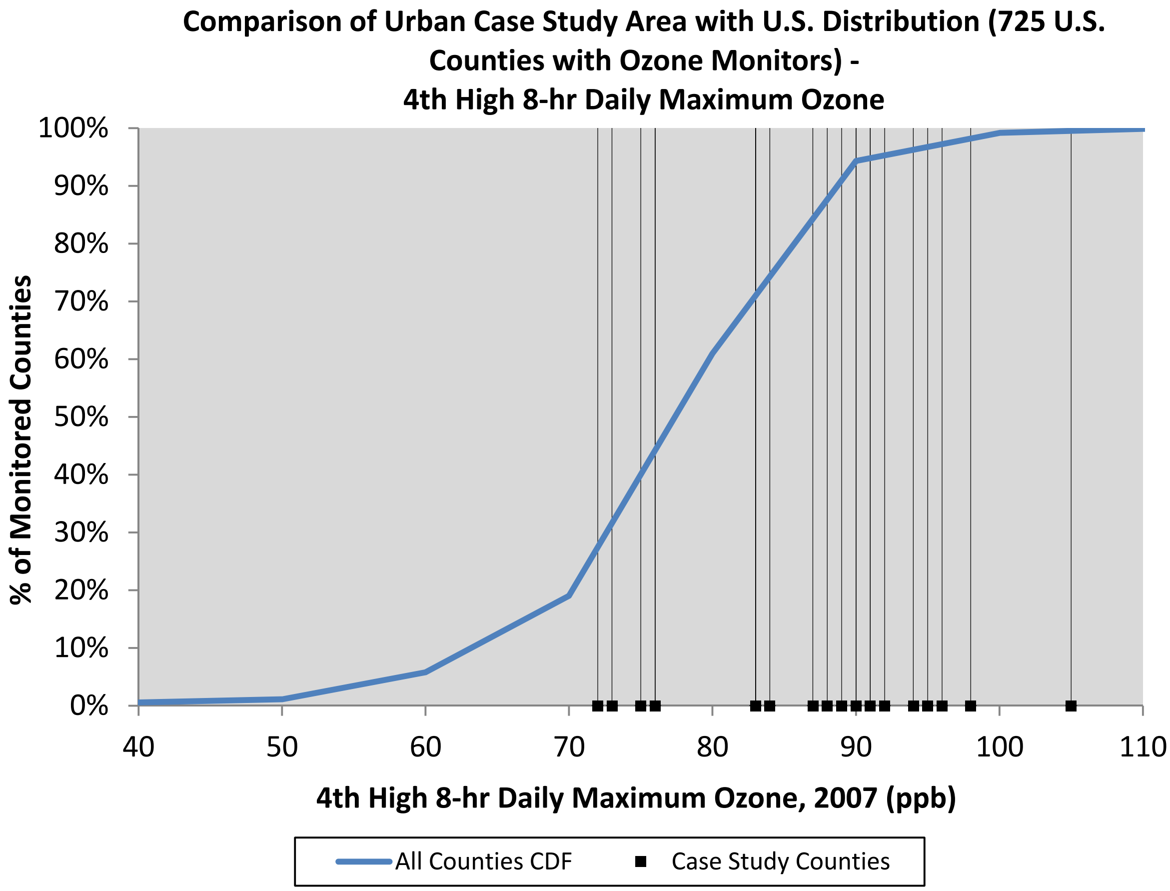

Figure 8B-6. Comparison of distributions for key elements of the risk equation: 4th highest 8-hr daily maximum ozone concentration.

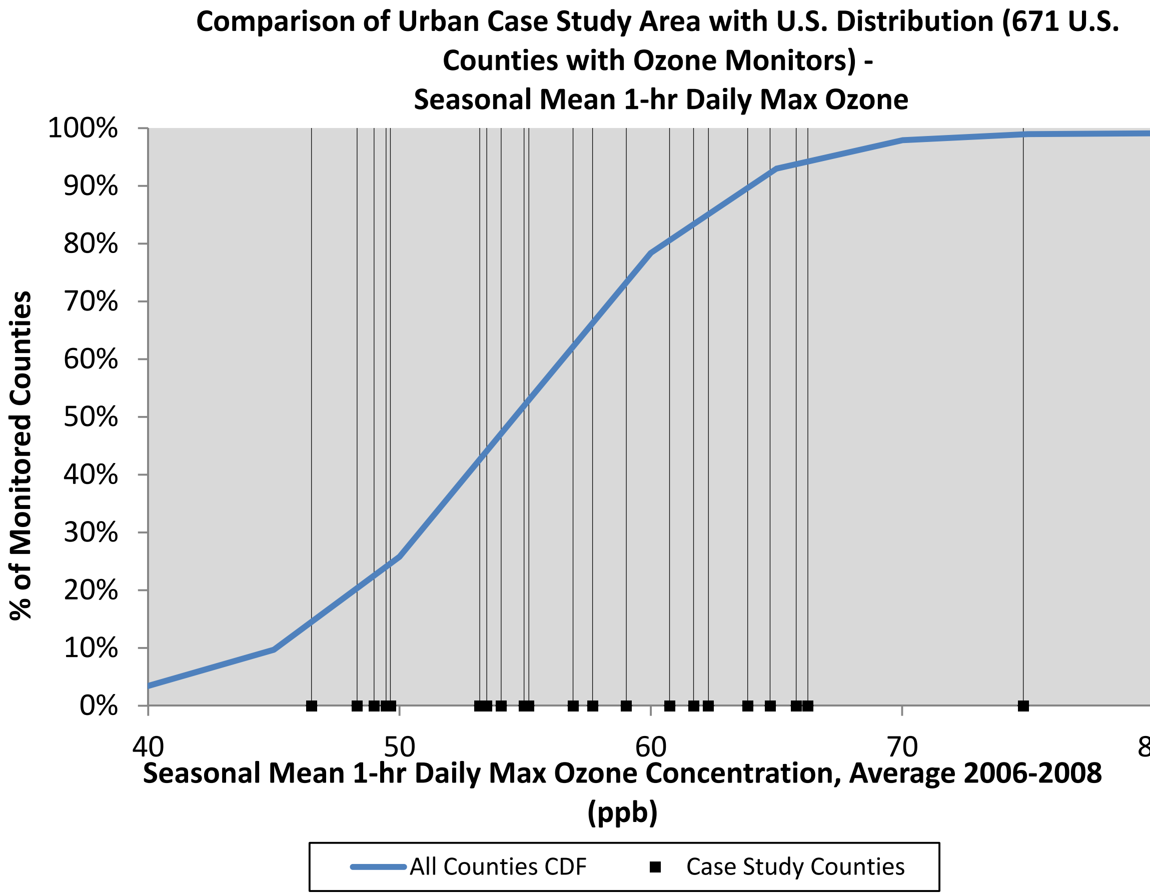

Figure 8B-7. Comparison of distributions for key elements of the risk equation: Seasonal mean 1-hr daily maximum ozone concentration.

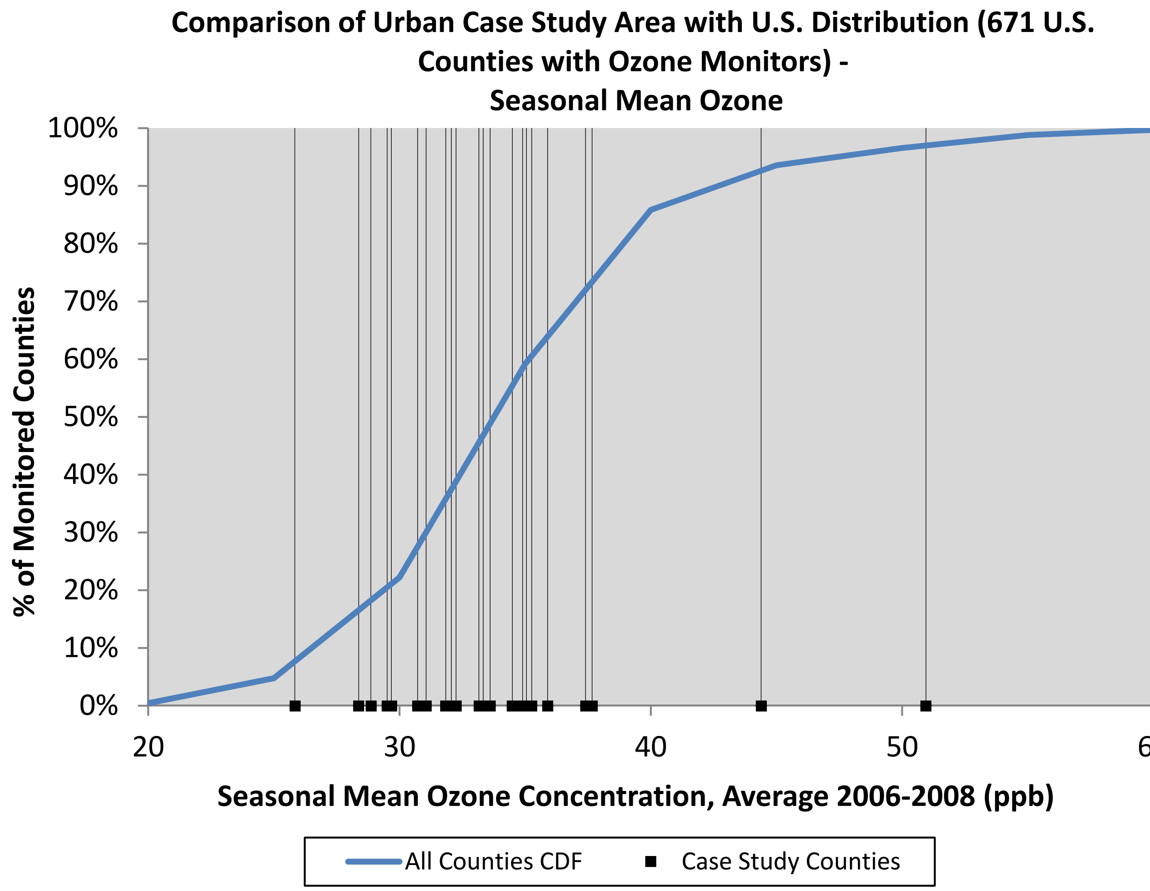

Figure 8B-8. Comparison of distributions for key elements of the risk equation: Seasonal mean ozone concentration.

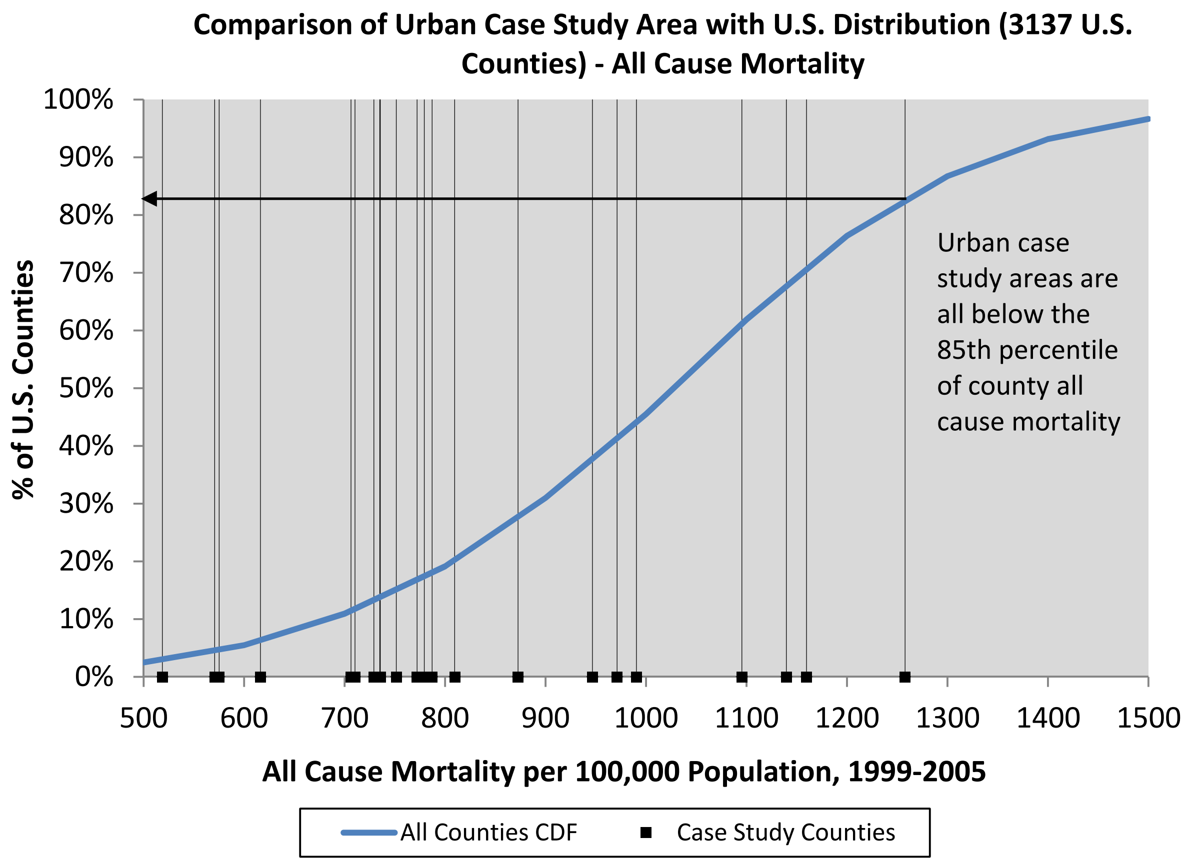

Figure 8B-9. Comparison of distributions for key elements of the risk equation: Baseline all-cause mortality.

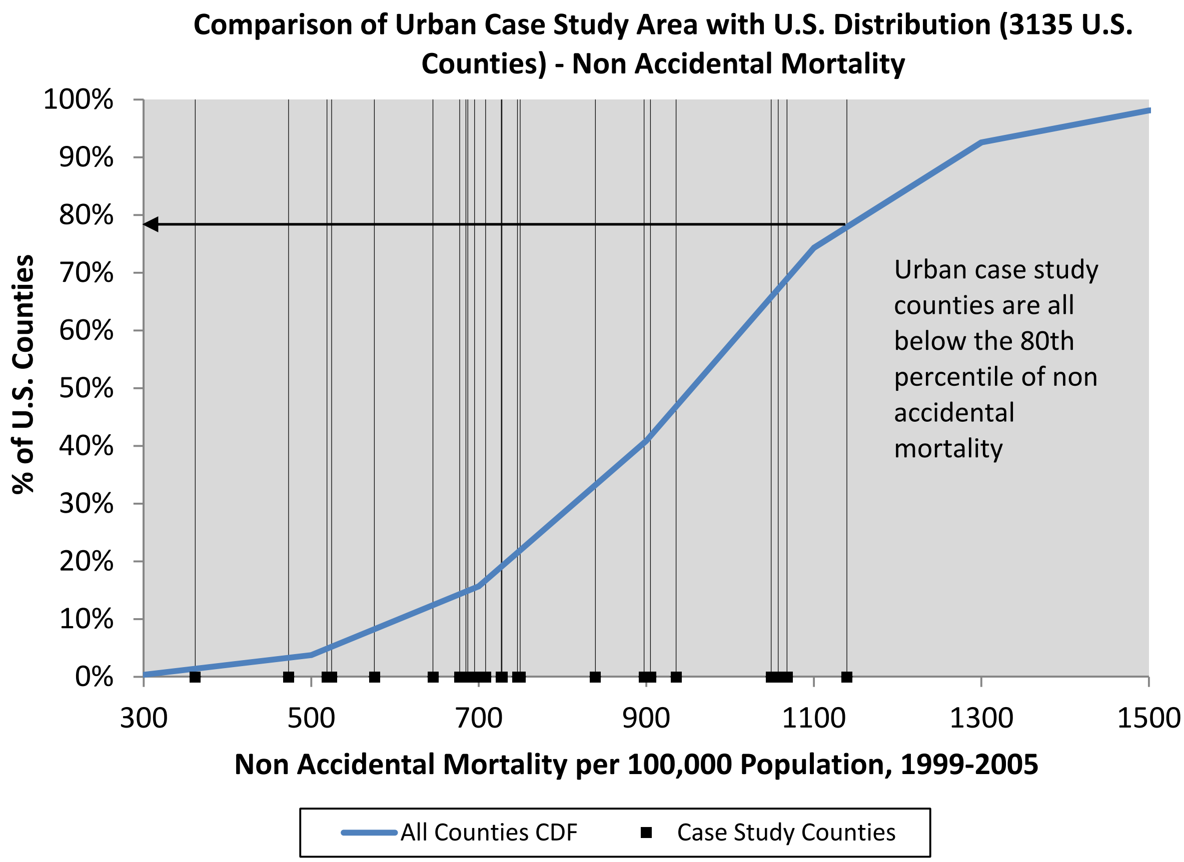

Figure 8B-10. Comparison of distributions for key elements of the risk equation: Baseline non-accidental mortality.

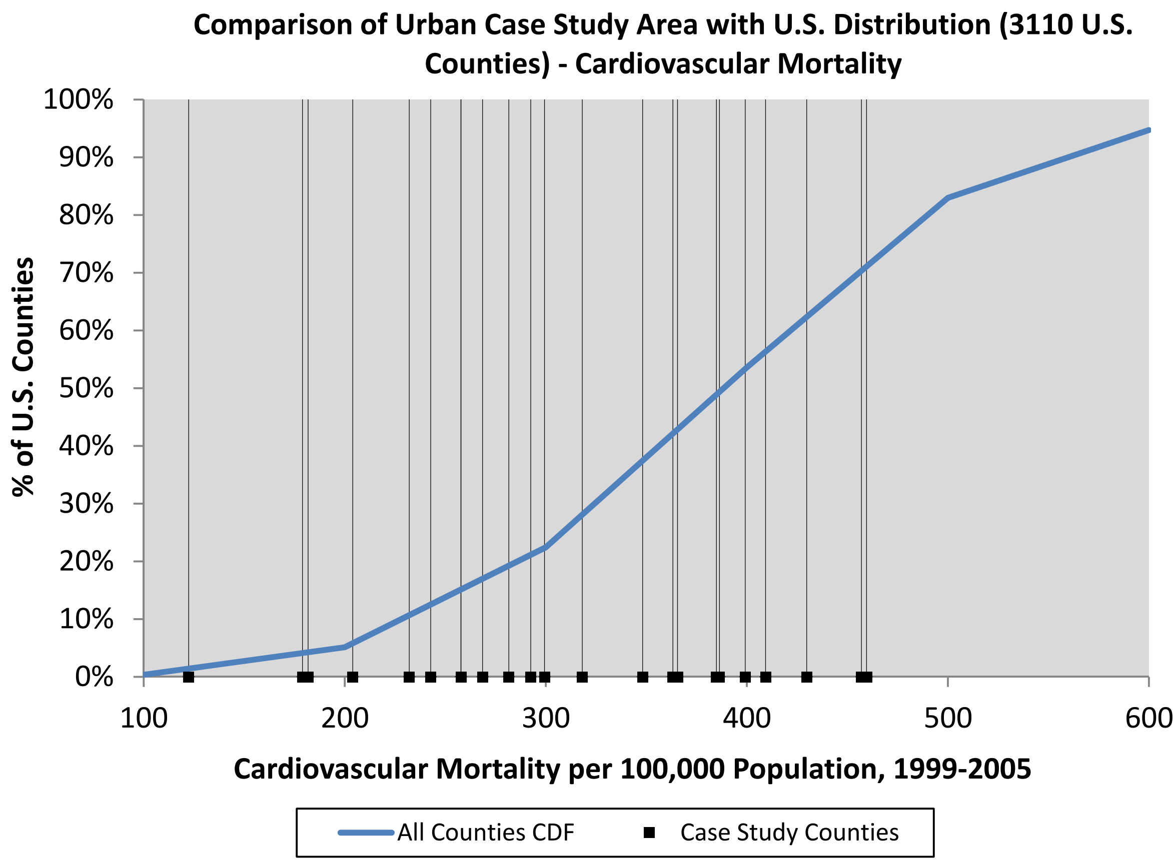

Figure 8B-11. Comparison of distributions for key elements of the risk equation: Baseline cardiovascular mortality.

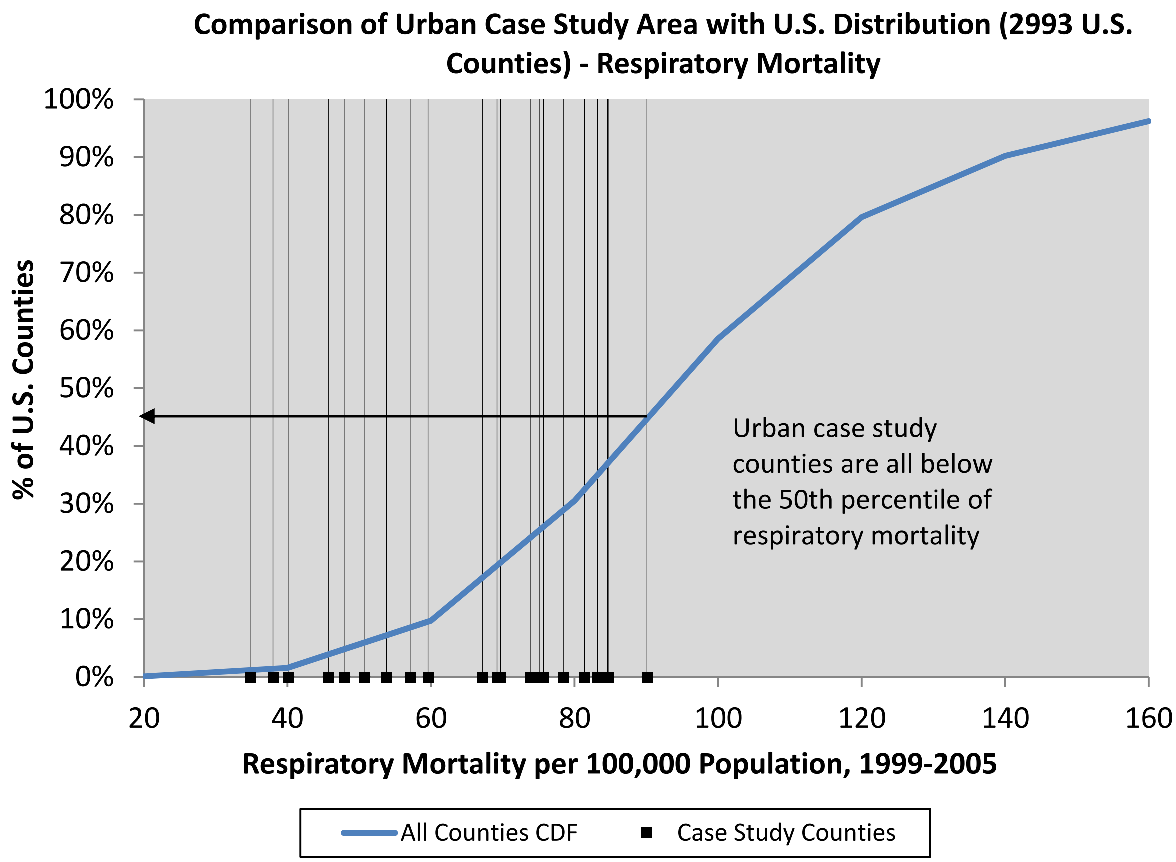

Figure 8B-12. Comparison of distributions for key elements of the risk equation: Baseline respiratory mortality.

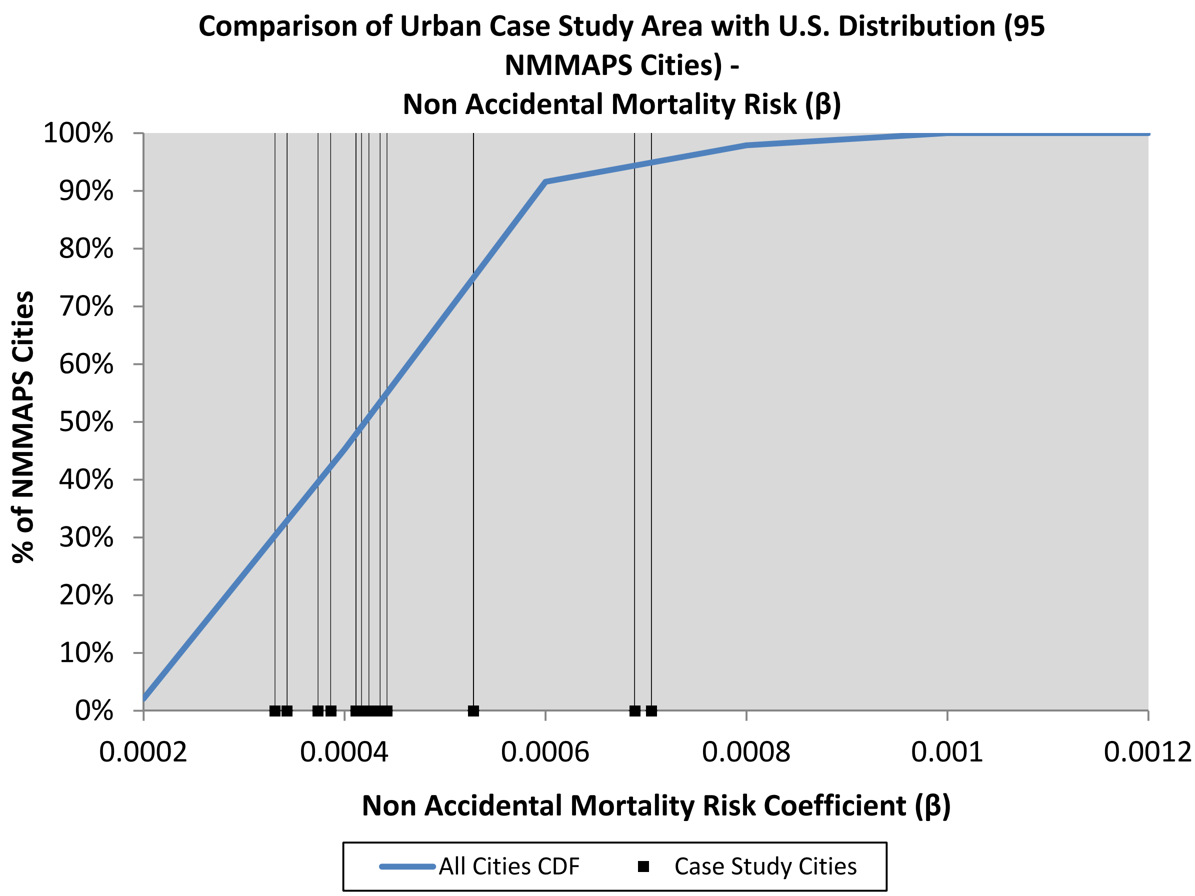

Figure 8B-13. Comparison of distributions for key elements of the risk equation: Non-accidental mortality risk coefficient from Bell et al. (2004).

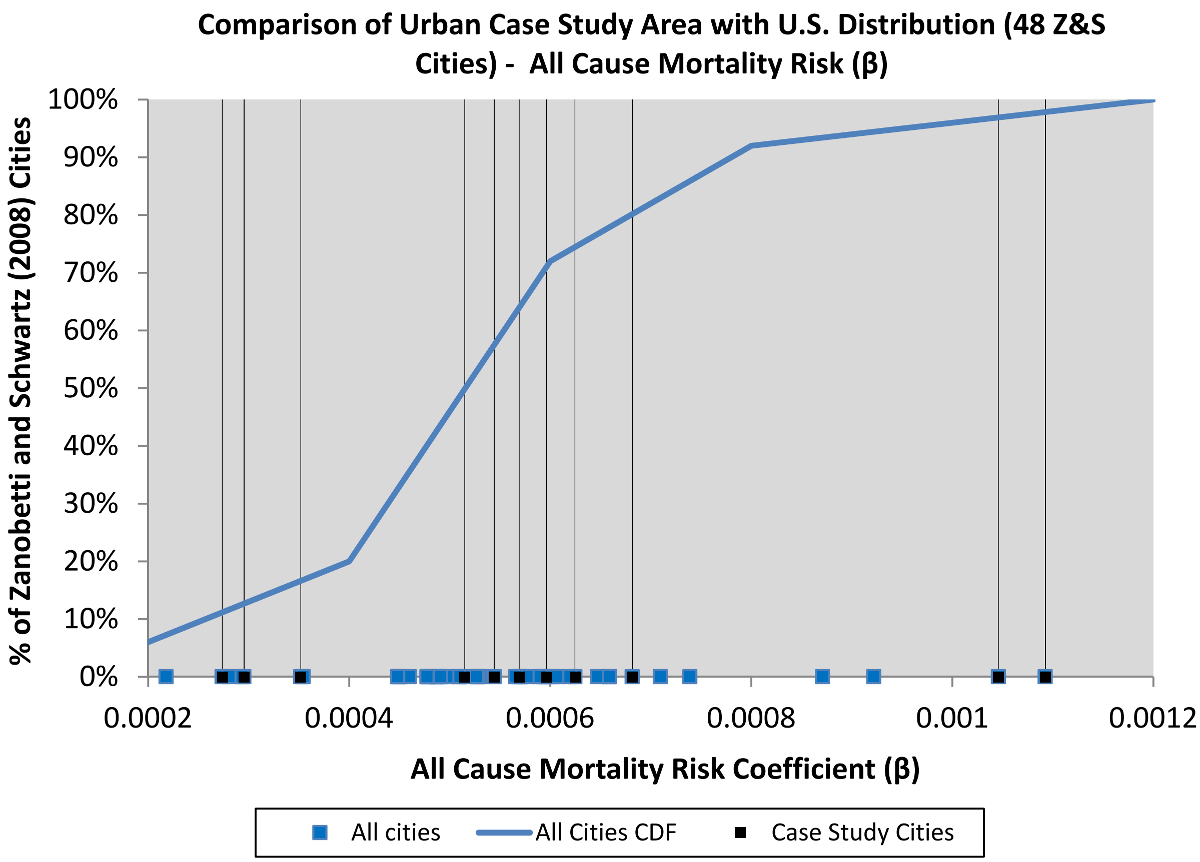

Figure 8B-14. Comparison of distributions for key elements of the risk equation: All-cause mortality risk coefficient from Zanobetti and Schwartz (2008).

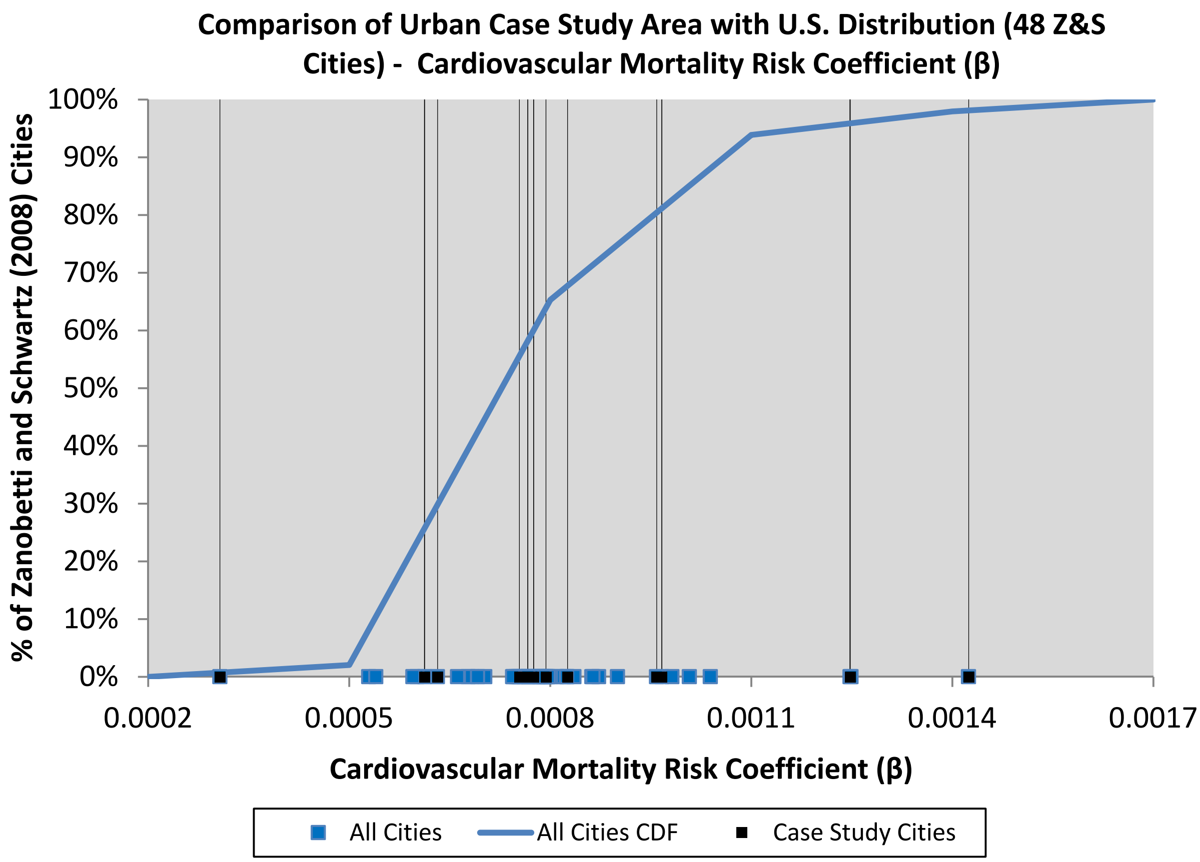

Figure 8B-15. Comparison of distributions for key elements of the risk equation: Cardiovascular mortality risk coefficient from Zanobetti and Schwartz (2008).

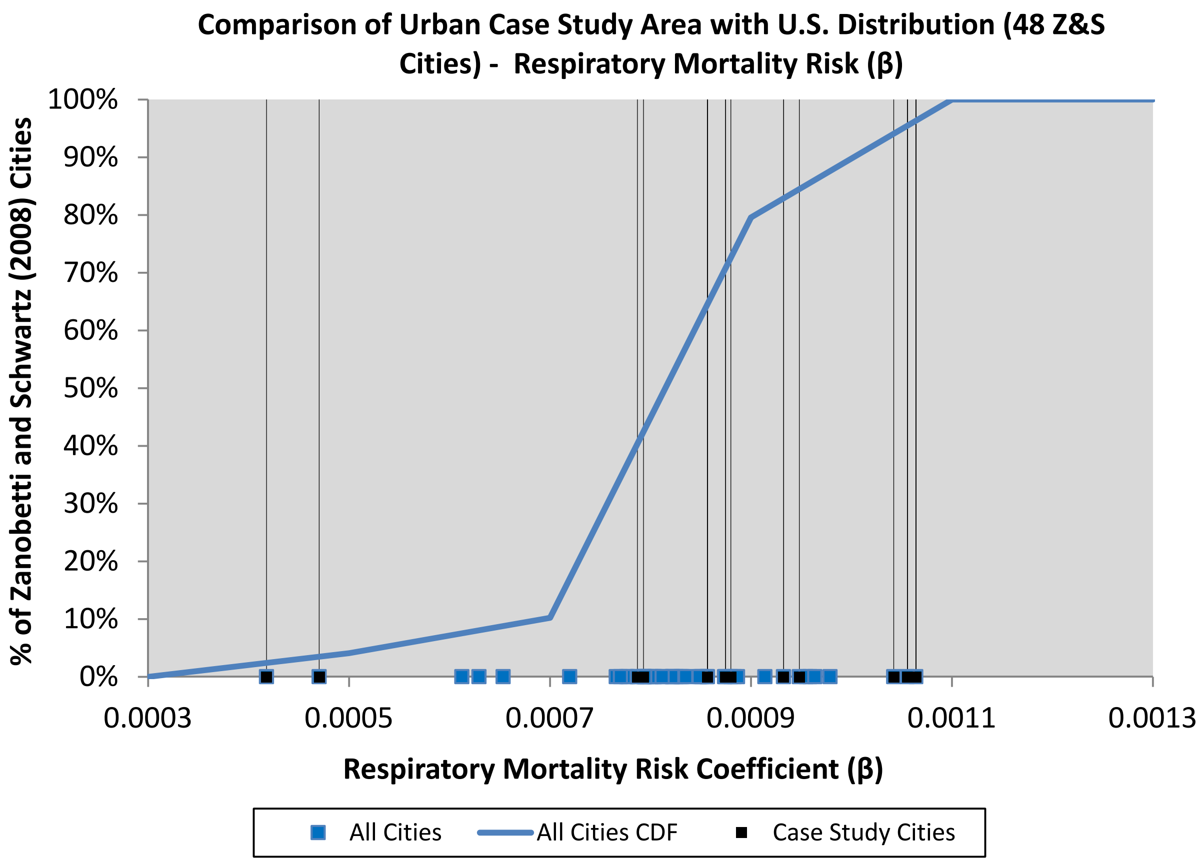

Figure 8B-16. Comparison of distributions for key elements of the risk equation: Respiratory mortality risk coefficient from Zanobetti and Schwartz (2008).

8B-2. VARIABLES EXPECTED TO INFLUENCE THE RELATIVE RISK FROM OZONE

8B-2.1 Demographic Variables

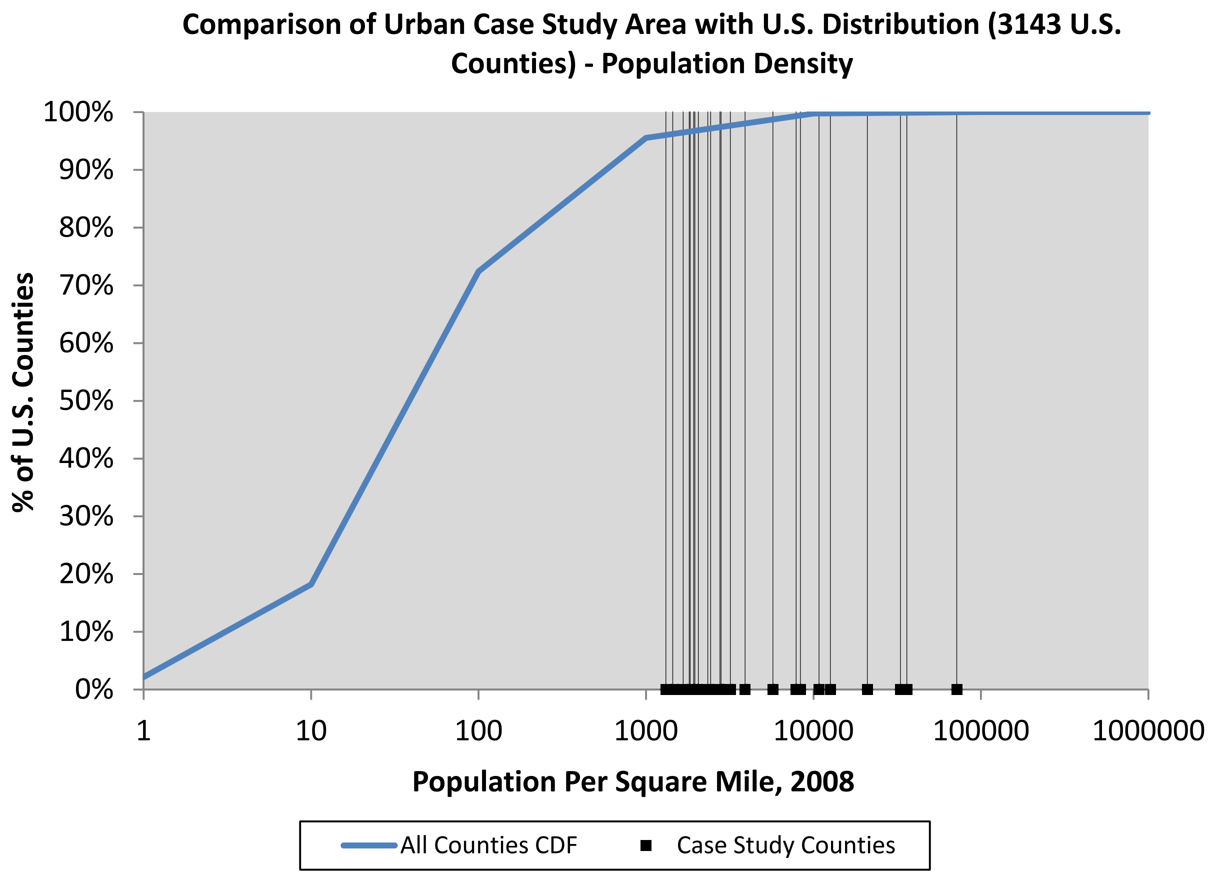

Figure 8B-17. Comparison of distributions for selected variables expected to influence the relative risk from ozone: Population density.

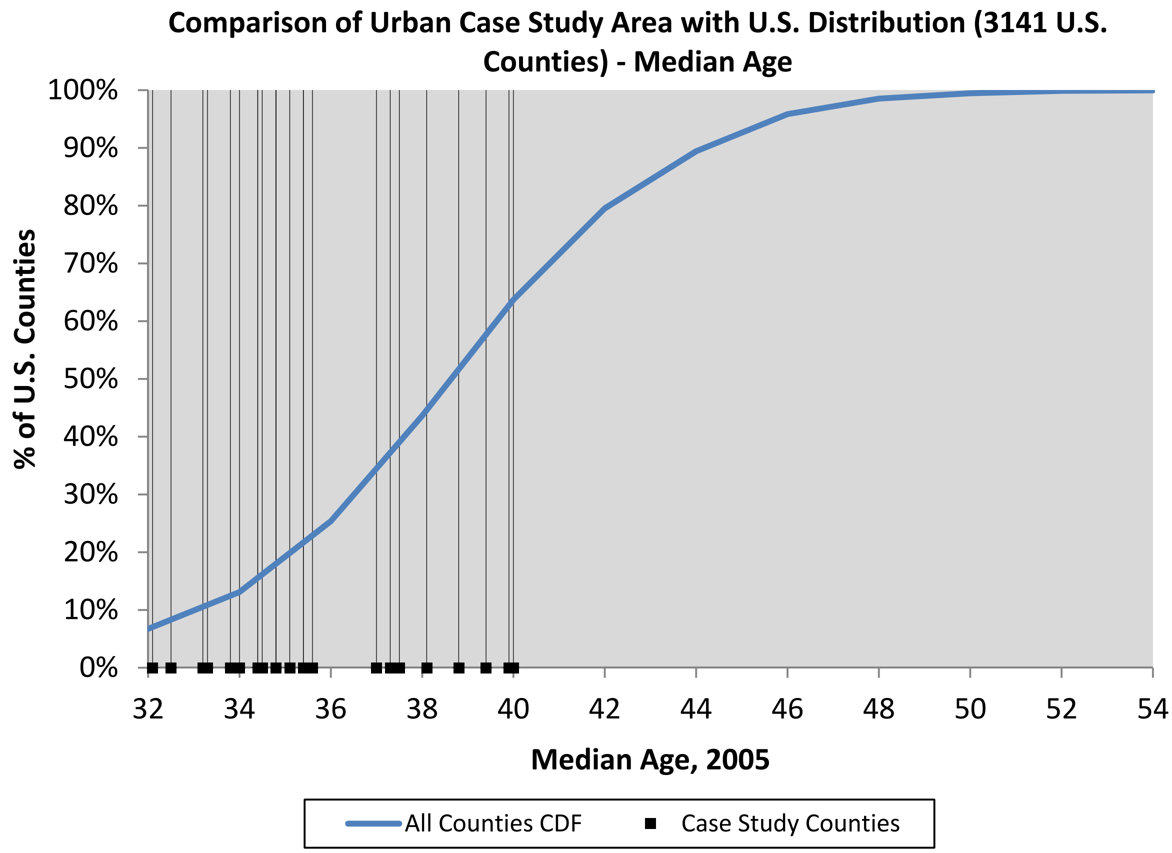

Figure 8B-18. Comparison of distributions for selected variables expected to influence the relative risk from ozone: Median age.

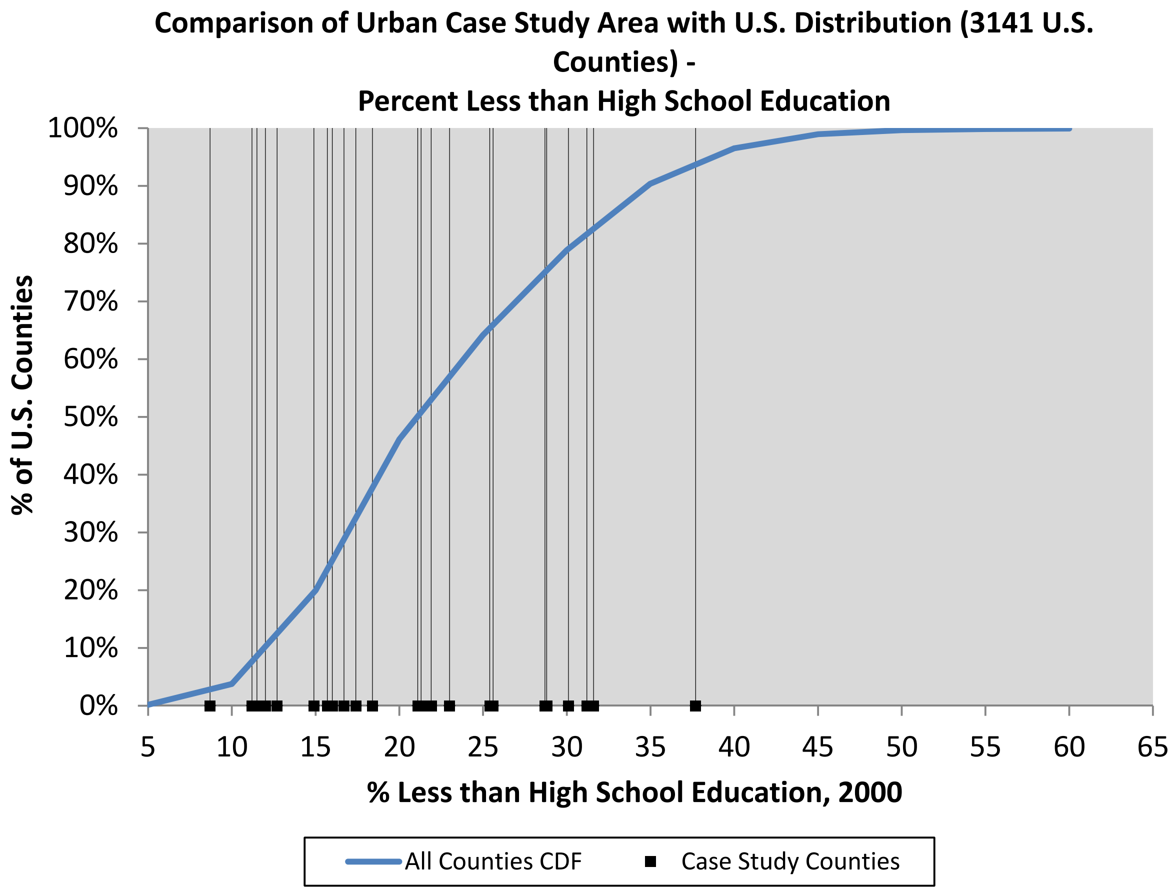

Figure 8B-19. Comparison of distributions for selected variables expected to influence the relative risk from ozone: Percent less than high school education.

Figure 8B-20. Comparison of distributions for selected variables expected to influence the relative risk from ozone: Unemployment rate.

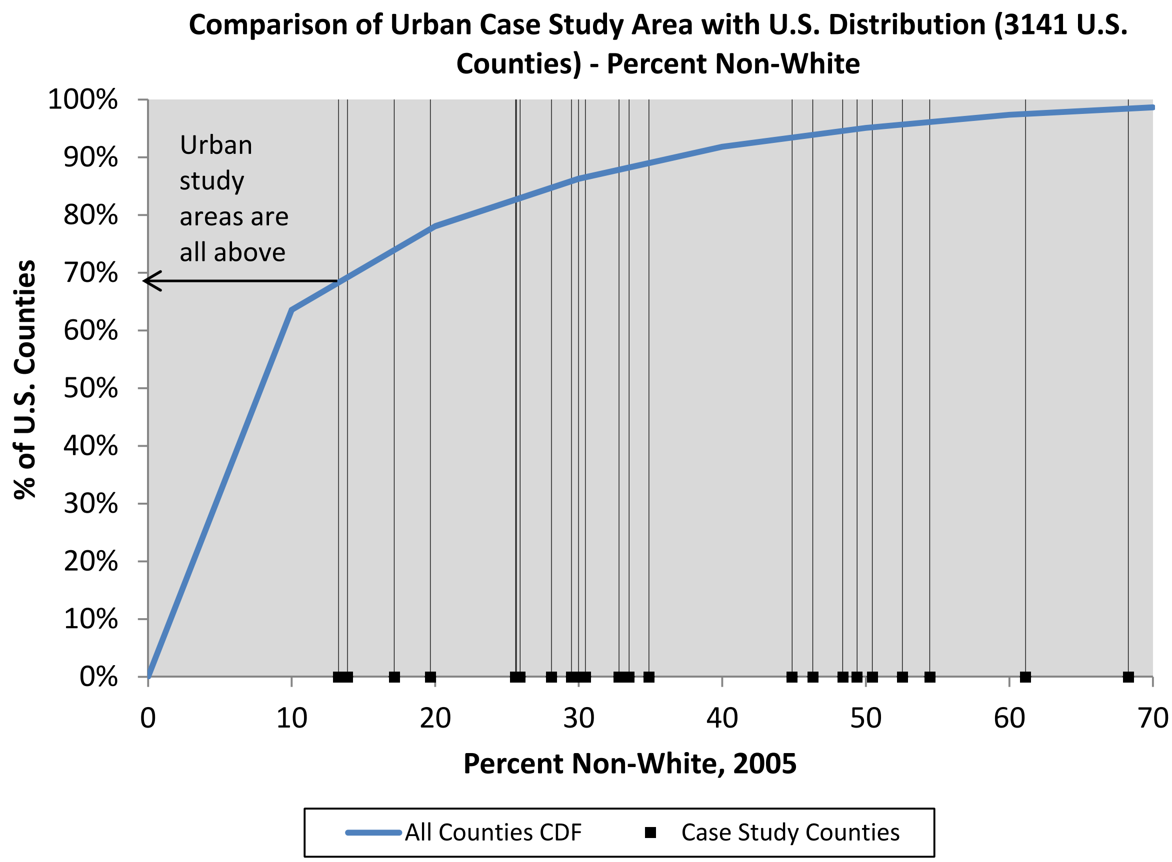

Figure 8B-21. Comparison of distributions for selected variables expected to influence the relative risk from ozone: Percent non-white.

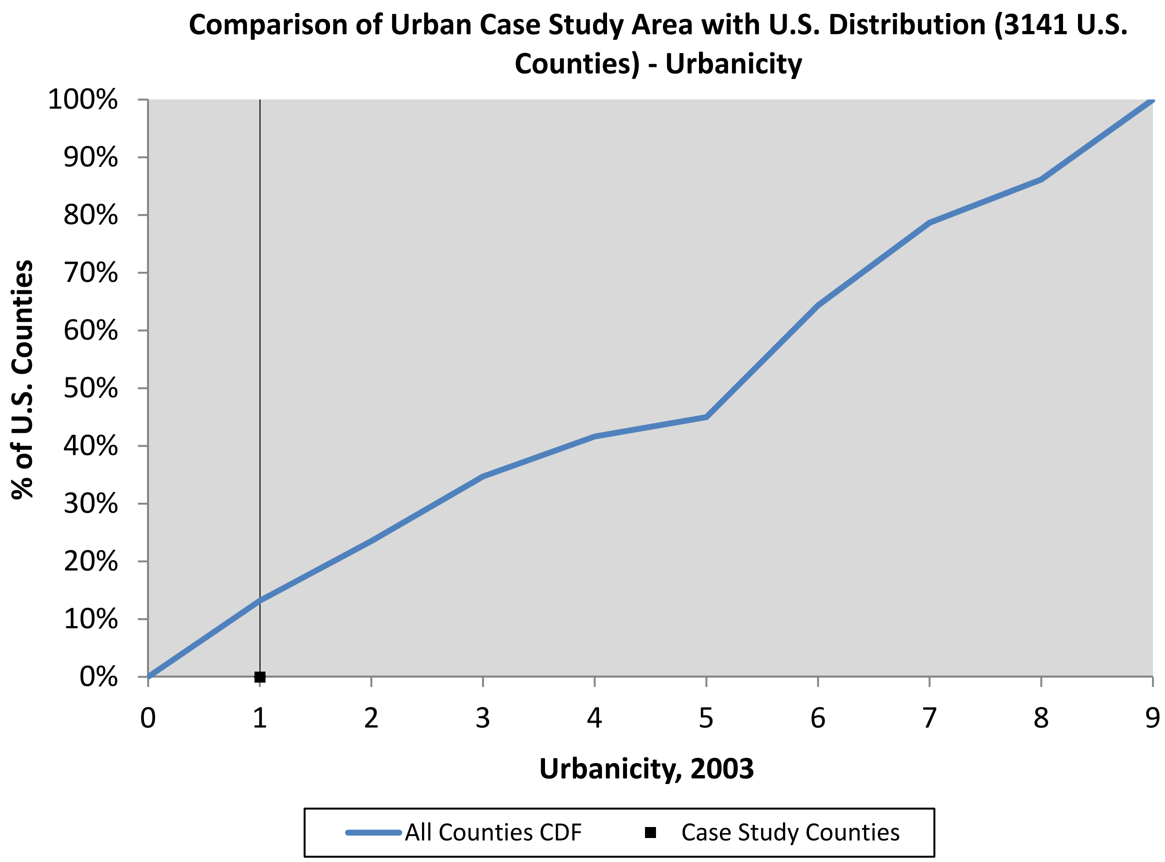

Figure 8B-22. Comparison of distributions for selected variables expected to influence the relative risk from ozone: Urbanicity.

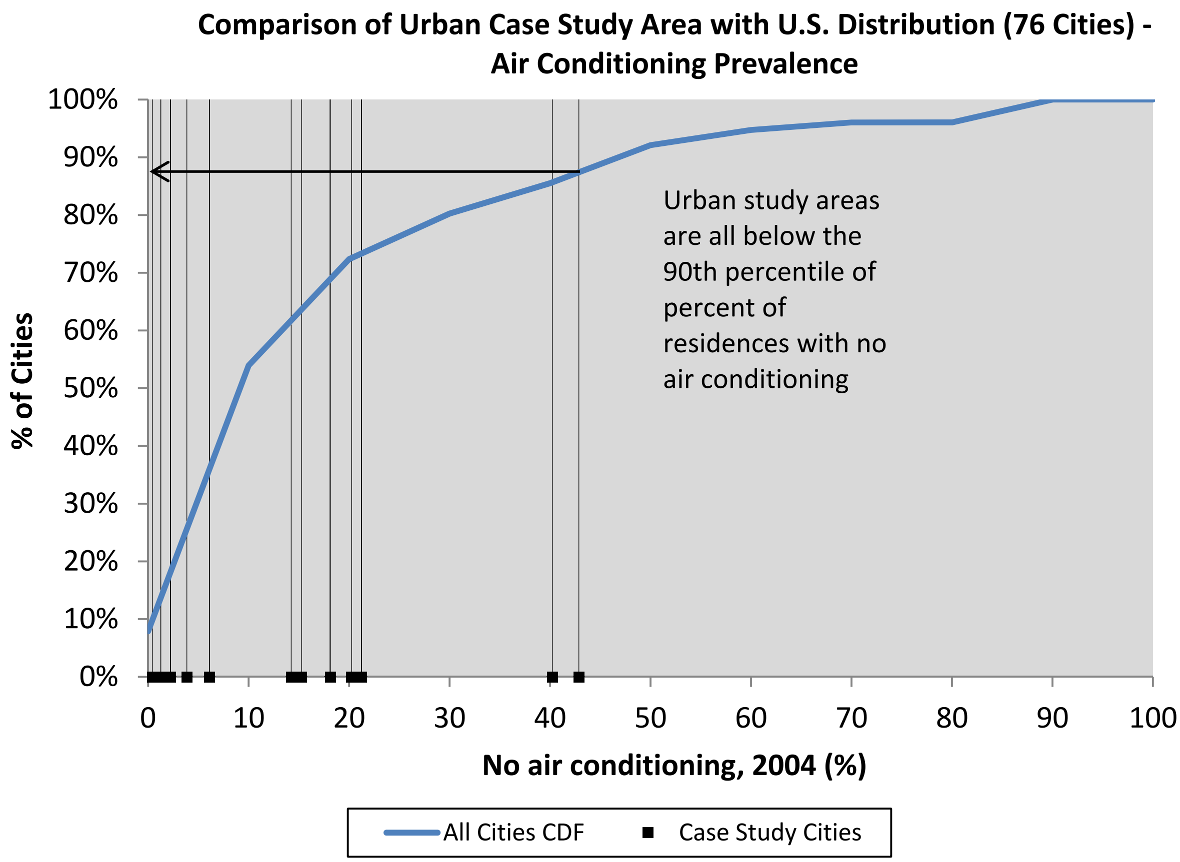

Figure 8B-23. Comparison of distributions for selected variables expected to influence the relative risk from ozone: Air conditioning prevalence.

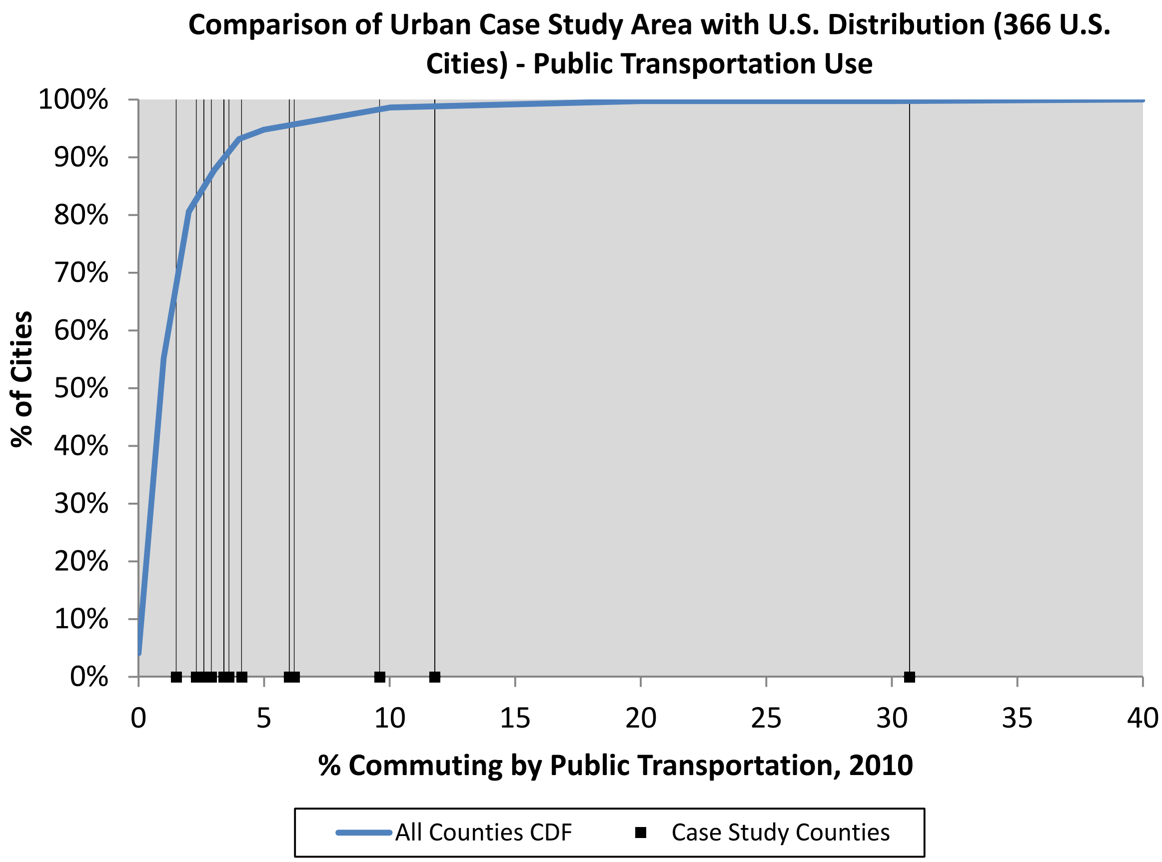

Figure 8B-24. Comparison of distributions for selected variables expected to influence the relative risk from ozone: Percent commuting by public transportation.

8B-2.2 Health Conditions

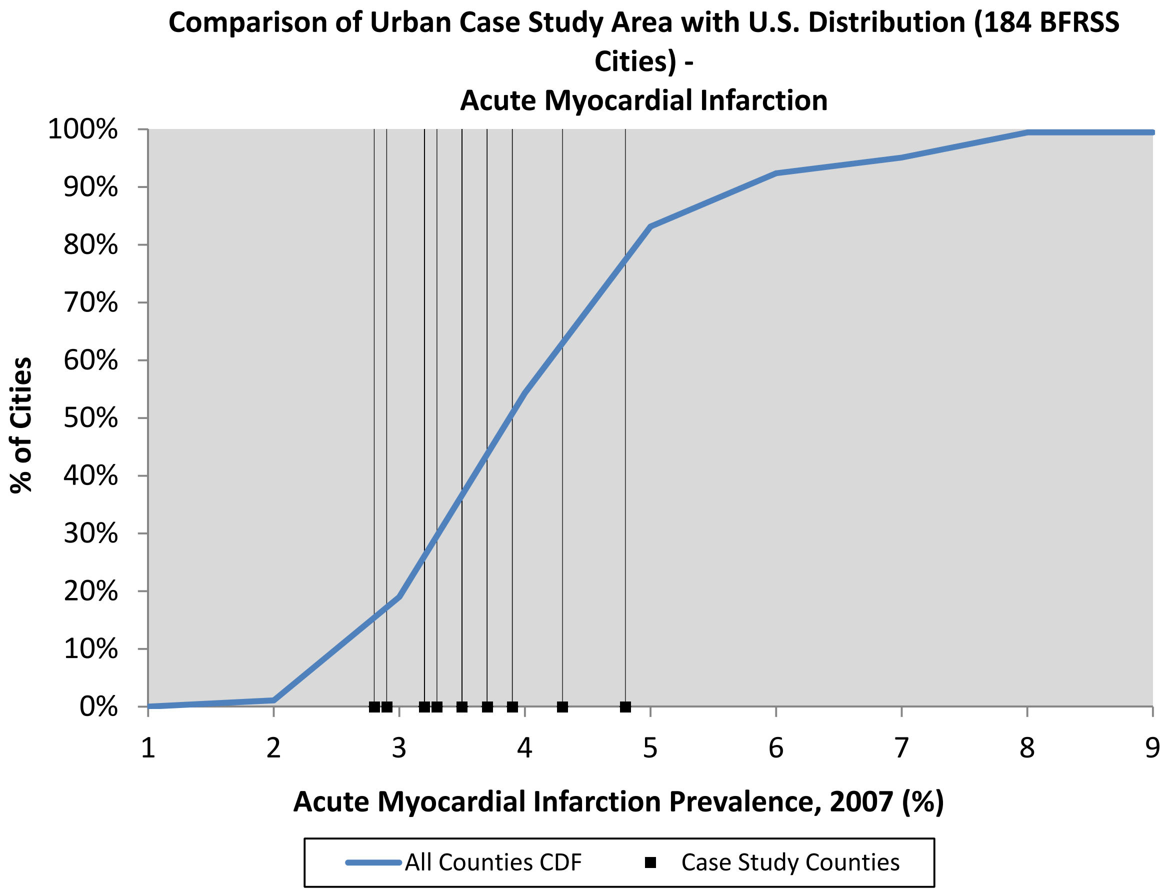

Figure 8B-25. Comparison of distributions for selected variables expected to influence the relative risk from ozone: Acute myocardial infarction prevalence.

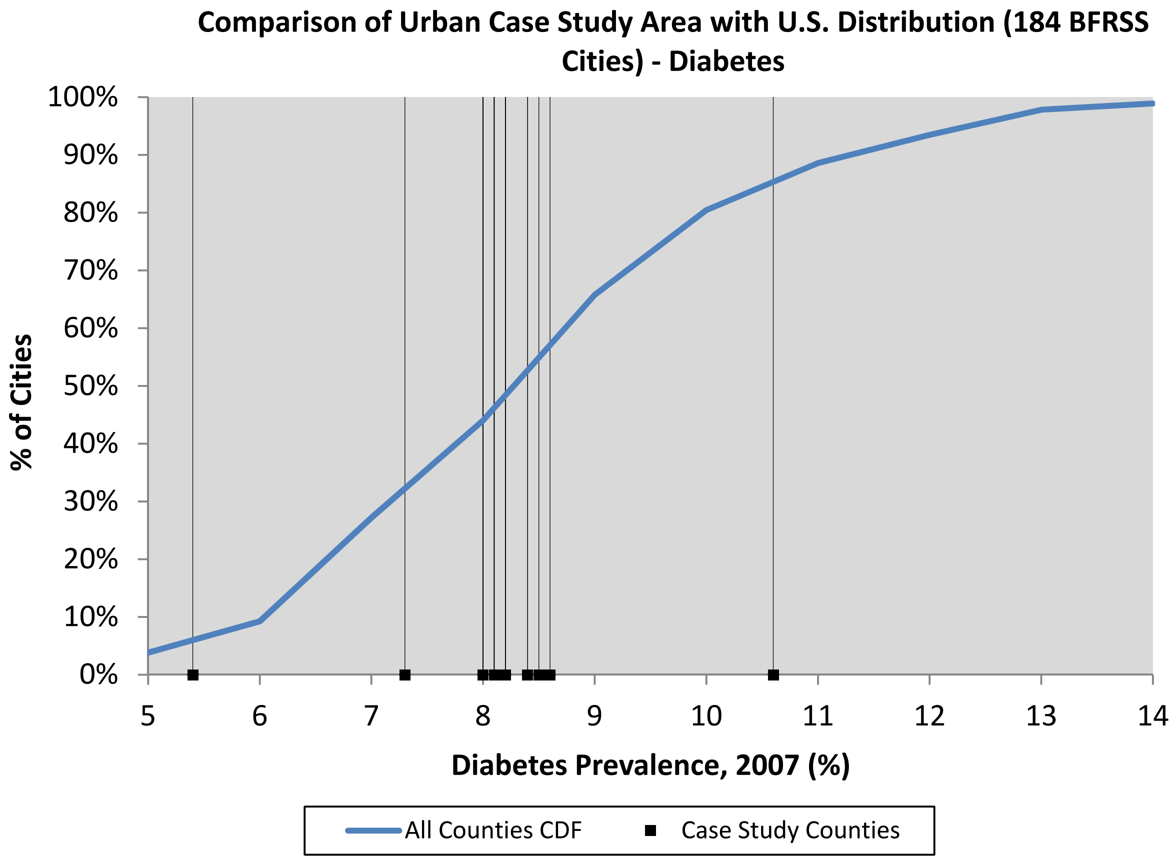

Figure 8B-26. Comparison of distributions for selected variables expected to influence the relative risk from ozone: Diabetes prevalence.

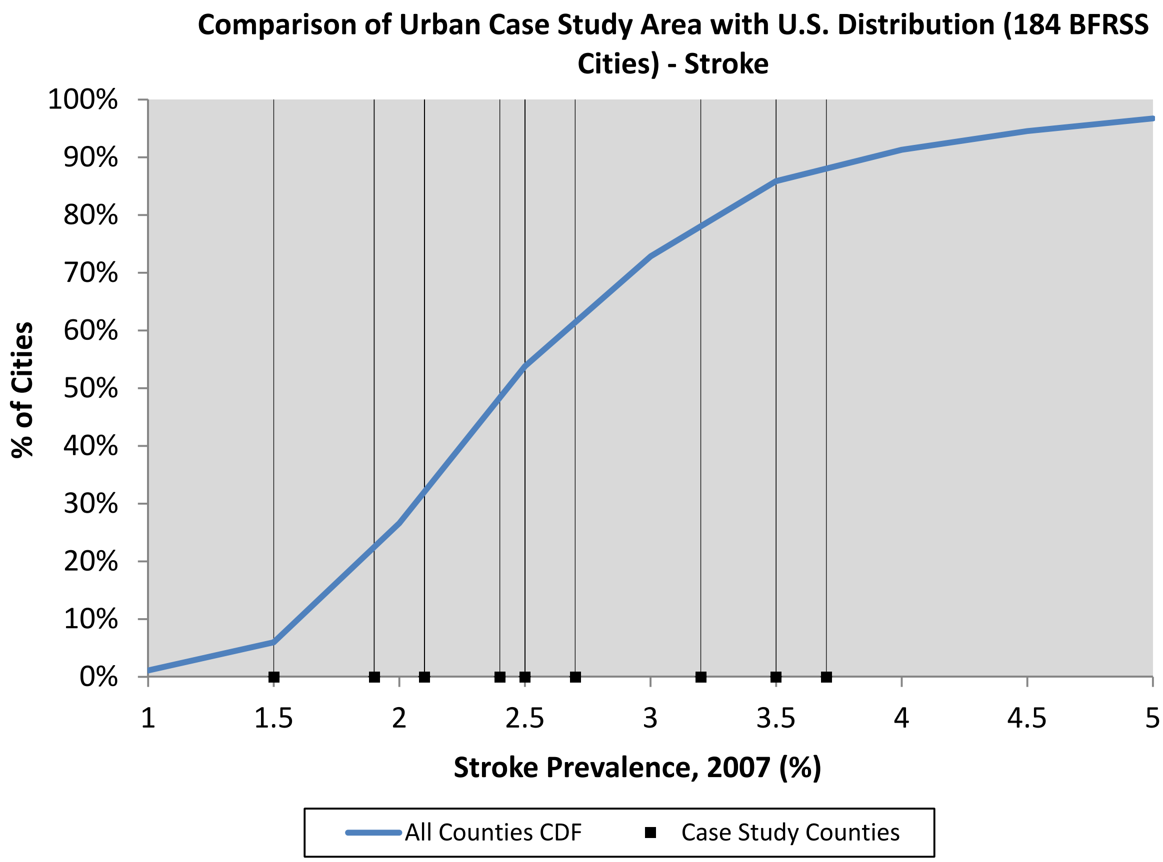

Figure 8B-27. Comparison of distributions for selected variables expected to influence the relative risk from ozone: Stroke prevalence.

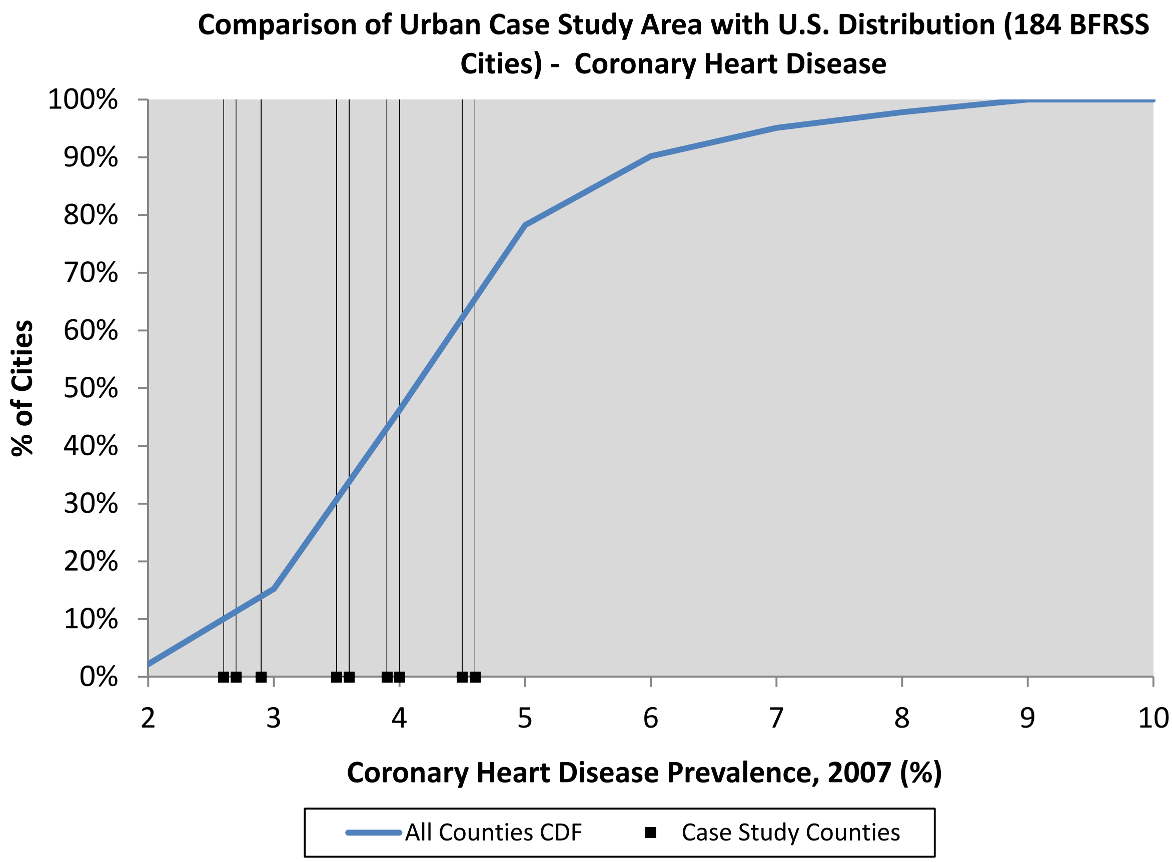

Figure 8B-28. Comparison of distributions for selected variables expected to influence the relative risk from ozone: Coronary heart disease prevalence.

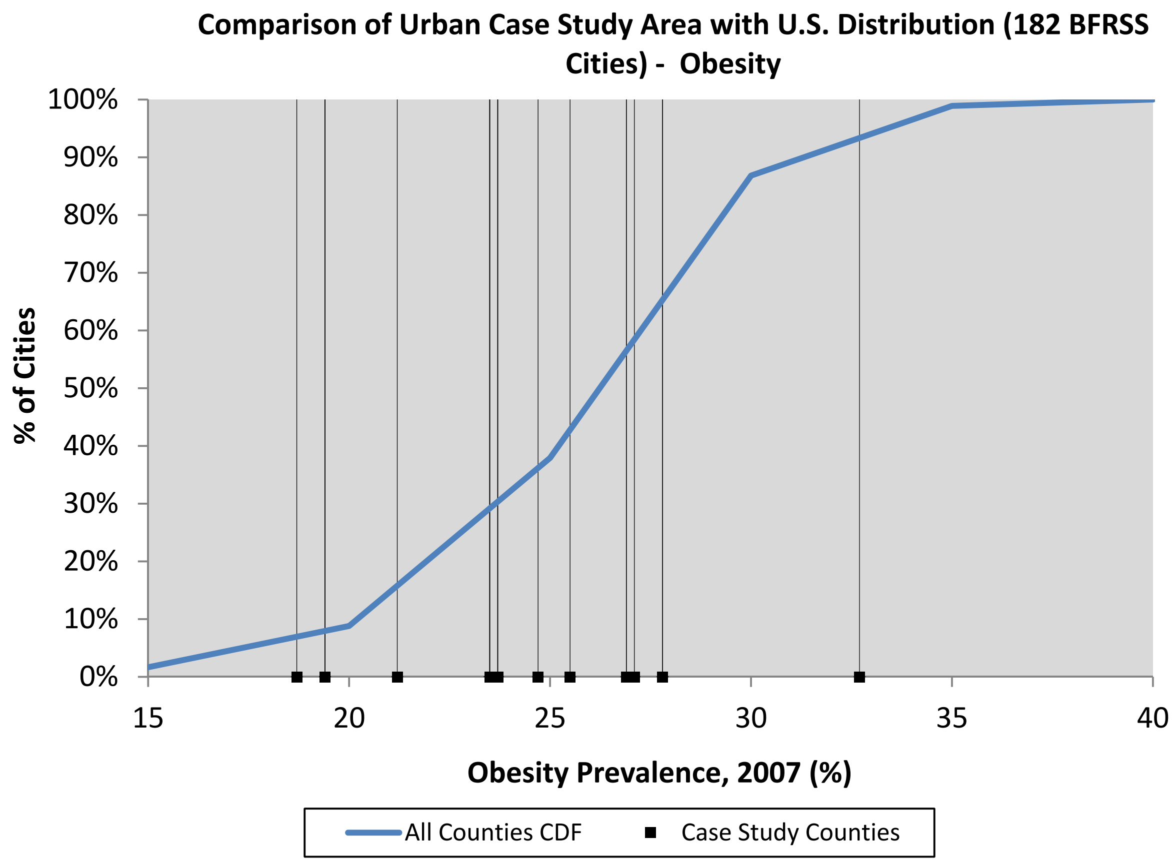

Figure 8B-29. Comparison of distributions for selected variables expected to influence the relative risk from ozone: Obesity prevalence.

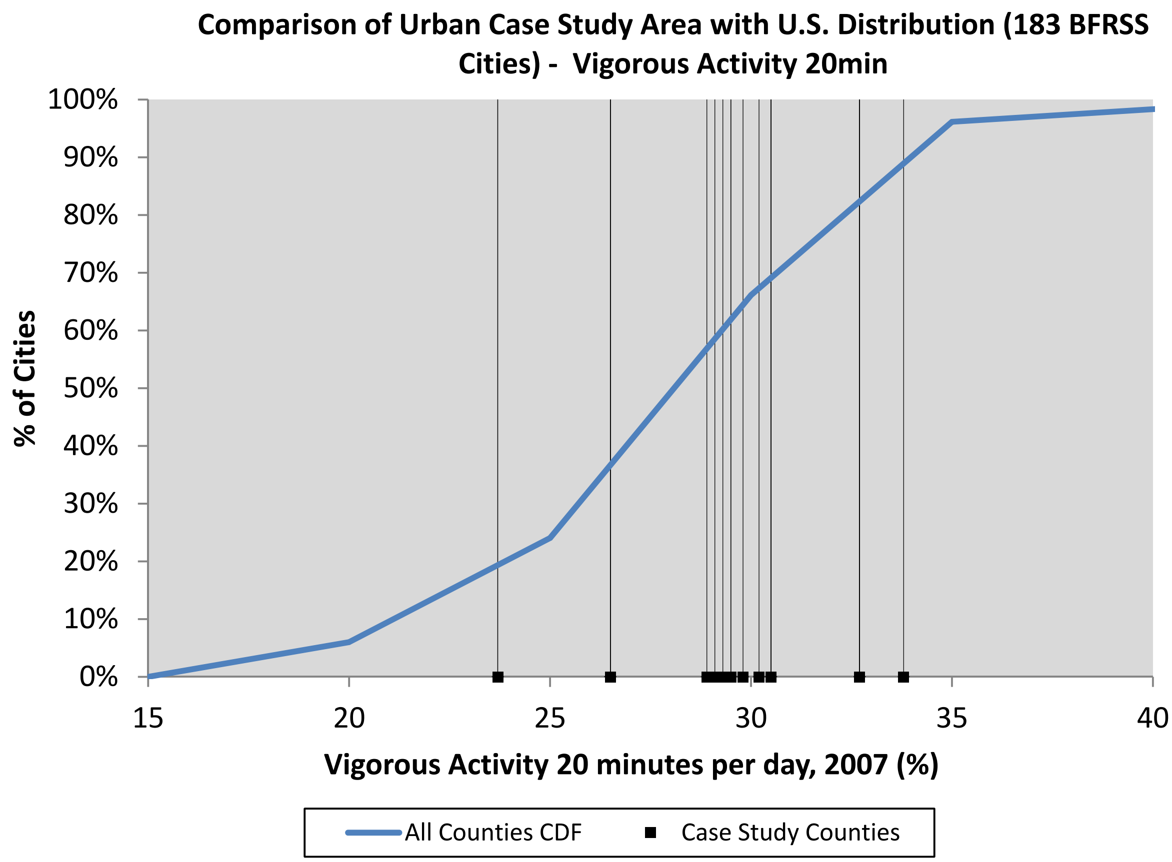

Figure 8B-30. Comparison of distributions for selected variables expected to influence the relative risk from ozone: Vigorous activity at least 20 minutes per day.

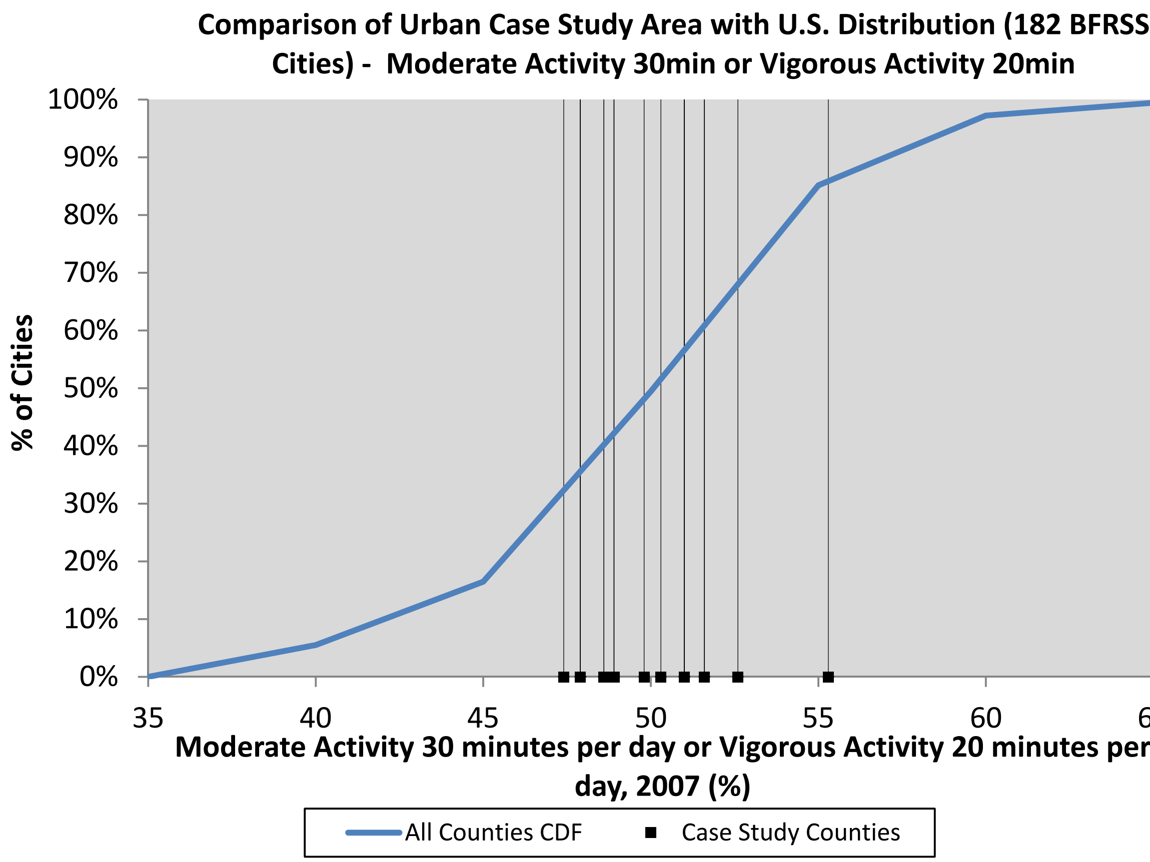

Figure 8B-31. Comparison of distributions for selected variables expected to influence the relative risk from ozone: Moderate activity at least 30 minutes per day or vigorous activity at least 20 minutes per day.

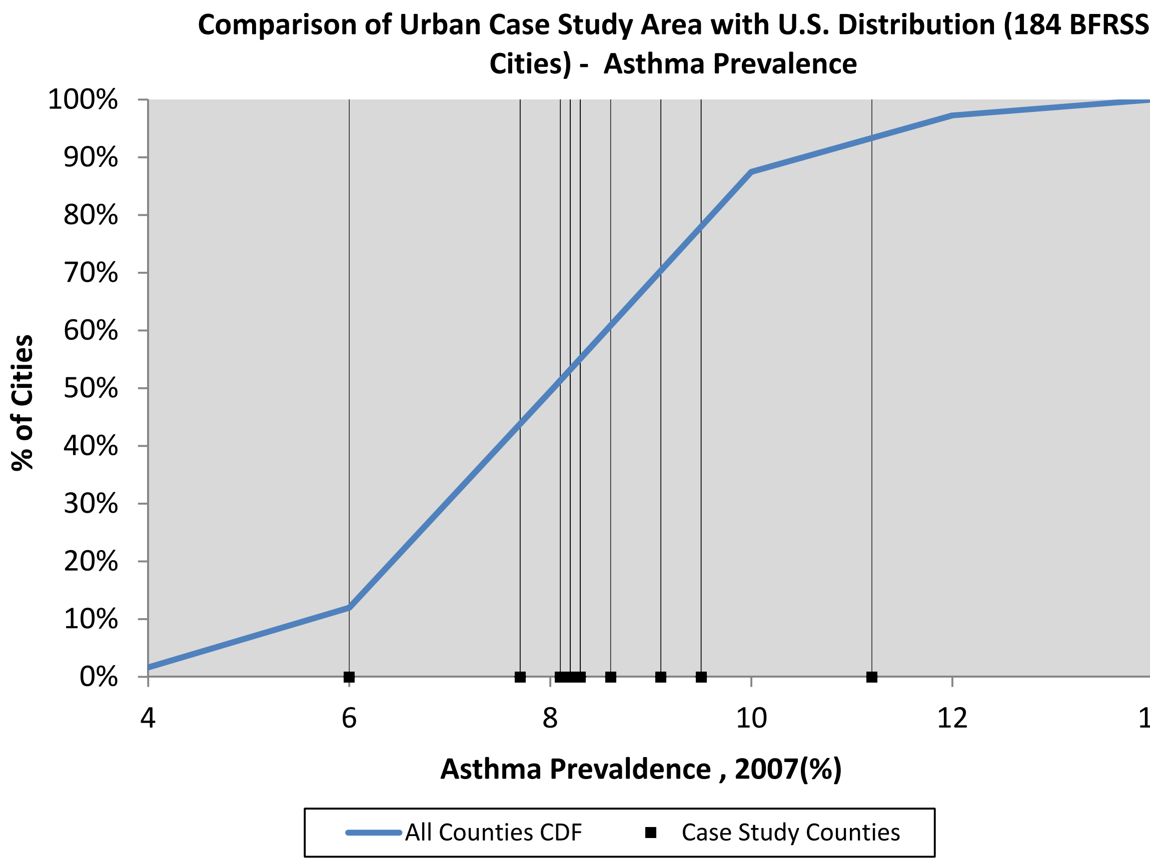

Figure 8B-32. Comparison of distributions for selected variables expected to influence the relative risk from ozone: Asthma prevalence.

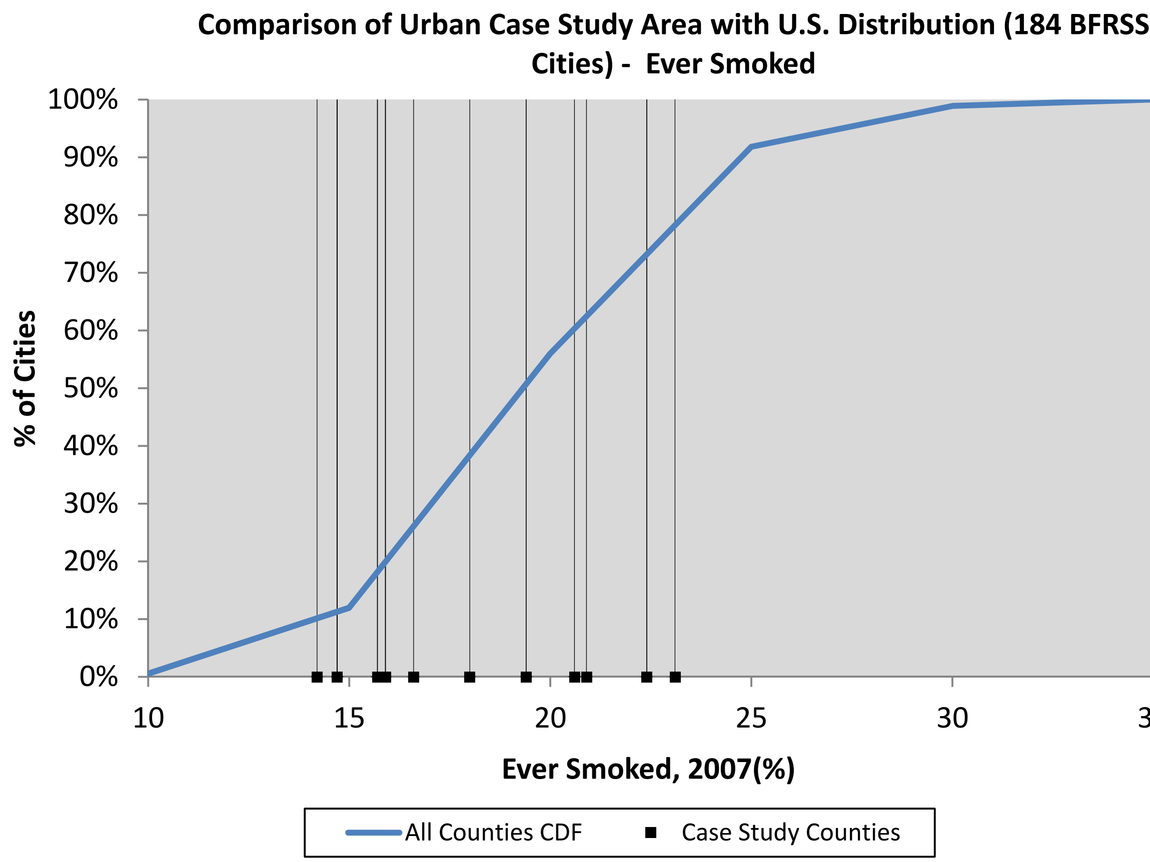

Figure 8B-33. Comparison of distributions for selected variables expected to influence the relative risk from ozone: Smoking prevalence.

8B-2.3 Air Quality and Climate Variables

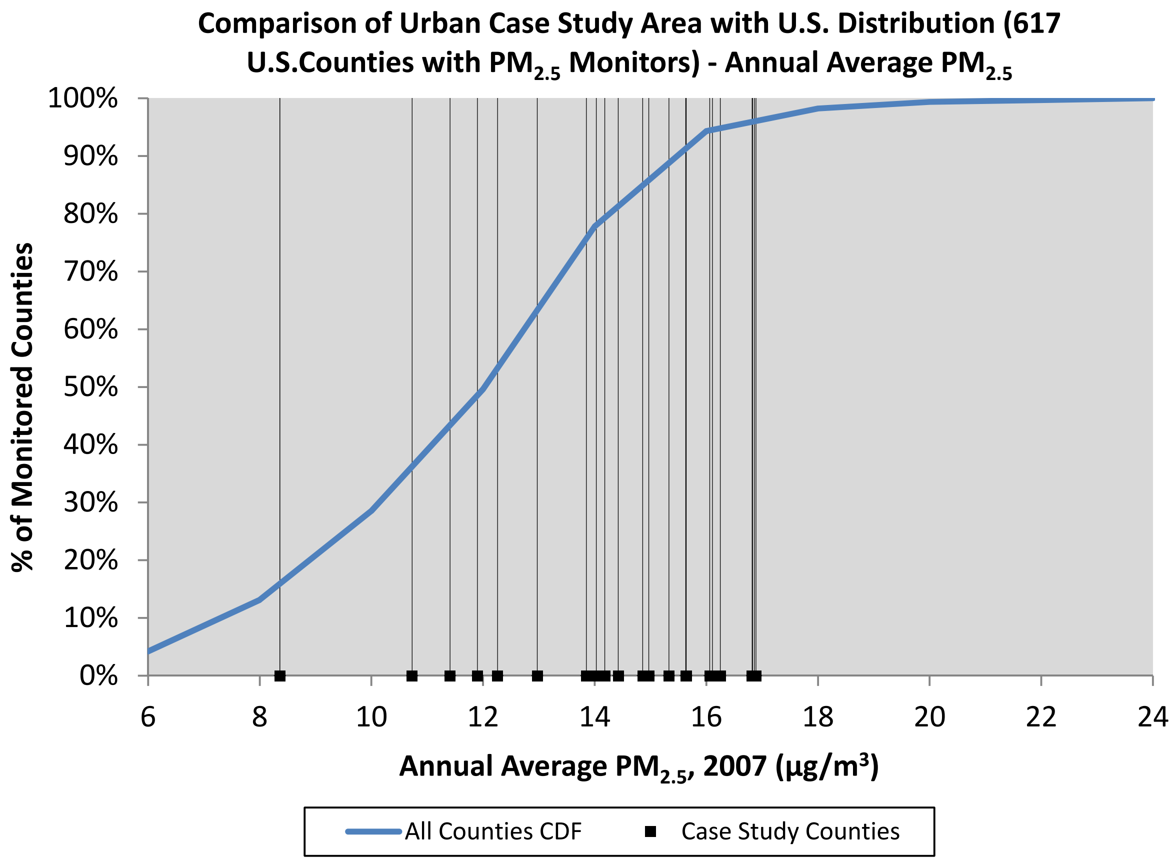

Figure 8B-34. Comparison of distributions for selected variables expected to influence the relative risk from ozone: Annual average $PM_{2.5}$ concentration.

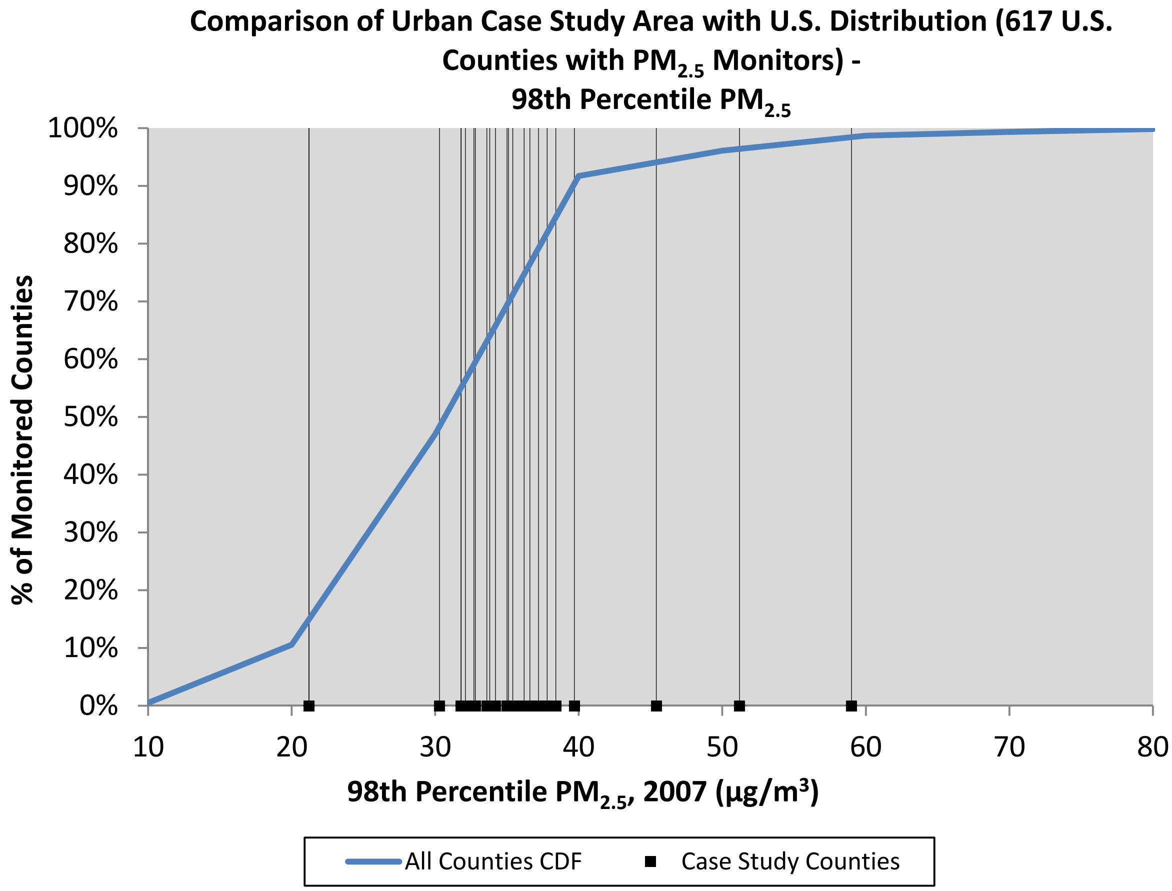

Figure 8B-35. Comparison of distributions for selected variables expected to influence the relative risk from ozone: 98th percentile $PM_{2.5}$ concentration.

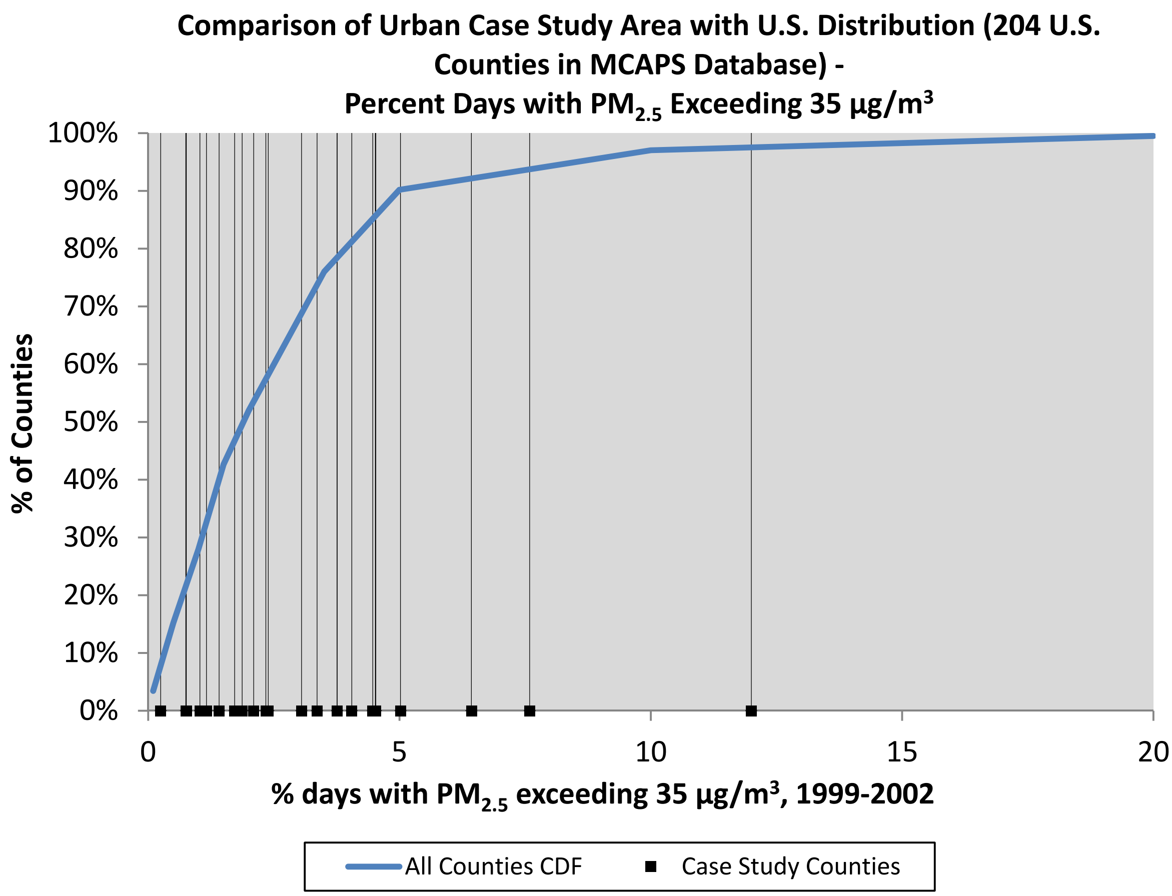

Figure 8B-36. Comparison of distributions for selected variables expected to influence the relative risk from ozone: Percent of days with $PM_{2.5}$ exceeding 35 µg/m^3.

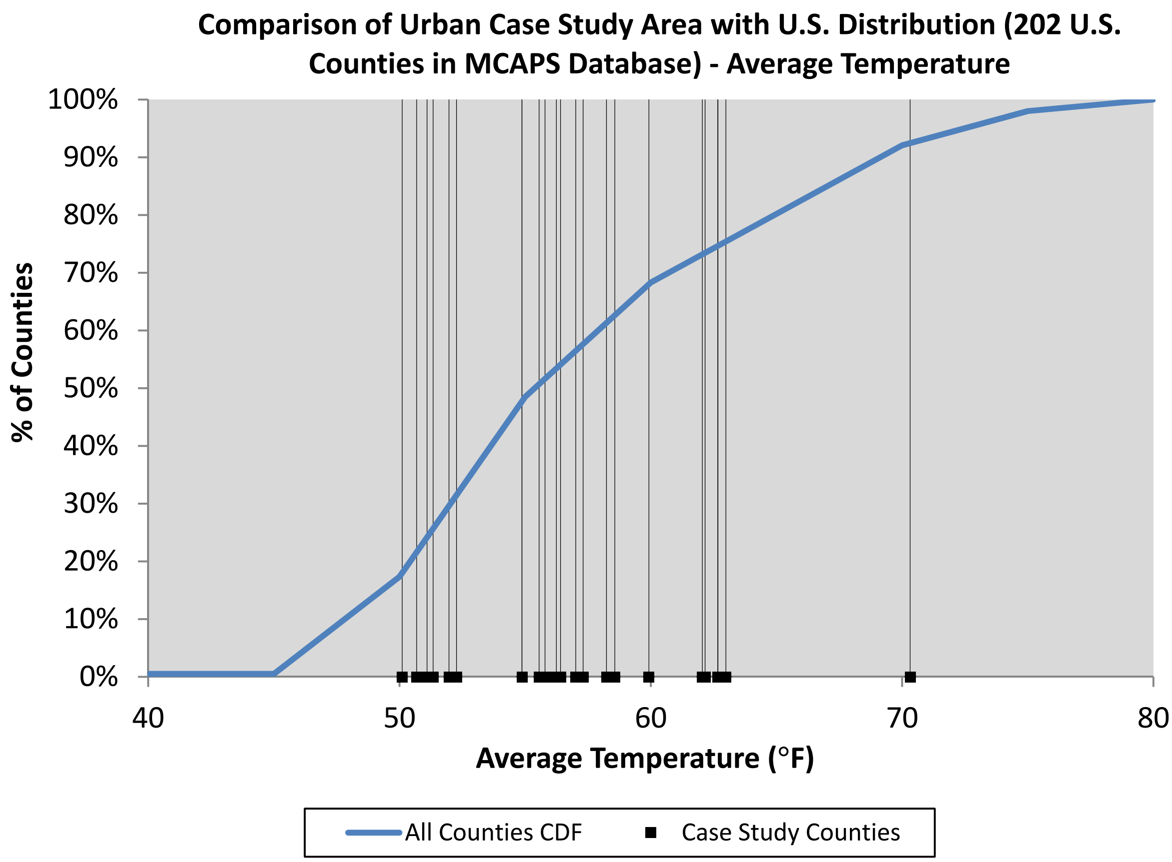

Figure 8B-37. Comparison of distributions for selected variables expected to influence the relative risk from ozone: Average temperature.

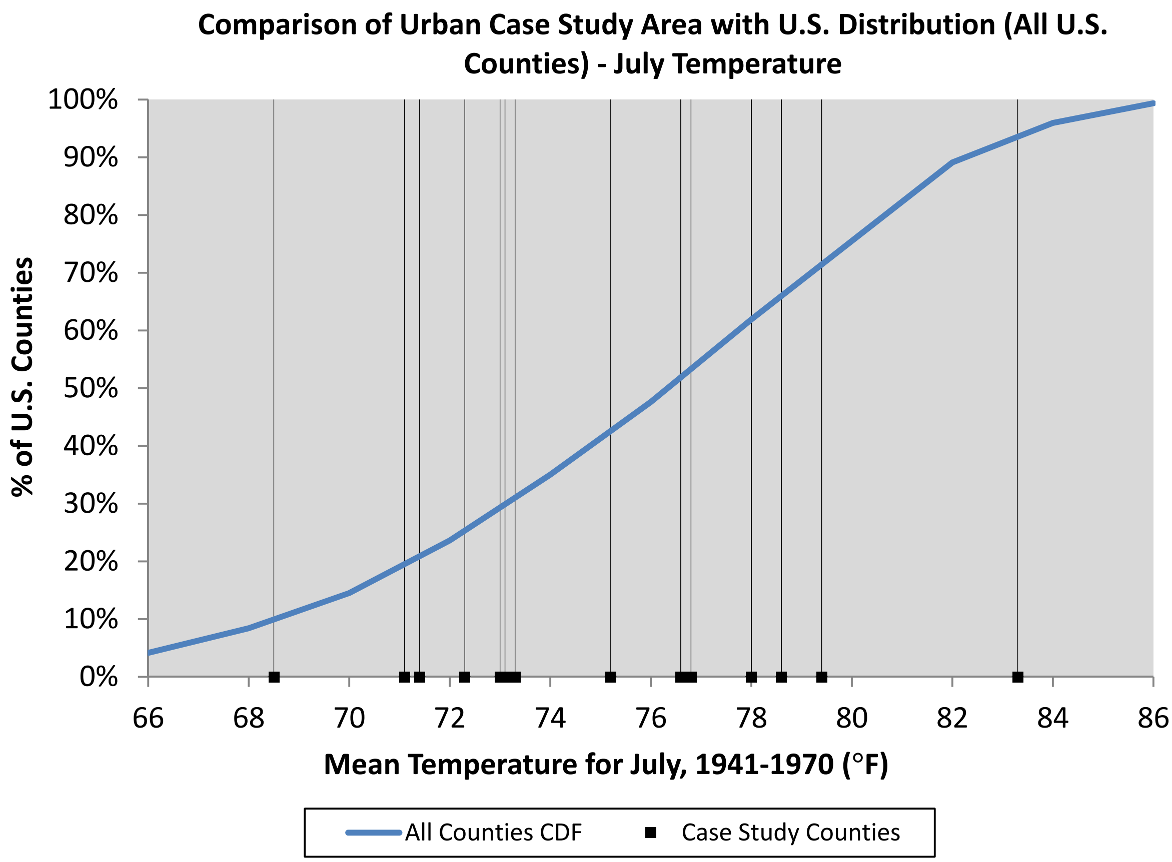

Figure 8B-38. Comparison of distributions for selected variables expected to influence the relative risk from ozone: July temperature.

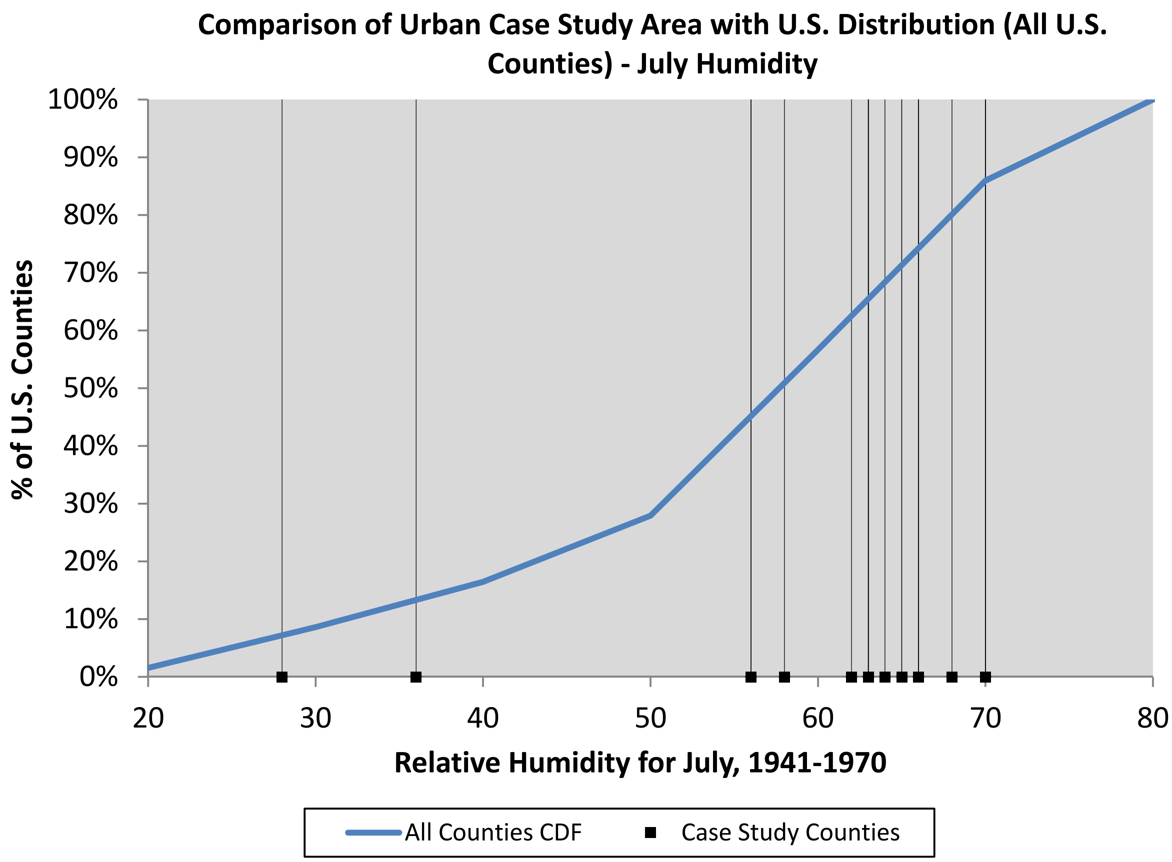

Figure 8B-39. Comparison of distributions for selected variables expected to influence the relative risk from ozone: Relative humidity.

APPENDIX 8C

National Representativeness of Ozone Response to Emissions Changes

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This Appendix provides additional plots and information to support the analysis provided in Chapter 8, section 8.2.3 of the main text of the Health Risk and Exposure Assessment (HREA).

8C-1. AMBIENT TRENDS OVER A PERIOD OF NATIONALLY DECREASING NOX EMISSIONS

8C-1.1. Nationwide Maps Showing Absolute Changes in Ozone Between 2001-2003 and 2008-2010

In HREA Chapter 8 we provided maps of US ozone monitors showing absolute changes in ozone percentiles between a 3-year period before many of the nationwide NO_x reductions took place (2001-2003) and a period after many of these reductions took place (2008-2010). Here we provide a full set of maps which includes not only the behavior of the 50th and 95th percentiles but also 5th, 25th, and 75th percentiles for three different groupings of months: short summer season (June-August), longer warm season (April-October), and all year. These plots further support the general trends that were noted in HREA Chapter 8: ozone increases occurred more in cooler months than warmer months, ozone increases occurred more at the lower end of the distribution that the upper end of the distribution, and ozone increases were more likely to occur in urban core area than at locations further from the city centers. The plots of 95th percentile ozone changes show that high ozone days have decreased across the country at all times of year. The June-August plots show that mid-range ozone has also decreased at most locations during the warmest time of year when ozone levels are highest. See Figure 8C-1 through Figure 8C-15 for details.

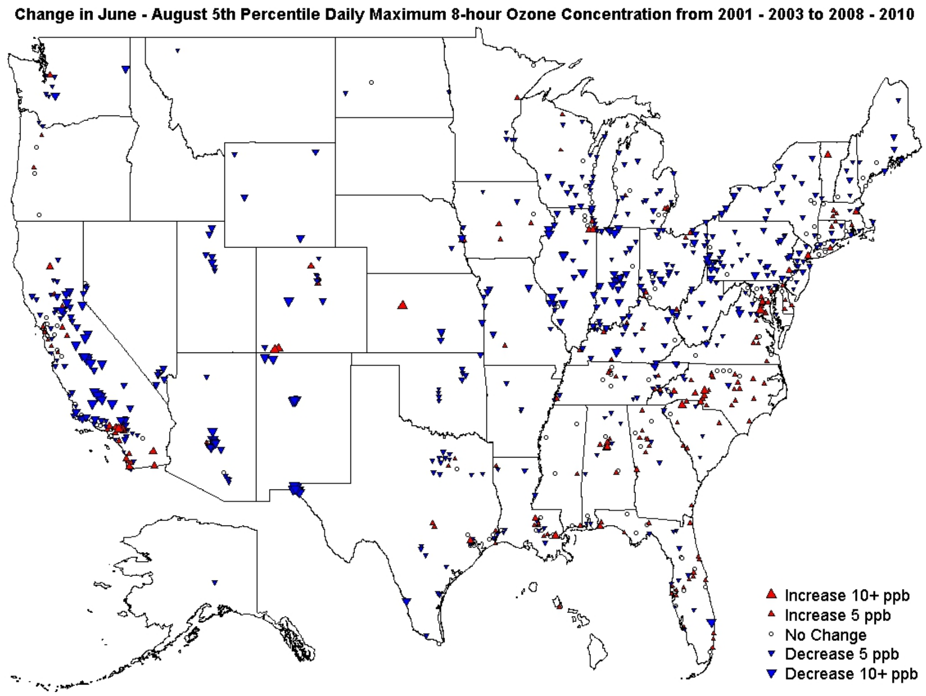

Figure 8C-1. Change in 5th percentile June-August summer season daily 8-hour maximum ozone concentrations between 2001-2003 and 2008-2010.

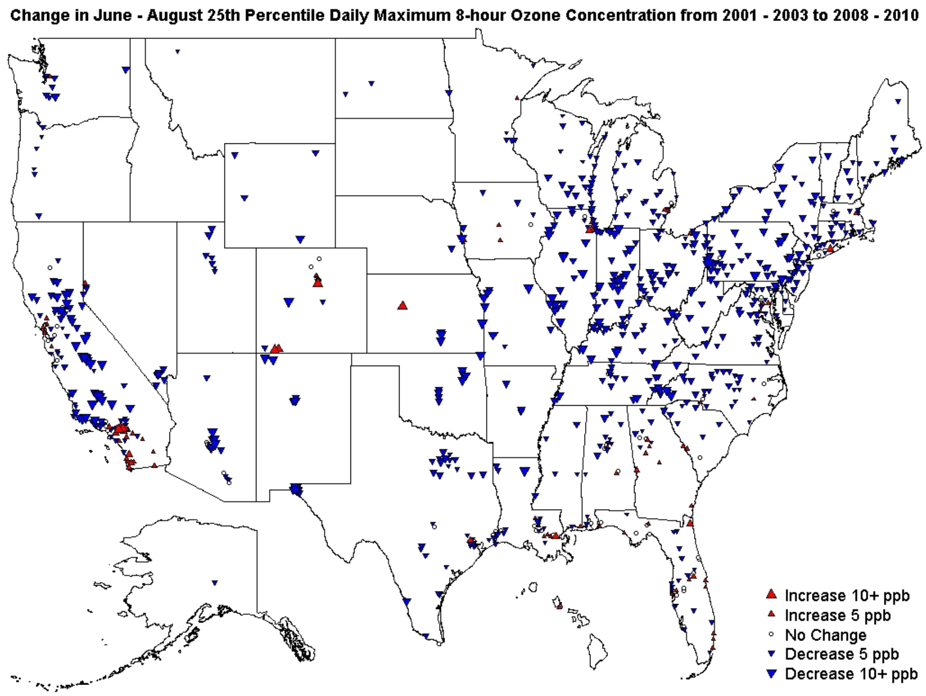

Figure 8C-2. Change in 25th percentile June-August summer season daily 8-hour maximum ozone concentrations between 2001-2003 and 2008-2010.

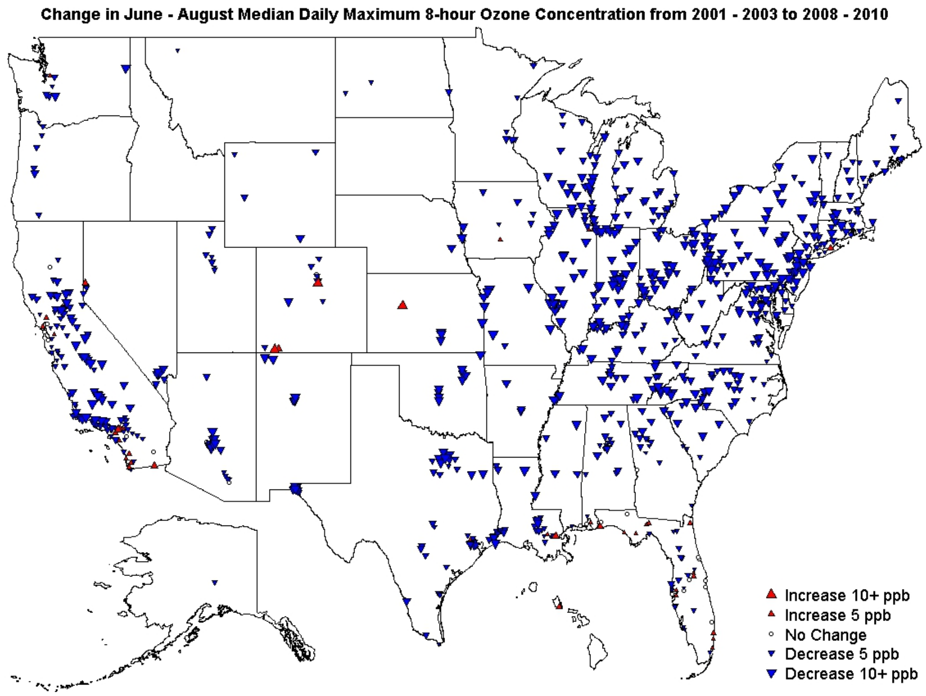

Figure 8C-3. Change in 50th percentile June-August summer season daily 8-hour maximum ozone concentrations between 2001-2003 and 2008-2010.

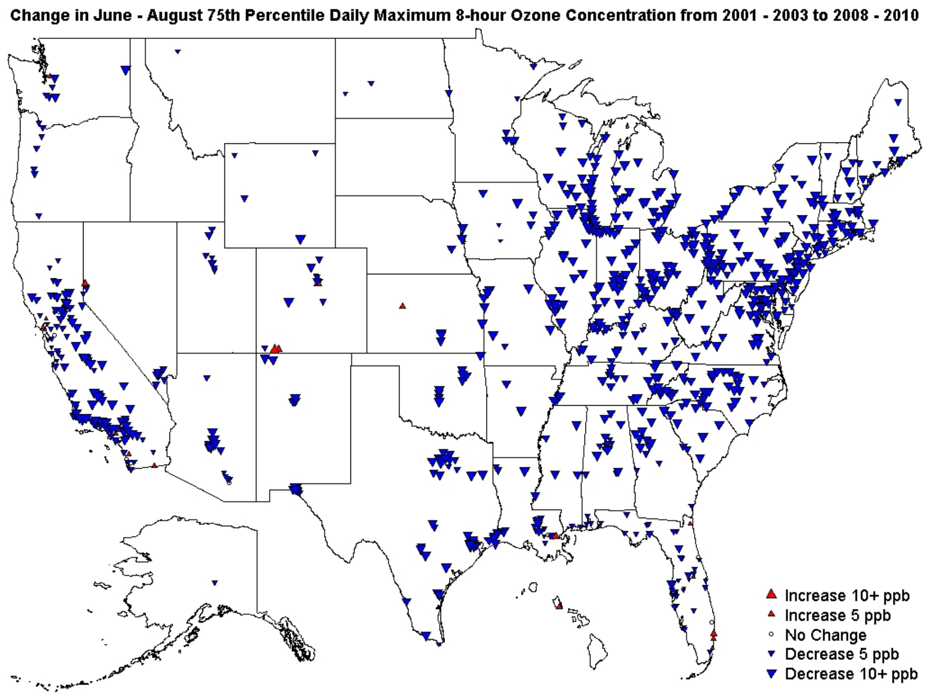

Figure 8C-4. Change in 75th percentile June-August summer season daily 8-hour maximum ozone concentrations between 2001-2003 and 2008-2010.

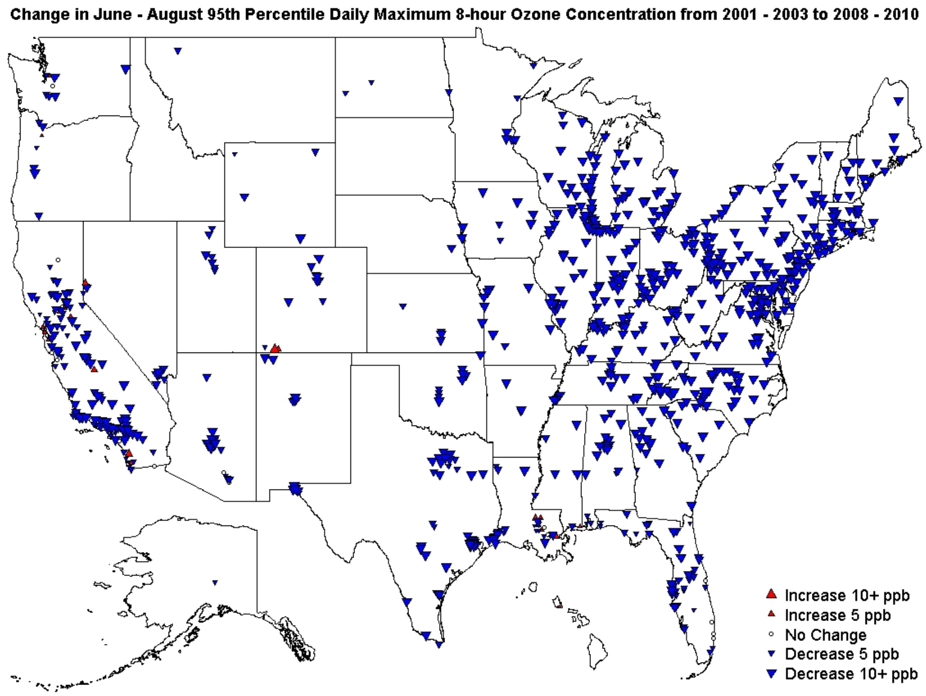

Figure 8C-5. Change in 95th percentile June-August summer season daily 8-hour maximum ozone concentrations between 2001-2003 and 2008-2010.

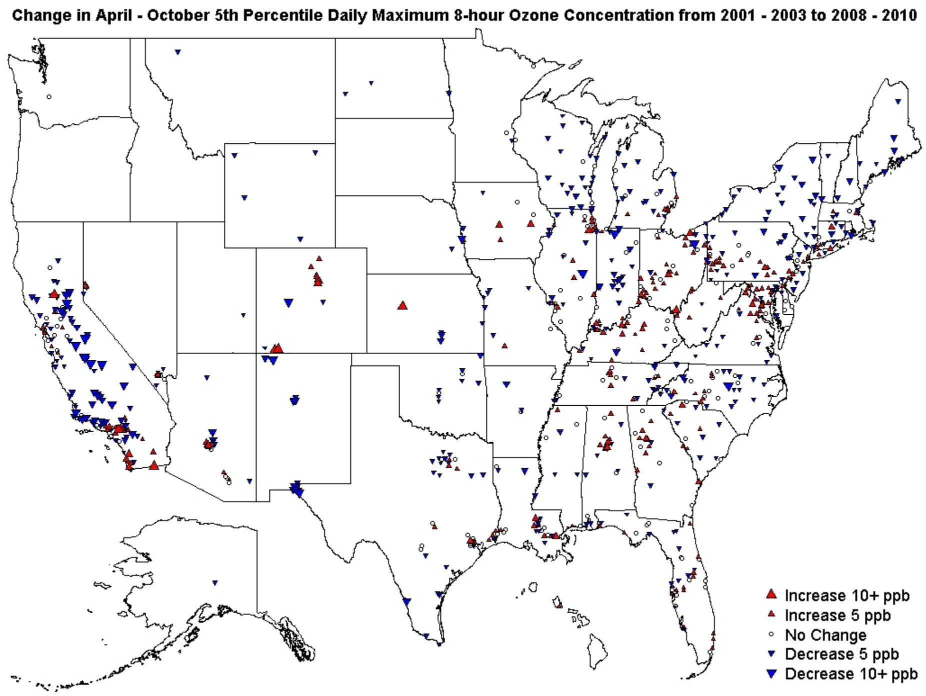

Figure 8C-6. Change in 5th percentile April-October summer season daily 8-hour maximum ozone concentrations between 2001-2003 and 2008-2010.

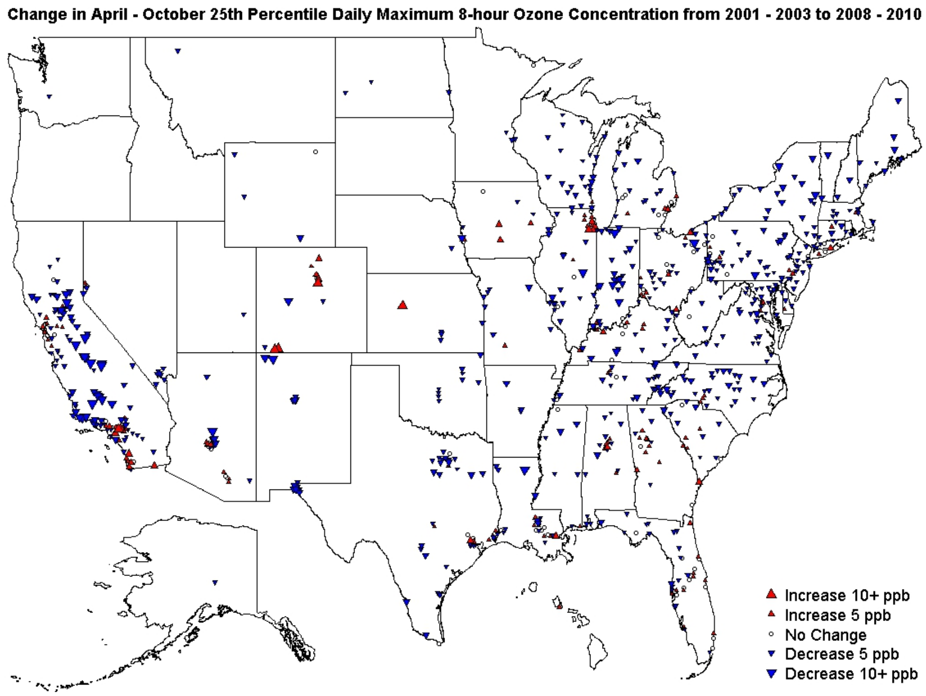

Figure 8C-7. Change in 25th percentile April-October summer season daily 8-hour maximum ozone concentrations between 2001-2003 and 2008-2010.

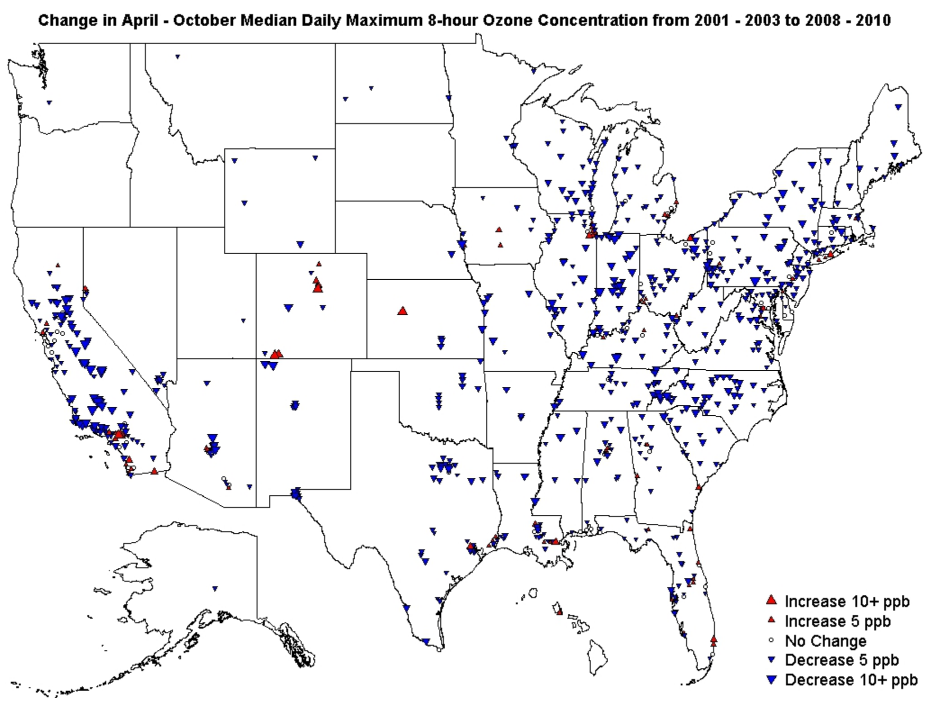

Figure 8C-8. Change in 50th percentile April-October summer season daily 8-hour maximum ozone concentrations between 2001-2003 and 2008-2010.

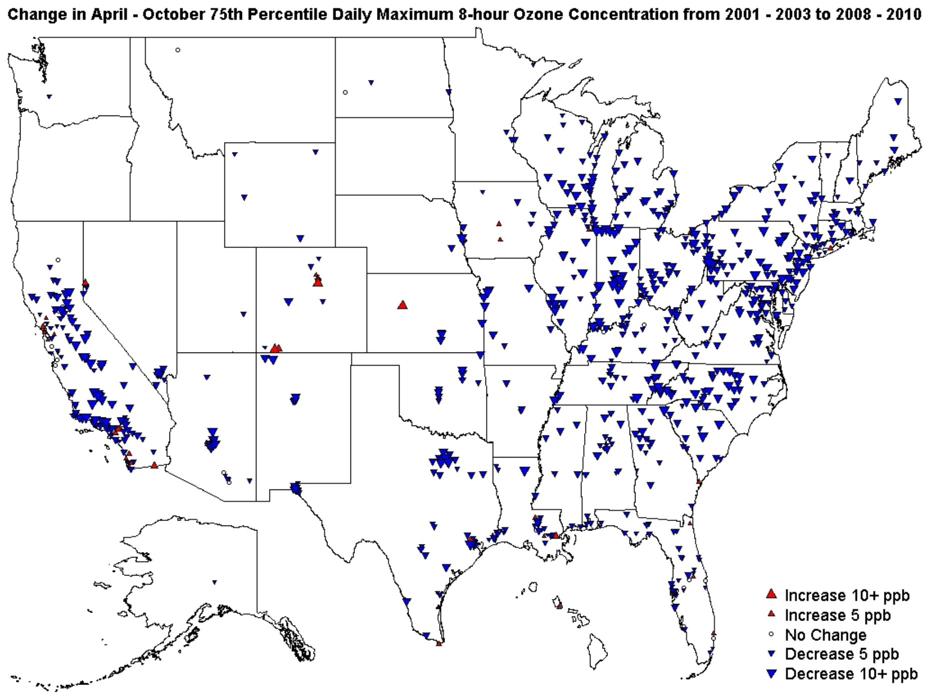

Figure 8C-9. Change in 75th percentile April-October summer season daily 8-hour maximum ozone concentrations between 2001-2003 and 2008-2010.

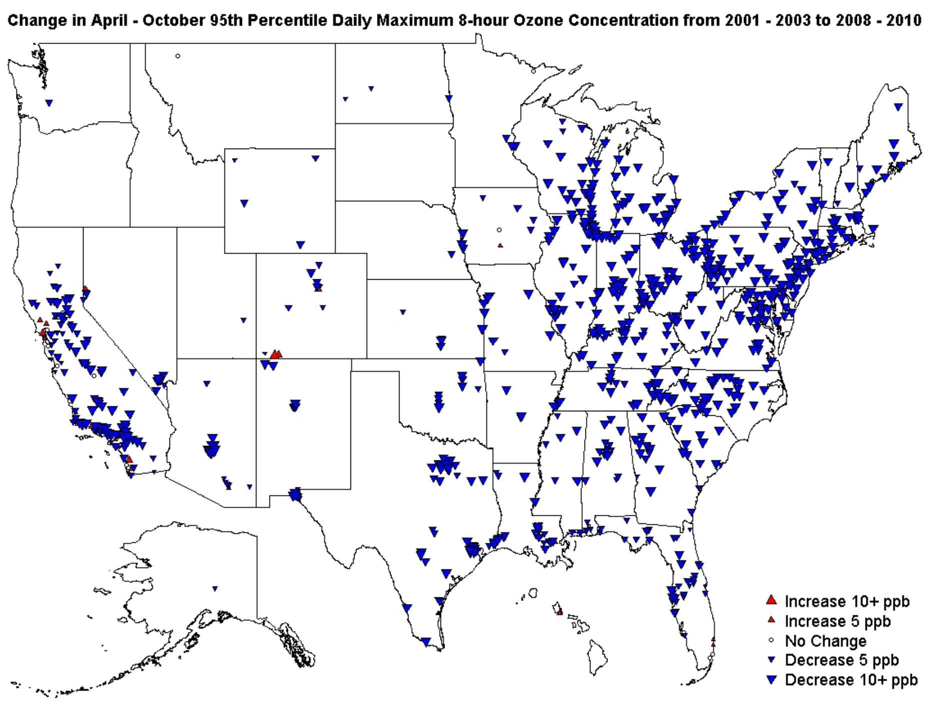

Figure 8C-10. Change in 95th percentile April-October summer season daily 8-hour maximum ozone concentrations between 2001-2003 and 2008-2010.

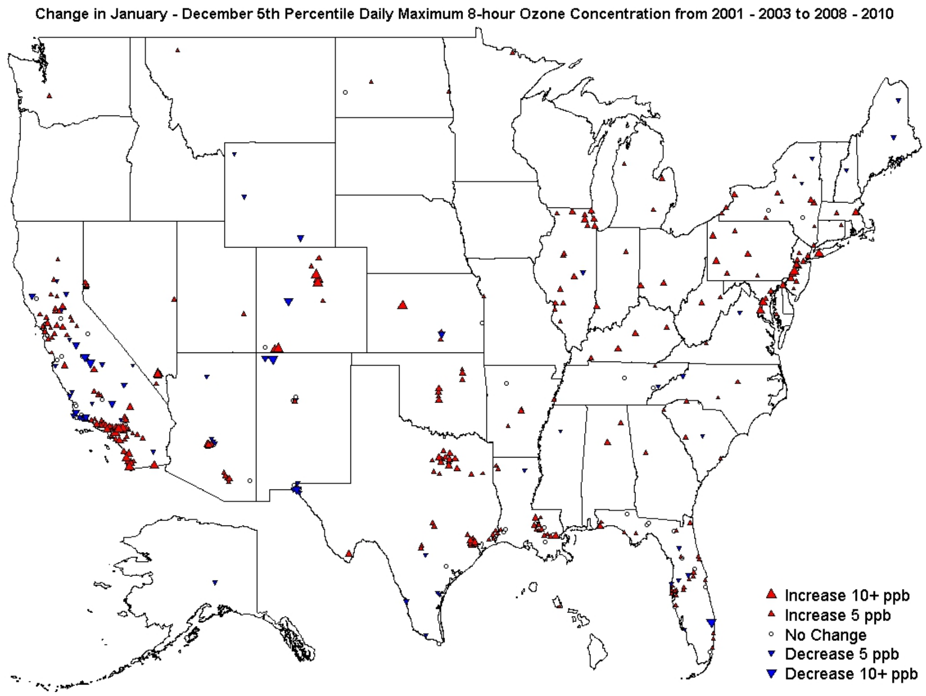

Figure 8C-11. Change in 5th percentile annual daily 8-hour maximum ozone concentrations between 2001-2003 and 2008-2010.

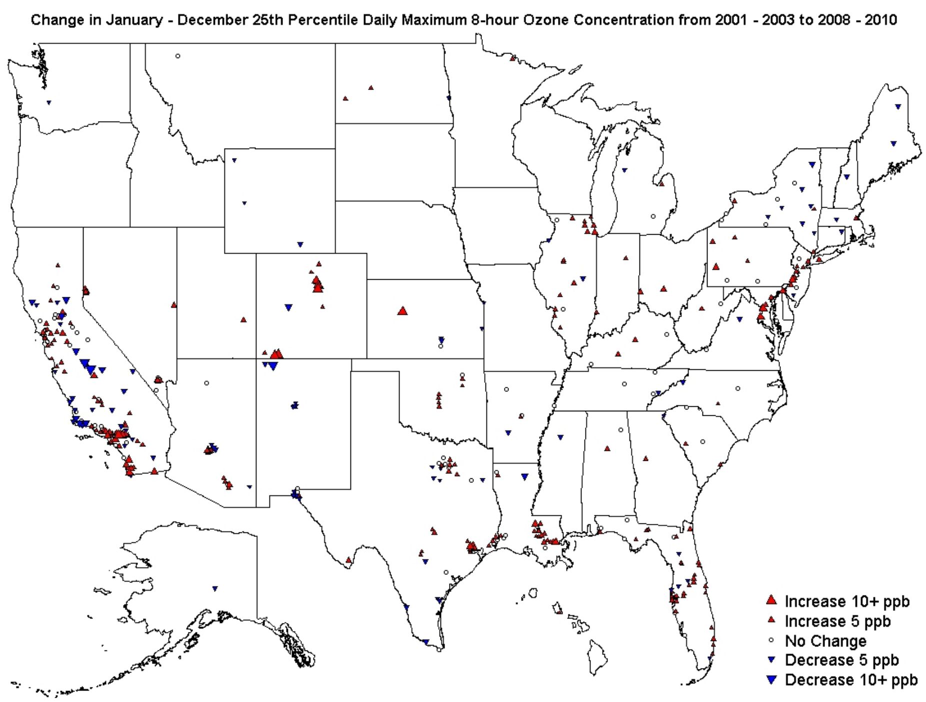

Figure 8C-12. Change in 25th percentile annual daily 8-hour maximum ozone concentrations between 2001-2003 and 2008-2010.

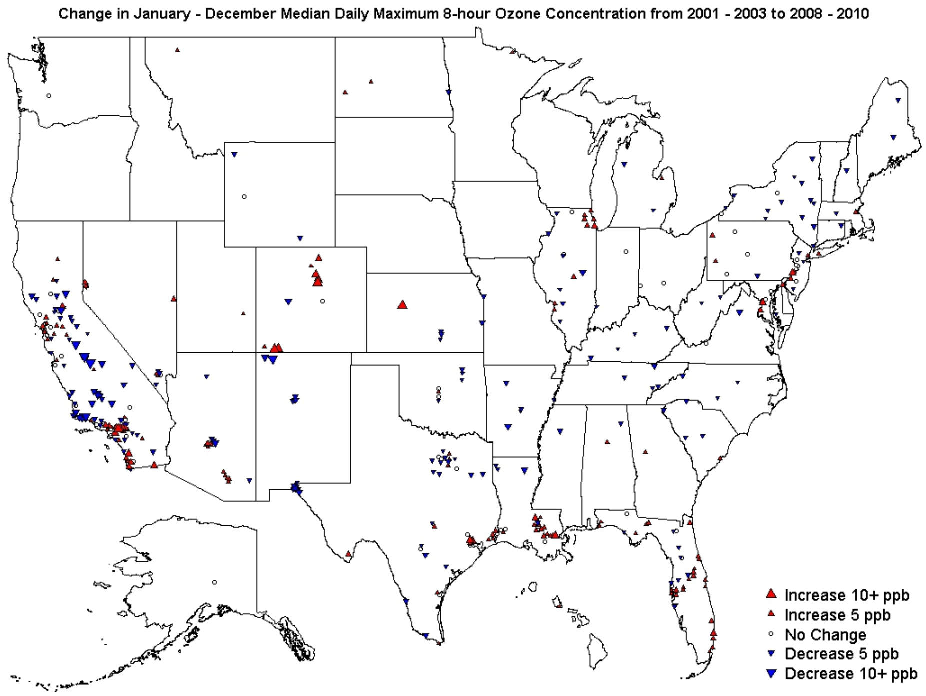

Figure 8C-13. Change in 50th percentile annual daily 8-hour maximum ozone concentrations between 2001-2003 and 2008-2010.

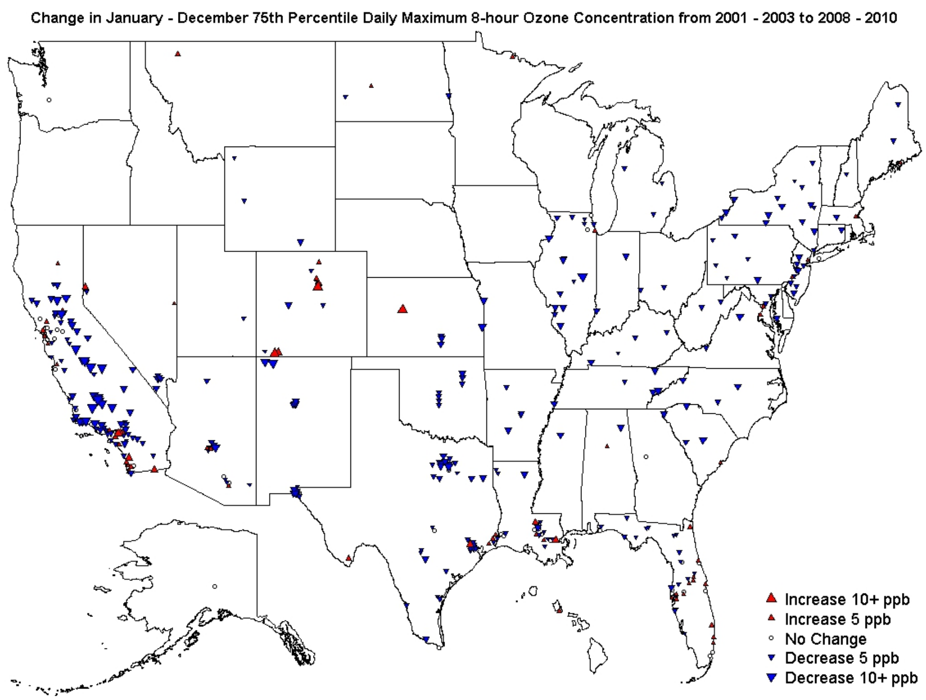

Figure 8C-14. Change in 75th percentile annual daily 8-hour maximum ozone concentrations between 2001-2003 and 2008-2010.

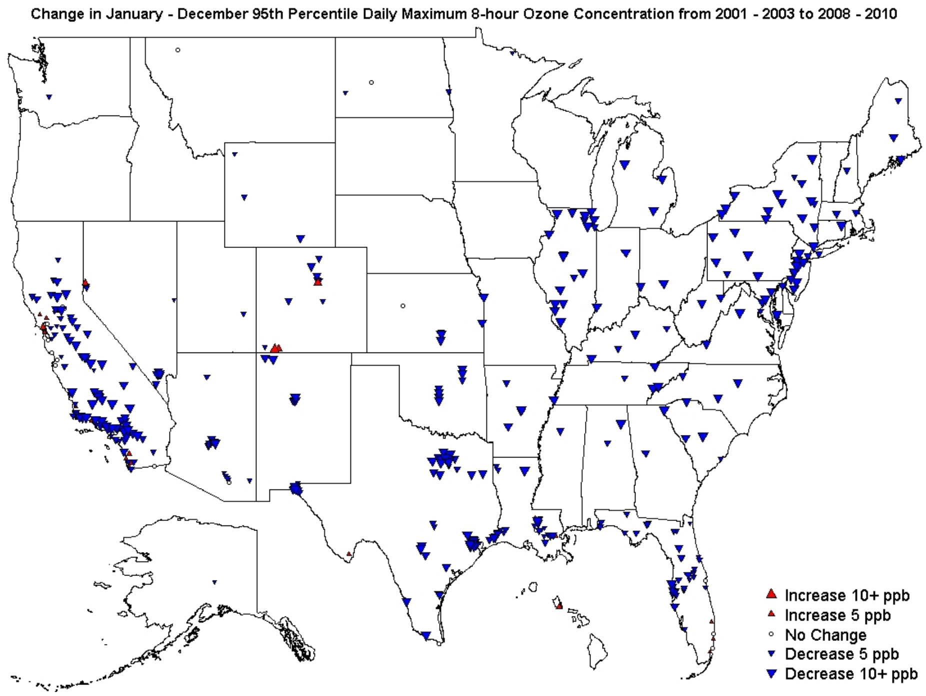

Figure 8C-15. Change in 95th percentile annual daily 8-hour maximum ozone concentrations between 2001-2003 and 2008-2010.

8C-1.2. Thirteen-year Ozone Trends Across the U.S. and in Urban Study Areas

An initial illustrative summary of the O_3 trends by the categories described in HREA Chapter 8, section 8.2.4 of the main text is shown in Figure 8C-16, where the trend for annual medians of each monitor under study are displayed as separate lines. Although it generally illustrates the range in which average concentrations of O_3 tend to fall (often 40-60 ppb), the simplicity of the plot makes it difficult to discern either spatial or temporal trends. Information about other parts of the annual distribution are also likely to be useful. To concisely display many different distributions in the same template of panels as Figure 8C-16, kernel density estimates (KDEs) of the data were calculated. This process is displayed in Figure 8C-17.

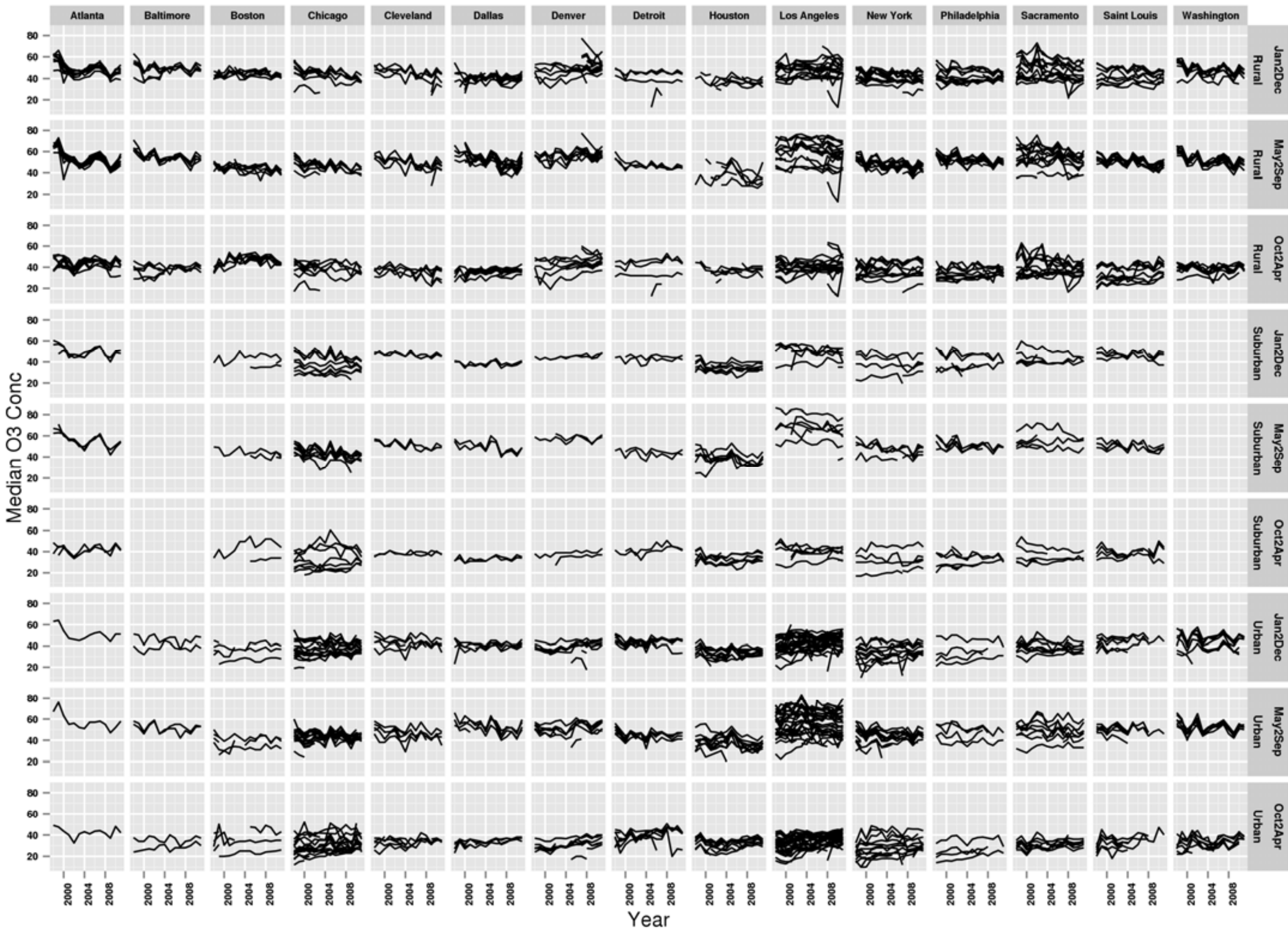

Figure 8C-16. Annual medians of ozone concentrations at each monitor based on different subsets of months.

Figure 8C-17 visually illustrates the process of forming and display a KDE from a year of O_3 data from a single monitoring site. This raw data is displayed in the top panel as a time series of O_3 concentrations. A KDE is then formed from the raw data, which is similar in principle to a histogram, which gives counts of data that fall within user-defined bins. However, the KDE "smoothes" out the histogram so that arbitrary bins do not need to be set, and converts the counts to a "density". The density can yield a probability if desired, but that is beyond the scope of this display; for our purposes, a higher density for a given concentration simply means that more O_3 measurements were collected near that value compared to other possible concentrations. The curve of the KDE can then be converted to a color stripe as shown in the bottom panel of Figure 8C-17, where the color is related to the height of the curve in the middle panel.

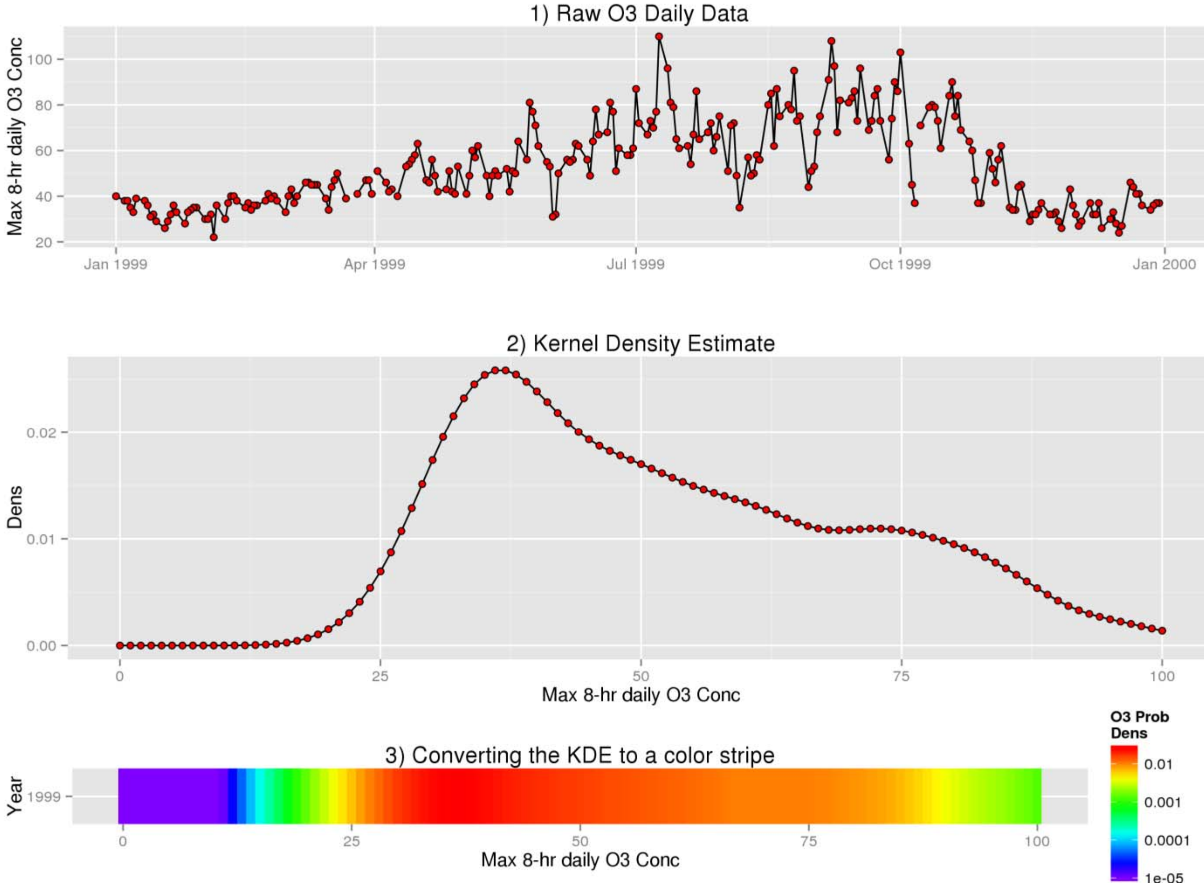

Figure 8C-17. Procedure for creating the display of O_3 distributions shown in Figure 8C-18.

Each year of data shown in the groups in Figure 8C-16 was thus converted to a color-based KDE as shown in Figure 8C-17, and the resulting collection of KDEs is shown in Figure 8C-18. Annual medians and modes of the distributions across all monitors in each group indicated by the plot's panels are also shown, with color indicating the direction of the trend over time. Statistical significance for multi-year ozone trends was determined using the Spearman rank order correlation coefficient (p-value < 0.05). The general pattern of KDEs over time appears to be either small or insignificant changes to the central tendencies of the distributions (i.e. mode and median), but with a “condensing” of the concentration to the 40-50 ppb range, meaning that lower concentrations grow and high concentrations decrease.

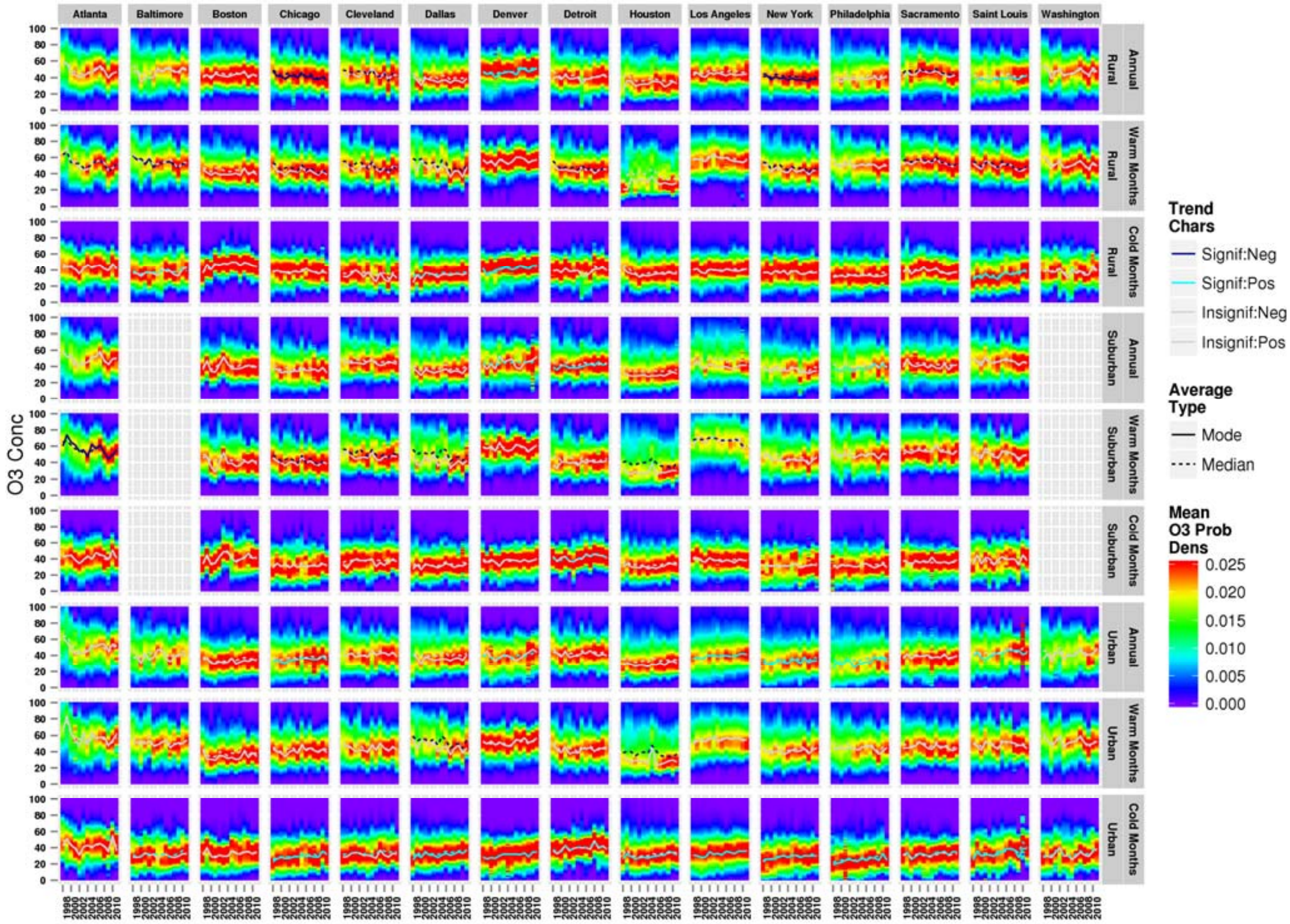

Figure 8C-18. KDEs of groups of monitors' annual O_3 concentrations for different subsets of months, shown on a linear color scale. The modes and medians of these concentrations across the year and monitors for each group are shown in the overlaying lines.

HREA chapter 8, section 8.2.3provided maps showing summertime (May-September) ozone trends at specific monitor locations within two urban study areas. Here, we provide similar maps for the other 13 urban study areas. In section 8.2.3 we also described the general trend of fourth high ozone values decreasing in most locations while mean and median values were more likely to increase in core urban areas and decrease in surrounding suburban and rural areas. In addition, in most cities, the monitor with the highest design values did not occur in the urban core. These trends were demonstrated by maps of the New York and Chicago areas in the main text. Here we see that the trends are visible in many other urban study areas, including Baltimore, Boston, Cleveland, Denver, Houston, Los Angeles, and Saint Louis. However, ozone trends in a few urban areas exhibit different behavior. In Atlanta and Sacramento, the highest design value monitor occurs near the urban core. In Atlanta, mid-range ozone has statistically significant decreases trends at monitors both in the urbanized and in the surrounding area. All urban monitors in Detroit and Sacramento showed no significant trend in either mean or median ozone values. In Dallas, significant increases in mid-range ozone occurred at sites outside of the urban core. Finally in Philadelphia, there was no statistically significant trend at any monitor for the fourth highest 8-hour daily maximum ozone value. See Figure 8C-19 through Figure 8C-30 for details.

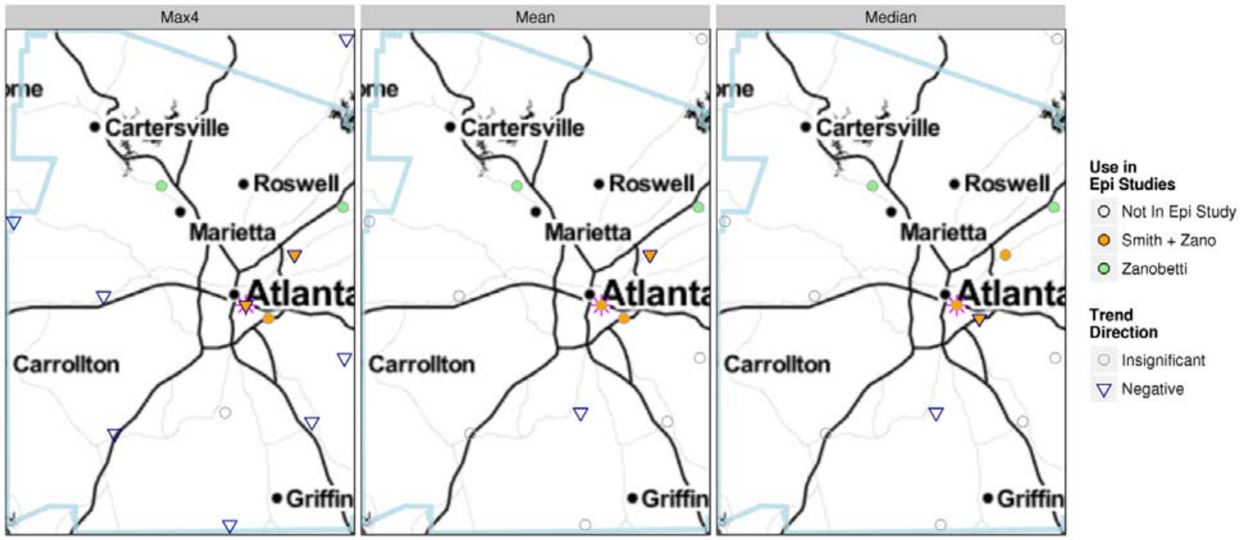

Figure 8C-19. Map of ozone trends at specific monitor locations in the Atlanta area. All upward and downward facing triangles represent statistically significant trends from 1998-2001 (p<0.05), circles represent locations with no significant trends. The pink star indicates the site with the highest design values in 2011. Left panel shows trends in May-September 4th highest 8-hour daily maximum ozone values, center panel shows trends in May-September mean 8-hour daily maximum, and left panel shows trends in May-September median 8-hour daily maximum ozone values.

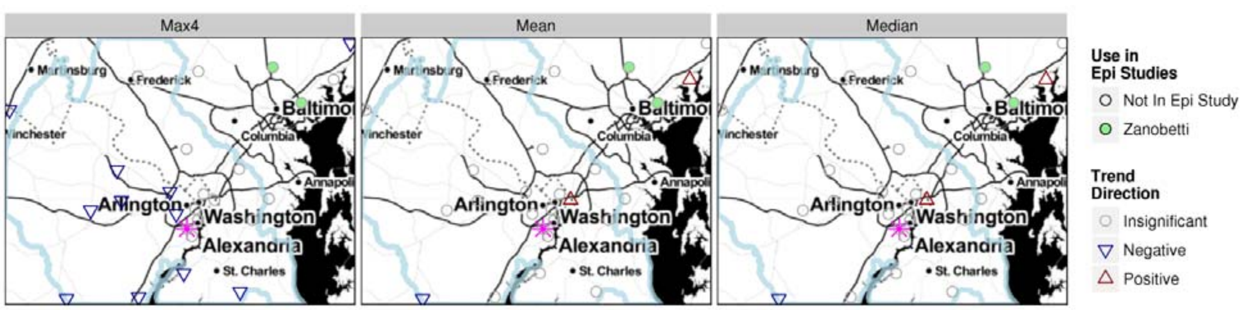

Figure 8C-20. Map of ozone trends at specific monitor locations in the Baltimore/Washington D.C. area. All upward and downward facing triangles represent statistically significant trends from 1998-2001 (p<0.05), circles represent locations with no significant trends. The pink star indicates the site with the highest design values in 2011. Left panel shows trends in May-September 4th highest 8-hour daily maximum ozone values, center panel shows trends in May-September mean 8-hour daily maximum, and left panel shows trends in May-September median 8-hour daily maximum ozone values.

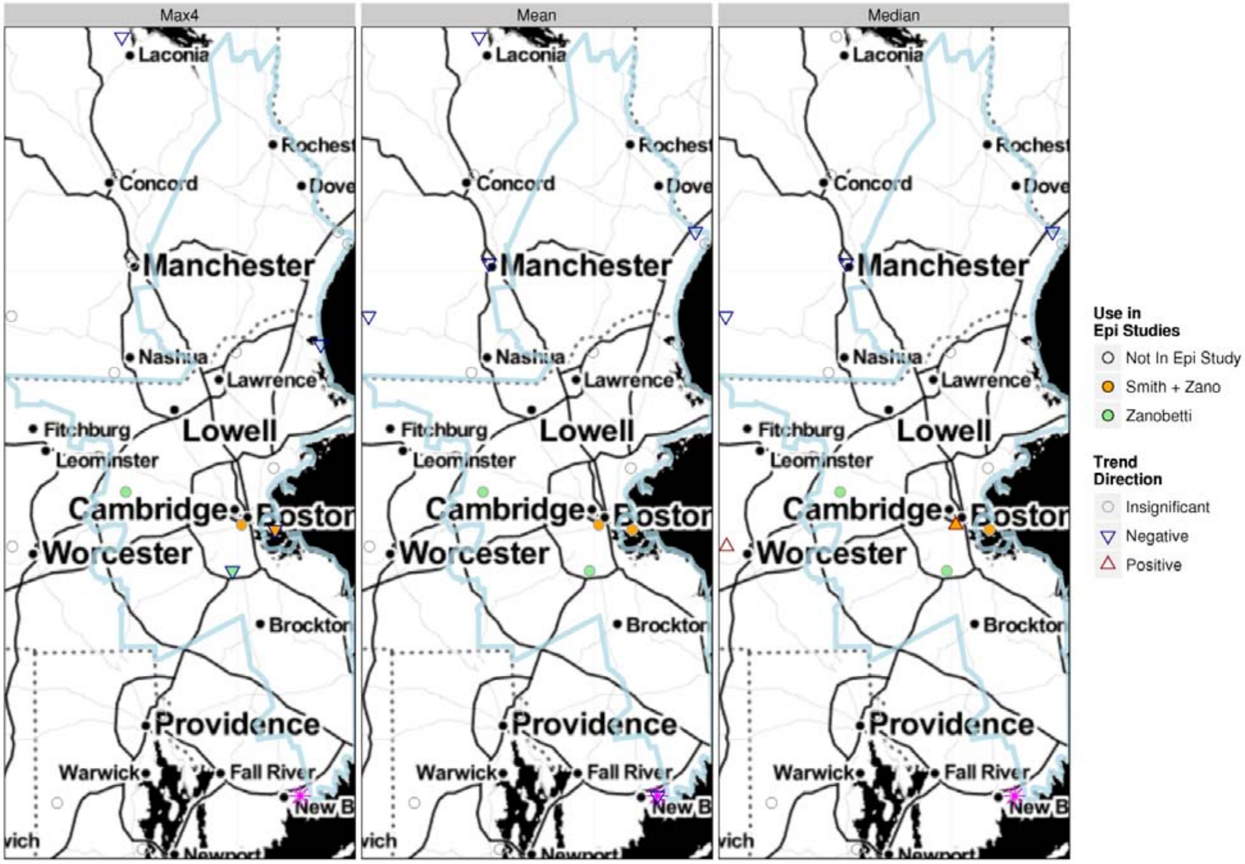

Figure 8C-21. Map of ozone trends at specific monitor locations in the Boston area. All upward and downward facing triangles represent statistically significant trends from 1998-2001 ($p<0.05$), circles represent locations with no significant trends. The pink star indicates the site with the highest design values in 2011. Left panel shows trends in May-September 4th highest 8-hour daily maximum ozone values, center panel shows trends in May-September mean 8-hour daily maximum, and left panel shows trends in May-September median 8-hour daily maximum ozone values.

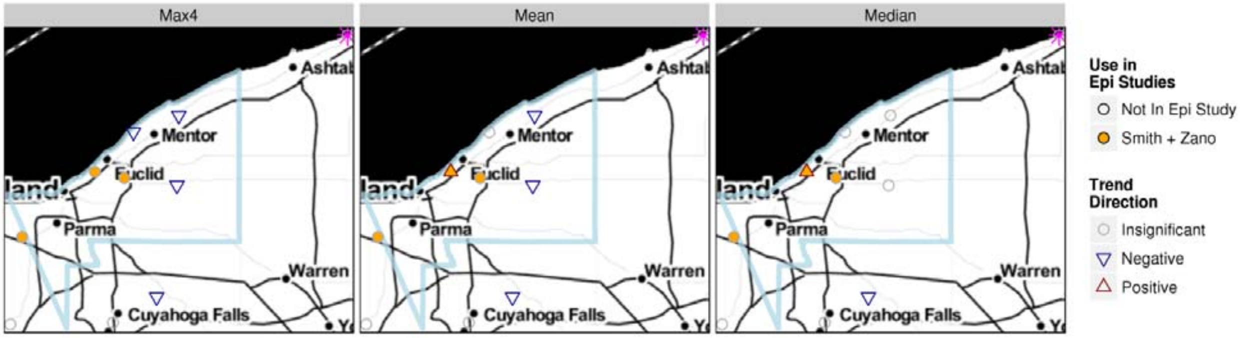

Figure 8C-22. Map of ozone trends at specific monitor locations in the Cleveland area. All upward and downward facing triangles represent statistically significant trends from 1998-2001 (p<0.05), circles represent locations with no significant trends. The pink star indicates the site with the highest design values in 2011. Left panel shows trends in May-September 4th highest 8-hour daily maximum ozone values, center panel shows trends in May-September mean 8-hour daily maximum, and left panel shows trends in May-September median 8-hour daily maximum ozone values.

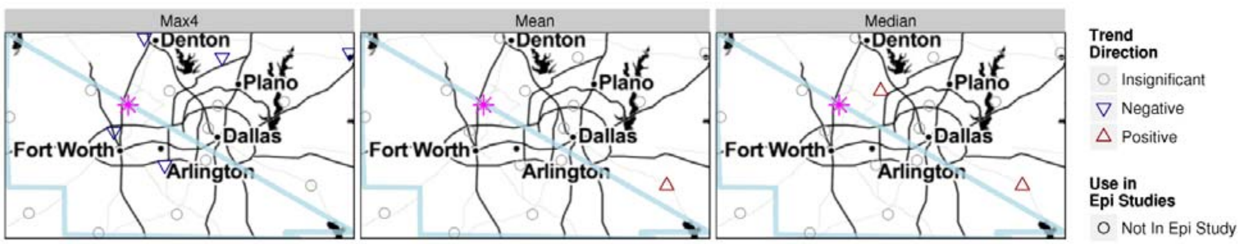

Figure 8C-23. Map of ozone trends at specific monitor locations in the Dallas area. All upward and downward facing triangles represent statistically significant trends from 1998-2001 (p<0.05), circles represent locations with no significant trends. The pink star indicates the site with the highest design values in 2011. Left panel shows trends in May-September 4th highest 8-hour daily maximum ozone values, center panel shows trends in May-September mean 8-hour daily maximum, and left panel shows trends in May-September median 8-hour daily maximum ozone values.

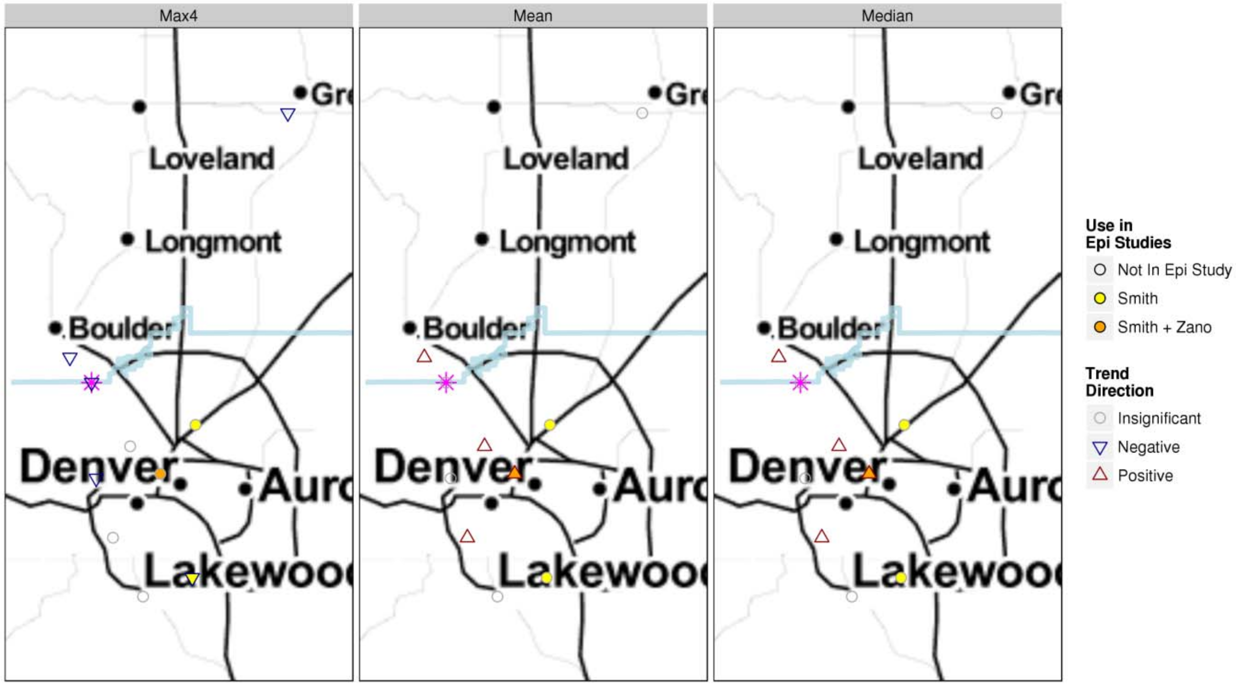

Figure 8C-24. Map of ozone trends at specific monitor locations in the Denver area. All upward and downward facing triangles represent statistically significant trends from 1998-2001 ($p<0.05$), circles represent locations with no significant trends. The pink star indicates the site with the highest design values in 2011. Left panel shows trends in May-September 4th highest 8-hour daily maximum ozone values, center panel shows trends in May-September mean 8-hour daily maximum, and left panel shows trends in May-September median 8-hour daily maximum ozone values.

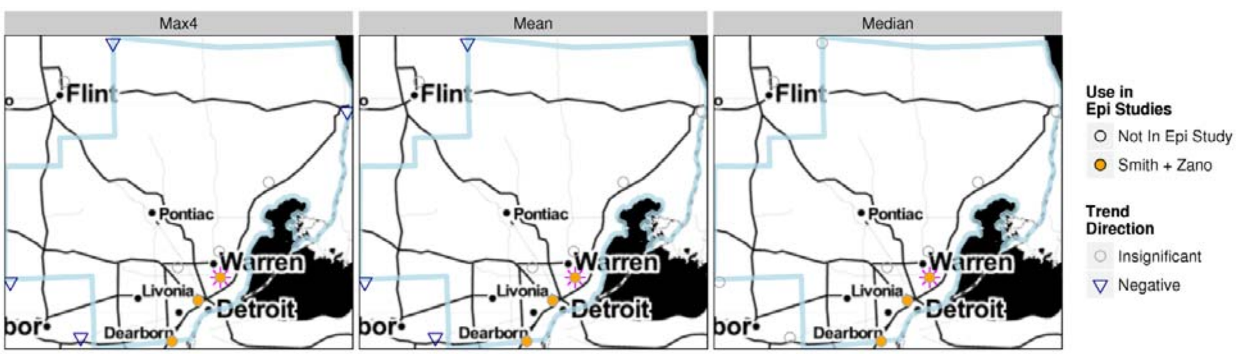

Figure 8C-25. Map of ozone trends at specific monitor locations in the Detroit area. All upward and downward facing triangles represent statistically significant trends from 1998-2001 ($p<0.05$), circles represent locations with no significant trends. The pink star indicates the site with the highest design values in 2011. Left panel shows trends in May-September 4th highest 8-hour daily maximum ozone values, center panel shows trends in May-September mean 8-hour daily maximum, and left panel shows trends in May-September median 8-hour daily maximum ozone values.

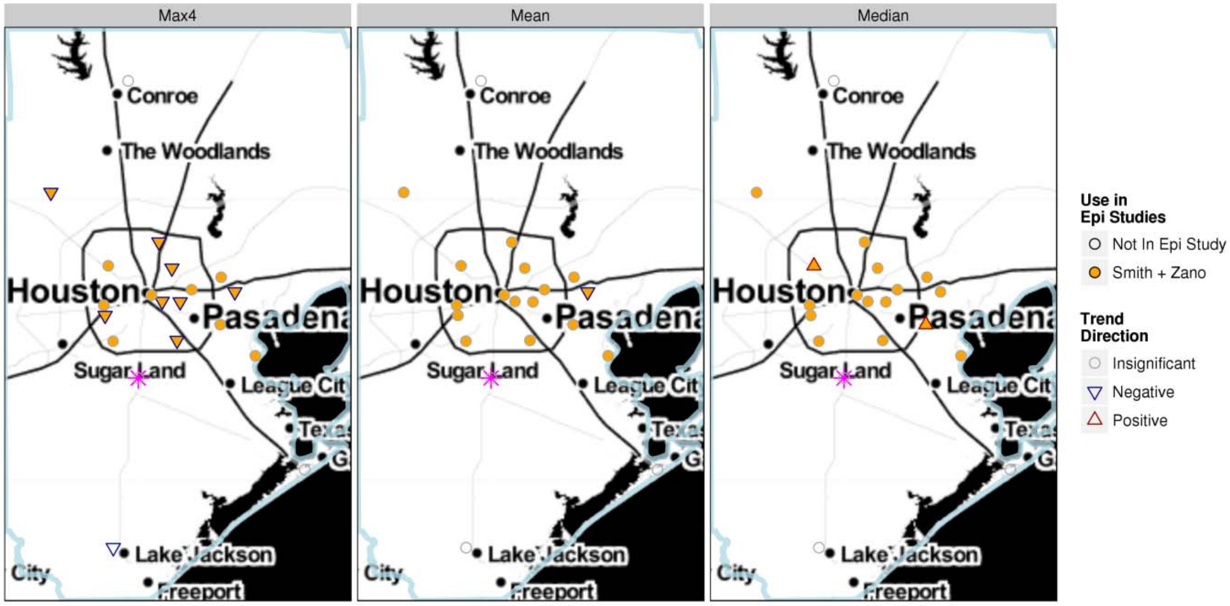

Figure 8C-26. Map of ozone trends at specific monitor locations in the Houston area. All upward and downward facing triangles represent statistically significant trends from 1998-2001 (p<0.05), circles represent locations with no significant trends. The pink star indicates the site with the highest design values in 2011. Left panel shows trends in May-September 4th highest 8-hour daily maximum ozone values, center panel shows trends in May-September mean 8-hour daily maximum, and left panel shows trends in May-September median 8-hour daily maximum ozone values.

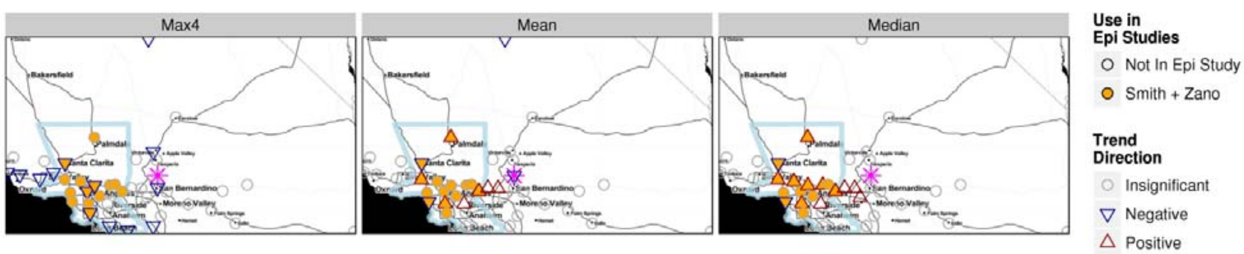

Figure 8C-27. Map of ozone trends at specific monitor locations in the Los Angeles area. All upward and downward facing triangles represent statistically significant trends from 1998-2001 (p<0.05), circles represent locations with no significant trends. The pink star indicates the site with the highest design values in 2011. Left panel shows trends in May-September 4th highest 8-hour daily maximum ozone values, center panel shows trends in May-September mean 8-hour daily maximum, and left panel shows trends in May-September median 8-hour daily maximum ozone values.

Figure 8C-28. Map of ozone trends at specific monitor locations in the Philadelphia area. All upward and downward facing triangles represent statistically significant trends from 1998-2001 (p<0.05), circles represent locations with no significant trends. The pink star indicates the site with the highest design values in 2011. Left panel shows trends in May-September 4th highest 8-hour daily maximum ozone values, center panel shows trends in May-September mean 8-hour daily maximum, and left panel shows trends in May-September median 8-hour daily maximum ozone values.

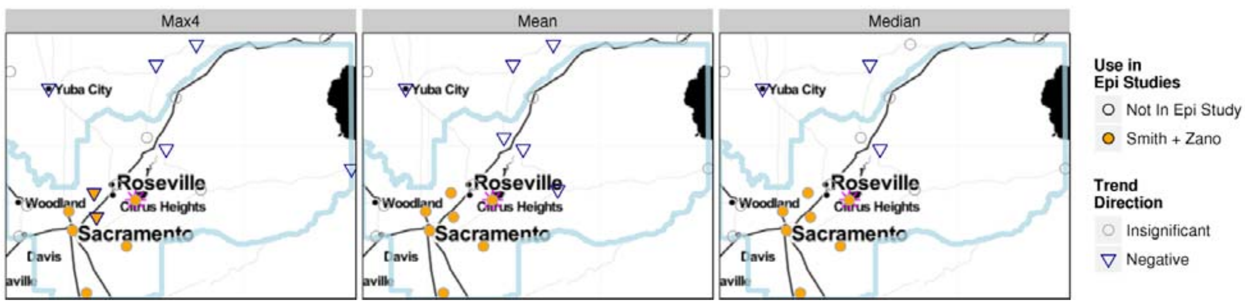

Figure 8C-29. Map of ozone trends at specific monitor locations in the Sacramento area. All upward and downward facing triangles represent statistically significant trends from 1998-2001 (p<0.05), circles represent locations with no significant trends. The pink star indicates the site with the highest design values in 2011. Left panel shows trends in May-September 4th highest 8-hour daily maximum ozone values, center panel shows trends in May-September mean 8-hour daily maximum, and left panel shows trends in May-September median 8-hour daily maximum ozone values.

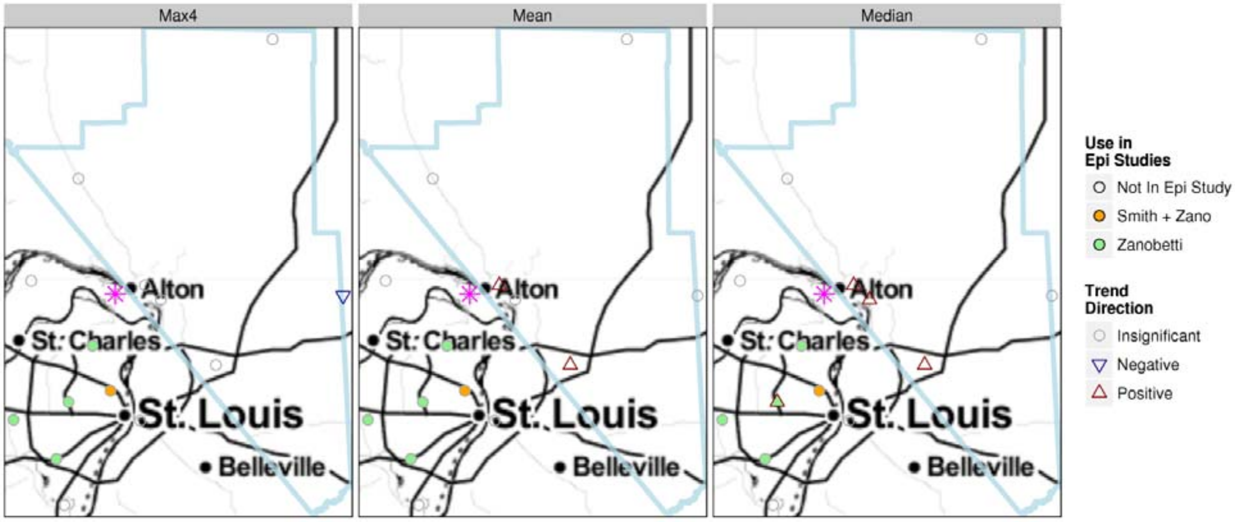

Figure 8C-30. Map of ozone trends at specific monitor locations in the Saint Louis area. All upward and downward facing triangles represent statistically significant trends from 1998-2001 ($p<0.05$), circles represent locations with no significant trends. The pink star indicates the site with the highest design values in 2011. Left panel shows trends in May-September 4th highest 8-hour daily maximum ozone values, center panel shows trends in May-September mean 8-hour daily maximum, and left panel shows trends in May-September median 8-hour daily maximum ozone values.

In addition to the ozone trends, HREA Chapter 8 includes Table 8-8 which shows relationships between regional trends in NO_x and VOC emissions and regional ozone trends. The objective was to investigate possible similarities in broad trends of O_3 concentrations and anthropogenic NO_x and VOC emissions. Trends of emissions were derived from county-level emissions data from the 2002, 2005, 2008, and 2011 EPA National Emissions Inventory (NEI). This data was in the form of annual totals for the 'Tier 1' sectors, which refers to the most general classification scheme of source categories in the NEI. This raw data is plotted in U.S. maps in Figure 8C-31. The row of maps labeled "TierTotal" refers to the sum of all the other maps. Note that the Wildfires and Biogenics sectors are absent from all these analyses due to their large magnitude and non-anthropogenic origin.

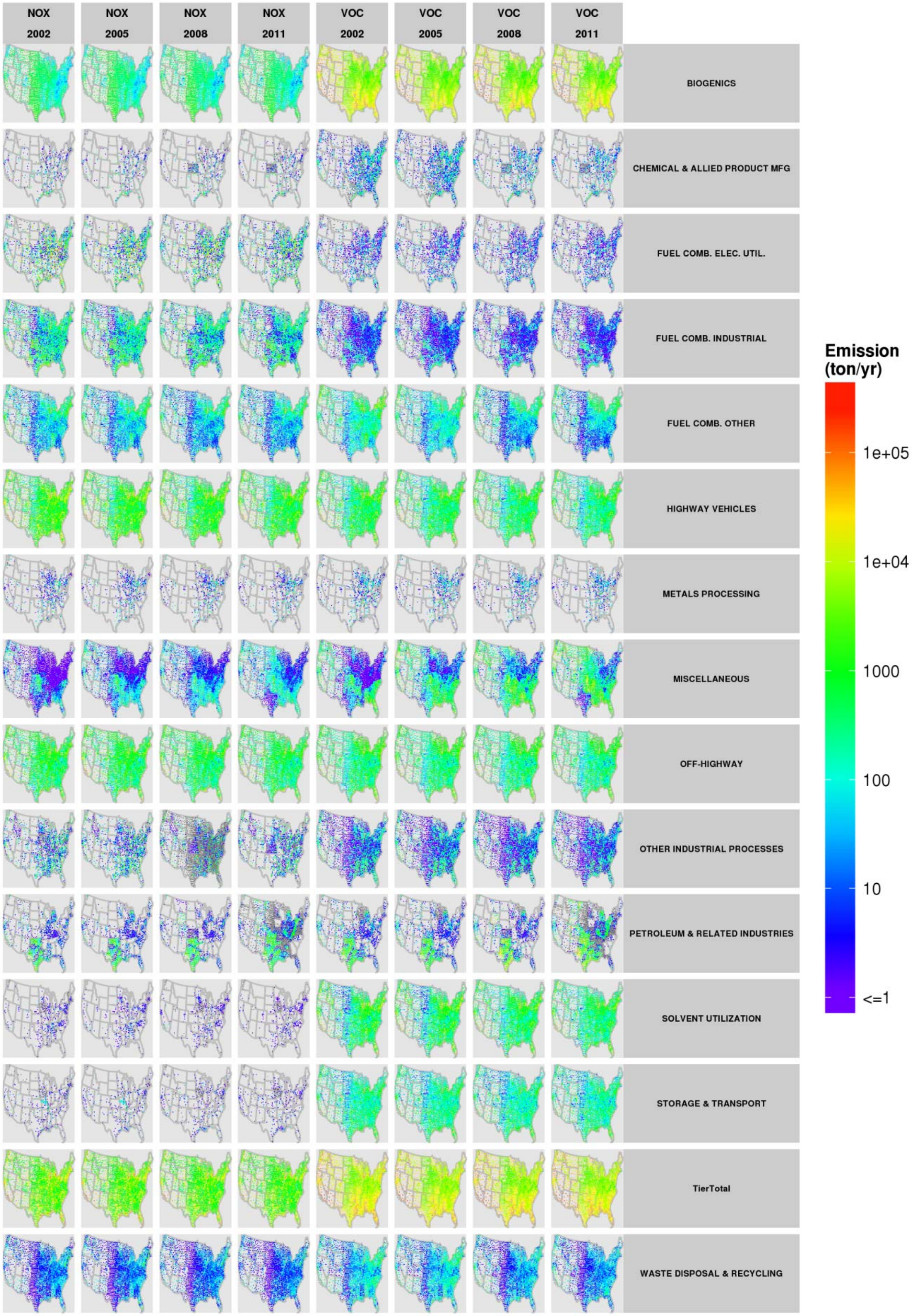

Figure 8C-31. Maps of NO_x and VOC emissions by source sector for 2002, 2005, 2008, and 2011.

To analyze trends, emissions were spatially summed for each year and each sector across the NOAA Climate Regions[1] (shown in Figure 8C-32). The resulting trend lines for each sector and emissions pollutant are shown in Figure 8C-33. For direct comparison to O_3 trends, the ozone data from the urban study areas was grouped together by the same NOAA climate regions, and annual percentiles of the resulting distributions were calculated, which are shown in Figure 8C-34 and Figure 8C-35. The descriptors show in HREA Chapter 8 Table 8-8 of the main document were derived from Figure 8C-33, Figure 8C-34, and Figure 8C-35.

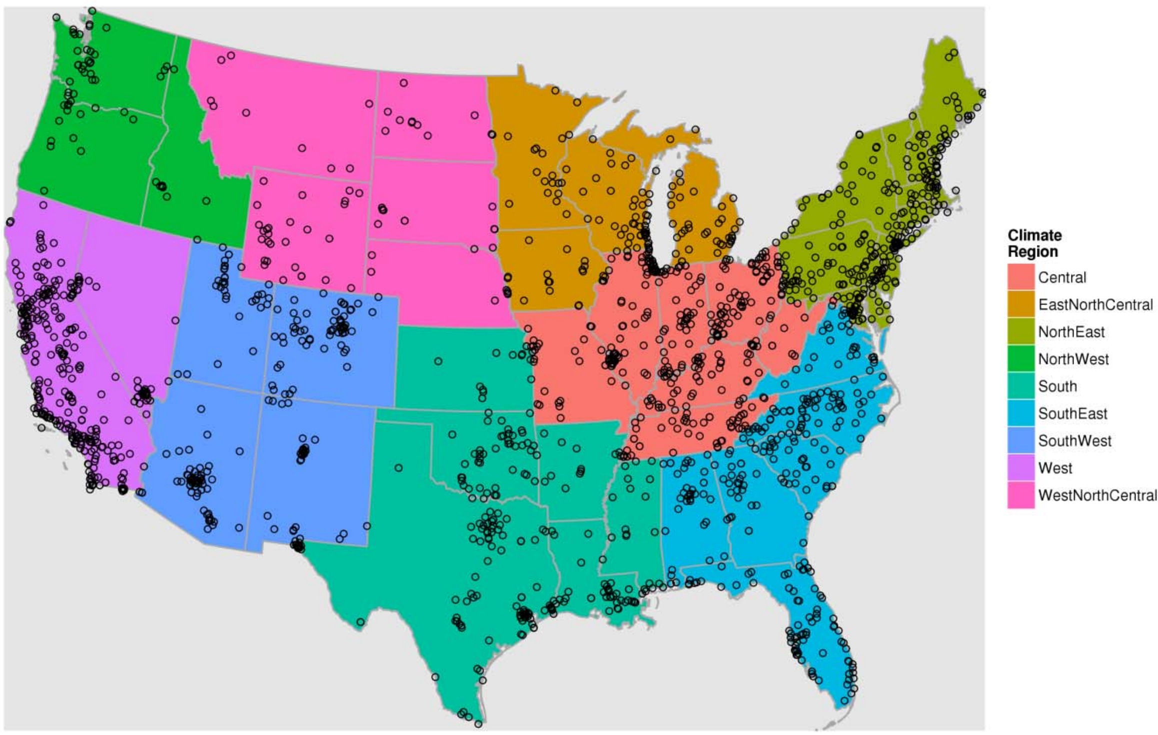

Figure 8C-32. Map of nine NOAA climate regions that were used to aggregate emissions and ambient ozone trends. Dots show locations of ozone monitors.

[1] Climate regions are defined by NOAA's National Climate Data Center: http://www.ncdc.noaa.gov/monitoring-references/maps/us-climate-regions.php

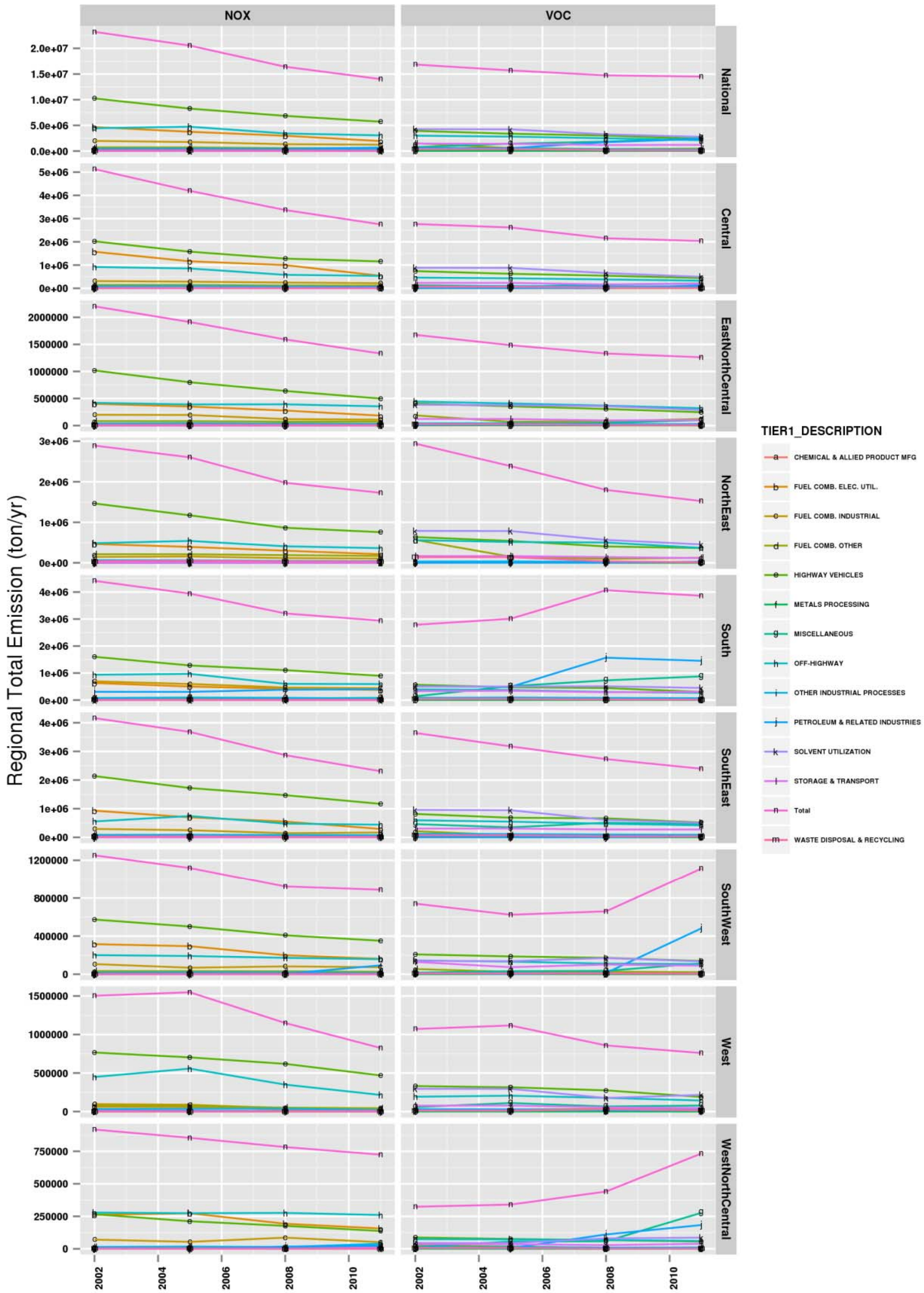

Figure 8C-33. Plots of NO_x and VOC emissions trends by source sector. Emissions are aggregated by NOAA climate region and by urban, rural, and suburban location.

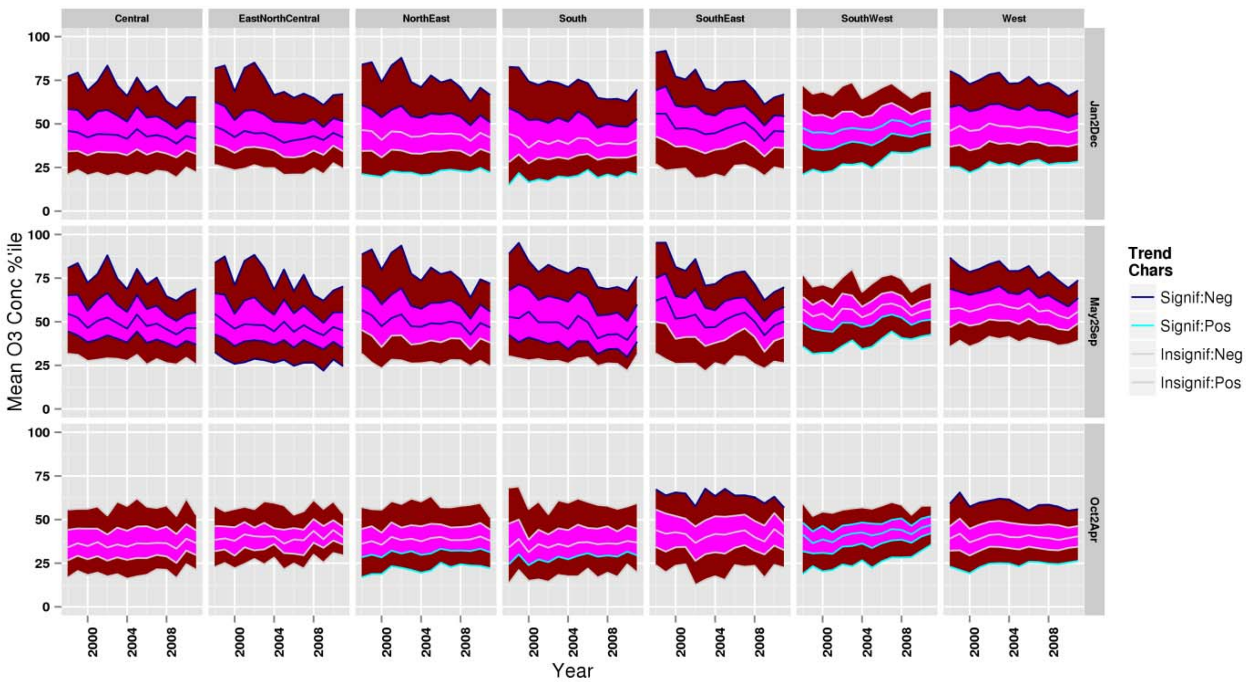

Figure 8C-34. Distributions of low population density (rural) monitors' O_3 concentrations for different subsets of months over a 13-year period. From top to bottom in each ribbon plot, the blue and white lines indicate the spatial mean of the 95th, 75th, 50th, 25th, and 5th percentiles for each monitor for every year from 1998-2011. Trend are shown for 7 of 9 NOAA climate regions (The Northwest and West North Central regions did not contain any urban study areas).

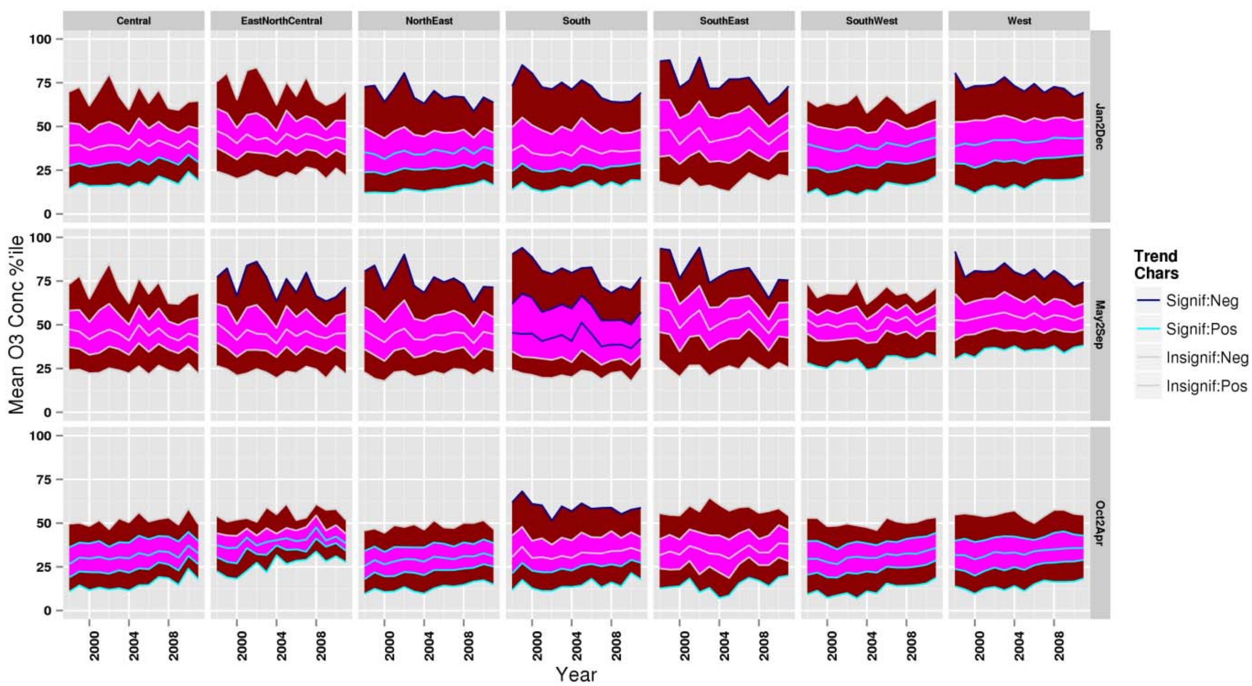

Figure 8C-35. Distributions of high population density monitor O_3 concentrations for different subsets of months over a 13-year period. From top to bottom in each ribbon plot, the blue and white lines indicate the spatial mean of the 95th, 75th, 50th, 25th, and 5th percentiles for each monitor for every year from 1998-2011. Trend are shown for each of 7 of 9 NOAA climate regions (The Northwest and West North Central regions did not contain any urban study areas).

8C-2. MODELED OZONE CHANGES IN RESPONSE TO ACROSS THE BOARD EMISSIONS REDUCTIONS

8C-2.1. Maps of Ratios of Mean Ozone from 2007 CMAQ Simulations including Emissions Reductions to Mean Ozone from 2007 Base CMAQ Simulations.

In HREA Chapter 8 section 8.2.3.2 we evaluated ozone response from two CMAQ model simulations with across-the-board reductions in US anthropogenic emissions. We presented results using ratios of the mean ozone concentrations in the emissions reduction scenario to mean ozone concentrations in the 2007 base CMAQ simulation. Here we provide a full set of maps which include mean ozone response over three different time periods (January 2007, April-October 2007, and May-September 2007) and for four different emissions reduction scenarios (50% NO_x reductions, 50% NO_x and VOC reductions, 90% NO_x reductions, and 90% NO_x and VOC reductions). These plots show that ozone increases are most pronounced in cooler months with January maps showing broad ozone increases across most of the modeling domain while May-September maps show broad ozone decreases across most of the modeling domain. The April-October maps show ozone decreases in most areas but localized increases in some large cities. Also, comparing the NO_x and VOC reductions to reductions in NO_x alone show the VOC has some effect at decreasing region ozone but does not fully mitigate ozone increases in urban areas in the April-October maps nor change the general trends described above. See Figure 8C-36 through Figure 8C-47 for details.

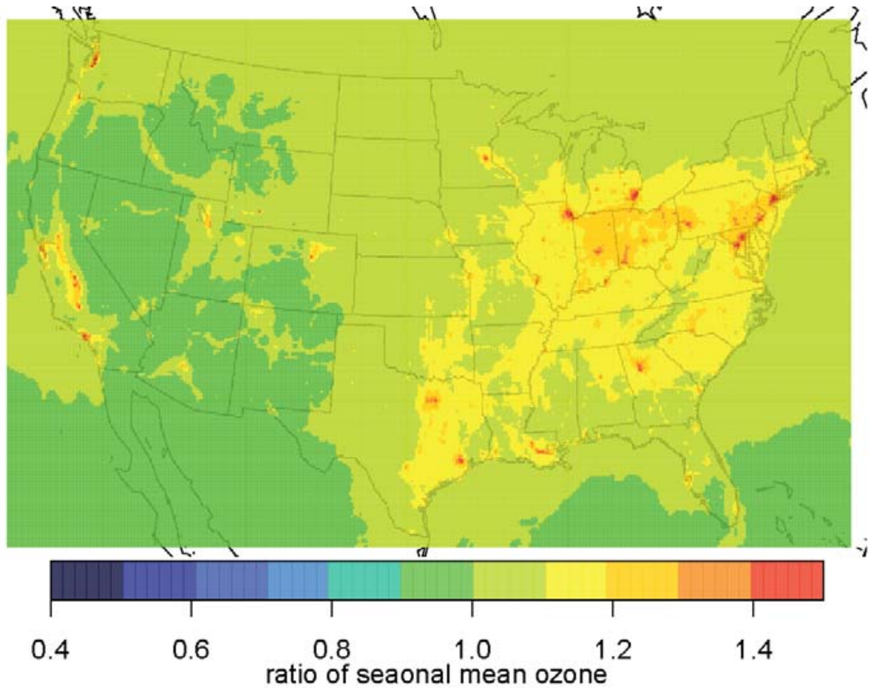

Figure 8C-36. Ratio of January monthly average ozone concentrations in brute force 50% NO_x emissions reduction CMAQ simulation to January monthly average ozone concentration in the 2007 base CMAQ simulation.

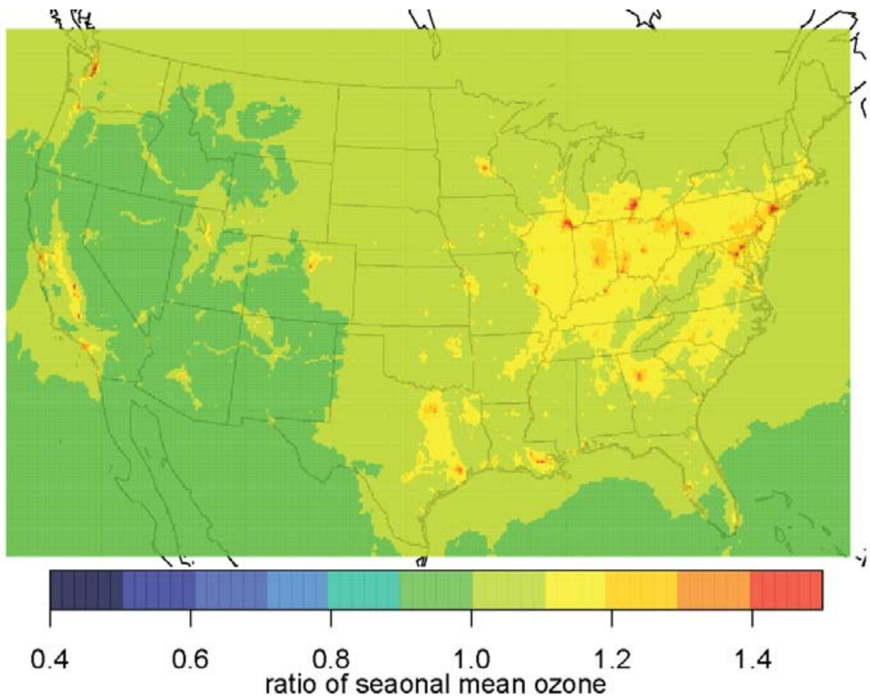

Figure 8C-37. Ratio of January monthly average ozone concentrations in brute force 50% NO_x and VOC emissions reduction CMAQ simulation to January monthly average ozone concentration in the 2007 base CMAQ simulation.

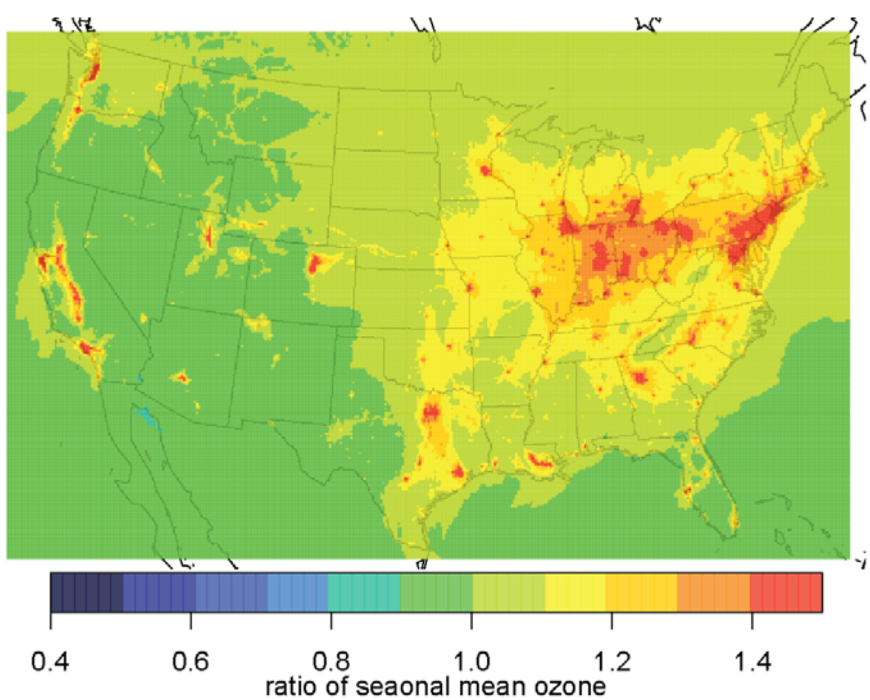

Figure 8C-38. Ratio of January monthly average ozone concentrations in brute force 50% NO_x and VOC emissions reduction CMAQ simulation to January monthly average ozone concentration in the 2007 base CMAQ simulation.

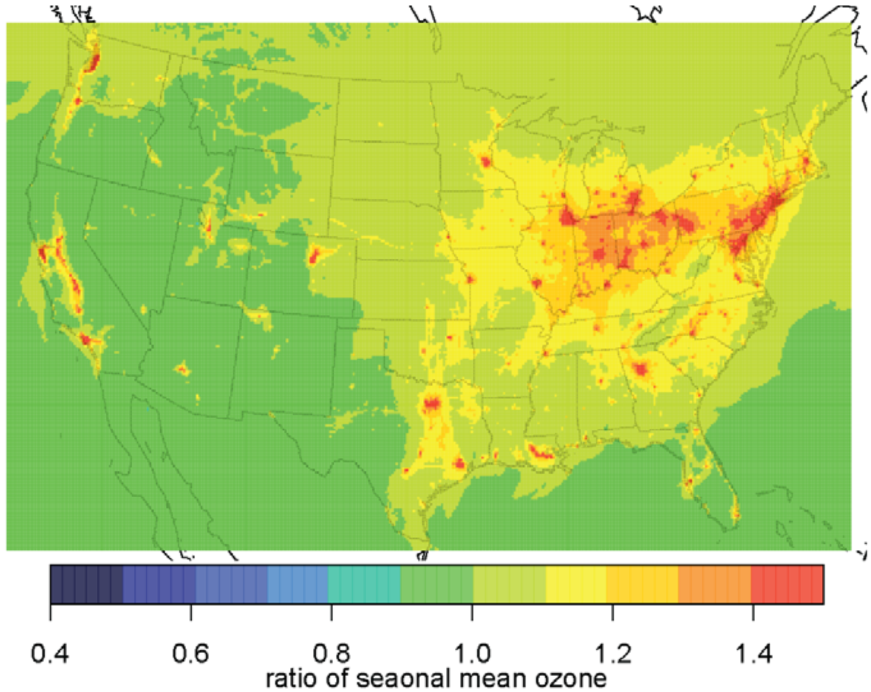

Figure 8C-39. Ratio of January monthly average ozone concentrations in brute force 90% NO_x and emissions reduction CMAQ simulation to January monthly average ozone concentration in the 2007 base CMAQ simulation.

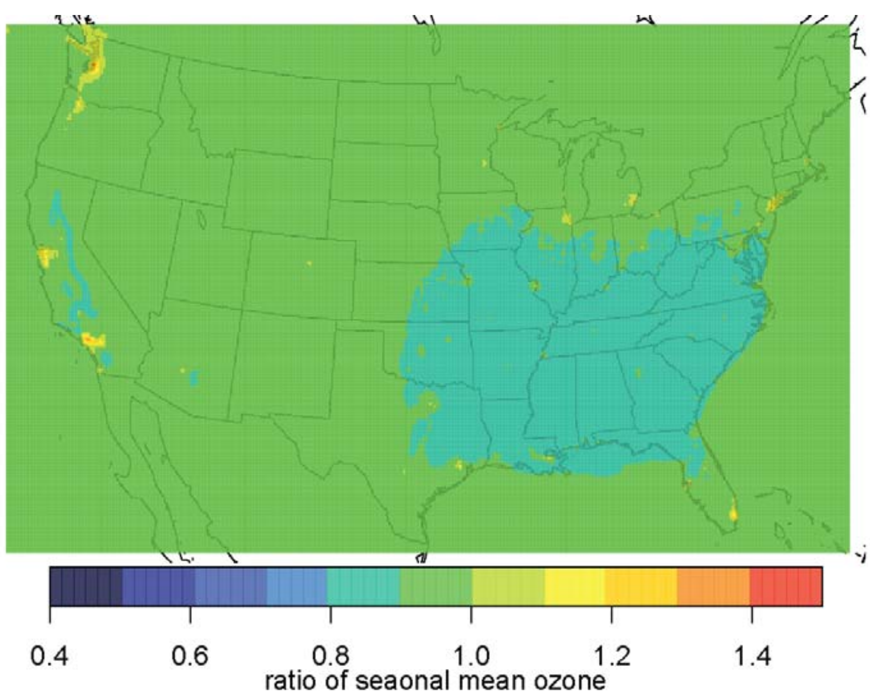

Figure 8C-40. Ratio of April-October seasonal average ozone concentrations in brute force 50% NO_x emissions reduction CMAQ simulation to April-October seasonal average ozone concentration in the 2007 base CMAQ simulation.

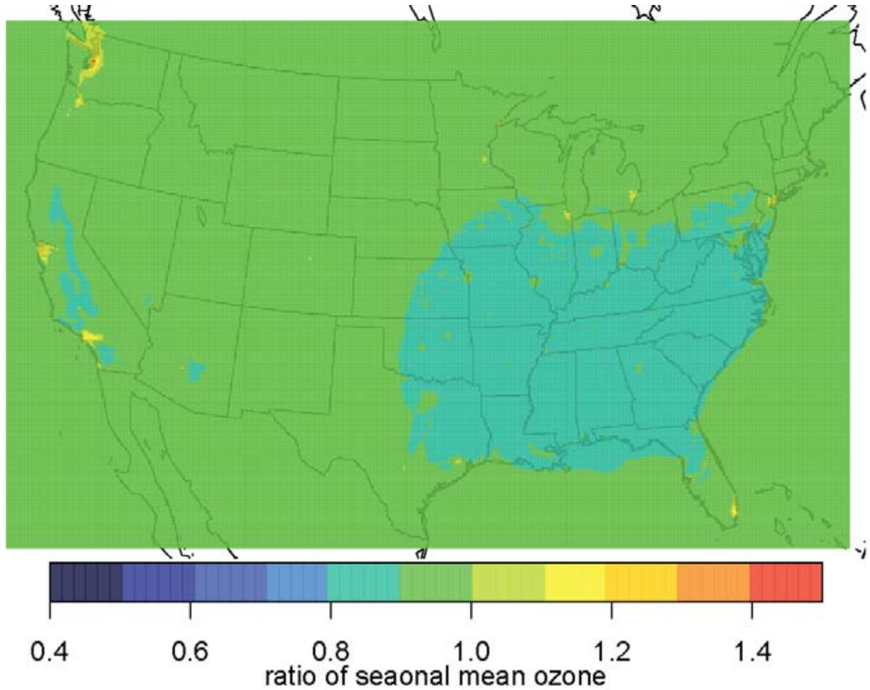

Figure 8C-41. Ratio of April-October seasonal average ozone concentrations in brute force 50% NO_x and VOC emissions reduction CMAQ simulation to April-October seasonal average ozone concentration in the 2007 base CMAQ simulation.

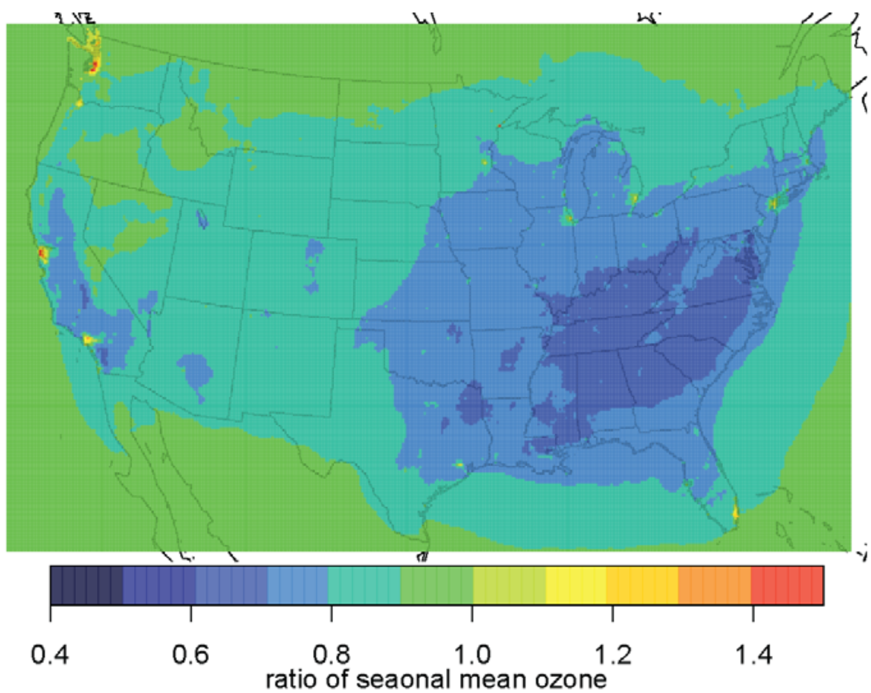

Figure 8C-42. Ratio of April-October seasonal average ozone concentrations in brute force 90% NO_x emissions reduction CMAQ simulation to April-October seasonal average ozone concentration in the 2007 base CMAQ simulation.

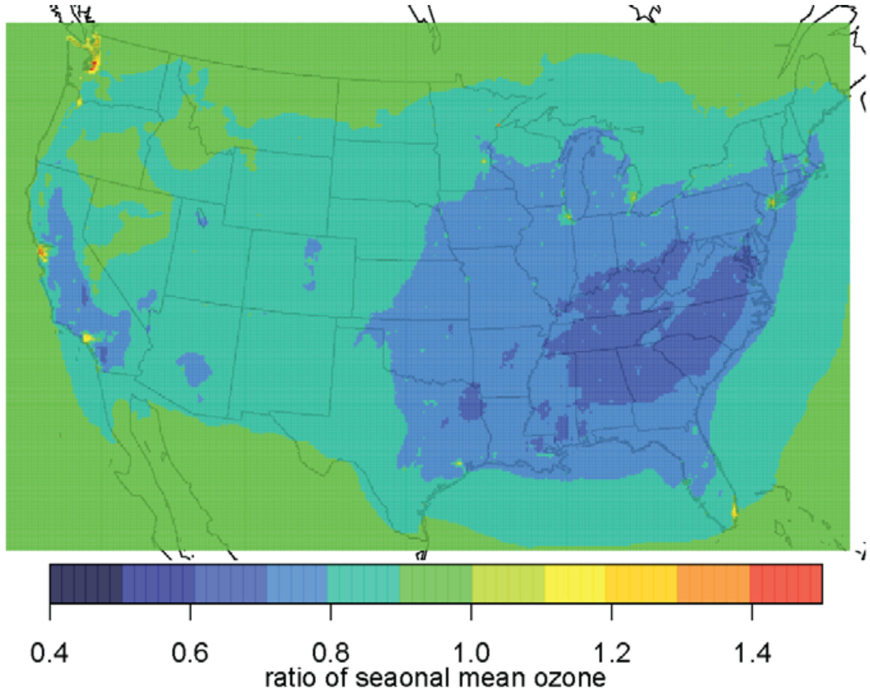

Figure 8C-43. Ratio of April-October seasonal average ozone concentrations in brute force 90% NO_x and VOC emissions reduction CMAQ simulation to April-October seasonal average ozone concentration in the 2007 base CMAQ simulation.

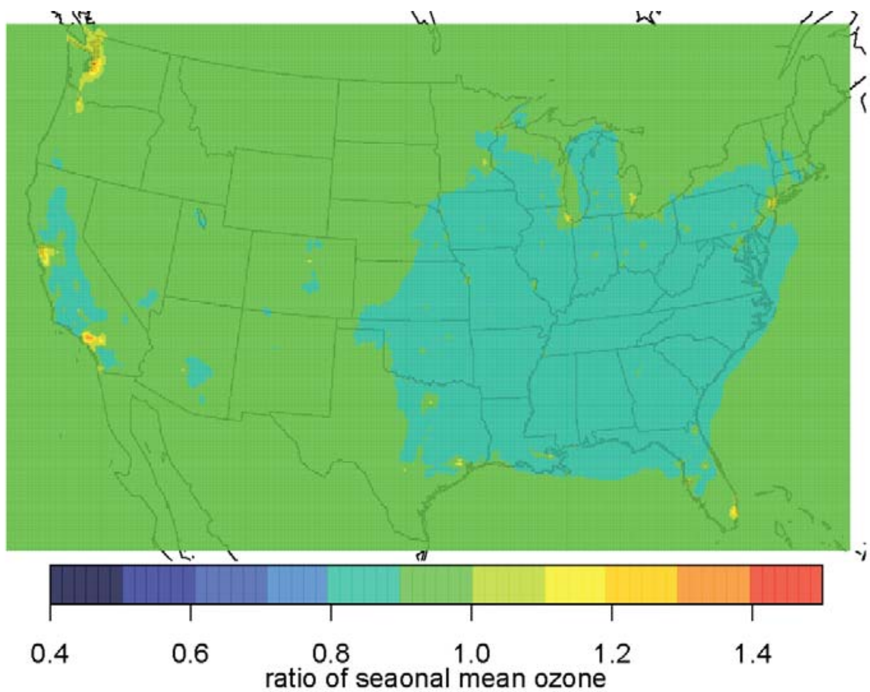

Figure 8C-44. Ratio of May-September seasonal average ozone concentrations in brute force 50% NO_x emissions reduction CMAQ simulation to May-September seasonal average ozone concentration in the 2007 base CMAQ simulation.

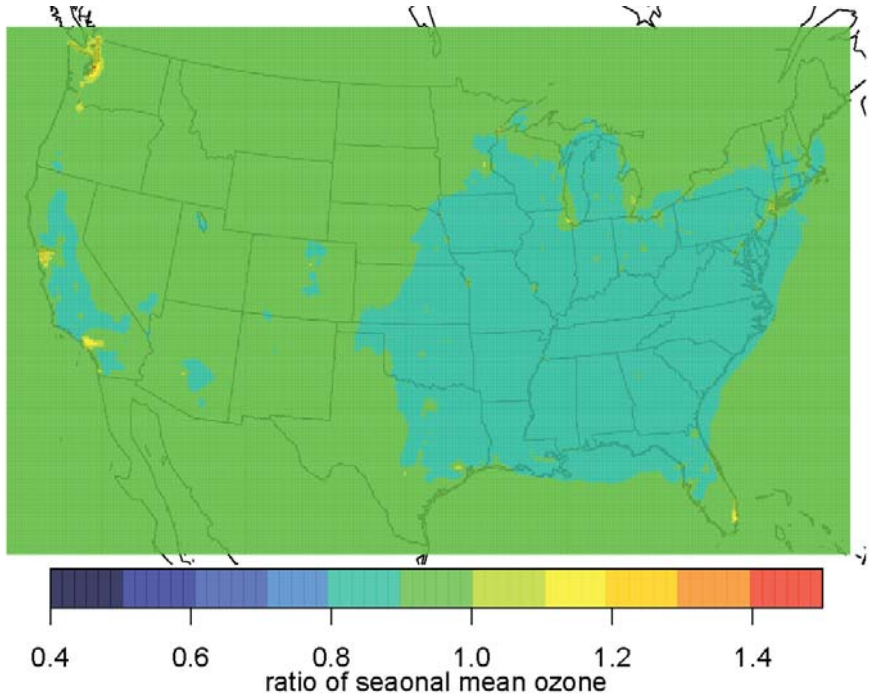

Figure 8C-45. Ratio of May-September seasonal average ozone concentrations in brute force 50% NO_x and VOC emissions reduction CMAQ simulation to May-September seasonal average ozone concentration in the 2007 base CMAQ simulation.

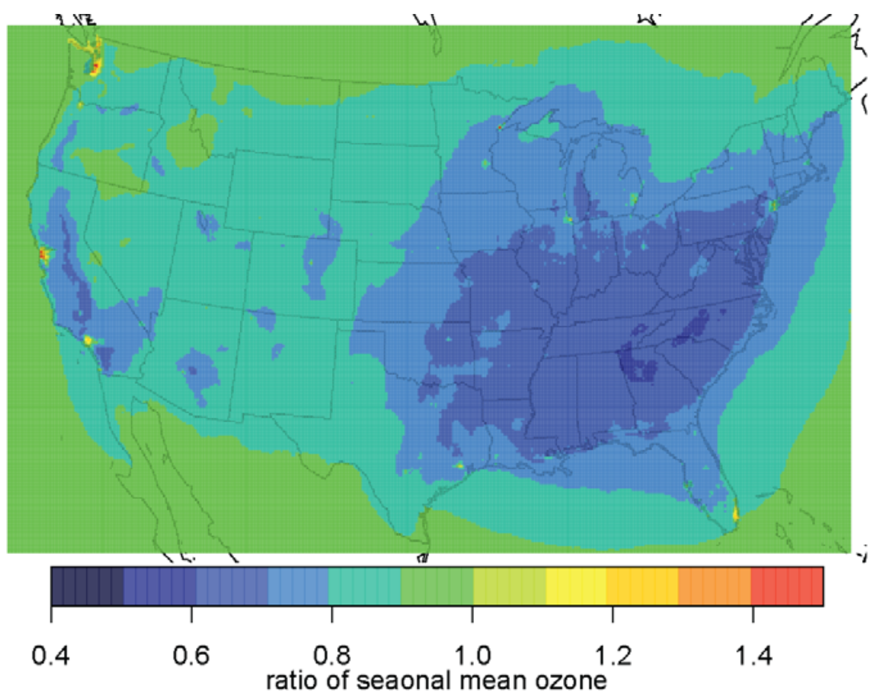

Figure 8C-46. Ratio of May-September seasonal average ozone concentrations in brute force 90% NO_x emissions reduction CMAQ simulation to May-September seasonal average ozone concentration in the 2007 base CMAQ simulation.

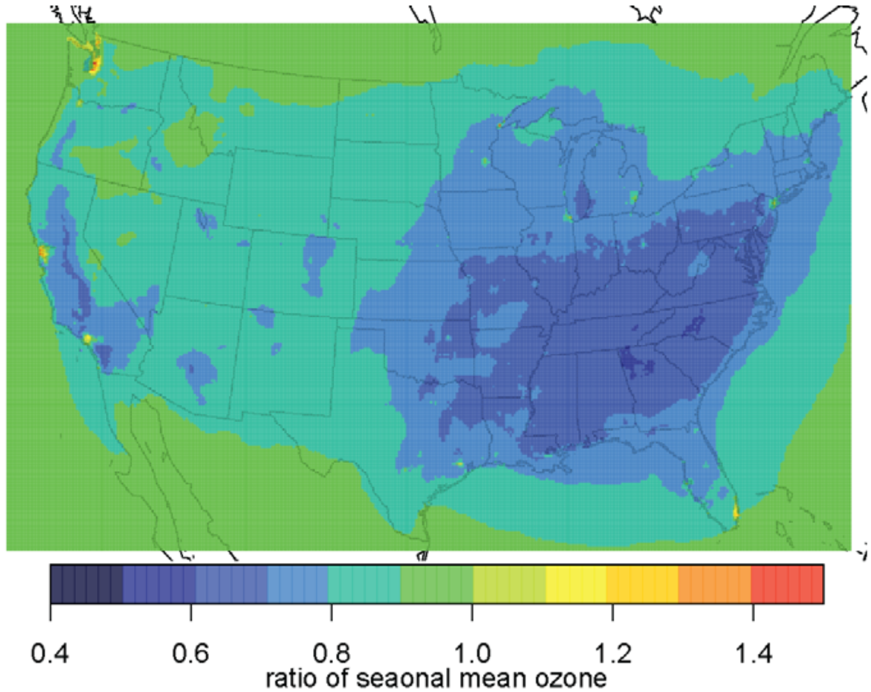

Figure 8C-47. Ratio of May-September seasonal average ozone concentrations in brute force 90% NO_x and VOC emissions reduction CMAQ simulation to May-September seasonal average ozone concentration in the 2007 base CMAQ simulation.

These maps can be further understood by breaking down response by month and binning increases and decreases by base ozone concentration. Figure 8C-48 and Figure 8C-49 show this breakdown for each emissions reduction scenario. This plot clearly shows that ozone increases predominantly occur at lower base ozone concentrations while high modeled base ozone concentrations appear to decrease in almost all cases in the emissions reduction scenarios. The ozone decreases occur more often and are more substantial during the months of June, July, August, and September. The 90% NO_x reduction simulations have few locations with ozone increases than the 50% NO_x reduction simulation however there are a limited number of grid cells in which the ozone increases are larger in the 90% NO_x reduction than in the 50% NO_x reduction simulation. Overall, the distributions of ozone response look similar when VOC reductions are added on top of NO_x reductions, although the NO_x and VOC reduction cases are shifted slightly more toward reducing ozone than the NO_x only reduction cases.

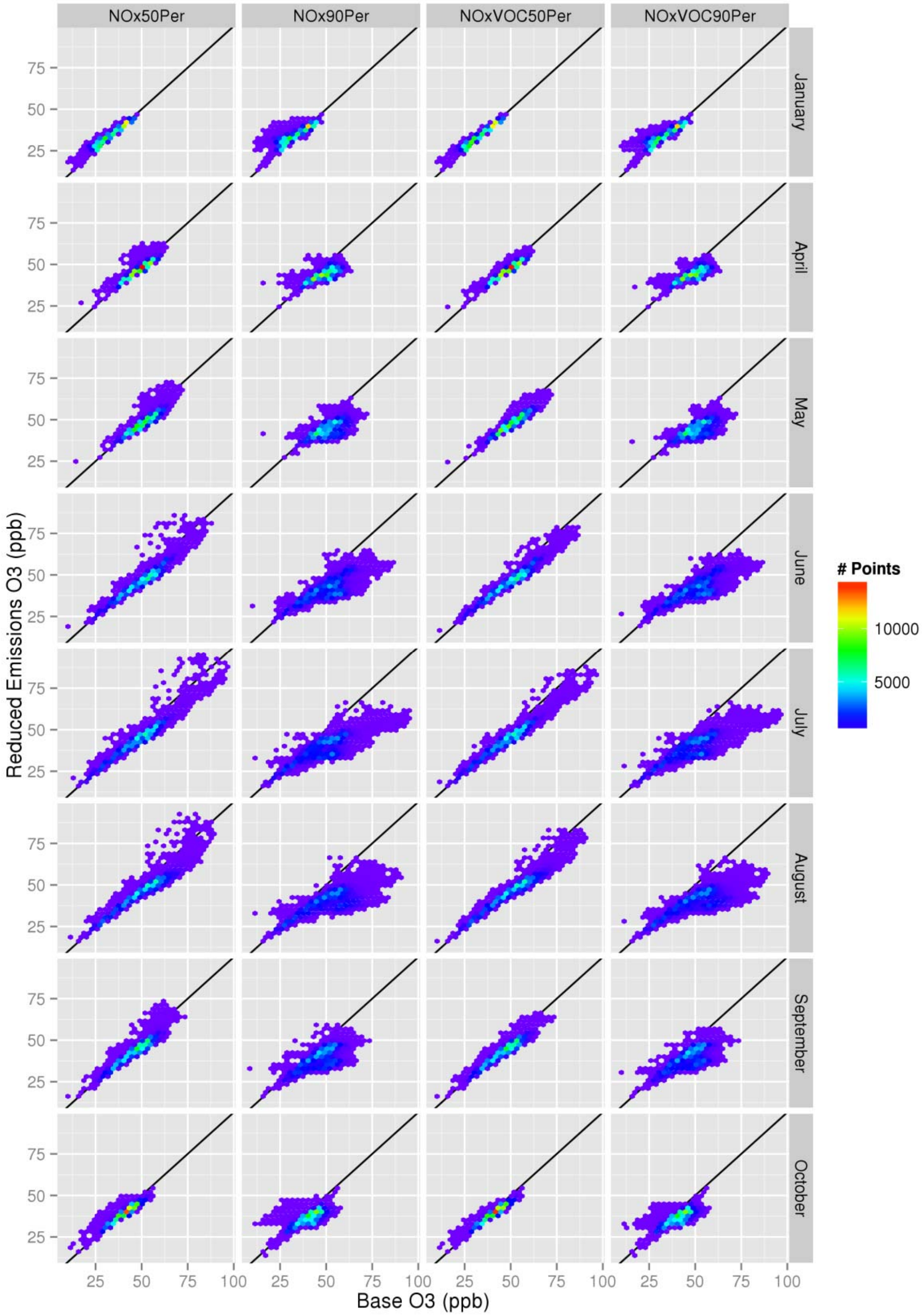

Figure 8C-48. Density scatter plot comparing modeled monthly mean ozone in the 2007 base CMAQ simulation to modeled monthly mean ozone in the emissions reduction CMAQ simulations. Colors depict the number of points occurring at any location on the scatter plot.

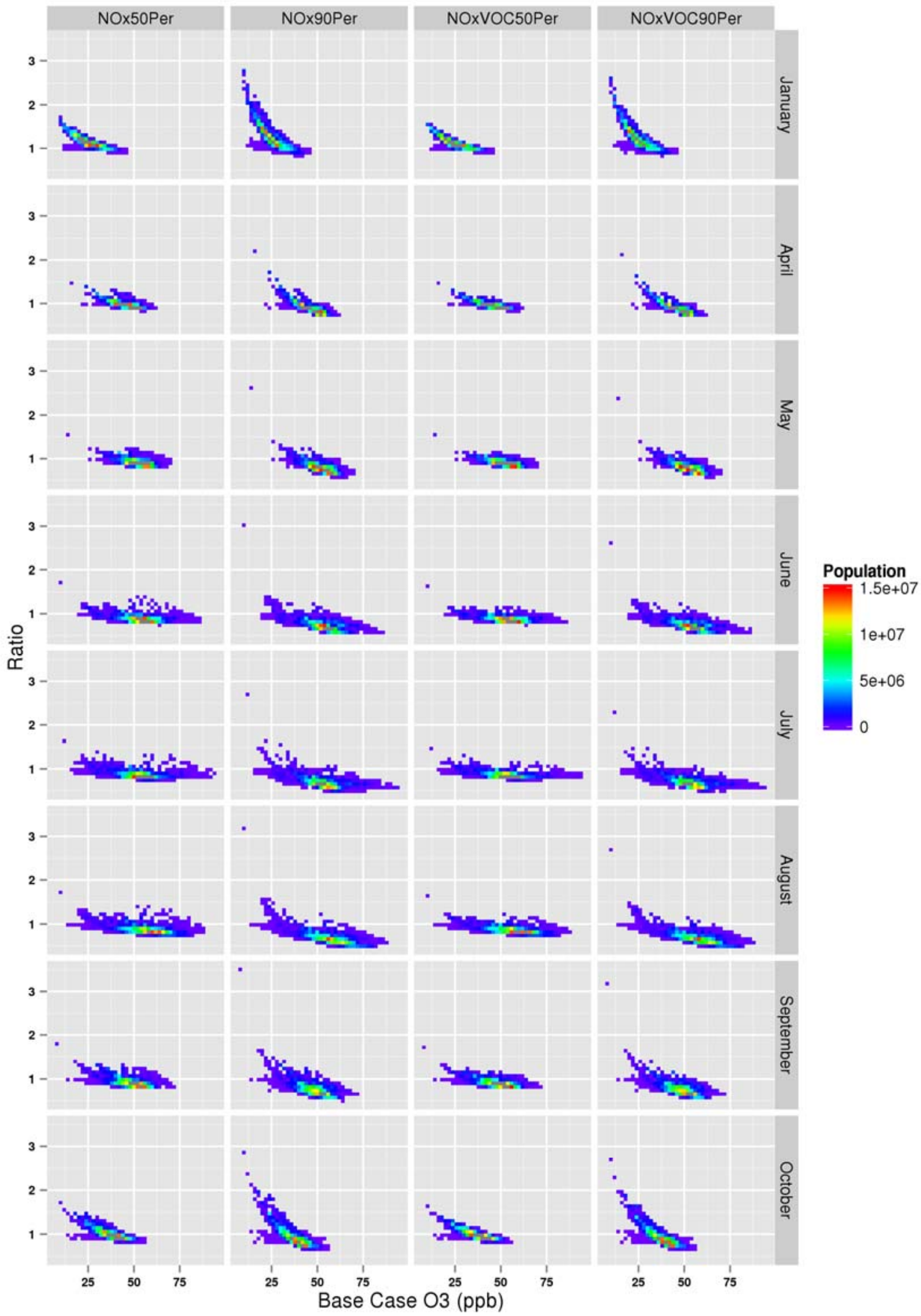

Figure 8C-49. Density scatter plot comparing modeled monthly mean ozone in the 2007 base CMAQ simulation to the relative change in monthly mean ozone from the emissions reduction CMAQ simulations. Relative change is shown as the ratio of ozone in the emissions reduction simulation to ozone in the 2007 base simulation. Colors depict the number of people living in areas that fall at any location on the scatter plot.

8C-2.2. Modeled Ozone Response Paired with Population Data

In addition to maps showing increases and decreases in mean ozone values, the gridded model data were paired with population information to quantify the number of people living in locations where modeled ozone decreased and increased for various time periods. Figure 8C-50 through Figure 8C-60 break down this information by location. These figures show changes in ozone using two different metrics: a relative metric (the ratio of mean ozone in the NO_x reduction CMAQ simulations (50% and 90%) to mean ozone in the 2007 base CMAQ simulation) and an absolute metric (the ppb change in mean ozone from the 2007 base CMAQ simulation to the emissions reduction CMAQ simulations). Note that the maps in the HREA chapter 8 show relative changes while the barplots in chapter 8 show absolute changes.

Figure 8C-50 shows the total population living in areas experiencing different ratios of mean ozone in the NO_x reduction CMAQ simulations (50% and 90%) to mean ozone in the 2007 base CMAQ simulation for the nine NOAA climate regions of the U.S. For each climate region, this information is shown for locations in an urban study area and for locations not in an urban study area. Two regions, the Northwest and the West North Central regions, did not include any urban study areas. Each area is further split out into high and low-mid population density classifications. Values for each month are displayed along the x-axis of each panel. Figure 8C-51 shows the same information for the combined NO_x and VOC reduction scenarios. Although there are more total people living in non- urban study area locations than urban study area locations within each region, the patterns in the two look similar for within each population density classification in each region. It should be noted that for the two regions of the country without an urban study area, the Northwest has larger percentages of their population living in areas where the ratio is > 1 (ozone increases) than most other regions and the West North Central has larger percentages of their population living in areas where the ratio is < 1 (ozone decreases) than most other regions. Figure 8C-52 shows the same information for the 15 urban study areas from all four emissions reduction CMAQ simulations but does not split out high versus low-mid population density locations. Also note that Figure 8C-52 shows breakdowns by percentage of urban study area population rather than by total population so that different urban study areas can more easily be compared.

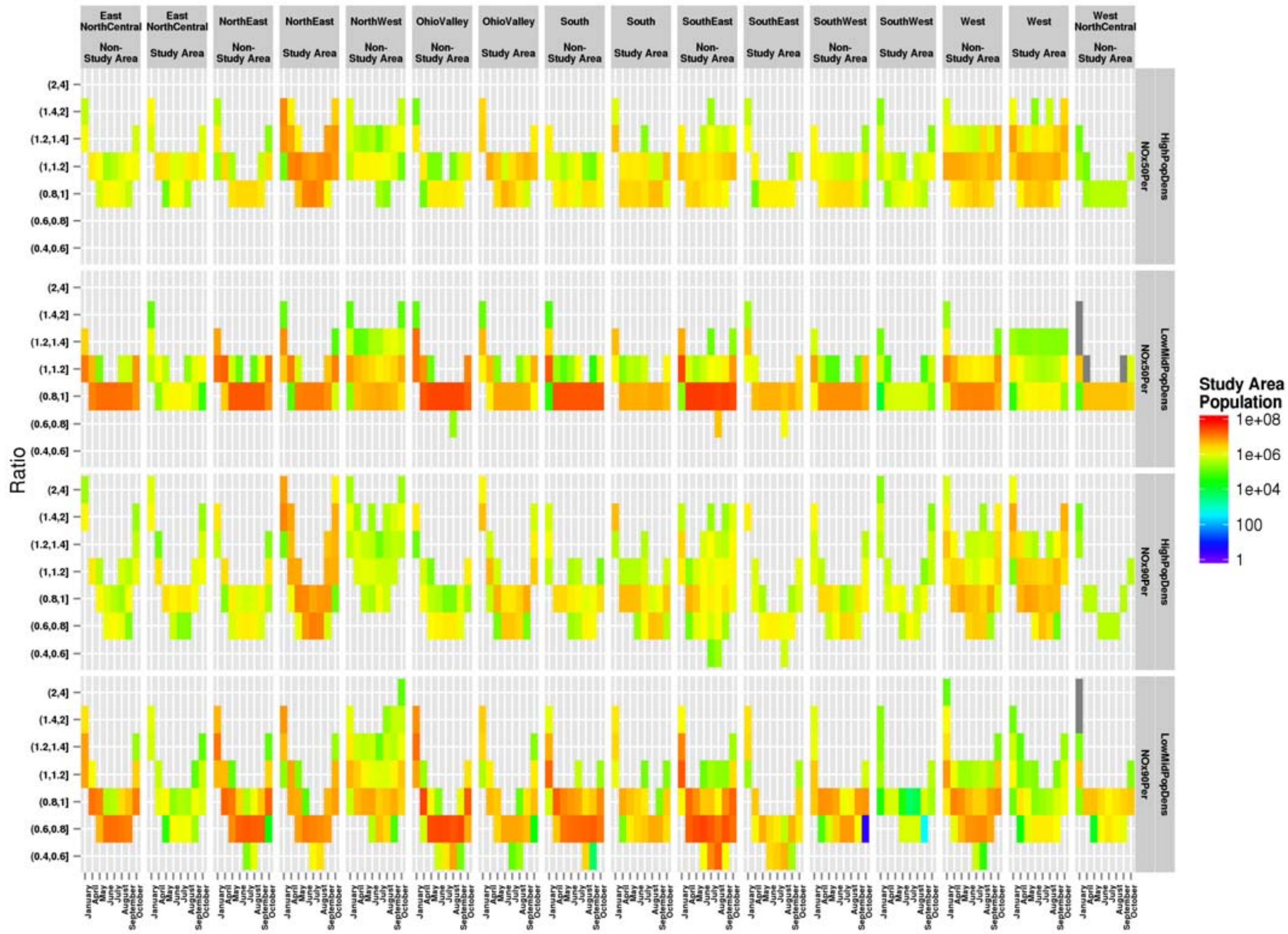

Figure 8C-50. Populations living in locations with various ranges of ratios of monthly mean ozone in the NO_x reduction simulations to monthly mean ozone in the 2007 base CMAQ simulation. Eight different monthly ratios are shown in each panel (January, April-October). Panels split population by 9 climate regions, urban study area vs non-urban study area, urban versus non-urban and 50% NO_x reduction scenario vs 90% NO_x reduction scenario.

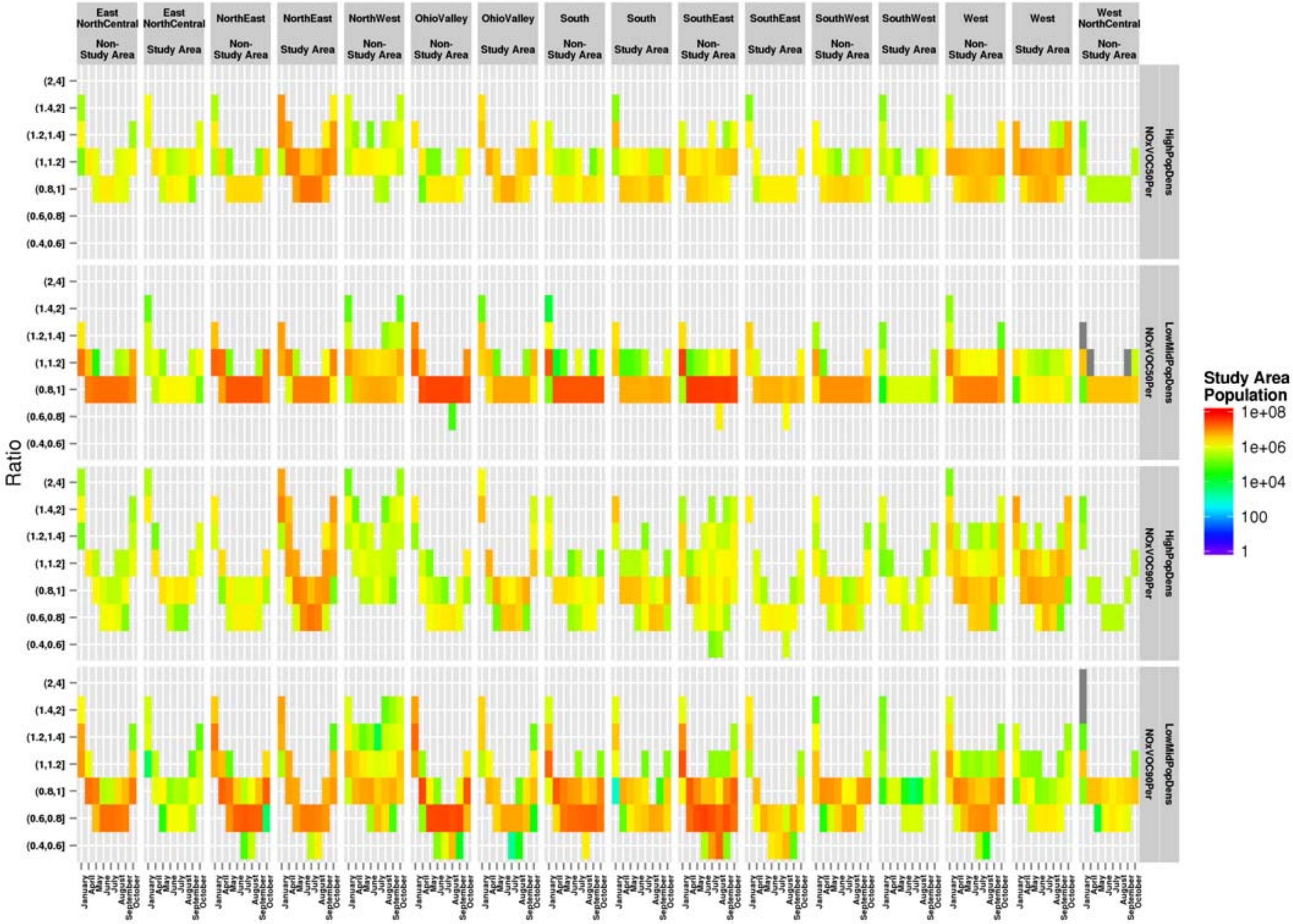

Figure 8C-51. Populations living in locations with various ranges of ratios of monthly mean ozone in the combined NO_x and VOC reduction simulations to monthly mean ozone in the 2007 base CMAQ simulation. Eight different monthly ratios are shown in each panel (January, April-October). Panels split population by 9 climate regions, urban study area vs non-urban study area, urban versus non-urban and 50% NO_x/VOC reduction scenario vs 90% NO_x/VOC reduction scenario.

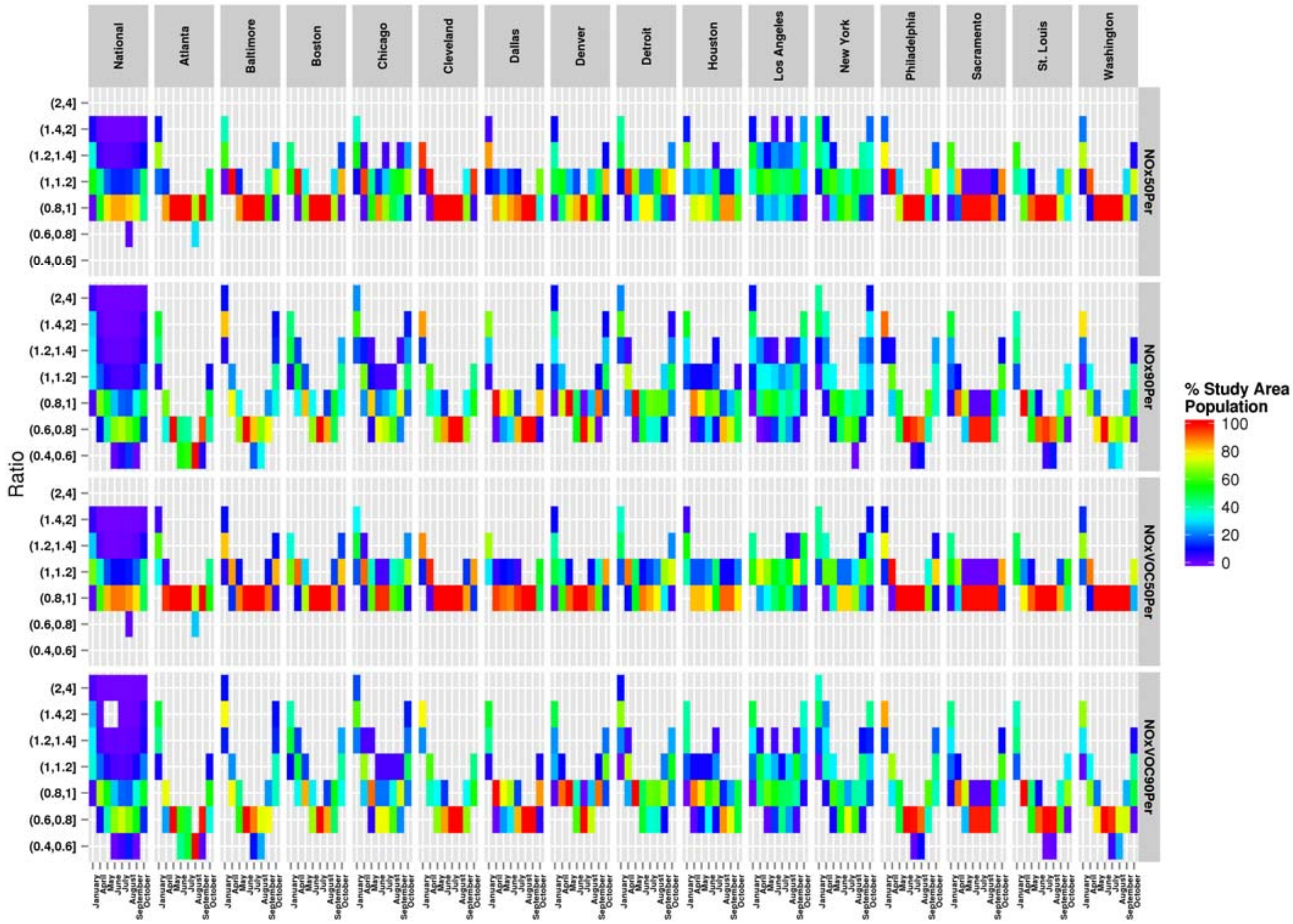

Figure 8C-52. Percent of population living in locations with various ranges of ratios of monthly mean ozone in the four emissions reduction simulations to monthly mean ozone in the 2007 base CMAQ simulation. Eight different monthly ratios are shown in each panel (January, April-October). Panels split population by 15 urban study areas and by four emissions reduction simulations: from top to bottom, 50% NOx reduction, 90% NOx reduction, 50% NOx and VOC reduction, 90% NO_x and VOC reduction.

Section 8.2.3 further examined these ozone ratios using histograms and lumping all urban study areas together and all non- urban study areas together. The main text provided histograms for the NO_x reduction scenarios only. This Appendix provides histograms for all four emission reduction simulations in using both relative and absolute metrics (Figure 8C-53 through Figure 8C-60). These figures show that the breakdown of people living in locations of increasing versus decreasing ozone for various monthly and seasonal time-periods does not change much between the NO_x reduction scenarios and the equivalent NO_x and VOC reduction scenarios. Table 8C-1 provides the numbers going into the 50% NO_x reduction and 90% NOx reduction histograms. Table 8C-2 and Table 8C-3 break down the April-October seasonal mean ozone results by two further classification schemes: high versus low-mid population density locations and by the 15 urban study areas.

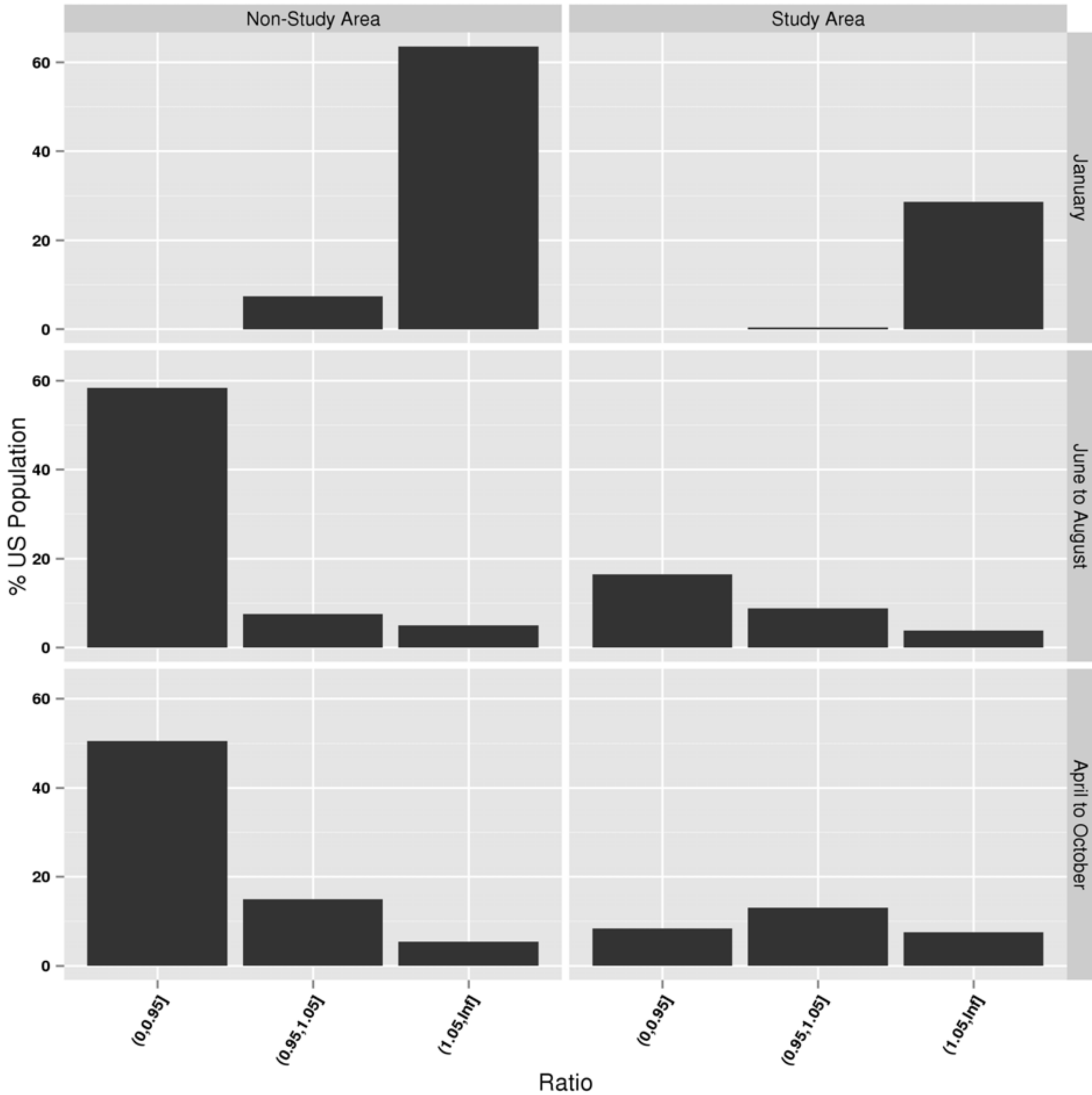

Figure 8C-53. Histograms of US population living in locations with increasing and decreasing mean ozone. Values on the x-axis represent the ratio of mean ozone in the 50% NO_x cut CMAQ simulation to the mean ozone in the 2007 base CMAQ simulation. The percentages of the US population living in areas that have ratios less than 0.95, from 0.95 to 1.05 and greater than 1.05 are shown on the y-axis. Left plots show population numbers in locations not included in one of the urban study areas while right plots show population numbers in locations included in one of the urban study areas. Top plots show ratios of January monthly mean ozone, middle plots show ratios of season mean June-August ozone, and bottom plots show ratios of seasonal mean April-October ozone.

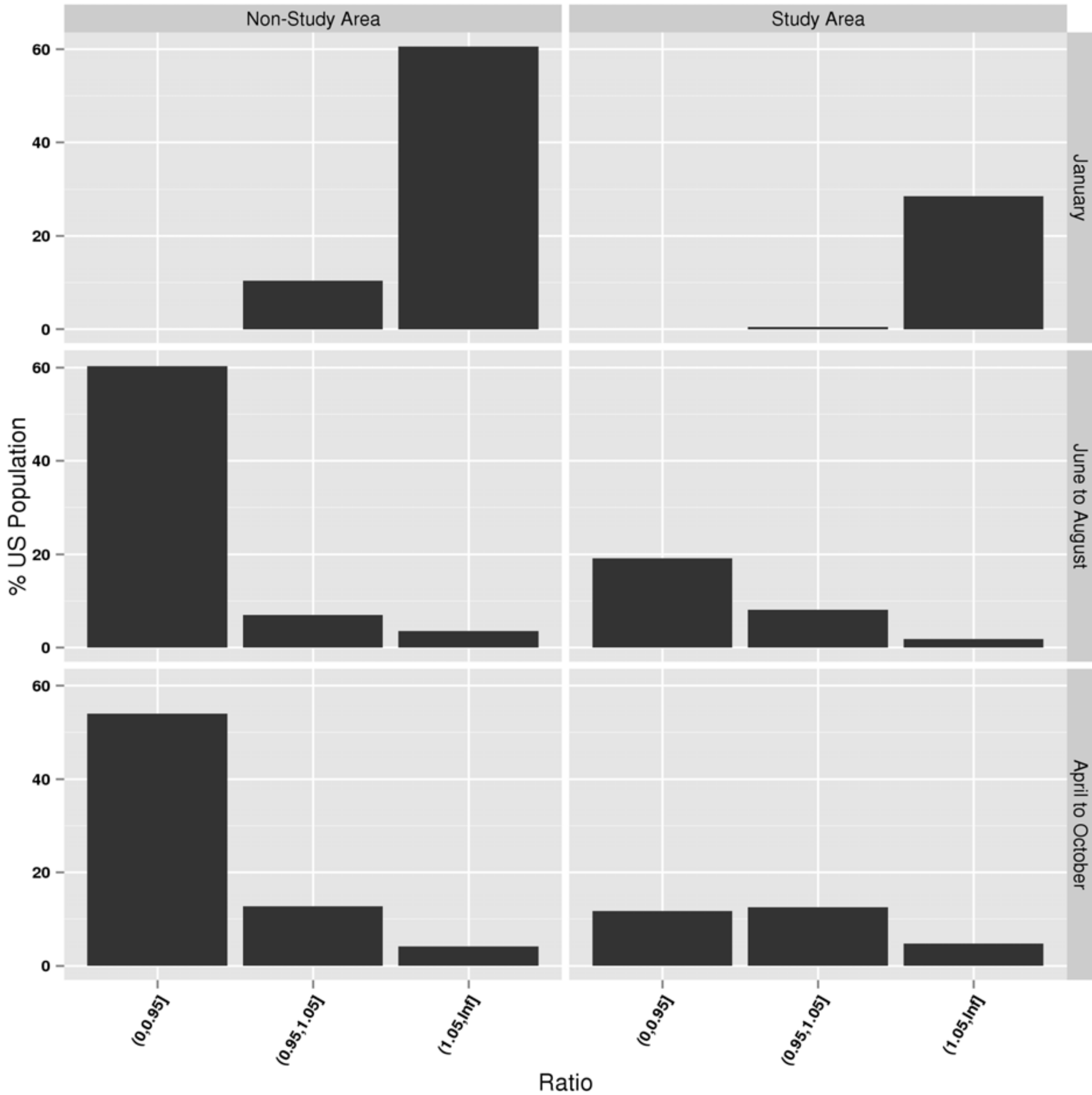

Figure 8C-54. Histograms of US population living in locations with increasing and decreasing mean ozone. Values on the x-axis represent the ratio of mean ozone in the 50% NO_x and VOC cut CMAQ simulation to the mean ozone in the 2007 base CMAQ simulation. The percentages of the US population living in areas that have ratios less than 0.95, from 0.95 to 1.05 and greater than 1.05 are shown on the y-axis. Left plots show population numbers in locations not included in one of the urban study areas while right plots show population numbers in locations included in one of the urban study areas. Top plots show ratios of January monthly mean ozone, middle plots show ratios of season mean June-August ozone, and bottom plots show ratios of seasonal mean April-October ozone.

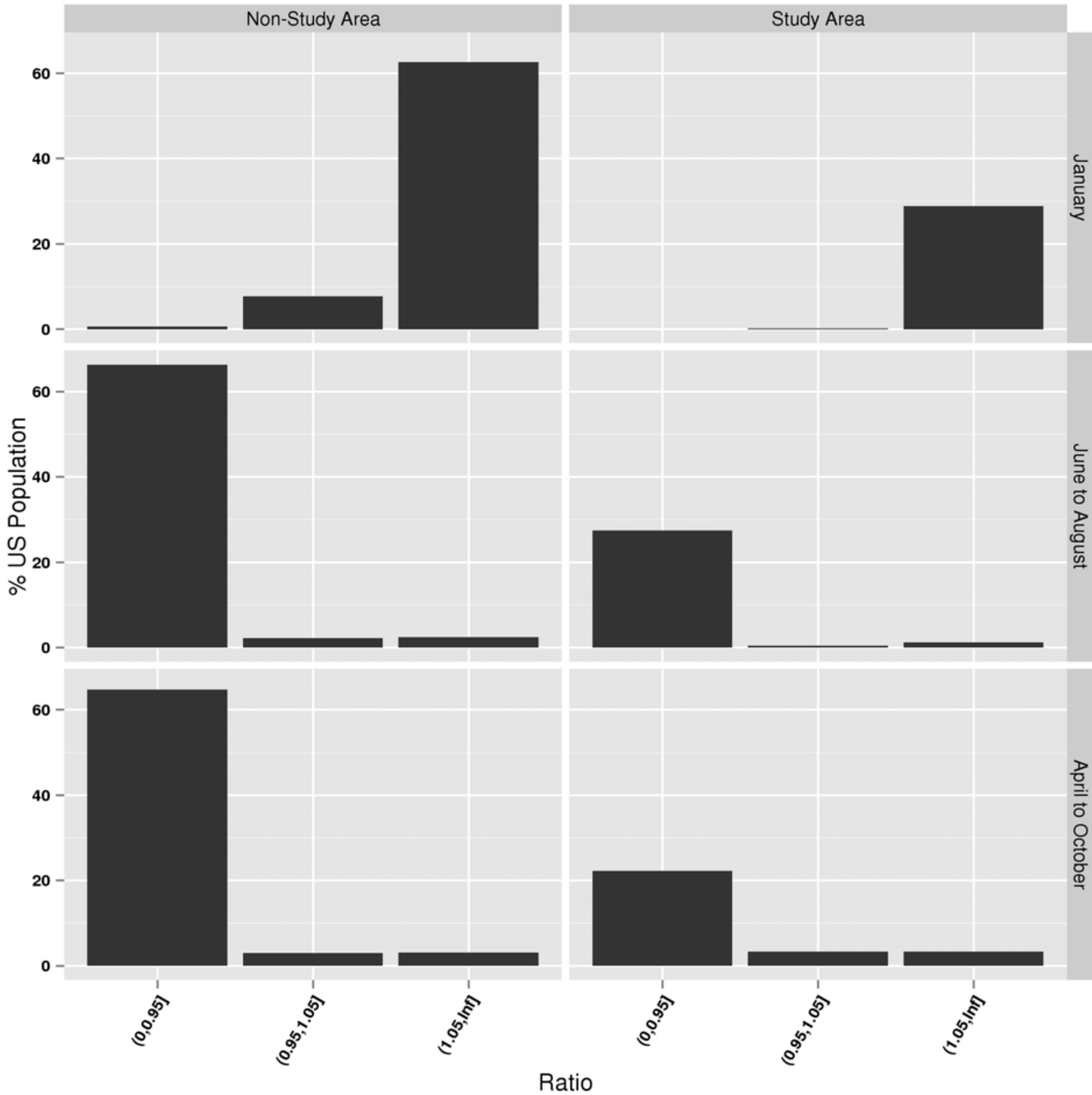

Figure 8C-55. Histograms of US population living in locations with increasing and decreasing mean ozone. Values on the x-axis represent the ratio of mean ozone in the 90% NO_x cut CMAQ simulation to the mean ozone in the 2007 base CMAQ simulation. The percentages of the US population living in areas that have ratios less than 0.95, from 0.95 to 1.05 and greater than 1.05 are shown on the y-axis. Left plots show population numbers in locations not included in one of the urban study areas while right plots show population numbers in locations included in one of the urban study areas. Top plots show ratios of January monthly mean ozone, middle plots show ratios of season mean June-August ozone, and bottom plots show ratios of seasonal mean April-October ozone.

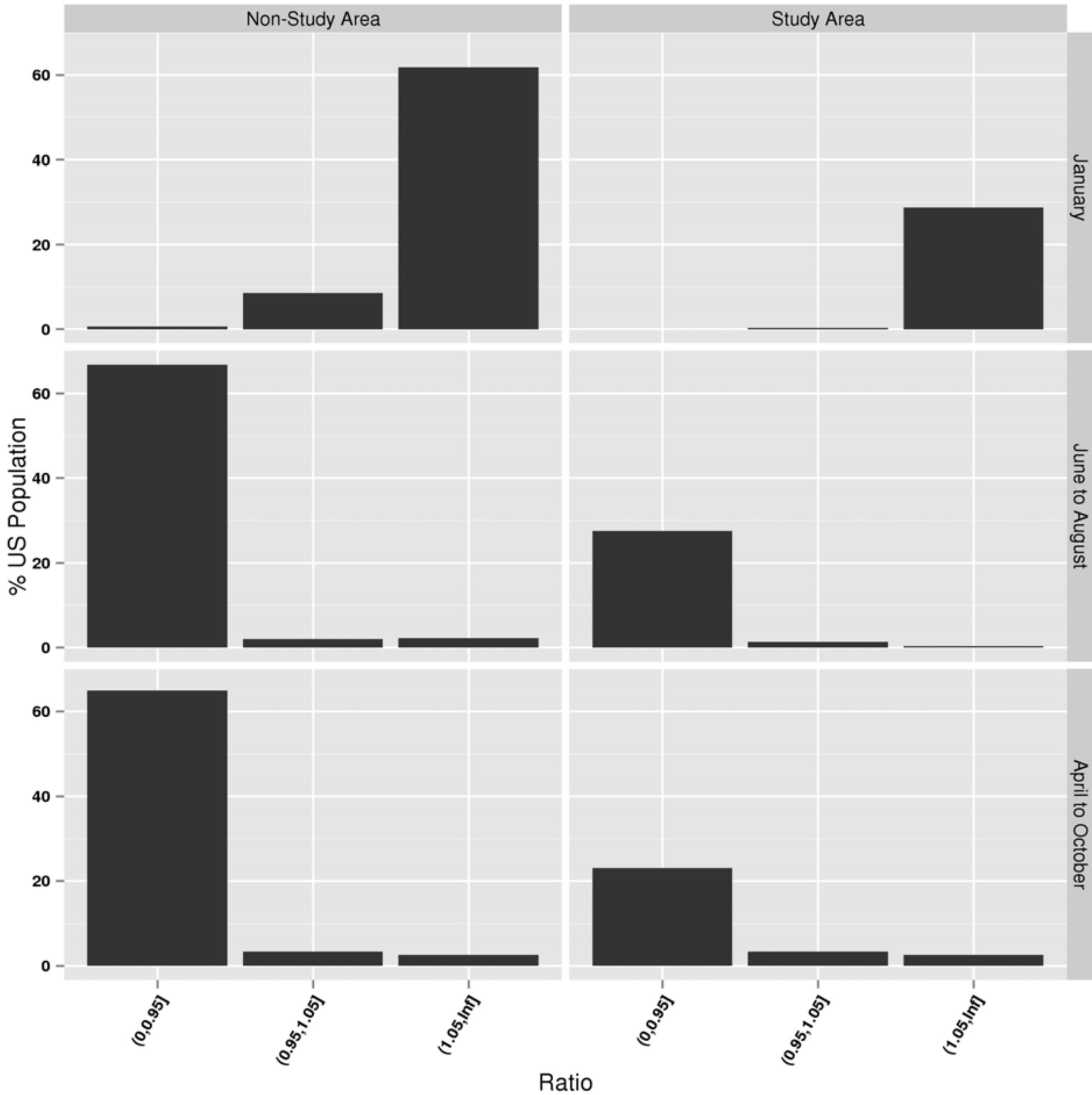

Figure 8C-56. Histograms of US population living in locations with increasing and decreasing mean ozone. Values on the x-axis represent the ratio of mean ozone in the 90% NO_x and VOC cut CMAQ simulation to the mean ozone in the 2007 base CMAQ simulation. The percentages of the US population living in areas that have ratios less than 0.95, from 0.95 to 1.05 and greater than 1.05 are shown on the y-axis. Left plots show population numbers in locations not included in one of the urban study areas while right plots show population numbers in locations included in one of the urban study areas. Top plots show ratios of January monthly mean ozone, middle plots show ratios of season mean June-August ozone, and bottom plots show ratios of seasonal mean April-October ozone.

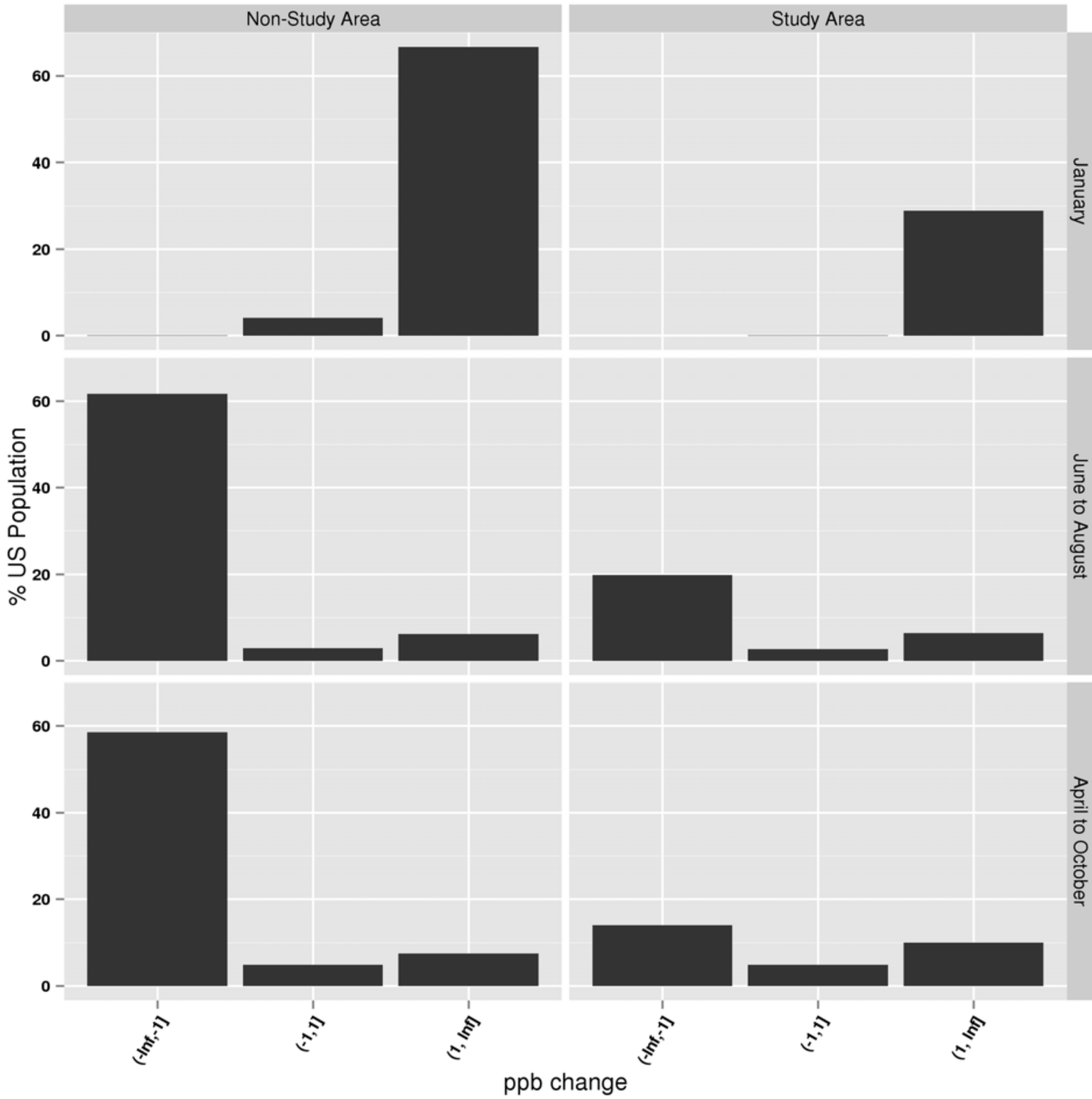

Figure 8C-57. Histograms of US population living in locations with increasing and decreasing mean ozone. Values on the x-axis represent the absolute (ppb) change of mean ozone from the 2007 base CMAQ simulation to the 50% NO_x cut CMAQ simulation to the mean ozone in the 2007 base CMAQ simulation. The percentages of the US population living in areas that have changes less than -1 ppb, between -1 and +1 ppb and greater than +1 ppb are shown on the y-axis. Left plots show population numbers in locations not included in one of the urban study areas while right plots show population numbers in locations included in one of the urban study areas. Top plots show ratios of January monthly mean ozone, middle plots show ratios of season mean June-August ozone, and bottom plots show ratios of seasonal mean April-October ozone.

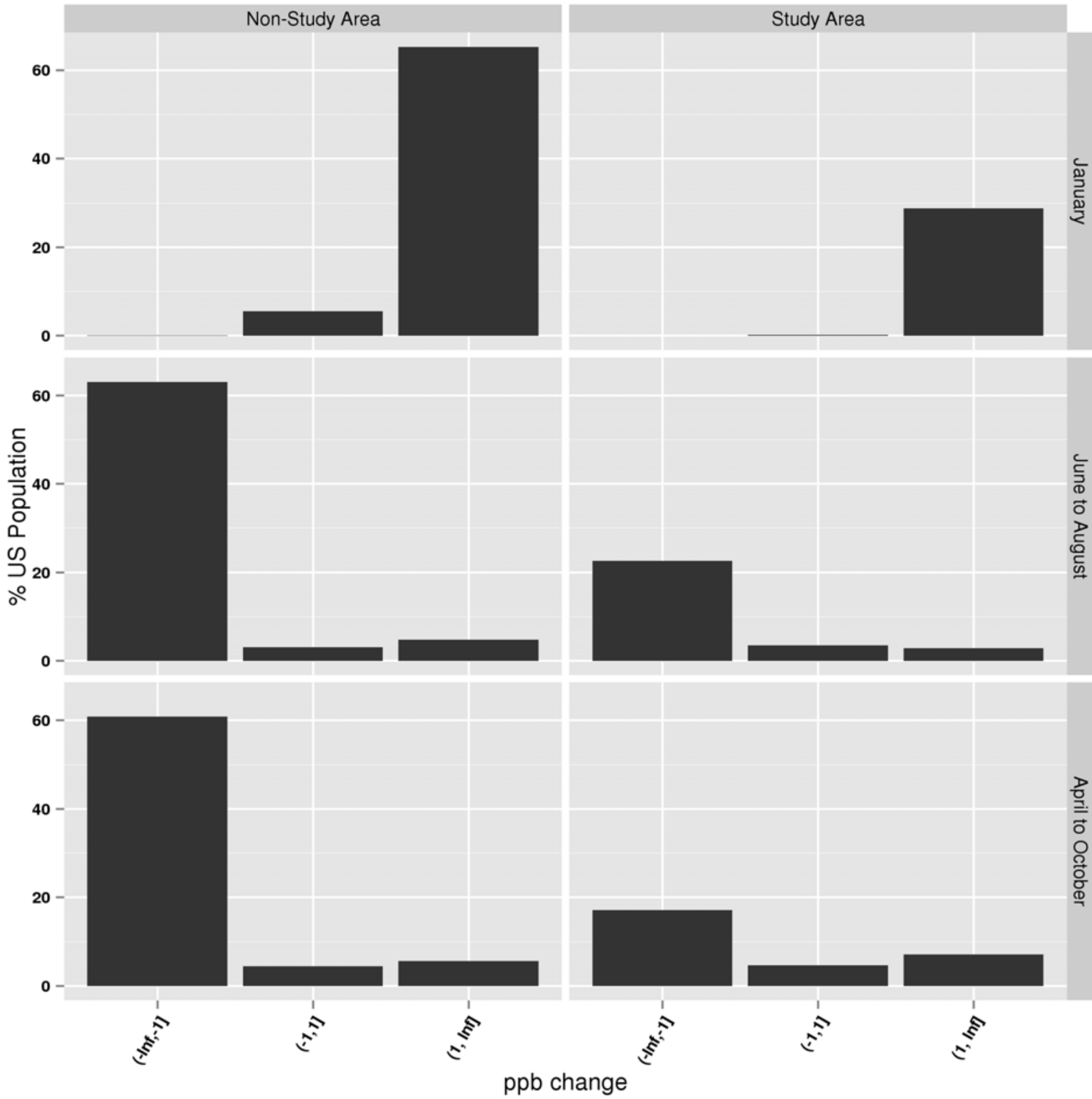

Figure 8C-58. Histograms of US population living in locations with increasing and decreasing mean ozone. Values on the x-axis represent the absolute (ppb) change of mean ozone from the 2007 base CMAQ simulation to the 50% NO_x and VOC cut CMAQ simulation to the mean ozone in the 2007 base CMAQ simulation. The percentages of the US population living in areas that have changes less than -1 ppb, between -1 and +1 ppb and greater than +1 ppb are shown on the y-axis. Left plots show population numbers in locations not included in one of the urban study areas while right plots show population numbers in locations included in one of the urban study areas. Top plots show ratios of January monthly mean ozone, middle plots show ratios of season mean June-August ozone, and bottom plots show ratios of seasonal mean April-October ozone.

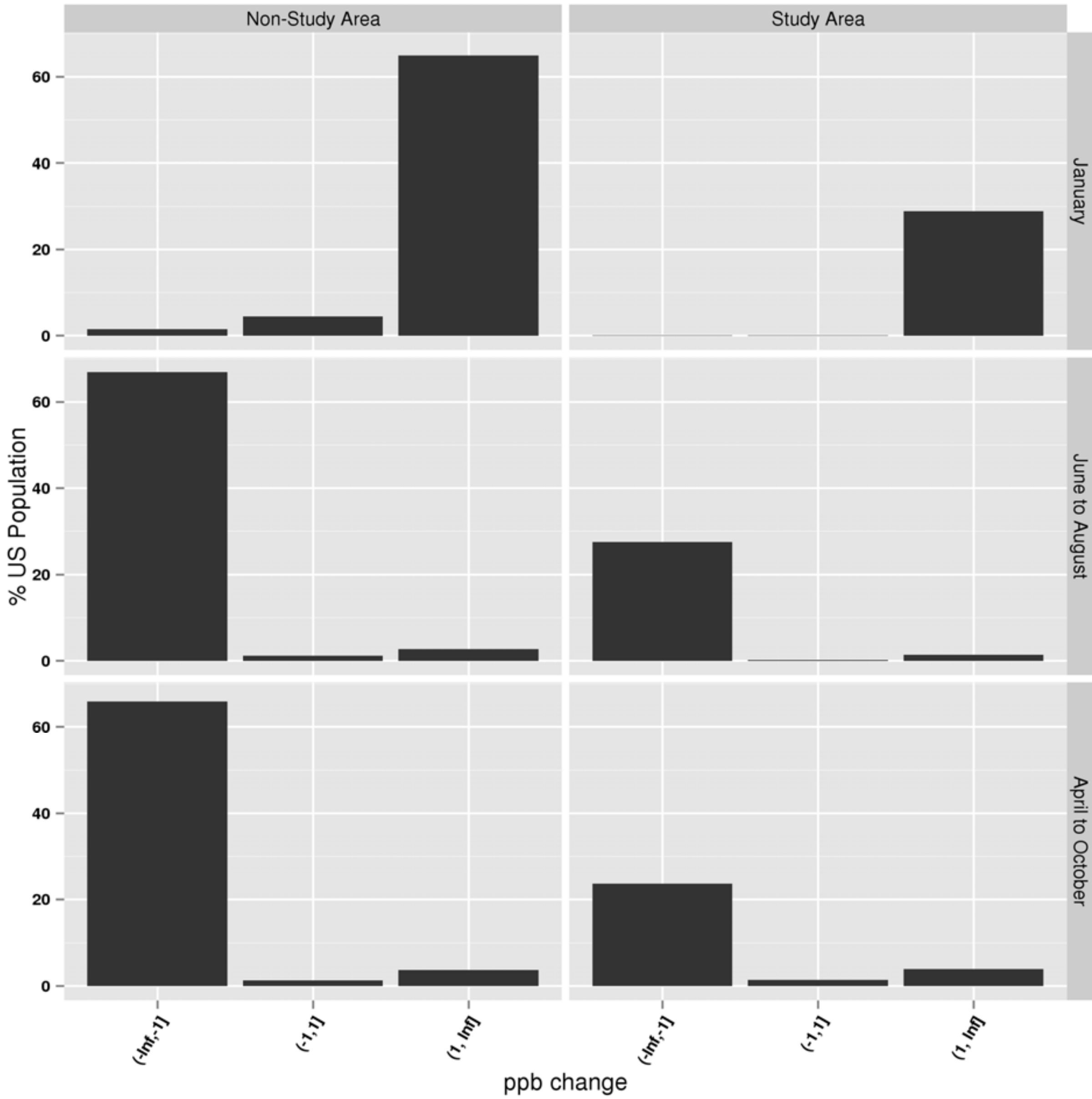

Figure 8C-59. Histograms of US population living in locations with increasing and decreasing mean ozone. Values on the x-axis represent the absolute (ppb) change of mean ozone from the 2007 base CMAQ simulation to the 90% NO_x cut CMAQ simulation to the mean ozone in the 2007 base CMAQ simulation. The percentages of the US population living in areas that have changes less than -1 ppb, between -1 and +1 ppb and greater than +1 ppb are shown on the y-axis. Left plots show population numbers in locations not included in one of the urban study areas while right plots show population numbers in locations included in one of the urban study areas. Top plots show ratios of January monthly mean ozone, middle plots show ratios of season mean June-August ozone, and bottom plots show ratios of seasonal mean April-October ozone.

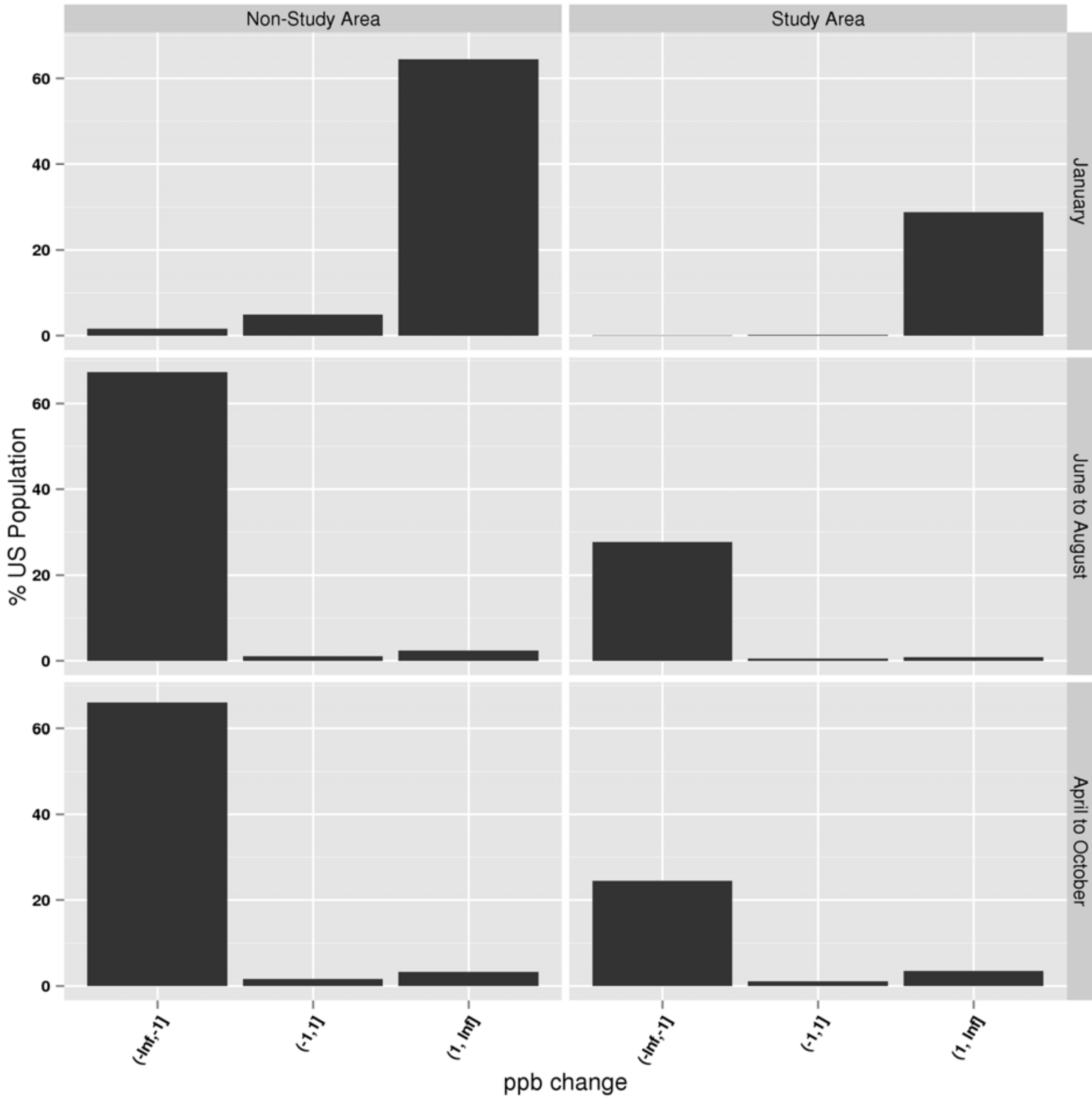

Figure 8C-60. Histograms of US population living in locations with increasing and decreasing mean ozone. Values on the x-axis represent the absolute (ppb) change of mean ozone from the 2007 base CMAQ simulation to the 90% NO_x and VOC cut CMAQ simulation to the mean ozone in the 2007 base CMAQ simulation. The percentages of the US population living in areas that have changes less than -1 ppb, between -1 and +1 ppb and greater than +1 ppb are shown on the y-axis. Left plots show population numbers in locations not included in one of the urban study areas while right plots show population numbers in locations included in one of the urban study areas. Top plots show ratios of January monthly mean ozone, middle plots show ratios of season mean June-August ozone, and bottom plots show ratios of seasonal mean April-October ozone.

Table 8C-1. Percentage of US population living in locations with increasing and decreasing mean ozone for the 50% NO_x reduction and 90% NO_x reductions CMAQ simulations broken down by different seasonal and monthly time periods.

		50% NO_x Reduction			90% NO_x Reduction		
	Ratio	Study Area	Non Study Area	US	Study Area	Non Study Area	US
January	<0.95	0.0	0.0	0.0	0.0	0.6	0.6
	0.95-0.96	0.0	0.0	0.0	0.0	0.3	0.3
	0.96-0.97	0.0	0.0	0.0	0.0	0.3	0.3
	0.97-0.98	0.1	0.1	0.1	0.0	0.5	0.5
	0.98-0.99	0.0	0.4	0.4	0.0	0.7	0.7
	0.99-1.00	0.0	0.7	0.7	0.0	0.7	0.8
	1.00-1.01	0.0	0.9	1.0	0.0	0.8	0.8
	1.01-1.02	0.0	1.1	1.1	0.0	0.8	0.8
	1.02-1.03	0.0	1.1	1.2	0.0	1.0	1.1
	1.03-1.04	0.1	1.4	1.5	0.0	1.2	1.2
	1.04-1.05	0.2	1.7	1.9	0.0	1.3	1.3
	>1.05	28.7	63.6	92.3	28.9	62.6	91.5
April-October	<0.95	8.4	50.6	59.0	22.3	64.7	87.0
	0.95-0.96	2.1	3.6	5.7	0.5	0.2	0.8
	0.96-0.97	1.7	2.8	4.5	0.6	0.6	1.2
	0.97-0.98	1.7	1.9	3.7	0.2	0.5	0.7
	0.98-0.99	1.4	1.6	3.0	0.5	0.2	0.6
	0.99-1.00	1.5	1.4	2.9	0.5	0.2	0.8
	1.00-1.01	0.8	0.7	1.5	0.2	0.5	0.6
	1.01-1.02	1.1	0.7	1.8	0.2	0.2	0.3
	1.02-1.03	0.8	0.9	1.7	0.2	0.3	0.5
	1.03-1.04	1.1	0.5	1.6	0.4	0.3	0.7
	1.04-1.05	0.7	0.7	1.4	0.1	0.2	0.3
	>1.05	7.6	5.5	13.1	3.4	3.2	6.6
June-August	<0.95	16.4	58.4	74.8	27.4	66.3	93.7
	0.95-0.96	1.1	1.6	2.7	0.1	0.3	0.4
	0.96-0.97	1.1	0.9	1.9	0.0	0.3	0.3
	0.97-0.98	1.1	1.1	2.1	0.0	0.3	0.4
	0.98-0.99	1.0	0.9	1.8	0.0	0.2	0.2
	0.99-1.00	1.1	0.7	1.8	0.0	0.2	0.2
	1.00-1.01	0.5	0.6	1.1	0.1	0.3	0.4
	1.01-1.02	0.7	0.5	1.2	0.1	0.2	0.3
	1.02-1.03	0.5	0.5	0.9	0.0	0.0	0.1
	1.03-1.04	0.6	0.4	1.0	0.0	0.2	0.2
	1.04-1.05	1.3	0.4	1.7	0.1	0.0	0.2
	>1.05	3.8	5.0	8.8	1.2	2.4	3.7

Table 8C-2. Percentage of US population living in locations with increasing and decreasing April-October seasonal mean ozone in the 50% NO_x reduction and 90% NOx reduction CMAQ simulations broken down by high and low-mid population density areas.

		50% NO_x Reduction			90% NO_x Reduction		
	Ratio	Study Area	Non Study Area	US	Study Area	Non Study Area	US
High population density	<0.95	0.8	1.7	2.5	9.8	6.7	16.5
	0.95-0.96	0.6	0.7	1.3	0.5	0.1	0.6
	0.96-0.97	0.8	0.6	1.4	0.6	0.4	1.0
	0.97-0.98	0.9	0.5	1.5	0.2	0.3	0.5
	0.98-0.99	0.9	0.6	1.6	0.5	0.1	0.6
	0.99-1.00	1.1	0.7	1.8	0.5	0.1	0.6
	1.00-1.01	0.7	0.3	1.0	0.2	0.3	0.5
	1.01-1.02	0.9	0.4	1.3	0.2	0.1	0.2
	1.02-1.03	0.7	0.7	1.4	0.2	0.1	0.3
	1.03-1.04	1.0	0.3	1.3	0.4	0.2	0.6
	1.04-1.05	0.7	0.5	1.1	0.1	0.1	0.1
	>1.05	7.3	3.8	11.1	3.4	2.3	5.7
Low-Mid population density	<0.95	7.6	48.9	56.5	12.5	58.1	70.6
	0.95-0.96	1.5	3.0	4.5	0.1	0.2	0.2
	0.96-0.97	0.9	2.1	3.1	0.0	0.1	0.1
	0.97-0.98	0.8	1.4	2.2	0.0	0.2	0.2
	0.98-0.99	0.5	0.9	1.4	0.0	0.1	0.1
	0.99-1.00	0.4	0.7	1.1	0.0	0.1	0.1
	1.00-1.01	0.1	0.4	0.5	0.0	0.1	0.2
	1.01-1.02	0.2	0.3	0.5	0.0	0.1	0.1
	1.02-1.03	0.1	0.3	0.3	0.0	0.1	0.1
	1.03-1.04	0.1	0.2	0.3	0.0	0.1	0.1
	1.04-1.05	0.0	0.2	0.3	0.0	0.1	0.1
	>1.05	0.3	1.7	2.0	0.0	0.8	0.9

Table 8C-3. Percentage of U.S. population living in locations with increasing and decreasing April-October seasonal mean ozone in the 50% NO_x reduction and 90% NO_x reduction CMAQ simulations broken down by 15 urban study areas.

		Ratio of April-October seasonal mean ozone in reduced emissions CMAQ simulation to April-October seasonal mean ozone in base 2007 CMAQ simulation											
Scenario	**Study Area**	**0-0.95**	**0.95-0.96**	**0.96-0.97**	**0.97-0.98**	**0.98-0.99**	**0.99-1.00**	**1.00-1.01**	**1.01-1.02**	**1.02-1.03**	**1.03-.04**	**1.04-1.05**	**>1.05**
50% NO_x reduction	Not in Study Area	50.6	3.6	2.8	1.9	1.6	1.4	0.7	0.7	0.9	0.5	0.7	5.5
	Atlanta	1.6	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Baltimore	0.4	0.0	0.2	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.0
	Boston	0.4	0.2	0.1	0.1	0.1	0.1	0.0	0.2	0.0	0.0	0.2	0.0
	Chicago	0.5	0.1	0.2	0.2	0.3	0.1	0.1	0.2	0.0	0.2	0.1	0.9
	Cleveland	0.2	0.1	0.1	0.0	0.1	0.1	0.0	0.1	0.0	0.0	0.0	0.0
	Dallas	1.0	0.4	0.2	0.1	0.1	0.1	0.0	0.1	0.0	0.0	0.0	0.0
	Denver	0.1	0.2	0.1	0.0	0.1	0.1	0.0	0.1	0.1	0.0	0.0	0.1
	Detroit	0.1	0.1	0.1	0.0	0.1	0.1	0.0	0.1	0.2	0.2	0.1	0.3
	Houston	0.8	0.1	0.0	0.2	0.1	0.1	0.1	0.0	0.1	0.1	0.1	0.2
	Los Angeles	0.2	0.1	0.1	0.0	0.0	0.4	0.0	0.1		0.2	0.0	2.8
	New York	0.5	0.3	0.3	0.2	0.2	0.3	0.1	0.2	0.2	0.1	0.1	3.4
	Philadelphia	0.7	0.1	0.2	0.3	0.2	0.2	0.1	0.0	0.2	0.2	0.0	0.0
	Sacramento	0.2	0.2	0.0	0.1	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0
	St. Louis	0.6	0.1	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
	Washington	1.1	0.1	0.2	0.2	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0
90% NO_x reduction	Not in Study Area	64.7	0.2	0.6	0.5	0.2	0.2	0.5	0.2	0.3	0.3	0.2	3.2
	Atlanta	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Baltimore	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Boston	1.2	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Chicago	2.4	0.0	0.3	0.0	0.1	0.3	0.0	0.0	0.0	0.0	0.0	0.1
	Cleveland	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Dallas	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Denver	0.7	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Detroit	1.0	0.1	0.0	0.0	0.1	0.0	0.1	0.1	0.1	0.0	0.0	0.0
	Houston	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0
	Los Angeles	1.7	0.1	0.2	0.1	0.0	0.2	0.1	0.1	0.0	0.2	0.0	1.4
	New York	3.2	0.3	0.0	0.0	0.3	0.1	0.0	0.0	0.0	0.2	0.0	1.9
	Philadelphia	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Sacramento	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	St. Louis	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Washington	1.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

APPENDIX 9A

Figures Summarizing Exposure and Lung-Function Risk Estimates for Sub-Regions of Each Study Area (Urban Core, Outer Ring, and Total Exposure Region)

List of Figures

OVERVIEW

Simulated populations within different sub-regions of a given urban study area may have different exposure and lung-function risk distributions reflecting potential differences both in their patterns of behavior (e.g., commuting patterns, outdoor activities) as well as differences in the spatio-temporal ambient ozone fields estimated for each sub-region. To explore potential spatial heterogeneity in both the exposure and lung-function risk estimates, we have completed a stratified analysis of risk for both of these assessments. These stratified analysis consider two sub-regions within each study area including: (a) a smaller urban core sub-area matching that used in the Smith et al., 2009 epidemiology study providing the effect estimates used in modeling short-term exposure-based mortality risk and (b) the outer ring reflecting the remainder of the larger study area used in the exposure and lung-function assessment (excluding the core urban area). In presenting risk estimates based on these two sub-regions, we also include risk estimates based on the entire exposure model urban study area for completeness.

Generating these sub-region risk estimates is relatively straight-forward. As part of our standard APEX output for the exposure and lung function risk estimates summarized in Chapters 5 and 6 respectively, limited exposure and FEV_1 results are retained for each simulated person including their daily maximum 1-hour ozone exposure and counts per ozone season of each time a simulated person experienced an FEV_1 decrement (10%, 15%, and 20%). Also retained is the location of their home census tract (and corresponding location of ambient concentration source used for calculating exposures) within the larger study areas used in the exposure and lung-function analyses. To generate the sub-region estimates, we subset these broader study area exposure and FEV_1 risk results into two sets of exposure results for each of 12 study areas: one containing those persons residing within the urban core and the other containing persons residing in the outer ring outside the urban core. In addition, two years of data were evaluated for the 12 study areas (2007 and 2009), matching the two years for which short term mortality risks were estimated. In generating these sub-region estimates, we focused on the 12 urban study areas used in the epidemiology-based risk assessment to allow these stratified results to be compared alongside the urban core and CBSA-based estimates generated as part of the epidemiological-based risk assessment.

In summarizing these risk estimates, we first focus on the exposure estimates (Figures 9A-1 through 9A-12), including the percent of all simulated individuals experiencing 1-hour exposure at or above each specified benchmark (see Chapter 5 for additional detail on this risk metric). Estimates are presented for both 2007 and 2009 within each figure. In order to compare, for example, exposure estimates (based on the 60 ppb benchmark) for the urban core between current conditions and the current standard for 2007, we would compare the darker blue column for *urb_122_base_07* with the darker blue column for *urb_122_75_07*.

After presenting the exposure estimates, we then present lung-function estimates (Figures 9A-13 through 9A-24) including percent of all simulated individuals experiencing at least one FEV_1 decrement of 10, 15, or 20% (see Chapter 6 for additional detail on this risk metric). Estimates are presented for both 2007 and 2009 within each figure. In order to compare, for example, exposure estimates (based on the 20 percent FEV1 decrement) for the urban core between current conditions and the current standard for 2007, we would compare the light tan column for *urb_122_base_07* with the light tan column for *urb_122_75_07*.

Generally for both the exposure and lung-function risk estimates, we see either a pattern of risk reduction or no change in risk when we look across air quality scenarios (recent conditions – current standard – alternative standard 70 ppb) for a given sub-region (i.e., urban core, outer ring or total combined area). Note however, that in one case (Boston for 2009 for the urban sub-region) we do see a slight risk increase for both exposure and lung function risk (see Figure 9A-3 and 9A-15, respectively). When we compare patterns of risk reduction for the urban core and outer ring (across urban study areas), we generally see larger degrees of risk reduction for the outer rings. This may reflect two factors: (a) design monitors (targeted for ozone reductions under simulated attainment of the current and alternative standard levels) tend to be located in the outer ring and consequently ozone levels near these monitors are likely to experience greater degrees of reduction and (b) there may be a degree of dampening of risk reduction in the urban core reflecting the non-linear nature of ozone formation which can result in increase in ozone on lower ozone days following simulation of both current and alternative standard levels (see section 7.1.1 for additional discussion).

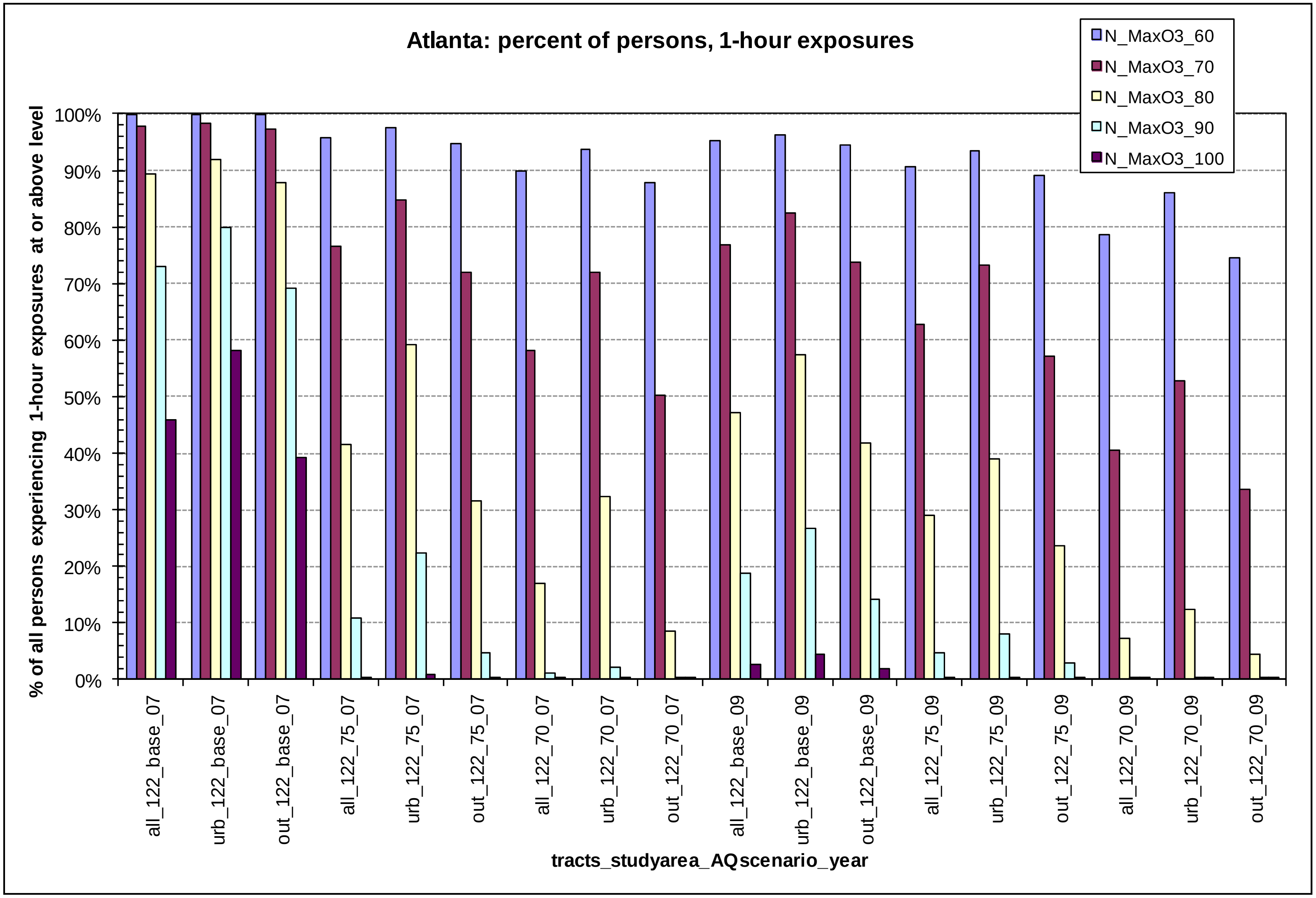

Figure 9A-1. Exposure Risk Estimates – Percent of Person with 1-Hour Exposures at or Above Benchmarks. (Spatially stratified: all study area, urban study area, outer study area) (Atlanta).

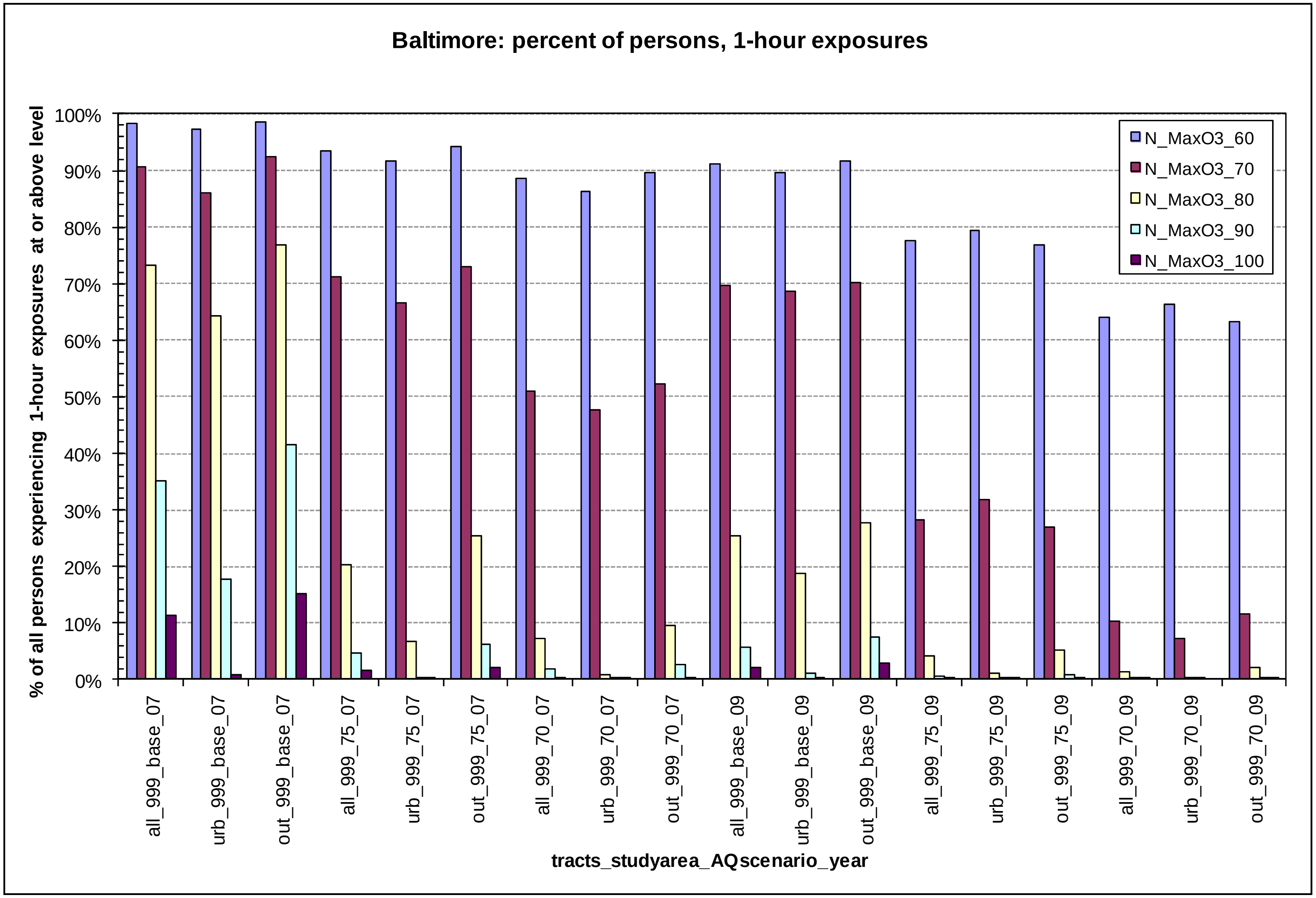

Figure 9A-2. Exposure Risk Estimates – Percent of Person with 1-Hour Exposures at or Above Benchmarks. (Spatially stratified: all study area, urban study area, outer study area) (Baltimore).

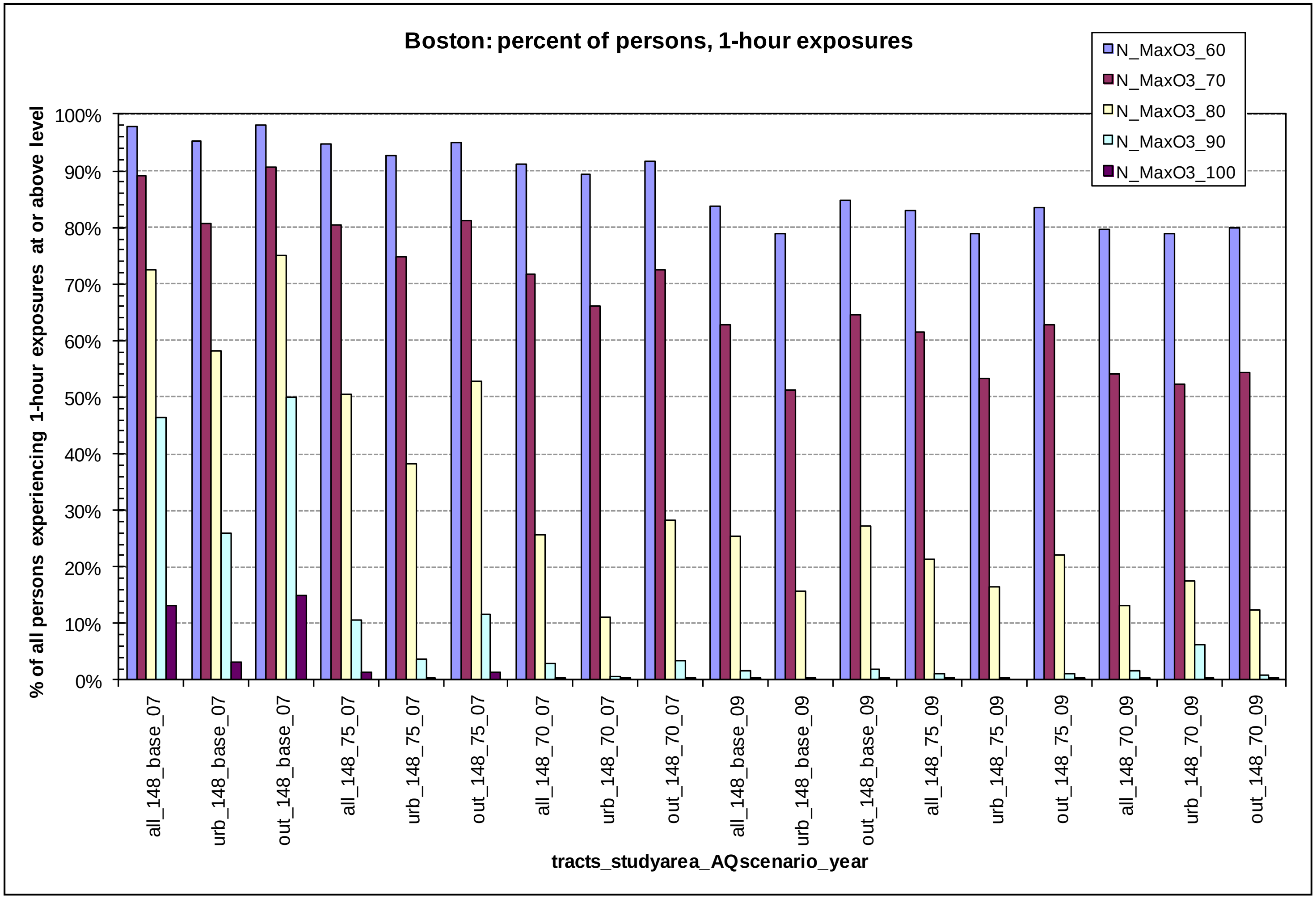

Figure 9A-3. Exposure Risk Estimates – Percent of Person with 1-Hour Exposures at or Above Benchmarks. (Spatially stratified: all study area, urban study area, outer study area) (Boston).

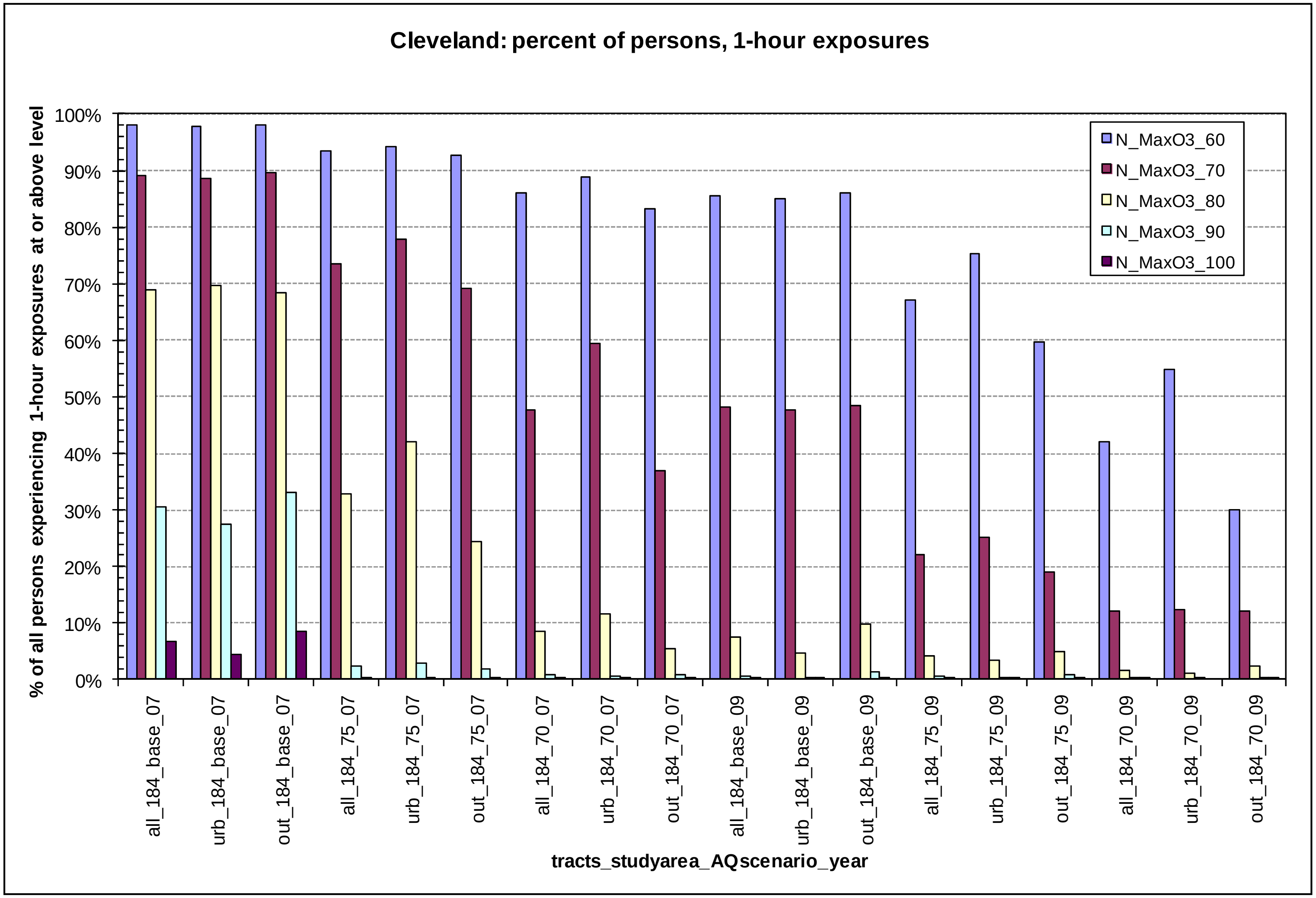

Figure 9A-4. Exposure Risk Estimates – Percent of Person with 1-Hour Exposures at or Above Benchmarks. (Spatially stratified: all study area, urban study area, outer study area) (Cleveland).

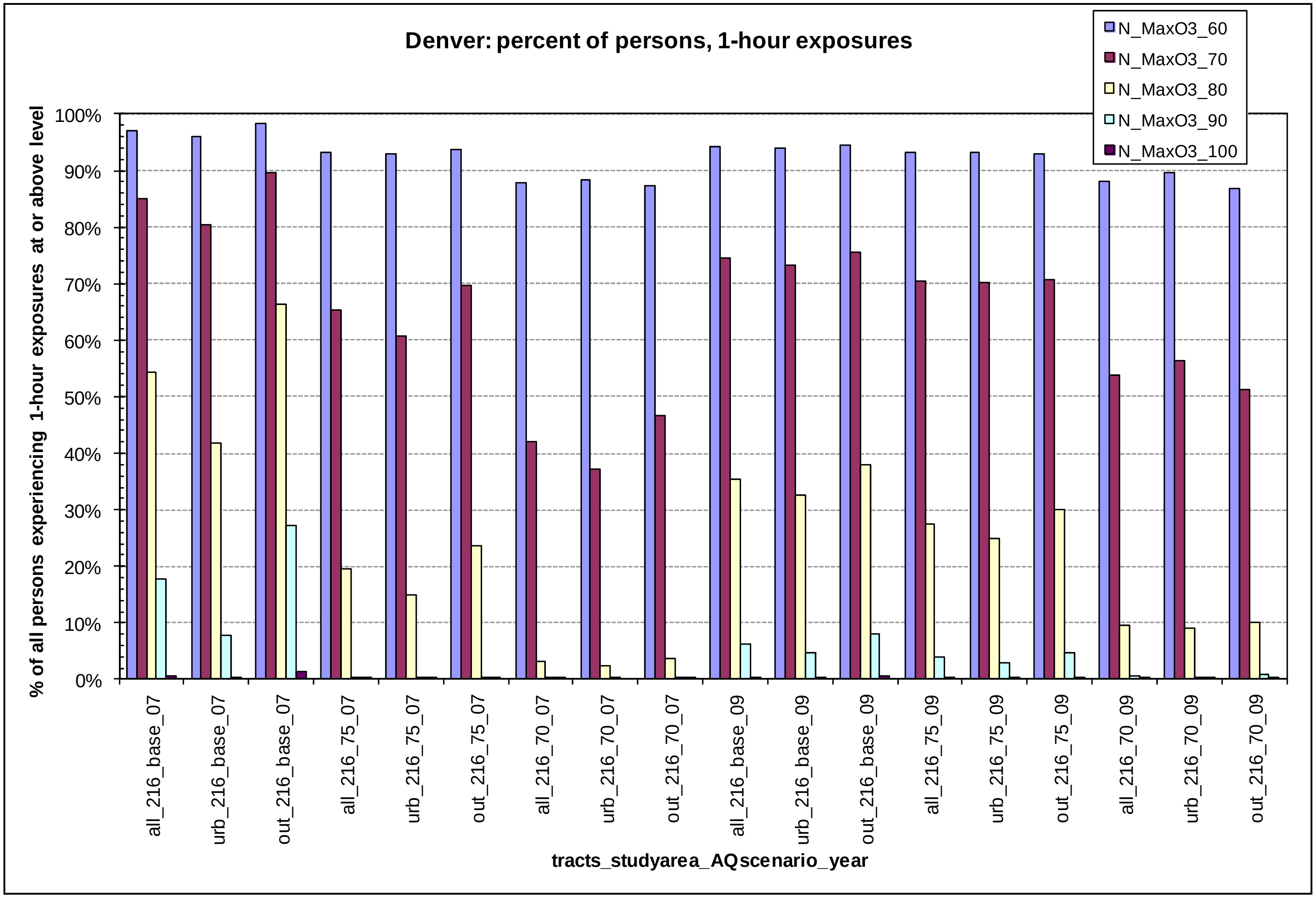

Figure 9A-5. Exposure Risk Estimates – Percent of Person with 1-Hour Exposures at or Above Benchmarks. (Spatially stratified: all study area, urban study area, outer study area) (Denver).

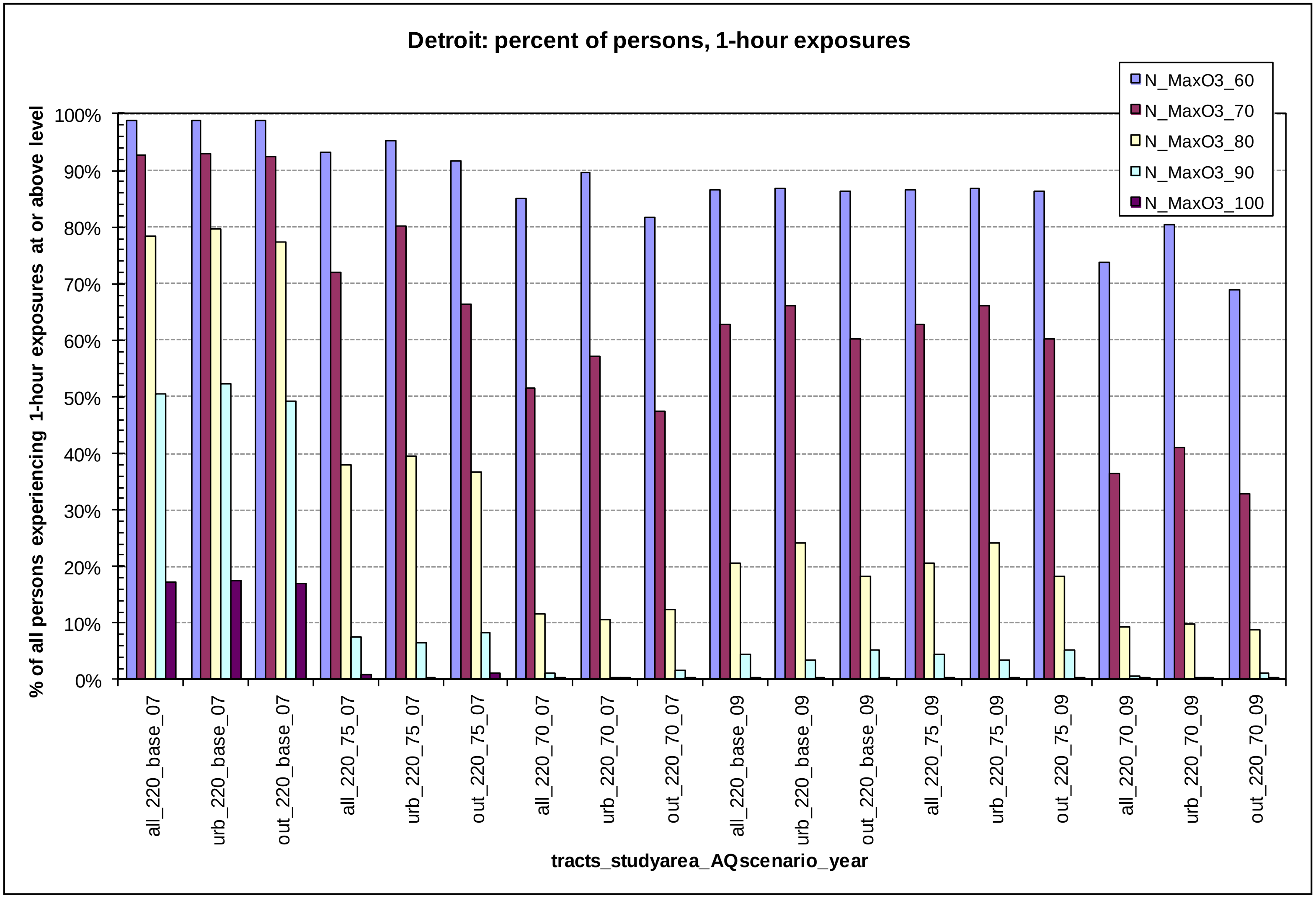

Figure 9A-6. Exposure Risk Estimates – Percent of Person with 1-Hour Exposures at or Above Benchmarks. (Spatially stratified: all study area, urban study area, outer study area) (Detroit).

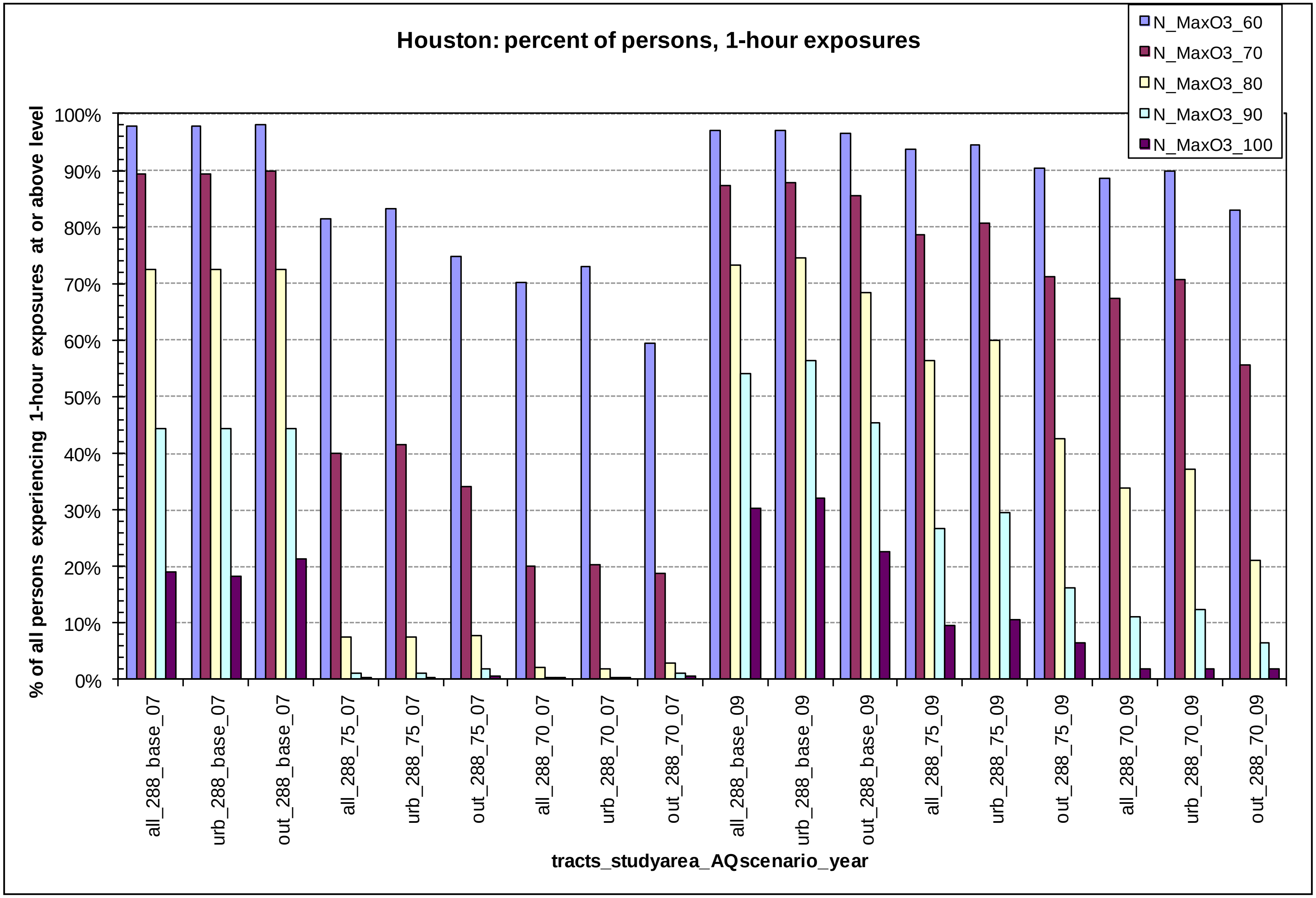

Figure 9A-7. Exposure Risk Estimates – Percent of Person with 1-Hour Exposures at or Above Benchmarks. (Spatially stratified: all study area, urban study area, outer study area) (Houston).

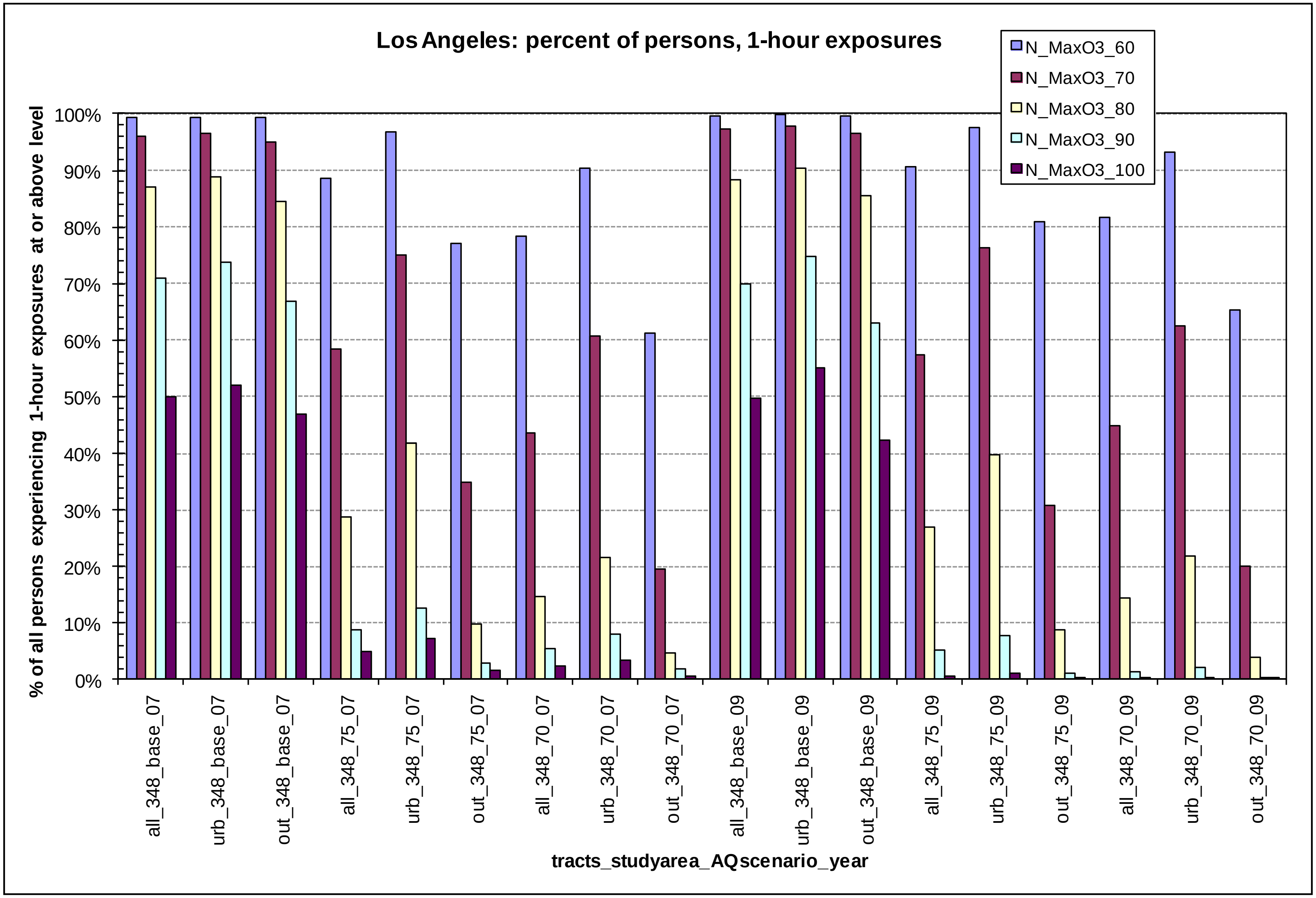

Figure 9A-8. Exposure Risk Estimates – Percent of Person with 1-Hour Exposures at or Above Benchmarks. (Spatially stratified: all study area, urban study area, outer study area) (Los Angeles).

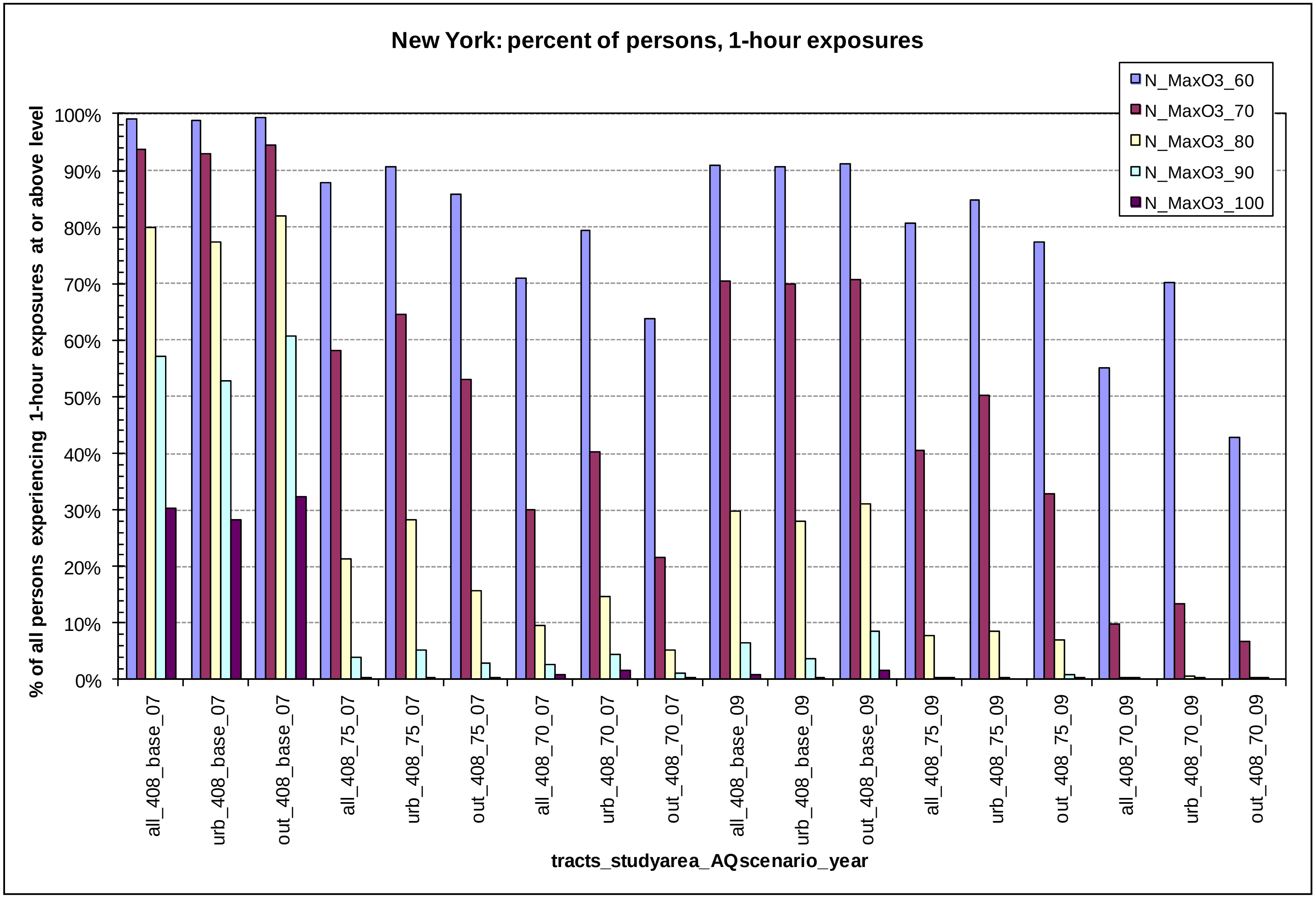

Figure 9A-9. Exposure Risk Estimates – Percent of Person with 1-Hour Exposures at or Above Benchmarks. (Spatially stratified: all study area, urban study area, outer study area) (New York).

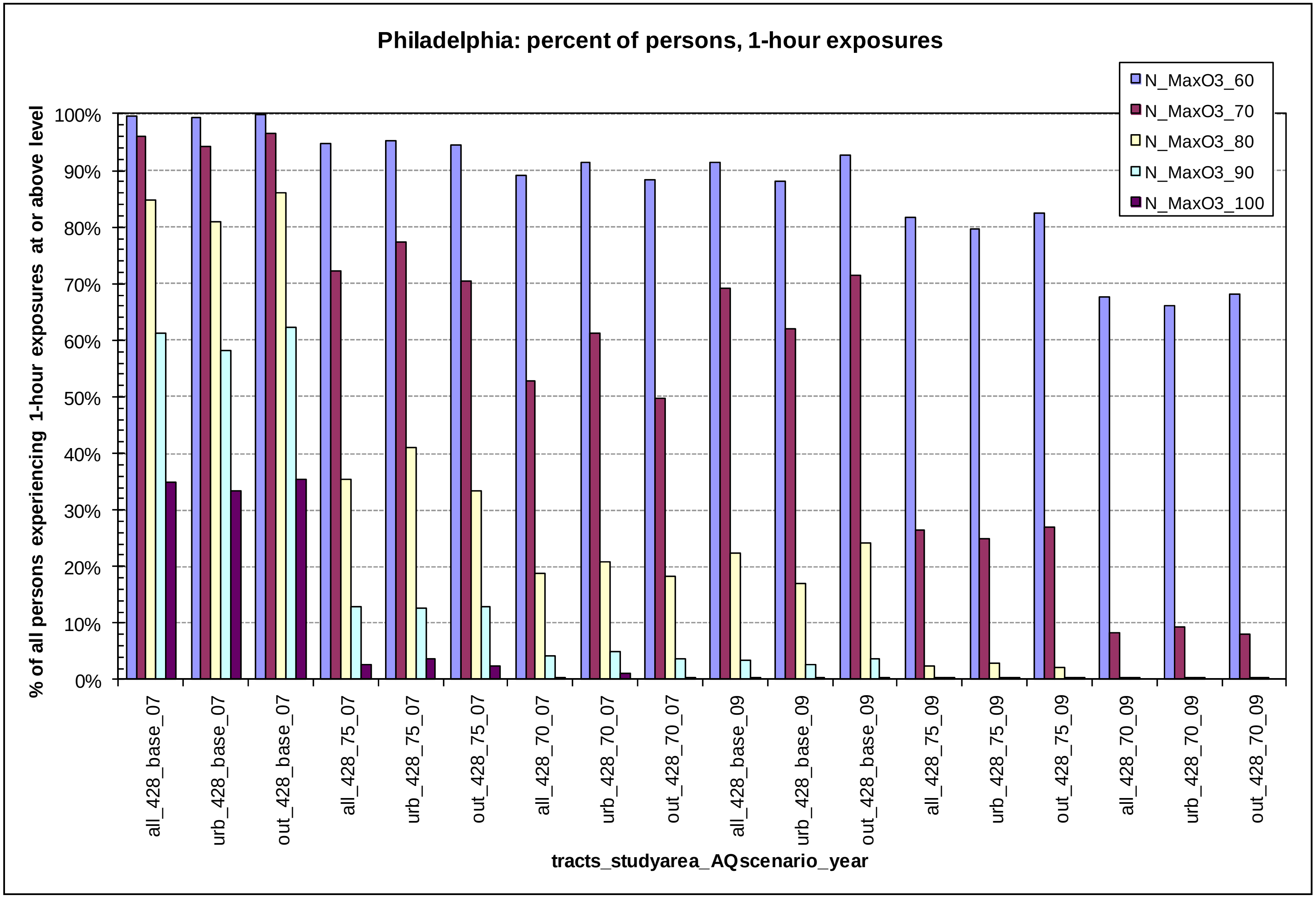

Figure 9A-10. Exposure Risk Estimates – Percent of Person with 1-Hour Exposures at or Above Benchmarks. (Spatially stratified: all study area, urban study area, outer study area) (Philadelphia).

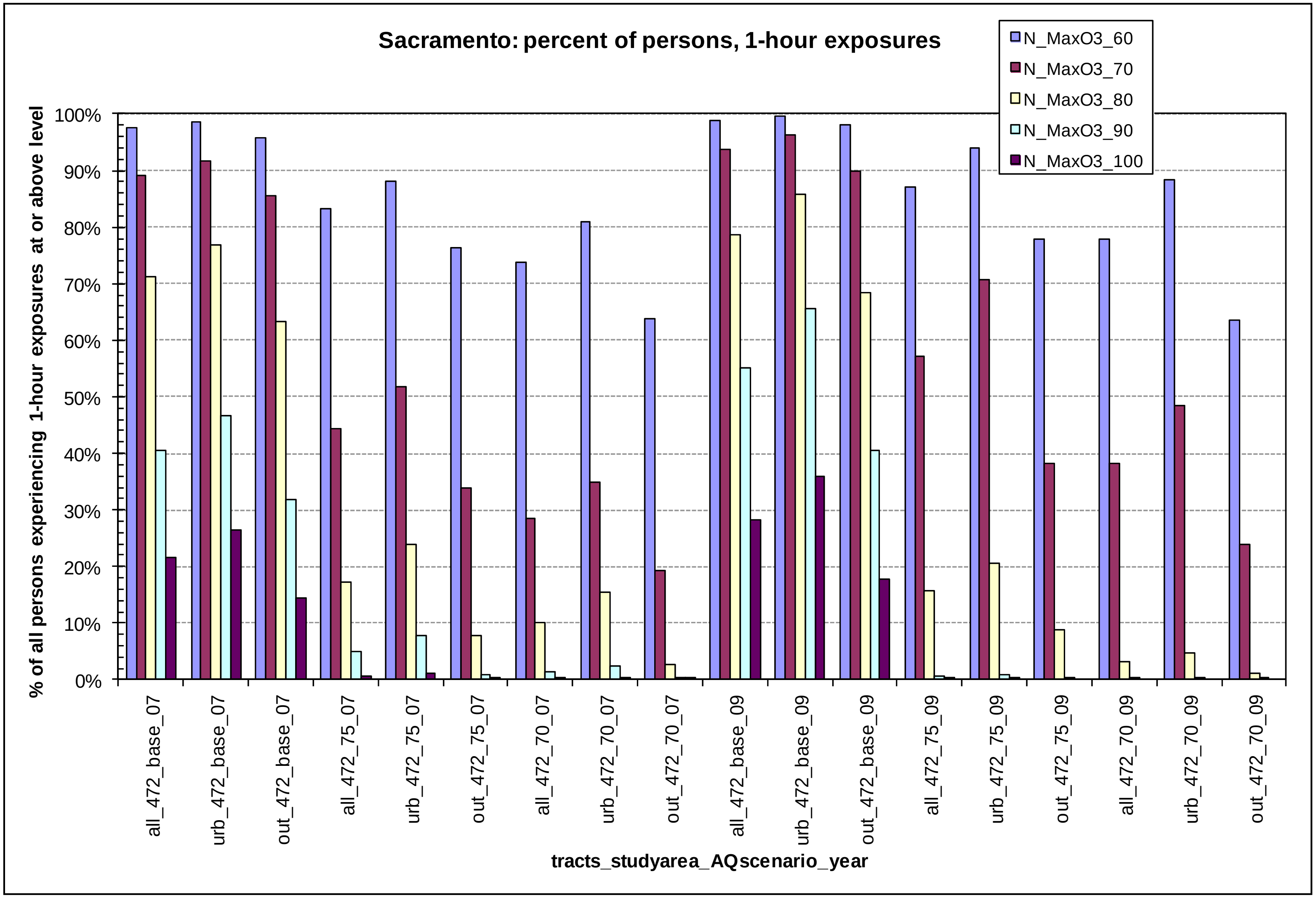

Figure 9A-11. Exposure Risk Estimates – Percent of Person with 1-Hour Exposures at or Above Benchmarks. (Spatially stratified: all study area, urban study area, outer study area) (Sacramento).

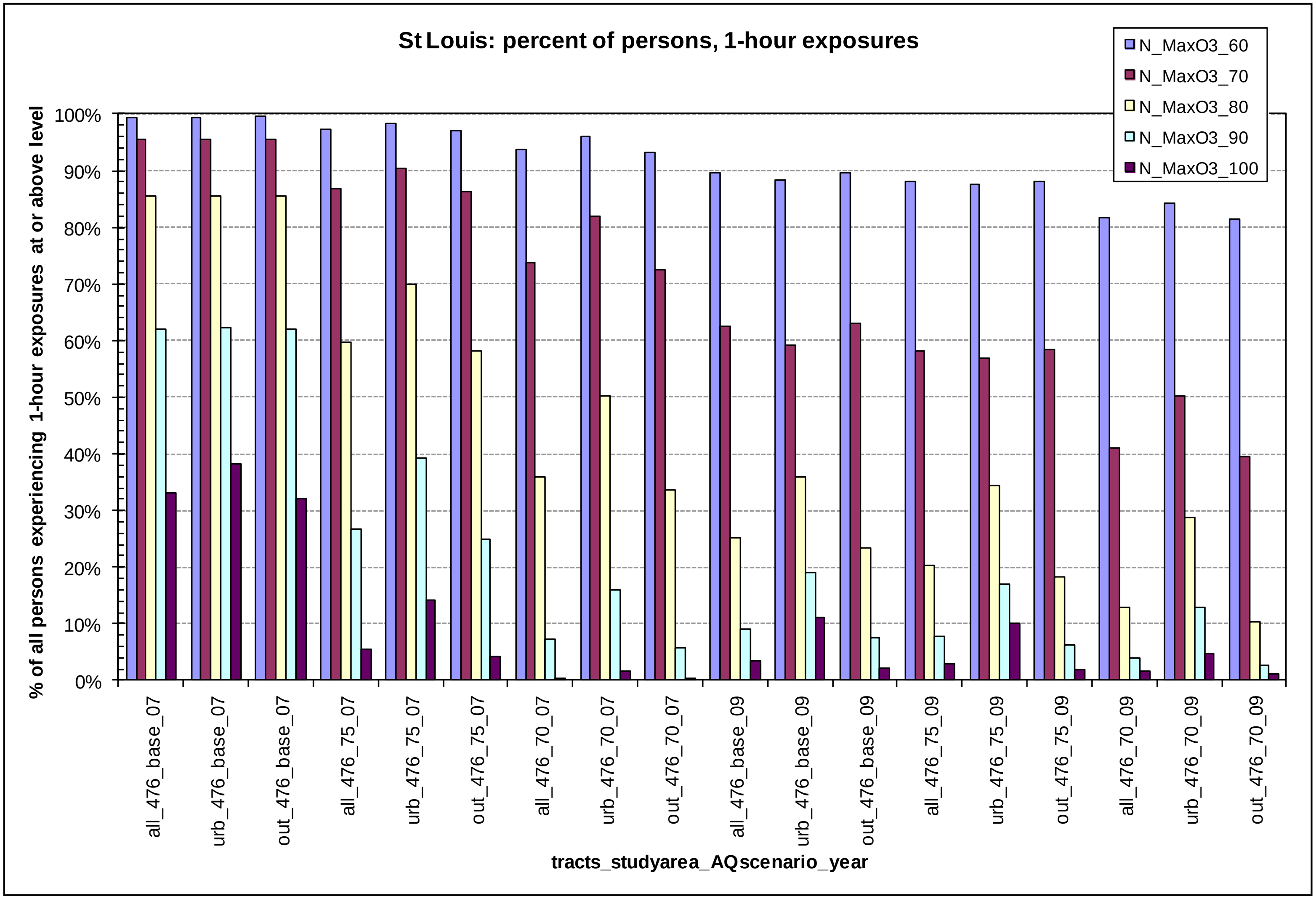

Figure 9A-12. Exposure Risk Estimates – Percent of Person with 1-Hour Exposures at or Above Benchmarks. (Spatially stratified: all study area, urban study area, outer study area) (St. Louis).

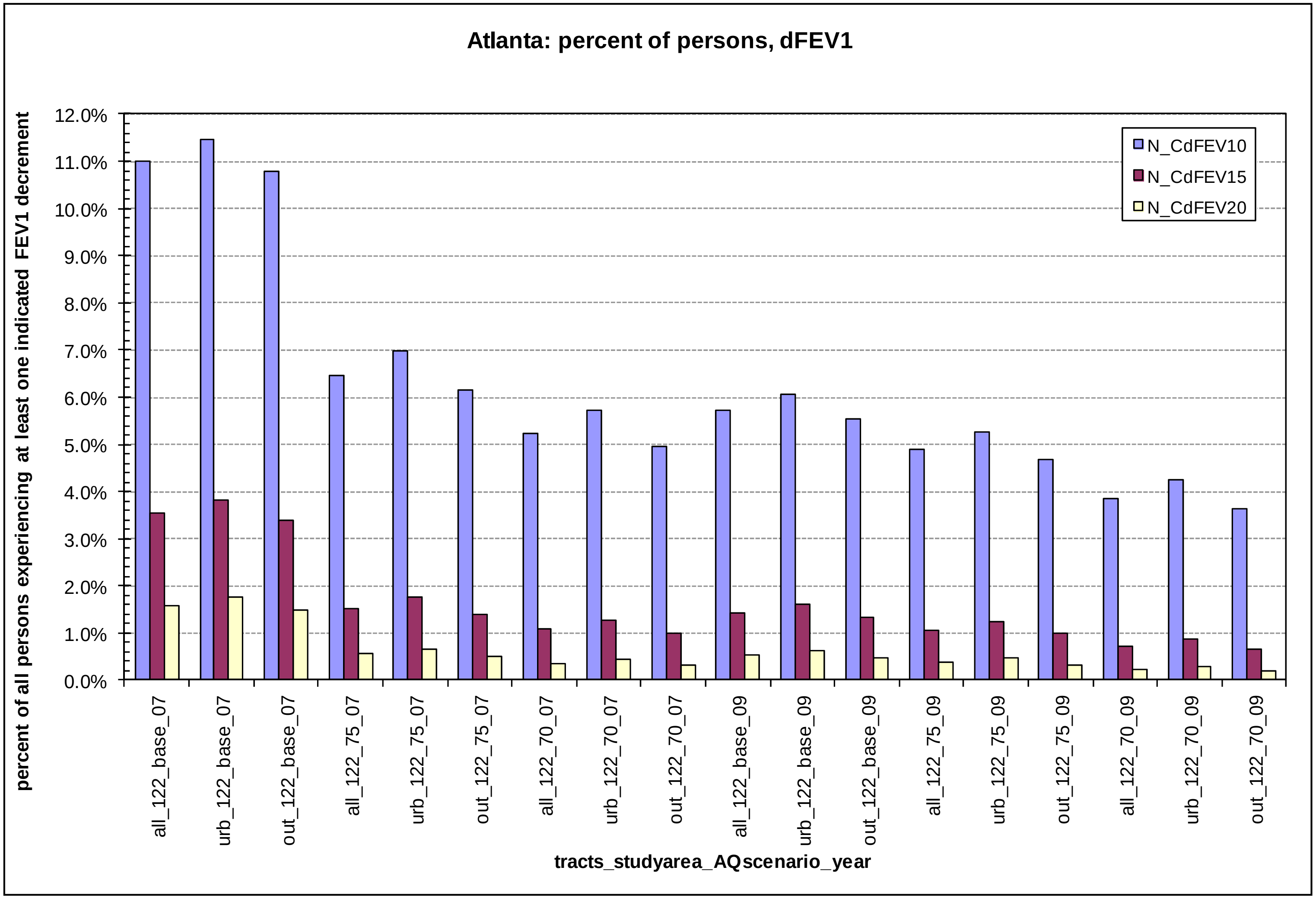

Figure 9A-13. Lung-Function Risk Estimates – Percent of Person with Specified FEV_1 Decrement. (Spatially stratified: all study area, urban study area, outer study area) (Atlanta).

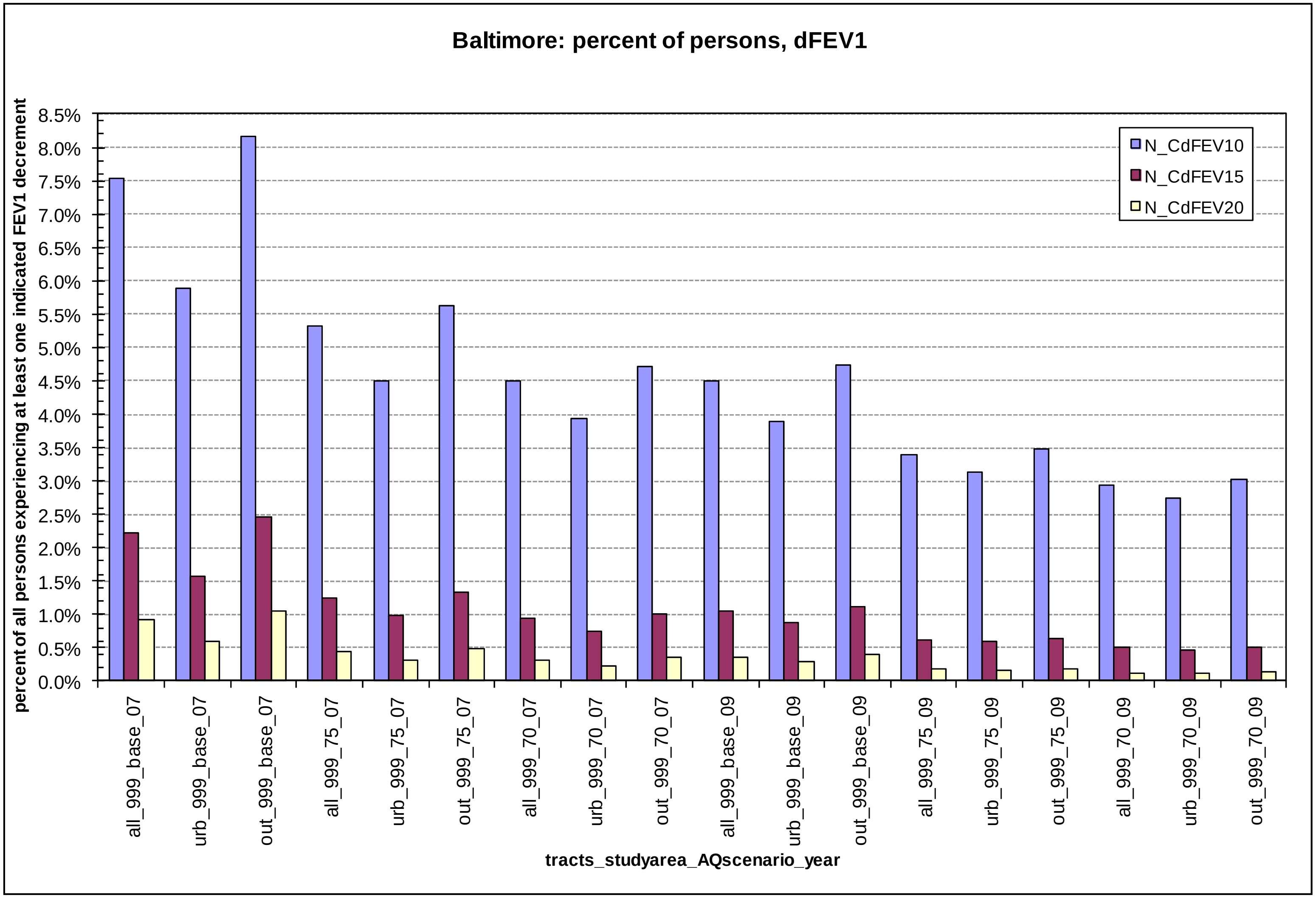

Figure 9A-14. Lung-Function Risk Estimates – Percent of Person with Specified FEV_1 Decrement. (Spatially stratified: all study area, urban study area, outer study area) (Baltimore).

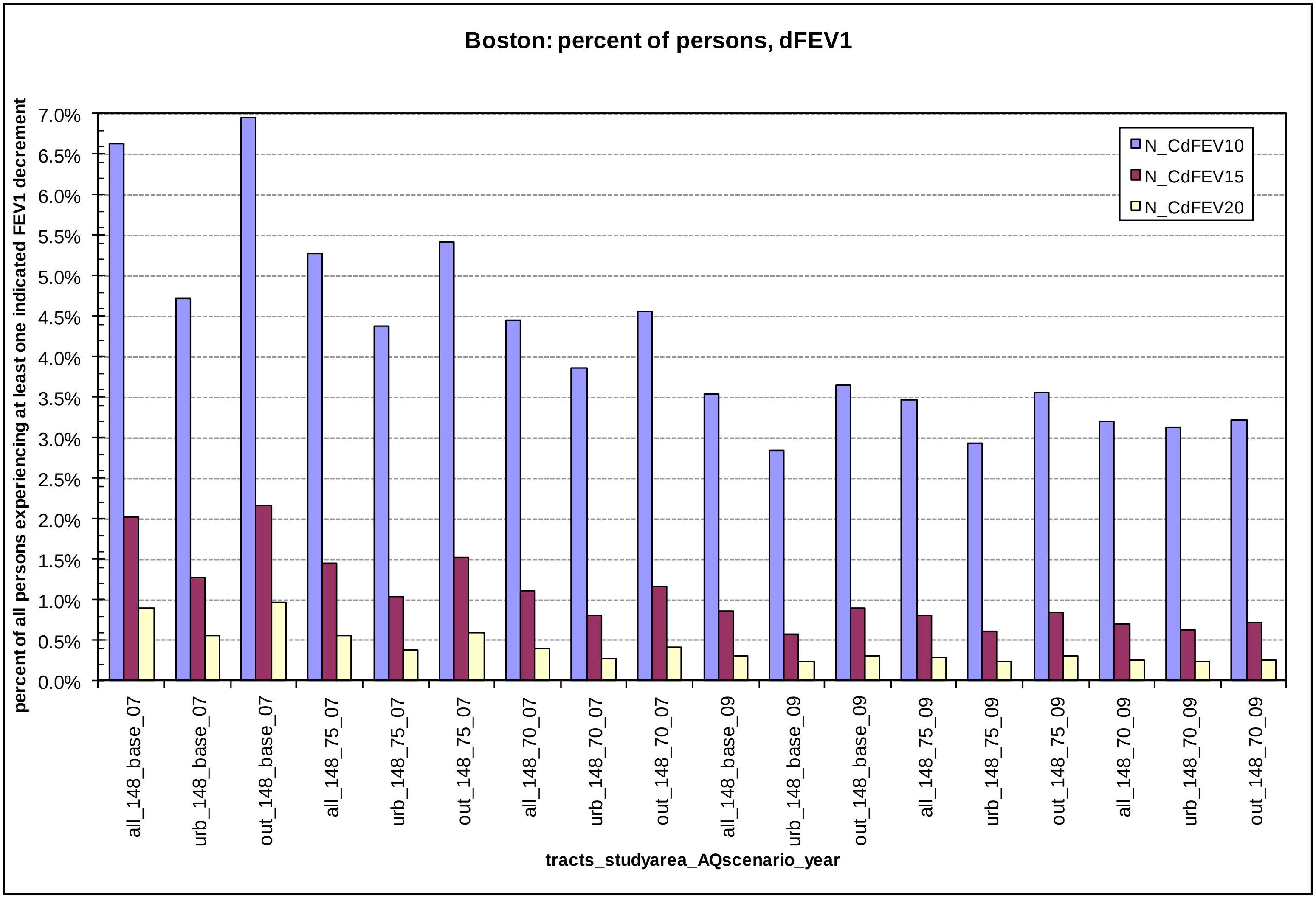

Figure 9A-15. Lung-Function Risk Estimates – Percent of Person with Specified FEV_1 Decrement. (Spatially stratified: all study area, urban study area, outer study area) (Boston).

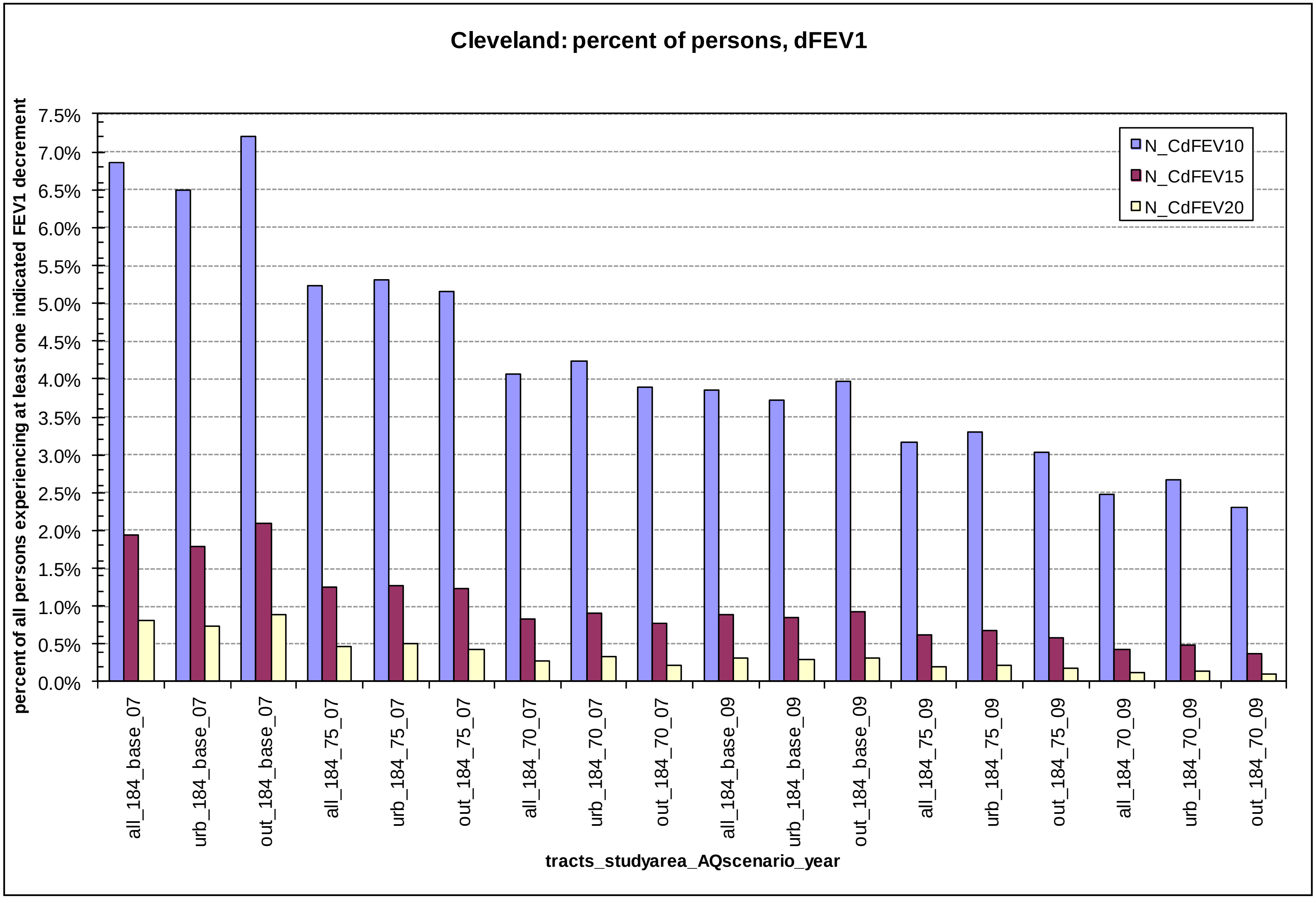

Figure 9A-16. Lung-Function Risk Estimates – Percent of Person with Specified FEV_1 Decrement. (Spatially stratified: all study area, urban study area, outer study area) (Cleveland).

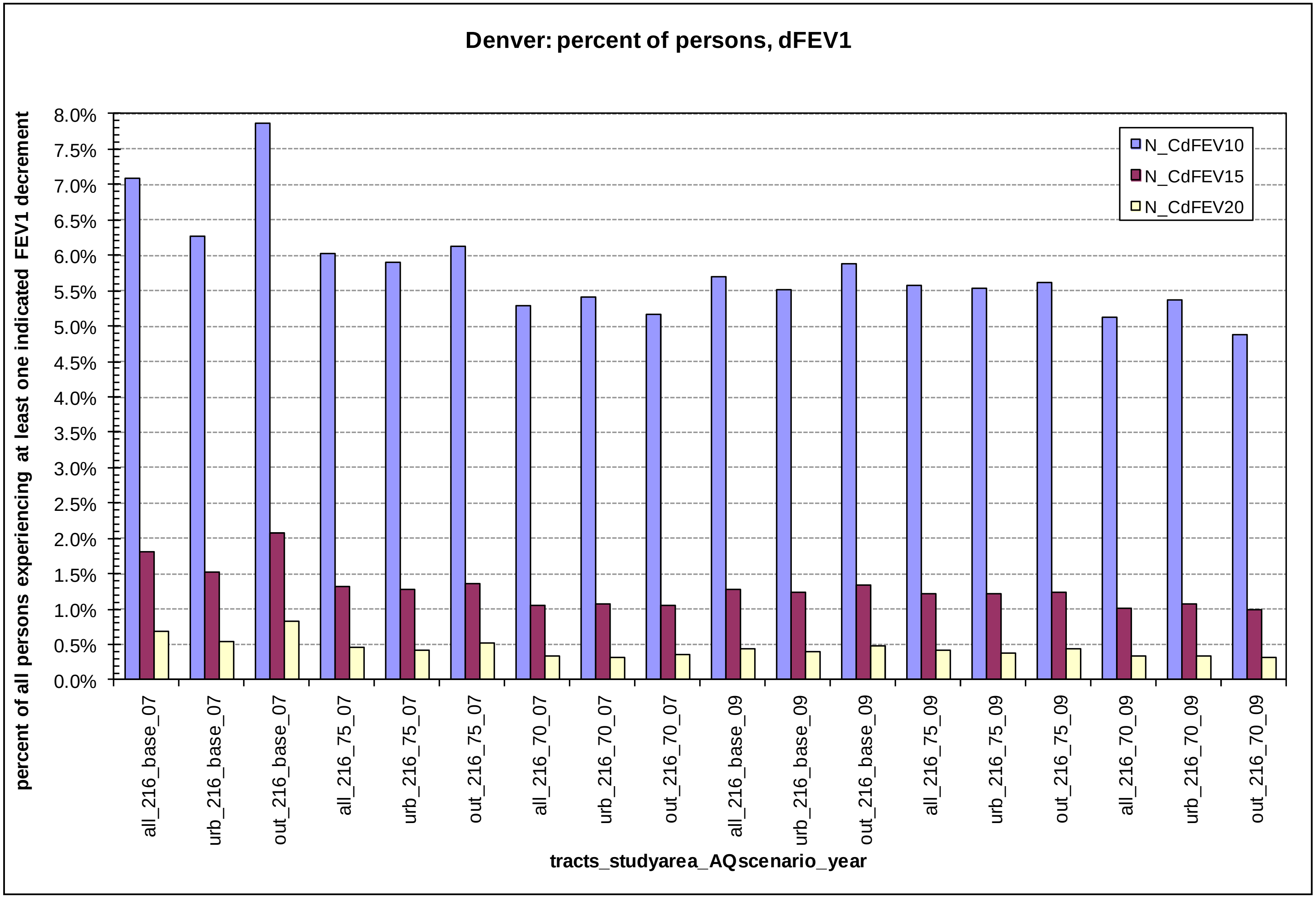

Figure 9A-17. Lung-Function Risk Estimates – Percent of Person with Specified FEV_1 Decrement. (Spatially stratified: all study area, urban study area, outer study area) (Denver).

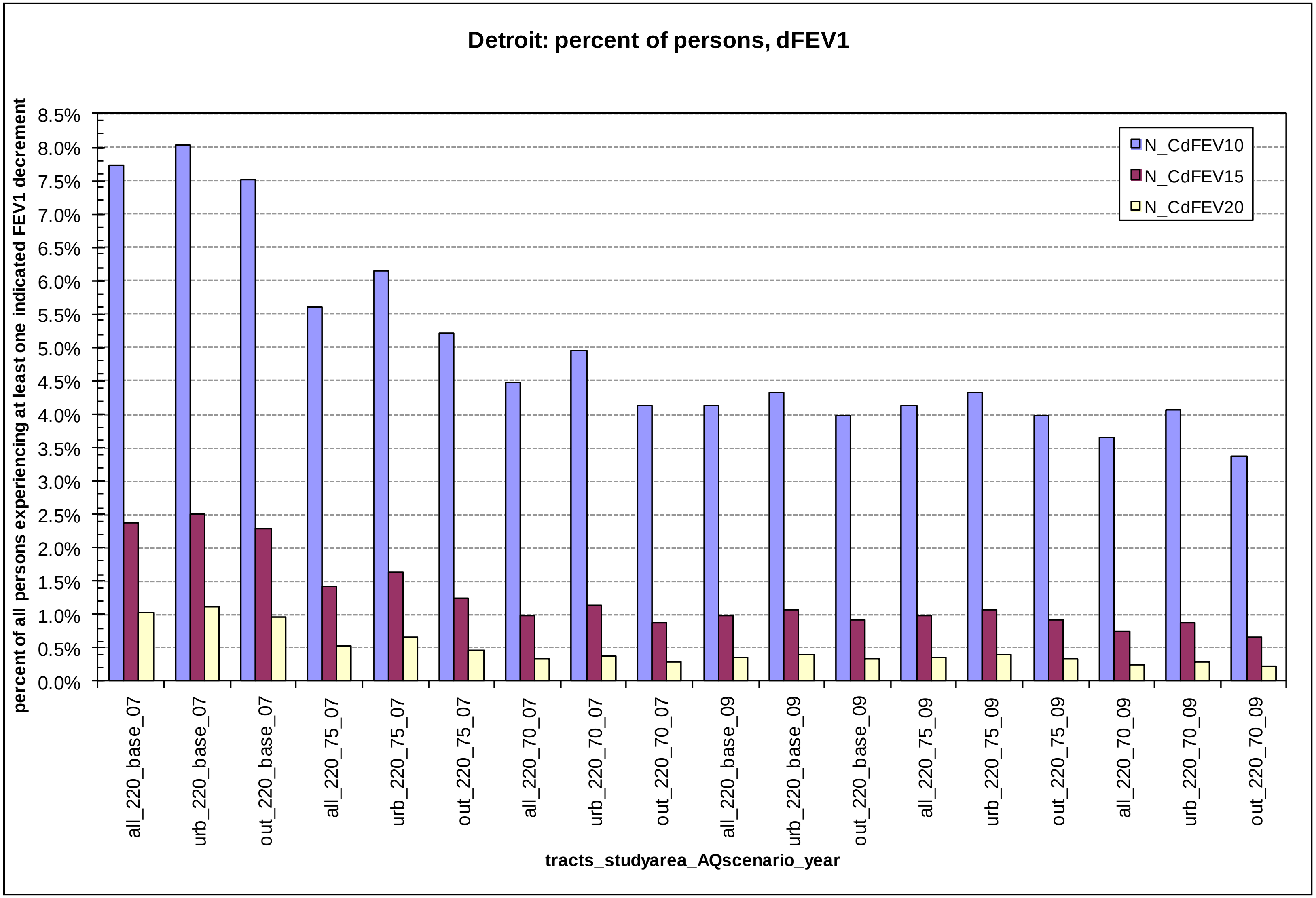

Figure 9A-18. Lung-Function Risk Estimates – Percent of Person with Specified FEV_1 Decrement. (Spatially stratified: all study area, urban study area, outer study area) (Detroit).

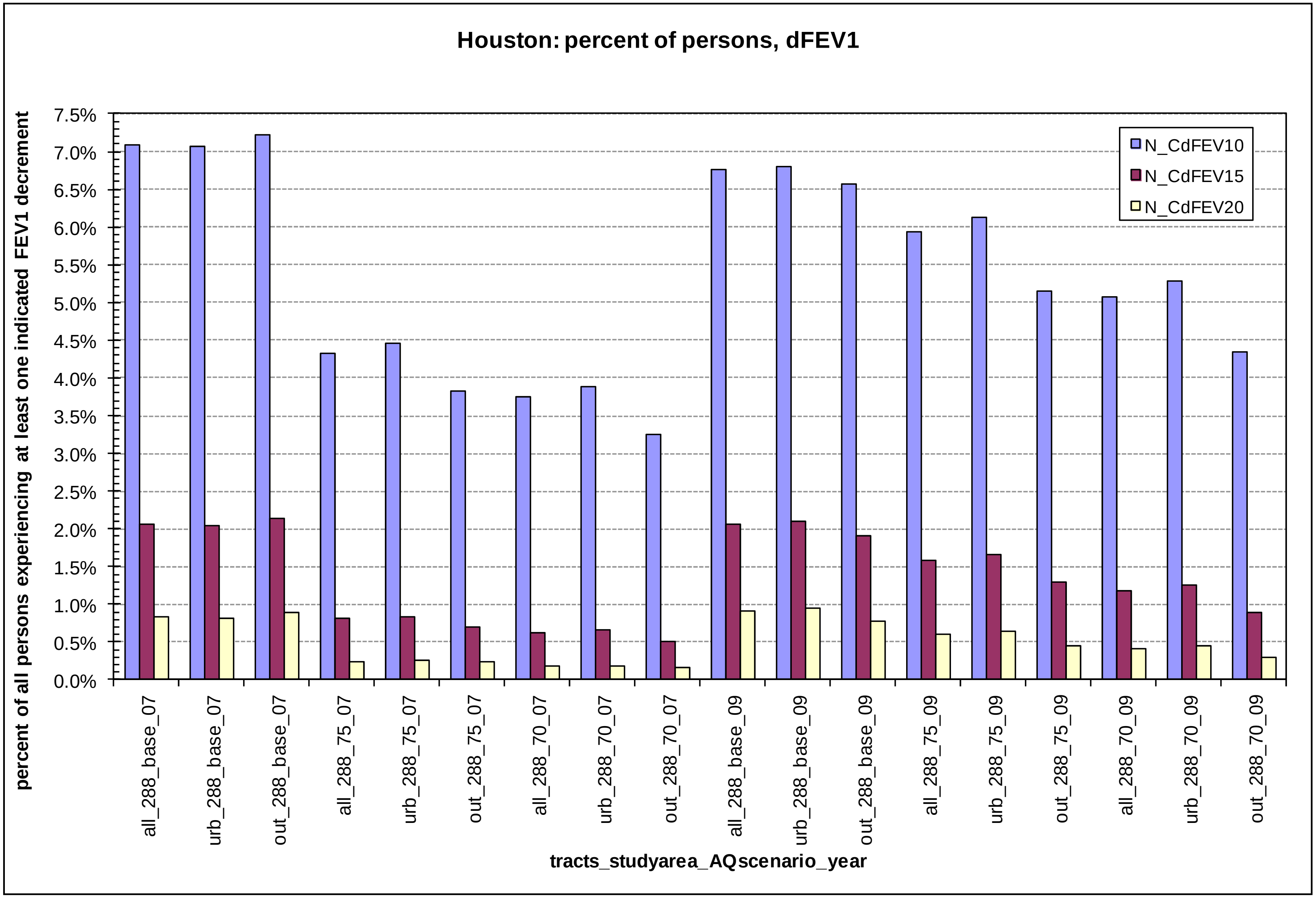

Figure 9A-19. Lung-Function Risk Estimates – Percent of Person with Specified FEV_1 Decrement. (Spatially stratified: all study area, urban study area, outer study area) (Houston).

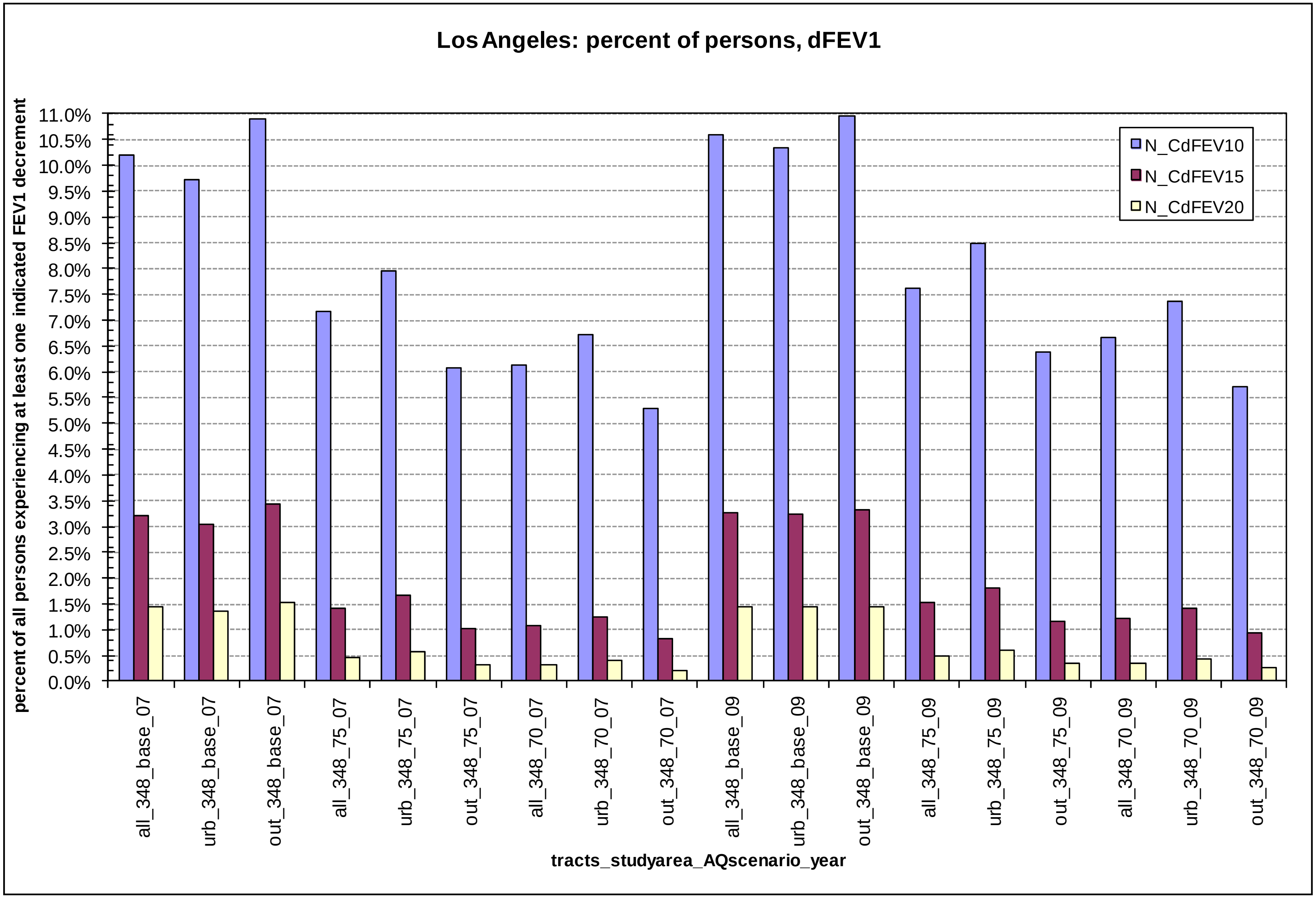

Figure 9A-20. Lung-Function Risk Estimates – Percent of Person with Specified FEV_1 Decrement. (Spatially stratified: all study area, urban study area, outer study area) (Los Angeles).

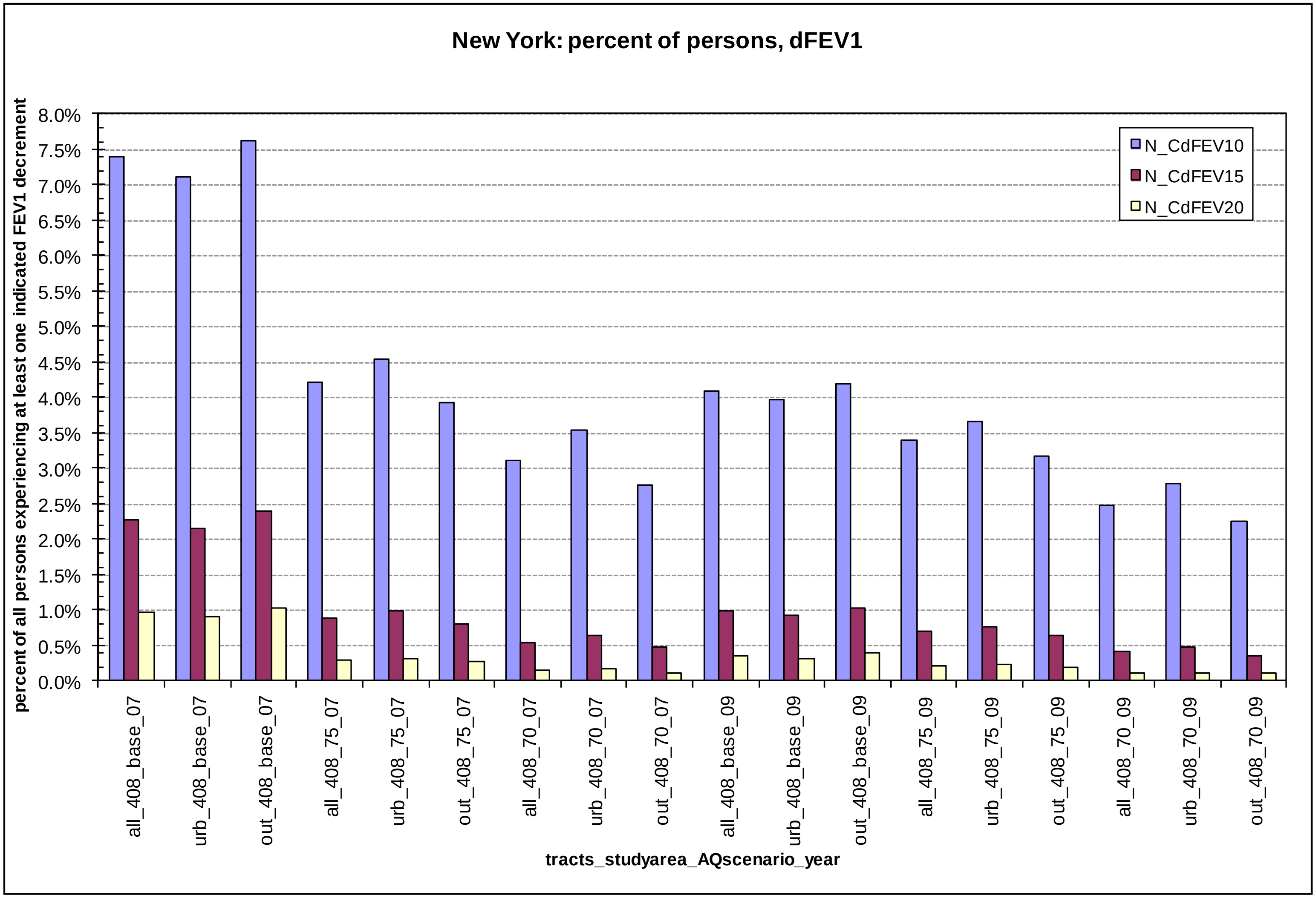

Figure 9A-21. Lung-Function Risk Estimates – Percent of Person with Specified FEV_1 Decrement. (Spatially stratified: all study area, urban study area, outer study area) (New York).

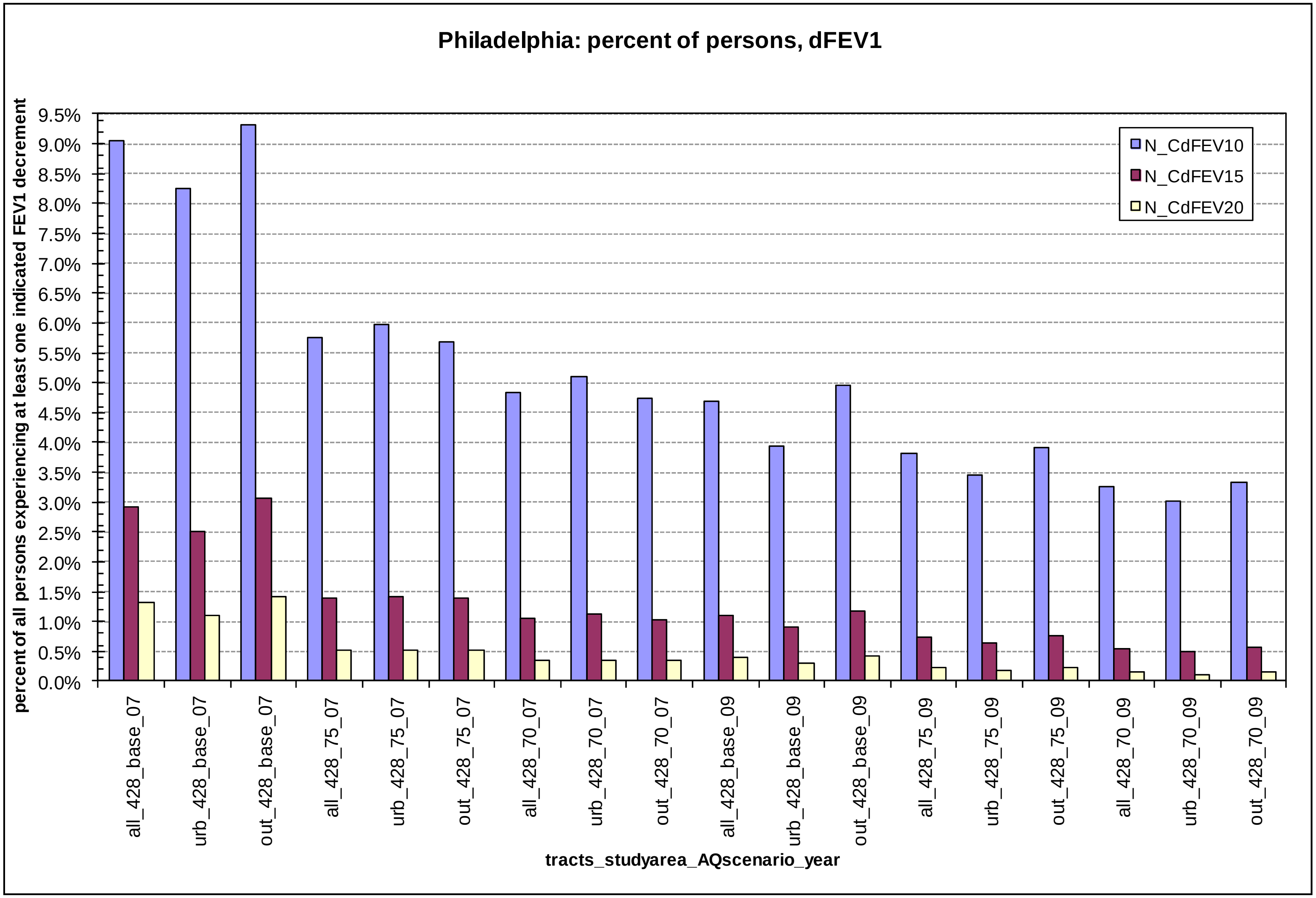

Figure 9A-22. Lung-Function Risk Estimates – Percent of Person with Specified FEV_1 Decrement. (Spatially stratified: all study area, urban study area, outer study area) (Philadelphia).

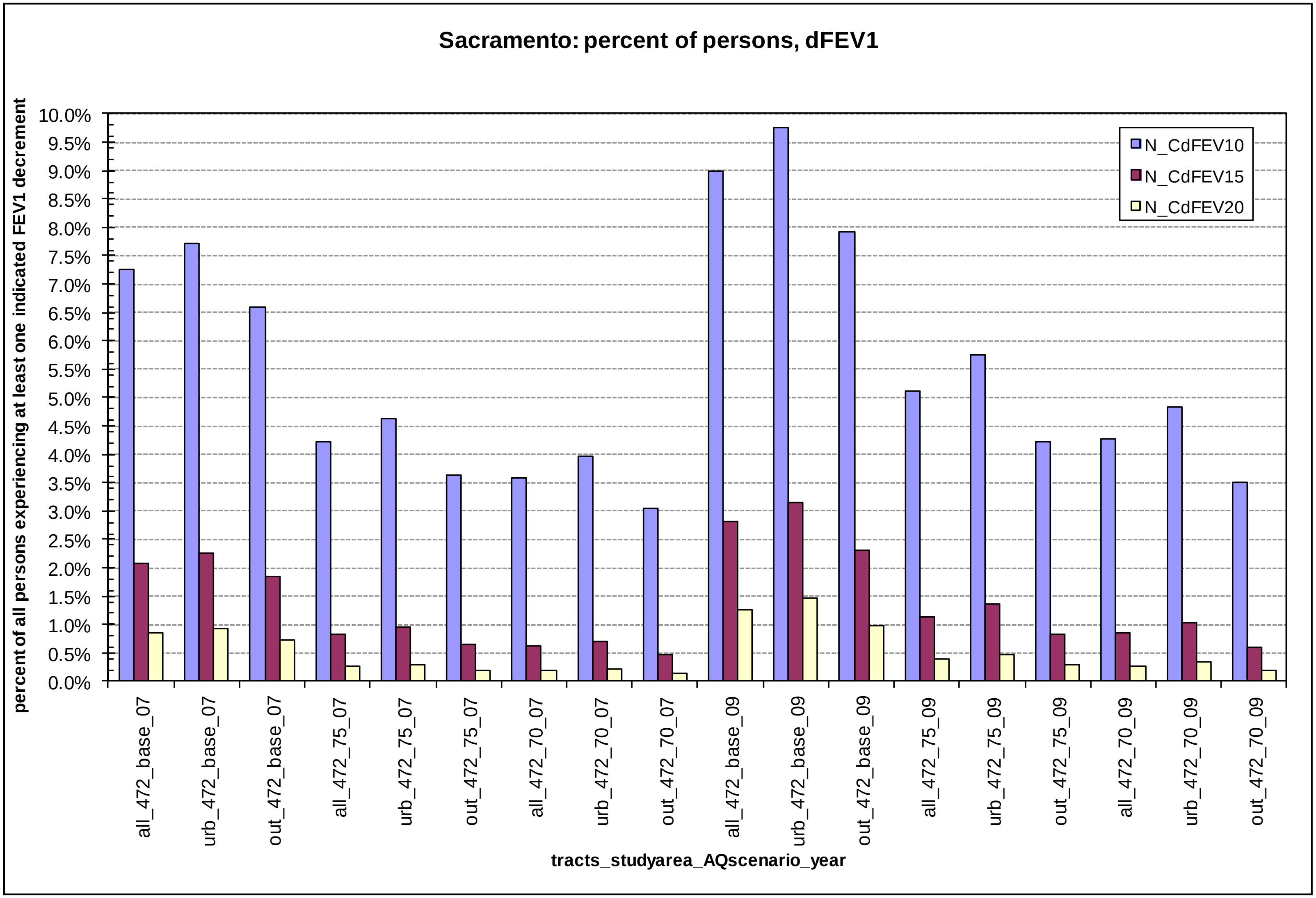

Figure 9A-23. Lung-Function Risk Estimates – Percent of Person with Specified FEV_1 Decrement. (Spatially stratified: all study area, urban study area, outer study area) (Sacramento).

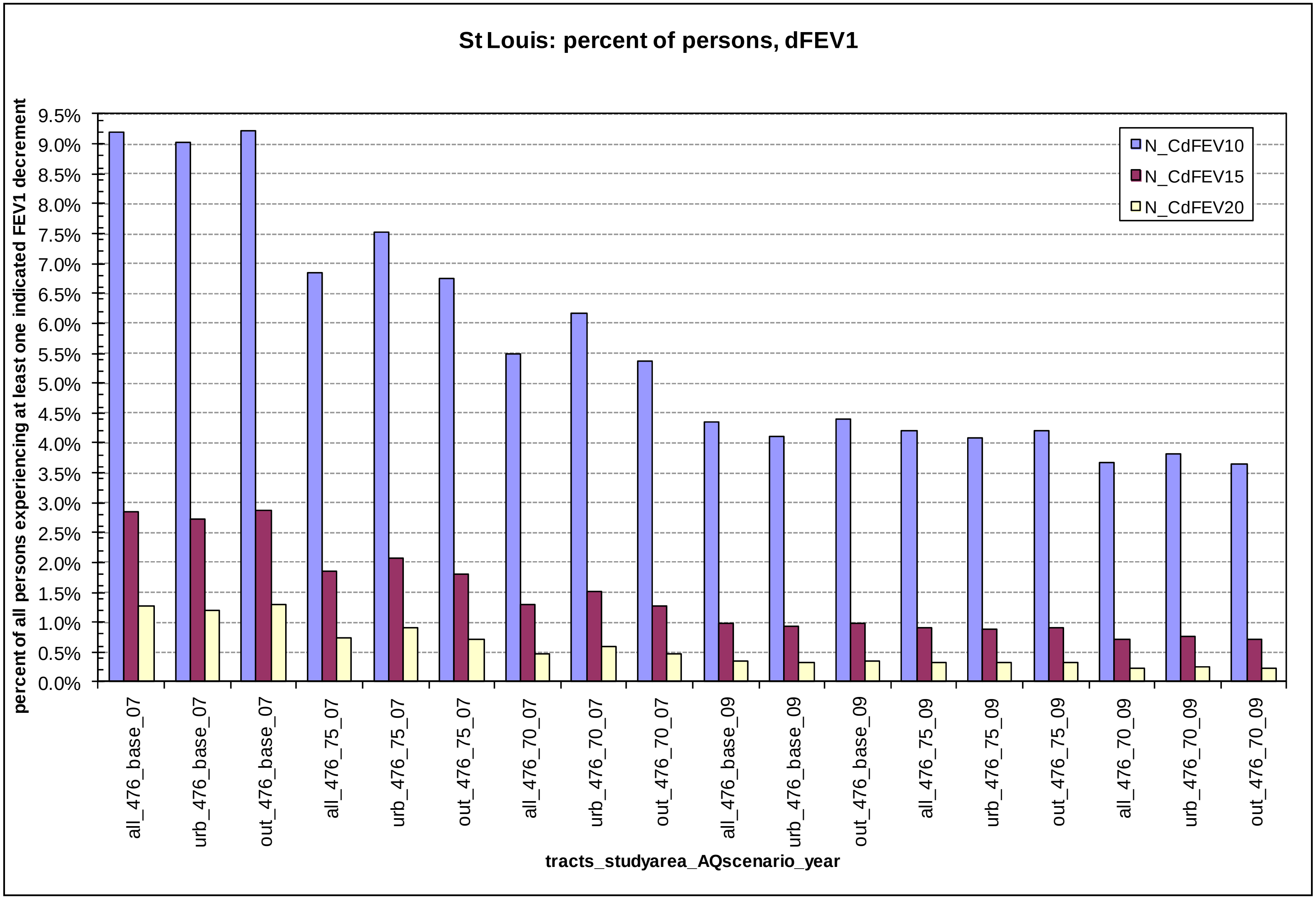

Figure 9A-24. Lung-Function Risk Estimates – Percent of Person with Specified FEV_1 Decrement. (Spatially stratified: all study area, urban study area, outer study area) (St. Louis).

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