

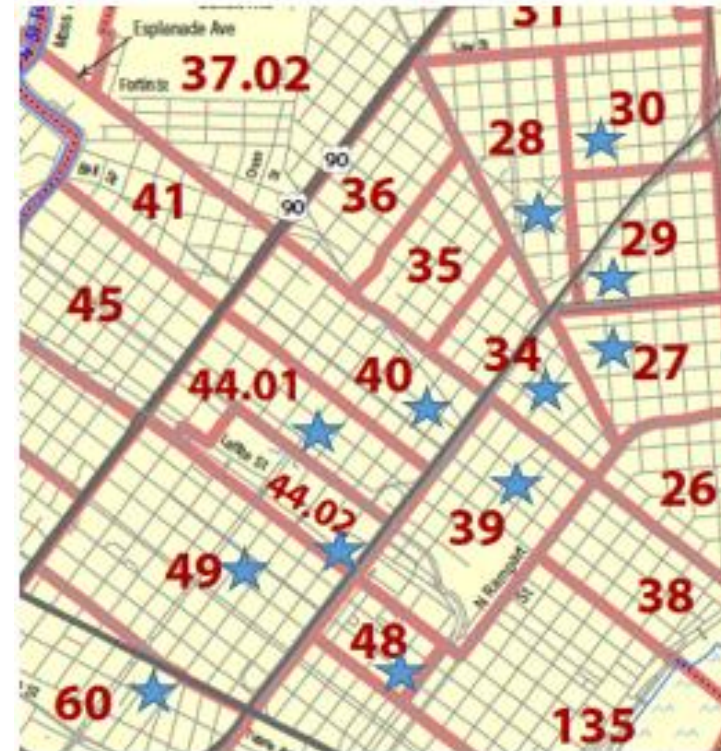
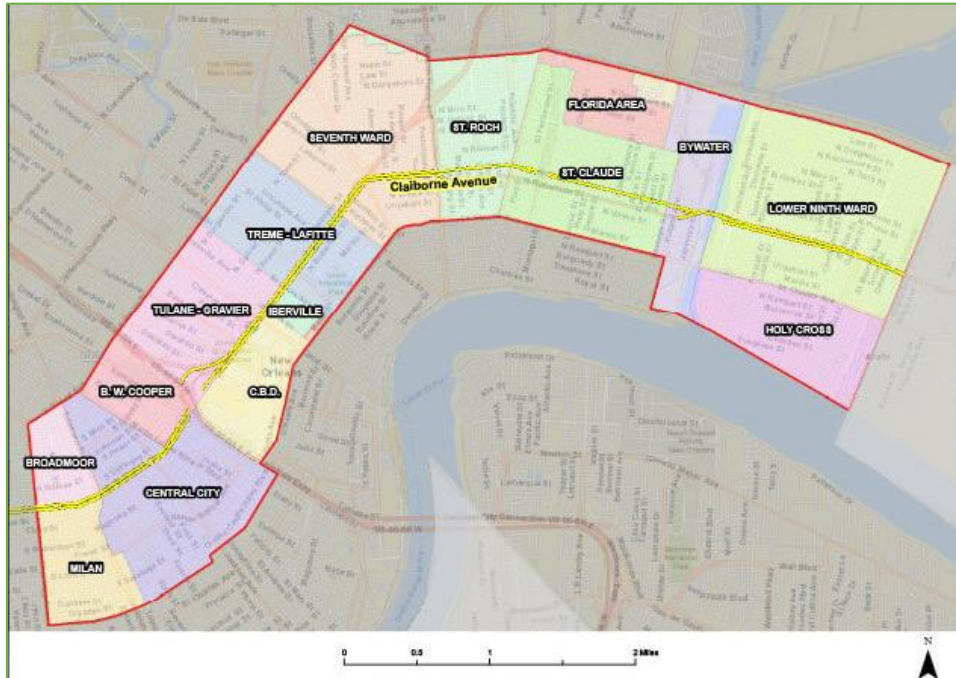
Final Report: Preliminary Assessment of Health Impacts of Interstate-10 Air Pollution in the Claiborne Corridor

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Claiborne Corridor



Consists of 13 Census Tracts: 22071002700 (27), 22071002800 (28), 22071002900 (29), 22071003000 (30), 22071003400 (34), 22071003500 (35), 22071003900 (39), 22071004000 (40), 22071004401 (44.01), 22071004402 (44.02), 22071004800 (48), 22071004900 (49), 22071006000 (60)

Health Impacts Significantly Associated with Traffic-Related Exposures

Pollutant	Significantly Associated Health Impacts	Adjusted Odds Ratio and 95% C.I. (or <i>p</i> -value) for Significant Level of Exposure	
Particulate Matter (e.g. PM _{2.5} , PM ₁₀ , diesel PM)	Ischemic heart disease mortality	OR=1.39 (1.12-1.73) for 10 µg/m ³ PM _{2.5}	
	Increased mean arterial blood pressure	+1.4 mm Hg (0.5-2.3) mean systolic BP and +0.9 mm Hg (0.4-1.4) mean diastolic BP for 2.4 µg/m ³ PM _{2.5}	
	Autism	Gestation	Year 1
		OR=2.08 (1.93-2.25) for 8.7 µg/m ³ PM _{2.5}	OR=2.12 (1.45-3.10) for 8.7 µg/m ³ PM _{2.5}
		OR=2.17 (1.49-3.16) for 14.6 µg/m ³ PM ₁₀	OR=2.14 (1.46-3.12) for 14.6 µg/m ³ PM ₁₀
	Preterm delivery	OR=1.81 (1.71-1.92) for 1.35 µg/m ³ PM _{2.5}	
	Preeclampsia	OR=1.42 (1.26-1.59) for 1.35 µg/m ³ PM _{2.5}	
	Impaired lung development	<i>p</i> =0.002 for -79.7 ml FEV ₁ growth (CI) for 22.8 µg/m ³ PM _{2.5}	
	Premature mortality	OR=1.17 (1.05-1.30) for 10 µg/m ³ PM _{2.5}	
Nitrogen Oxides (NO _x)	Asthma prevalence	• OR=1.83 (1.04-3.22) for 5.7 ppb NO ₂	
		• OR=2.17 (1.18-4.00) for 23.6 ppb NO ₂	
	Preeclampsia	OR=1.33 (1.18-1.49) for 5.65 ppb NO _x	
	Low birth weight	OR=1.11 (1.01-1.23) for 10 µg/m ³ NO ₂	
Preterm delivery	OR=2.28 (2.15-2.42) for 5.65 ppb NO _x		

Significantly Associated Health Impacts Continued

Carbon Monoxide (CO), Elemental Carbon (EC), Black Carbon (BC)	Asthma exacerbation	OR=1.30 (1.04-1.62) for 3.0 $\mu\text{g}/\text{m}^3$ EC
	Impaired cognition (Mini Mental State Exam score ≤ 25)	OR=1.3 (1.1-1.6) for each doubling of <u>ln</u> (BC)
	Preterm birth	OR=1.16 (1.02-1.32) for 100 $\mu\text{g}/\text{m}^3$ inverse- distance weighted CO
Volatile Organic Compounds (VOCs, e.g. benzene)	Childhood leukemia	OR=3.91 (1.36-11.27) for $>10 \mu\text{g}/\text{m}^3$ benzene/yr

Significantly Associated Health Impacts Continued

Noise	Coronary heart disease mortality	OR=1.22 (1.04-1.43) for highest decile noise exposure (continuous 6.6 dB)
	Stroke	<ul style="list-style-type: none"> • OR=1.07 (1.04-1.09) in men • OR=1.04 (1.02-1.06) in women, for highest noise exposure class (<200 m from main road)
	Myocardial infarction	<ul style="list-style-type: none"> • OR=1.12 (1.02-1.23) for 10 dB • OR=1.38 (1.11-1.71) for 50 <u>dB</u>A
	Hypertension	OR=1.28 (1.04-1.59) for >65 dB (long-term)
Ozone (O ₃)	Asthma onset	OR=1.50 (1.16-1.95) for 30.3 ppb O ₃ over 1000-1800 hours at home
	Childhood cancer: <ul style="list-style-type: none"> • All • Leukemia 	<ul style="list-style-type: none"> • OR=5.90 (1.69-20.56) • OR=8.28 (2.09-32.80), for >20,000 cars/day
Traffic Density and	Allergic sensitization	OR=1.57 (1.01-2.43) for >20,000 cars/day

Significantly Associated Health Impacts Continued

Traffic Proximity and Volume	Allergic sensitivity	<ul style="list-style-type: none"> • OR=2.57 (CI) (conjunctivitis) • OR=2.08 (CI) (itchy rash), at 500 m, 5190-22,326 trucks/day
	Chronic wheeze in infants	OR=2.5 (1.15-5.42) for 100 m from bus or state route <50 mph
	Low birth weight	OR=1.3 (1.07-1.58) for 80 th percentile distance-weighted traffic density
	Small for gestational age	OR=1.26 (1.07-1.49) for residence <50 m from highway
	Rheumatoid arthritis	OR=1.62 (1.04-2.52) for residence <50 m from highway
	Asthma exacerbation	OR=3.80 (1.20-11.71) for residence <75 m from highway
	Asthma prevalence	<ul style="list-style-type: none"> • OR=1.50 (1.16-1.95) for residence <75 m from highway • OR=2.28 (1.14-4.56) for residence 300 m from highway with >30 vehicles/day/meter
	COPD	OR=1.79 (1.06-3.02) for residence 100 m from road with >10,000 vehicles/day
	All-cause mortality	OR=1.18 (1.03-1.35) for residence <50 m from major road or <100 m from highway



Exposure

- ◆ Residential proximity to roadway (15-200 m)
- ◆ Traffic volume near home (100,000+ vehicles/day)
- ◆ Specific pollutant concentrations
 - Ambient
 - Modeled
 - Monitored
- ◆ Wind patterns

Average Daily Traffic in the Corridor

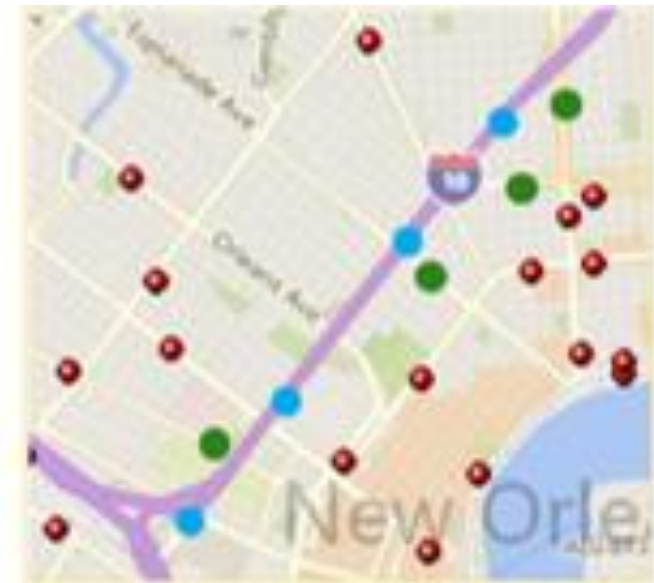
(From LA Dept. of Transportation and Development)

Station #	Location	Latitude & Longitude	Milepoint	Avg. Daily Traffic (Vehicles/Day): 2001	ADT: 2004	ADT: 2008	ADT: 2010	ADT: 2013	ADT: 2016	Average for all data collection years
222531	I-10 between Iberville & Bienville Streets	(29.604, -90.0765)	235.953	121464	99531	91600	69466	109923	147578	106593.6667
223051	I-10 between Esplanade Ave. & Kerlerec St.	(29.9698, -90.0681)	236.764	96782	113847	67633	100329	137820	137348	108959.8333
223061	I-10 between N. Johnson and N. Prieur	(29.997, -90.0617)	237.38	94599	121700	57278	83978	96675	109159	93898.16667
222521	US-90 just uptown from Poydras	(29.95334, -90.0831)	257.509	121367	101467	66343	95844	125924	125924	106144.8333
Annual Average for the Corridor				108553	109136.25	70713.5	87404.25	117585.5	130002.25	103899.125

Traffic on the I-10 Compared to Surrounding Roads

(LA DOTD, 2016)

Location within Corridor (monitors labeled in blue on map below)	Average Daily Traffic: 2016 (vehicles/day)
On the I-10 ●	130,002
On surrounding major roads (e.g., Tulane Ave.) ●	25,684



Proximity to Interstate



Point of Reference	Approximate Distance from Proximal Edge of Interstate
First row of houses across Claiborne Ave.	15 m
One block away from the Interstate	97 m
Two blocks away from the Interstate	200 m

Air Pollutant Exposure Levels: Modeled

Pollutant	Minimum Total Exposure Concentration in Corridor	Maximum Total Exposure Concentration in Corridor	Mean Total Exposure Concentration in Corridor	Mean Total Exposure Concentration in Orleans Parish	Mean Total Exposure Concentration in Louisiana
Benzene ($\mu\text{g}/\text{m}^3$)	0	1.05	0.76	0.64	0.52
Diesel PM ($\mu\text{g}/\text{m}^3$)	0.68	1.58	0.93	0.94	0.45

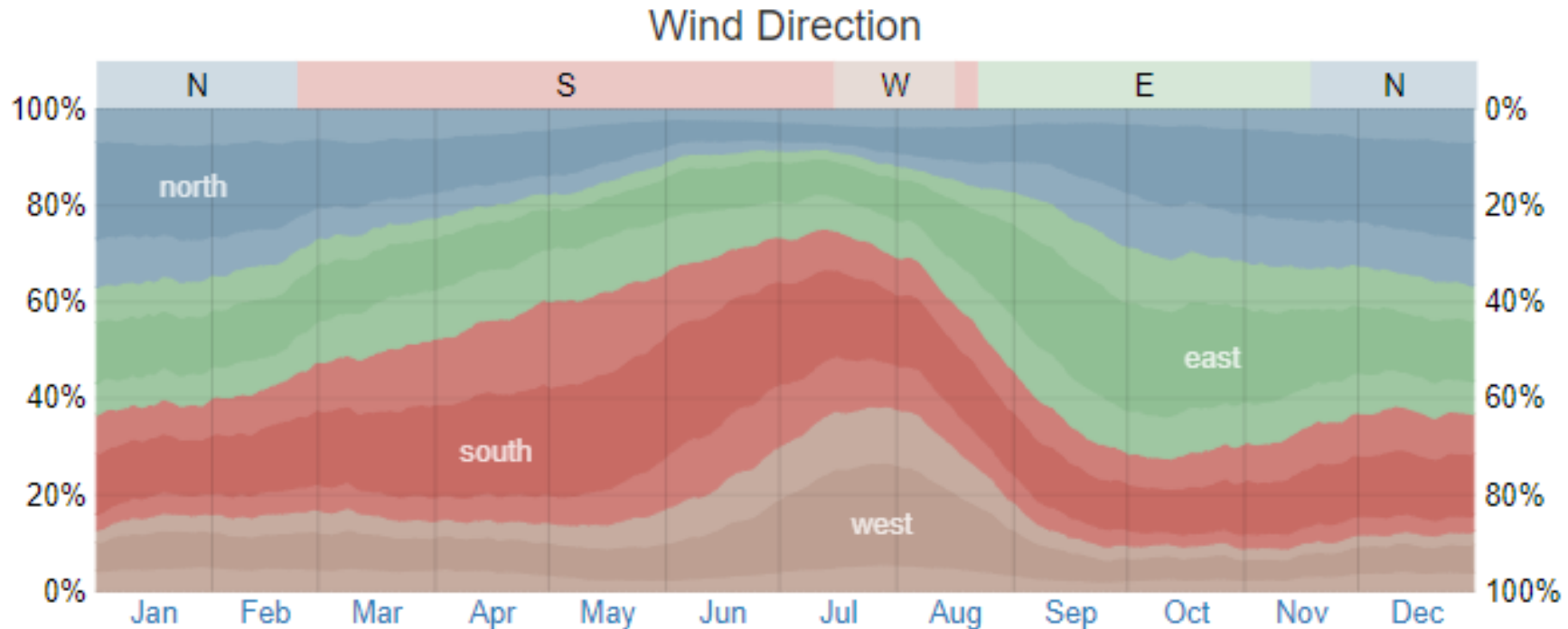
Air Pollutant Exposure Levels: Ambient

Pollutant	Minimum Ambient Concentration	Mean Ambient Concentration	Maximum Ambient Concentration
CO (ppm)	0	2.7	0.73
PM_{2.5} (µg/m³)	3.2	22.4	8.99
PM₁₀ (µg/m³)	-5	427	19
NO (ppb)	-1	221	6
NO₂ (ppb)	-1	82	6
NO_x (ppb)	-6	252	16

Measurements of ambient air quality are from LA DEQ monitors at I-610's West End Blvd. and near City Park at Florida Blvd. and Orleans Ave.

Effects of Seasonal Wind Patterns

Avg. Ambient PM ₁₀ : April	Avg. Ambient PM ₁₀ : July	Avg. Ambient PM ₁₀ : October	Annual Avg. Ambient PM ₁₀
16.8 µg/m ³	23.8 µg/m ³	17.3 µg/m ³	19 µg/m ³



The percentage of hours in which the mean wind direction is from each of the four cardinal wind directions (north, east, south, and west), excluding hours in which the mean wind speed is less than 1 mph. The lightly tinted areas at the boundaries are the percentage of hours spent in the implied intermediate directions (northeast, southeast, southwest, and northwest).

Health Impacts

Health Outcome	Average Crude Prevalence in Claiborne Corridor Census Tracts	Crude Prevalence in New Orleans
Asthma	29.1%	19.9%
High blood pressure	45.8%	38%
Cancer (excluding skin)	4.9%	5.3%
COPD	9.5%	6.7%
Coronary heart disease	8.2%	6.4%
Stroke	6.1%	9.4%

Deliverable: What are the risks?

Exposure:

- Residential proximity to traffic: 15-200 m from highway
- Traffic volume: 130,000+ cars/day
- Modeled average of $0.76 \mu\text{g}/\text{m}^3$ benzene/day
- Modeled average of $0.93 \mu\text{g}/\text{m}^3$ diesel particulate matter/day
- Annual ambient average of 0.73 ppm CO, $8.99 \mu\text{g}/\text{m}^3$ PM_{2.5}, $19 \mu\text{g}/\text{m}^3$ PM₁₀, $6 \mu\text{g}/\text{m}^3$ NO, $10 \mu\text{g}/\text{m}^3$ NO₂, $16 \mu\text{g}/\text{m}^3$ NO_x

Associated health impacts from literature:

- Ischemic heart disease mortality and all-cause mortality
- Increased blood pressure
- Preterm delivery, preeclampsia, low birth weight, and small for gestational age
- Autism
- Asthma prevalence and exacerbation, allergic sensitivity, COPD, and chronic wheeze in infants
- Childhood cancer, including leukemia
- Rheumatoid arthritis

Deliverable

Just an example here:

- **Exposure**

- CC's residents are **15-200 meters** away from the I-10
- Are exposed to **avg. 0.731 µg/L benzene/day, ug/m3 of X pollutants.....**
- Have **avg. 107,233 vehicles/day** traveling through the area (I-10).

- **Potential Impact**

- Literature has shown that **X and X health impacts** associated with these exposures.
- **Estimated risks** based on typical contaminant levels found or estimated for the area = # cancer per person for X contaminants, etc.....

- **Real Health Rates**

- In support of that theory, we observed that **CC residents experience higher adverse health conditions:** rates of X and X for X and X conditions compared to X areas of the city and state averages
 - **Cancer risk of 50.40 compared to Orleans Parish's 46.98; respiratory HI of 2.21 compared to OP's 1.98)**
 - This information should be considered before implementing proposed plans for further development along this corridor as it could pose a potential risk to residents and workers in this area.
 - This population is also **largely minority and low-income thus this situation poses an environmental injustice**
 - **75% of households are minority and 90% below \$75,000 annual income).**



Health Rates and Risk Burdens

- ◆ In support of that theory, we observed that CC residents experience higher adverse health conditions:
 - Asthma prevalence of 29.1% vs. 19.9% in Orleans Parish
 - High blood pressure prevalence of 45.8% vs. 38% in Orleans Parish
 - COPD prevalence of 9.5% vs. 6.7% in Orleans Parish
 - Coronary heart disease prevalence of 8.2% vs. 6.4% in Orleans Parish
- ◆ Cancer risk of 50.40 compared to Orleans Parish's 46.98; respiratory HI of 2.21 compared to OP's 1.98. (NATA)
- ◆ This information should be considered before implementing proposed plans for further development along this corridor, as it could pose a potential risk to residents and workers in this area.

Poster Presentation

Preliminary Assessment of Interstate-10's Health Impacts in the Claiborne Corridor

Caroline Stallard¹, Amy Stelly², Emily Gaddis², & Adrienne Katner¹



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Background

This study seeks to identify potential air pollution exposures and health outcomes associated with the Interstate-10 (I-10) over Claiborne Avenue in order to inform policy.



Objectives

1. Review literature on the health effects of road traffic pollutants
2. Identify and summarize air pollution, exposure and health data
3. Characterize potential pollutant exposures and risks

Methods

- Literature review: sources from the past 25 years on traffic-related air pollution impacts on health, gathered from Google Scholar (n=62)
- Evaluate and summarize available data:
 - Air quality: EPA's National Air Toxics Assessment (NATA), Louisiana Department of Environmental Quality (LADEQ)
 - Traffic: Louisiana Department of Transportation and Development (LA DOTD), Google Maps
 - Health outcomes: NAPA, The Data Center, Centers for Disease Control (CDC)
 - Demographic: EUSCREEN, Trust for Public Land, American Community Survey

Exposure: Traffic Volume and Proximity

Location within Corridor (monitors labeled in blue on map below)

Average Daily Traffic: 28,66 (vehicles/day)

On the I-10: 130,002

On surrounding major roads (e.g., Tulane Ave.): 25,684

Point of Reference: Approximate Distance from Proximal Edge of Interstate

1st row of houses across Claiborne Ave.: 15 m

1 block from I-10: 97 m

2 blocks from I-10: 200 m

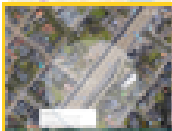
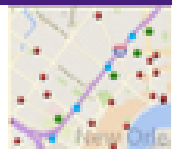


Figure 4. Proximity to Interstate 10. Average Daily Traffic Volume from Corridor, by mile offset (50 or 100 meters) upstream or downstream. Distance from health impacts (road closures, air quality monitoring) to I-10 (see Google Maps Distance Tool) at Approximate Distance to Proximal Edge.

Health Hazards

Pollutant	Significantly associated health impacts	Adjusted Risk Ratio and 95% CI, per unit for Significant Level of Exposure
Particulate Matter (e.g., PM ₁₀ , PM _{2.5} , Diesel PM)	Increased cardiovascular mortality	RR=1.16 (1.11-1.22) for 10 µg/m ³ PM ₁₀
	Increased mean arterial blood pressure	+0.44 mm Hg (0.15-0.73) mean systolic BP and +0.37 mm Hg (0.1-0.6) mean diastolic BP for 3.0 µg/m ³ PM ₁₀
	Lung cancer	RR=1.08 (1.03-1.13) for 1.0 µg/m ³ PM ₁₀ RR=1.17 (1.05-1.29) for 1.0 µg/m ³ PM _{2.5} RR=1.11 (1.03-1.20) for 1.0 µg/m ³ Diesel PM
	Proteinuria	RR=1.45 (1.1-1.92) for 1.0 µg/m ³ PM ₁₀ RR=1.42 (1.0-1.95) for 1.0 µg/m ³ PM _{2.5}
	Impaired lung development	RR=1.11 (1.0-1.23) for 1.0 µg/m ³ Diesel PM
Nitrogen Dioxide (NO ₂)	Asthma prevalence	• RR=1.15 (1.0-1.32) for 5.1 ppb NO ₂ • RR=1.17 (1.0-1.35) for 20.4 ppb NO ₂
	Proteinuria	RR=1.38 (1.0-1.83) for 5.0 ppb NO ₂
	Low birth weight	RR=1.11 (1.0-1.23) for 1.0 ppb NO ₂
	Proteinuria	RR=1.35 (1.0-1.82) for 5.0 ppb NO ₂
Carbon Monoxide (CO), Elemental Carbon (EC), Black Carbon (BC)	Asthma exacerbations	RR=1.30 (1.0-1.62) for 0.3 ppb CO
	Impaired cognition (Black Matter)	RR=1.32 (1.1-1.6) for each doubling of BC
	Stroke	RR=1.16 (1.0-1.32) for 1.00 ppb increase distance weighted CO RR=1.15 (1.0-1.31) for 0.02 ppb increase
Compartments	Stroke	RR=1.11 (1.0-1.23) for 0.02 ppb increase
Stroke	Coronary heart disease mortality	RR=1.11 (1.0-1.23) for 0.02 ppb increase
	Stroke	RR=1.07 (1.0-1.15) in men RR=1.08 (1.0-1.16) in women, for highest value exposure class (>100 m from main road)
	Myocardial infarction	RR=1.17 (1.0-1.33) for 0.02 ppb RR=1.18 (1.1-1.27) for 0.02 ppb RR=1.18 (1.0-1.37) for 0.02 ppb (long term)
Stroke (Ch)	Asthma onset	RR=1.10 (1.0-1.21) for 10.1 ppb CO (near 1,000-1,500 houses)
	All childhood cancer	RR=1.10 (1.0-1.21)
	Childhood leukemia	RR=1.26 (1.0-1.56) for 0.02 ppb CO/day
	Allergic sensitivity	RR=1.17 (1.0-1.37) (postnatal)
Traffic Proximity and Volume	Obesity prevalence	RR=1.08 (1.0-1.16) for 100 m from road with 5,700-20,000 trucks/day
	Low birth weight	RR=1.12 (1.0-1.23) for 1.00 m from bus or state route with 100 trucks/day
	Small for gestational age	RR=1.16 (1.0-1.33) for 100 m from highway
	Phenotypic asthma	RR=1.02 (1.0-1.03) for 100 m from highway
	Asthma exacerbations	RR=1.00 (1.0-1.01) for 100 m from highway
	Asthma prevalence	• RR=1.03 (1.0-1.07) for 100 m from highway • RR=1.04 (1.0-1.08) for 100 m from highway with 0.02 vehicles/minute
	COPD	RR=1.19 (1.0-1.33) for 100 m from road with 0.02 vehicles/minute
	All-cause mortality	RR=1.14 (1.0-1.19) for 100 m from highway

Air Pollutant Exposure Estimates

Pollutant	Maximum Total Exposure Concentration In Corridor	Maximum Total Exposure Concentration In Corridor	Mean Total Exposure Concentration In Corridor	Mean Total Exposure Concentration In State	Mean Total Exposure Concentration In State
Aerosols (µg/m ³)	0	1.29	0.31	0.14	0.12
Diesel PM (µg/m ³)	0.08	1.24	0.13	0.14	0.14

Figure 5. Modelled Air Pollutant Exposure for Corridor Traffic, On-road/Off-road/In-state (2009-2017)

Pollutant	Minimum Concentration	Mean Concentration	Maximum Concentration
CO (ppm)	0	0.1	0.29
PM ₁₀ (µg/m ³)	0.1	20.1	6.91
PM _{2.5} (µg/m ³)	0	201	1.8
NO (ppb)	0	201	0
NO ₂ (ppb)	0	90	0
SO ₂ (ppb)	0	200	1.8

Figure 6. Modelled Annual Air Concentrations Near I-10 and West Post Road in On-road/Off-road/In-state (2009-2017)

Health Impacts

Health Outcome	Average Corridor Prevalence in Claiborne Corridor Central Tracts	Grade Prevalence in New Orleans
Asthma	18.1%	18.9%
High blood pressure	45.8%	48%
Cancer (including skin)	6.9%	5.3%
COPD	0.9%	0.7%
Coronary heart disease	0.7%	0.4%
Stroke	6.7%	8.4%

Figure 8. Comparison of Health Impacts in Corridor Tracts (CDC NCHS, 2017)

Discussion

These health burdens are in line with the available exposure data. More data is needed on health outcomes at the neighborhood level, local pollutant monitoring, and prevailing wind patterns. Future studies should examine disproportionate risk burden using demographic data, the effects of seasonal wind variation on air pollution exposure, the effects of noise on residents' health, the potential use of GIS mapping to track health outcomes, the best ways to communicate risks to residents, and possible policy implementation.

References

Available upon request

Acknowledgement

LSU HSC, Claiborne Avenue Alliance, The Irving Parish Exchange, EPA, CDC, LA DOTD, LA DEQ, LA DOTD, Trust for Public Land, Blue State Center



Progress Report and Next Steps

◆ Caroline Stallard

- Literature review
- Data sets
- Preliminary assessment

◆ Erin LeCompte

- Noise assessment
- Risk assessment

◆ Ian Walsh

- GIS mapping of exposure and health indicators

◆ Communications

- Strategies for risk communication to residents
- Venue to present this slideshow or similar to community members?

◆ Exposure data

- More locally monitored air quality data
- Analysis of wind patterns

◆ Policy students

- Policy implications
- 