COVID-19 and Air Pollution in Louisiana

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Global Agenda | COVID-19 | Global Health

The deadly link between COVID-19 and air pollution

Clean air and clear skies in Delhi during India's COVID-19 lockdown

Image: REUTERS/Adnan Abidi

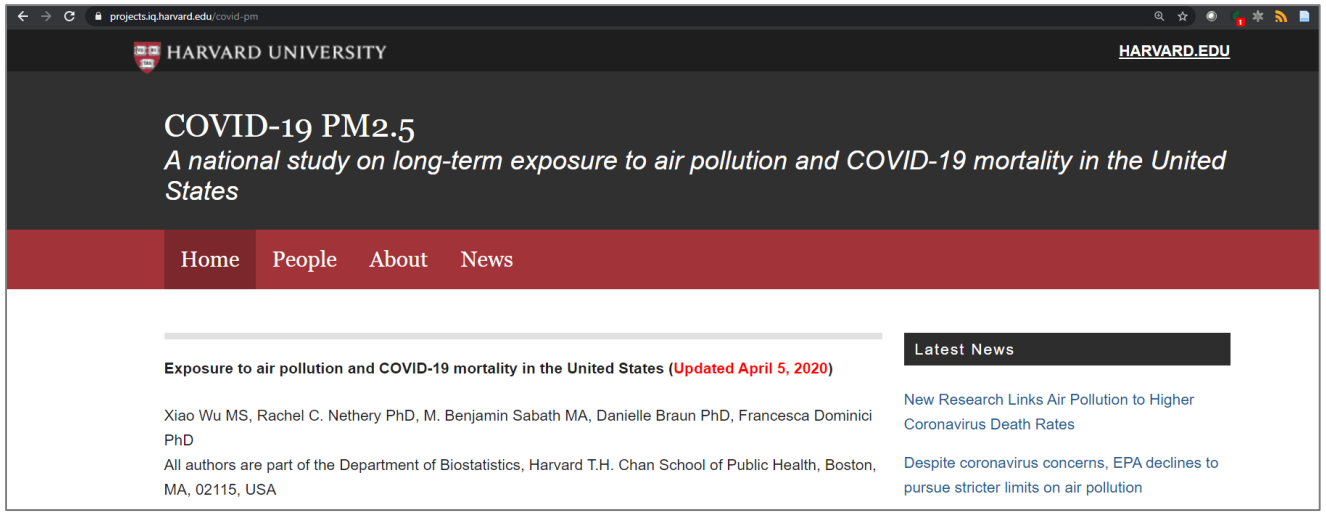
15 Apr 2020

The “Harvard Study”

“A small increase in long-term exposure to PM 2.5 leads to a large increase in COVID-19 death rate”

1 µg/m^3 PM 2.5 pollution increases COVID-19 death rate by 15%.

The COVID-19 death risk grows larger as pollution levels increase.



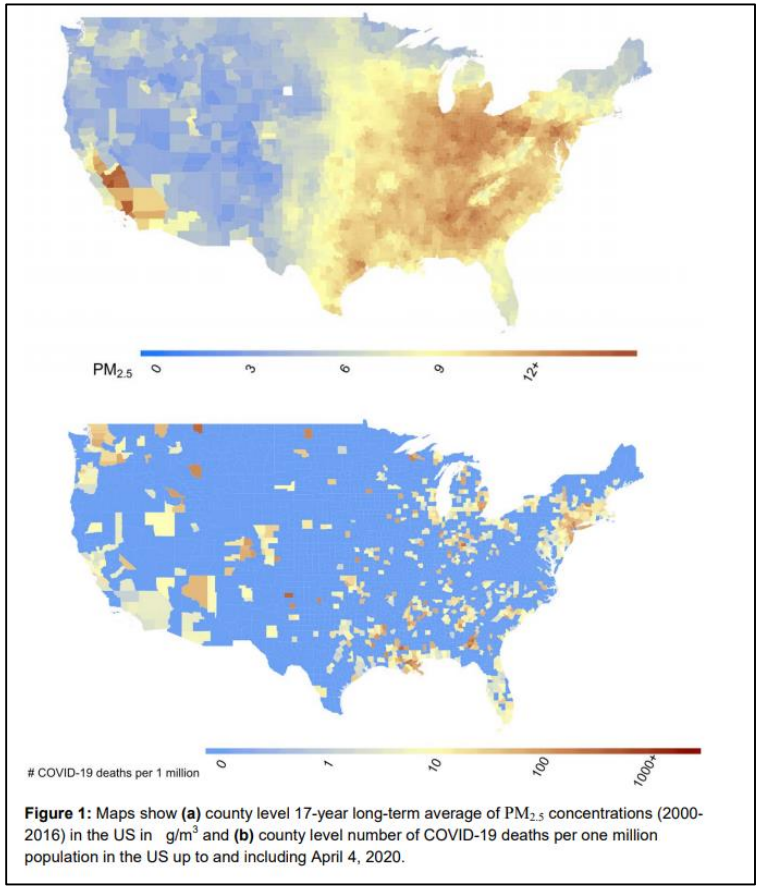


Figure 1: Maps show **(a)** county level 17-year long-term average of $PM_{2.5}$ concentrations (2000-2016) in the US in g/m^3 and **(b)** county level number of COVID-19 deaths per one million population in the US up to and including April 4, 2020.

Harvard Study: https://projects.iq.harvard.edu/covid-pm

Particulate Matter 2.5 (PM 2.5)

- Also called “fine particles”
- A mix of chemicals, dust, and liquid droplets
- The name comes from the small size of the particles: under 2.5 microns (about 1/30 the diameter of a human hair).
- Comes from combustion (industrial plants, cars, fires)
- Can get deep into your lungs and enter the bloodstream
- Causes lung disease, heart disease, and lung cancer
- Worsens pre-existing lung disease

https://www.epa.gov/pm-pollution/particulate-matter-pm-basics

Patterns and “Noise”

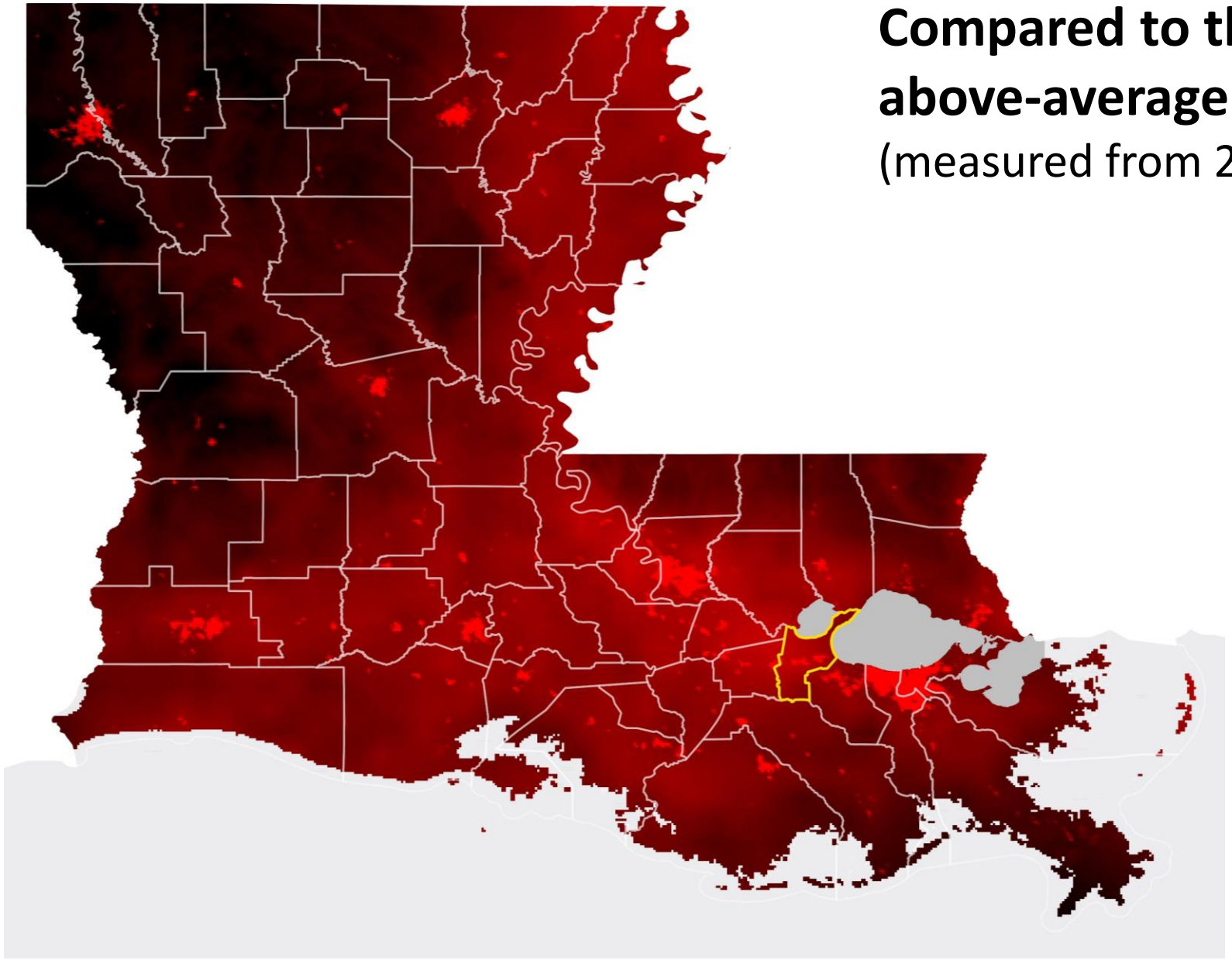
- The Harvard Study accounted for other factors that influence COVID-19 death risk: population size and density, # tests, # hospital beds, smoking, body mass index, poverty, income, education, age, race, and weather.

- Factors that influence COVID-19 deaths act as “noise” and can obscure the pattern of air pollution and COVID-19 deaths.

- We can’t eliminate all the “noise”, but, if we look at a big enough population, the pattern will rise above the “noise”.

- If we look at a small community, we probably won’t see the pattern because of this “noise”.

See: Wilson and Gordon, 1986. Calculating sample sizes in the presence of confounding variables. *Applied Statistics.* 35, p. 207-213. https://www.jstor.org/stable/2347271?seq=1



Compared to the U.S., Louisiana has above-average PM 2.5 pollution

(measured from 2000 – 2016).

PM 2.5 Pollution ($\mu g/m^3$)

0 — 8.4 (U.S. Average*) — 11.0 +

World Health Organization recommended limit (10 $\mu g/m^3$)

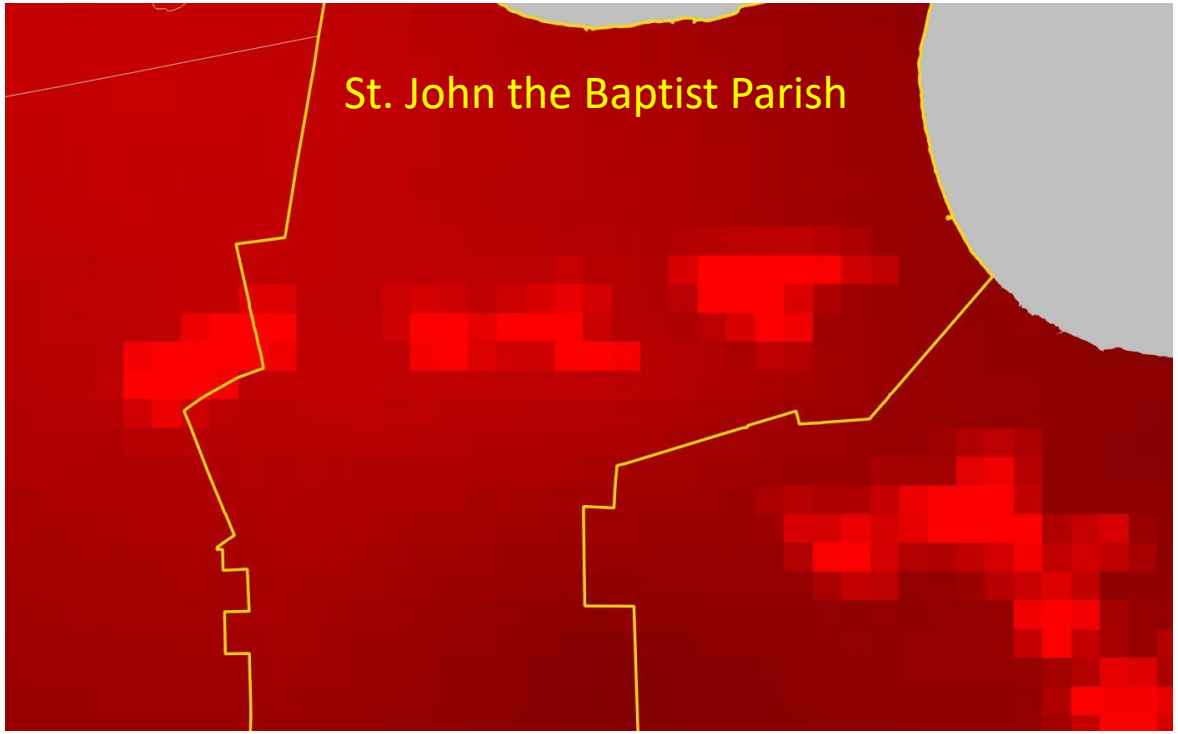
DATA SOURCE

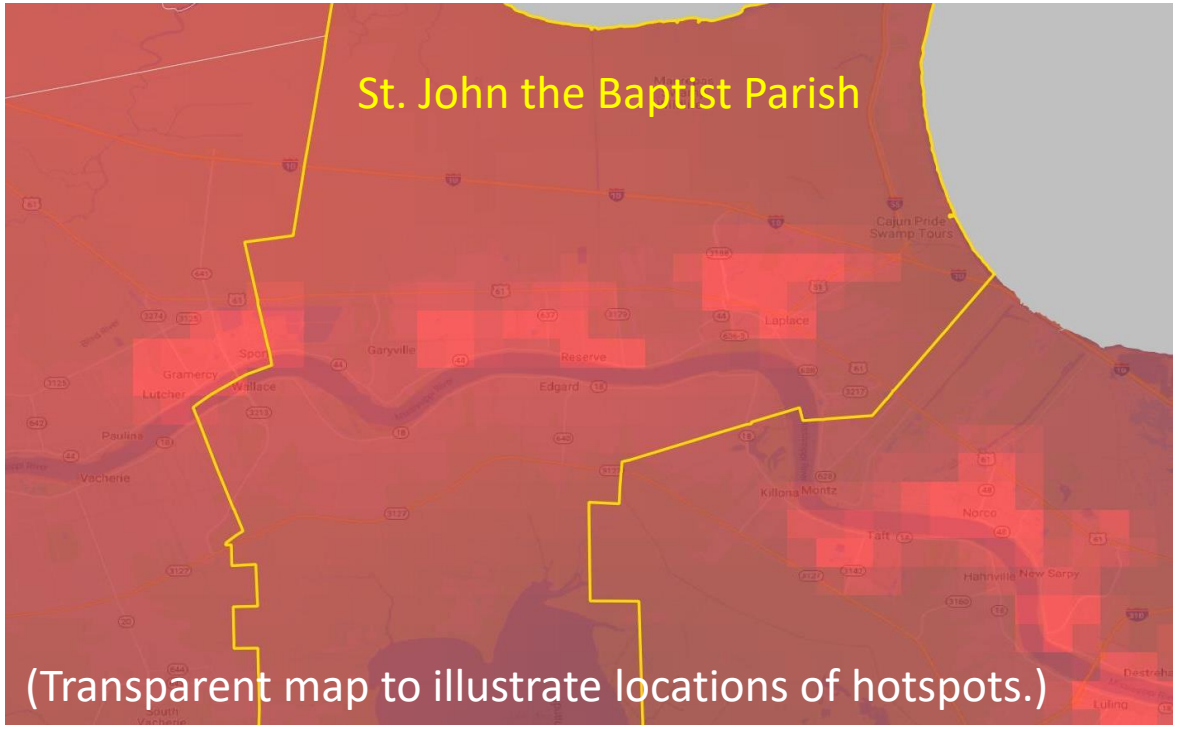
17-Year average PM 2.5 concentrations (2000 – 2016). From: van Donkelaar, A., R. V. Martin, et al. (2019). http://fizz.phys.dal.ca/~atmos/martin/?page_id=140

WHO limit: https://www.who.int/news-room/fact-sheets/detail/ambient-(outdoor)-air-quality-and-health

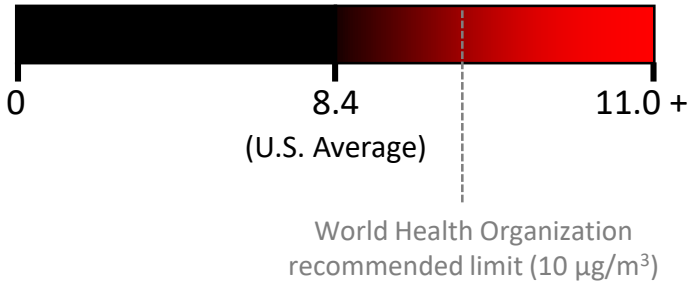
*Reported by https://projects.iq.harvard.edu/covid-pm.

St. John Parish has above-average PM 2.5 levels, plus hotspots of even higher PM 2.5 levels in Reserve and LaPlace (measured from 2000 – 2016).

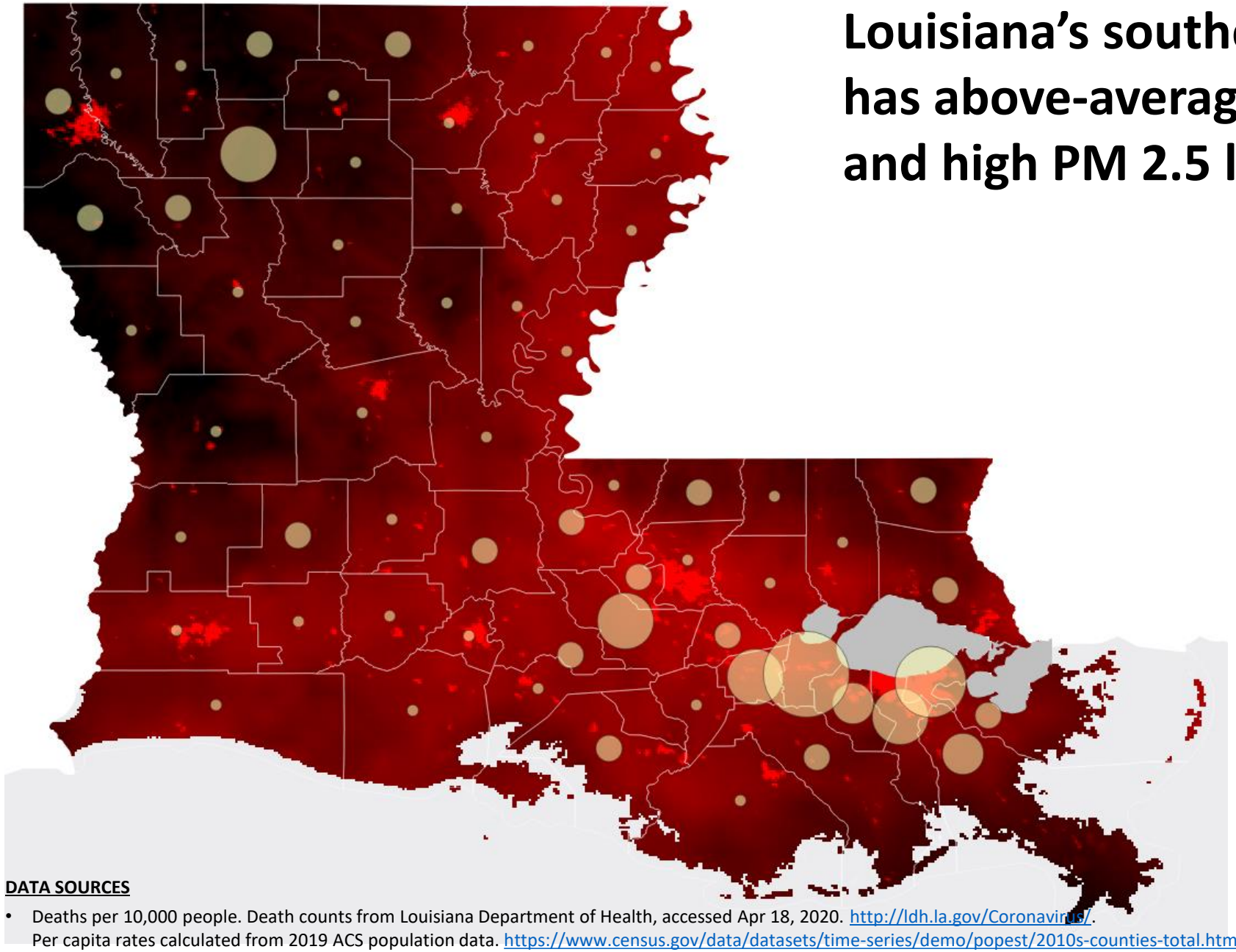




PM 2.5 Pollution ($\mu g/m^3$)



Louisiana's southeast industrial region has above-average COVID-19 death rates and high PM 2.5 levels.



COVID-19 Deaths by Parish*

(# deaths per 10,000 people, as of 4/18/20)

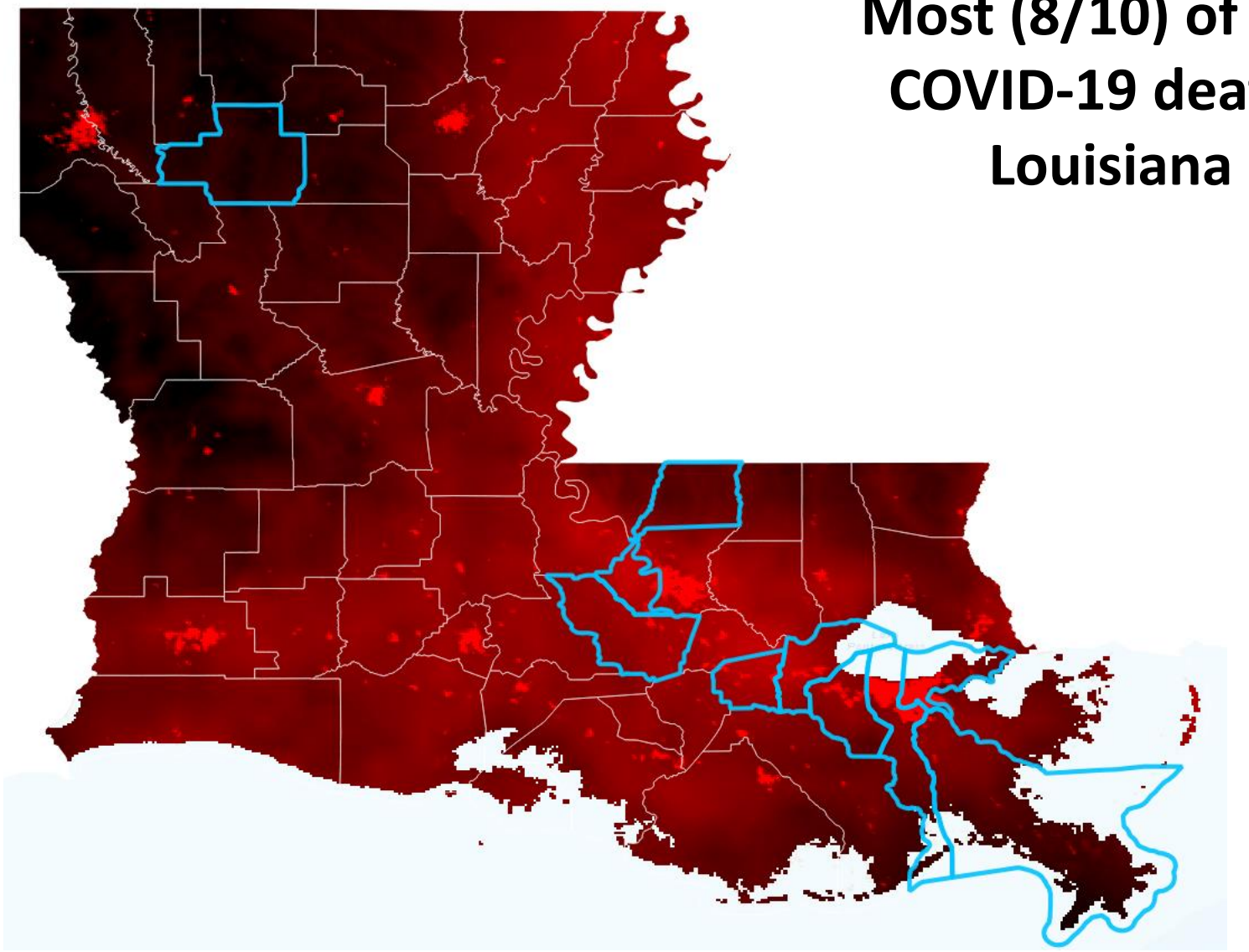
- 0.0 – 2.0 ---- U.S. overall (1.0)
- 2.0 – 4.1
- 4.1 – 6.2
- 6.2 – 8.2
- 8.2 – 10.3
- 10.3 – 12.4

*Based on CDC data, up to and including Apr 18, 2020 (33,049 deaths). Calculated from ACS 2019 U.S. population estimate (328,239,523).

DATA SOURCES

- Deaths per 10,000 people. Death counts from Louisiana Department of Health, accessed Apr 18, 2020. http://ldh.la.gov/Coronavirus/.
  Per capita rates calculated from 2019 ACS population data. https://www.census.gov/data/datasets/time-series/demo/popest/2010s-counties-total.html
- 17-Year average PM 2.5 concentrations (2000 – 2016), presented relative to the overall U.S. mean (8.4 μg/m^3). From: van Donkelaar, A., R. V. Martin, et al. (2019). Regional Estimates of Chemical Composition of Fine Particulate Matter using a Combined Geoscience-Statistical Method with Information from Satellites, Models, and Monitors. Environmental Science & Technology, 2019, doi:10.1021/acs.est.8b06392. [Link]

Most (8/10) of the parishes with the highest COVID-19 death rates are in the southeast Louisiana $PM_{2.5}$ Pollution Corridor.



COVID-19 Deaths by Parish
(# deaths per 10,000 people, as of 4/18/20)

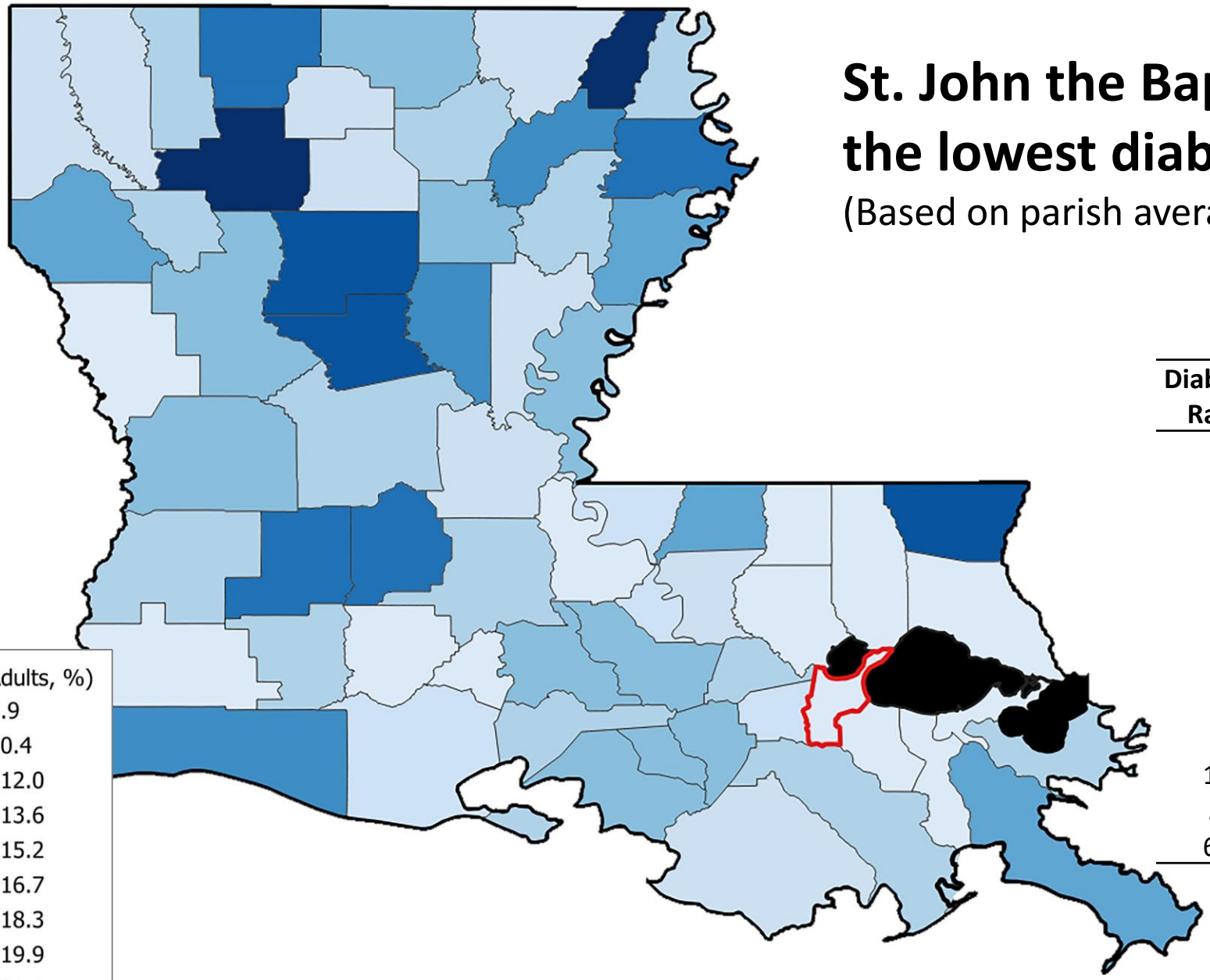
PARISH	DEATH RATE
St. John the Baptist	12.37
Orleans	8.30
Bienville	6.80
St. James	6.64
Iberville	6.46
Jefferson	6.36
St. Charles	5.08
Plaquemines	4.74
West Baton Rouge	3.78
East Feliciana	3.66

DATA SOURCES

- Deaths per 10,000 people calculated from 2019 ACS population data (https://www.census.gov/data/datasets/time-series/demo/popest/2010s-counties-total.html) and Louisiana Department of Health. Coronavirus (COVID-19). Data accessed 4/18/2020. http://ldh.la.gov/Coronavirus/.
- 17-Year average PM 2.5 concentrations (2000 – 2016), presented relative to the overall U.S. mean (8.4 μg/m^3). From: van Donkelaar, A., R. V. Martin, et al. (2019). Regional Estimates of Chemical Composition of Fine Particulate Matter using a Combined Geoscience-Statistical Method with Information from Satellites, Models, and Monitors. Environmental Science & Technology, 2019, doi:10.1021/acs.est.8b06392. [Link]

Diabetes and obesity are risk factors for death from COVID-19 in Louisiana. But these health conditions don’t fully explain the geographic pattern of COVID-19 death rates in Louisiana.

(Hypertension is also a risk factor for COVID-19 deaths in Louisiana, but hypertension data by parish aren’t available.)

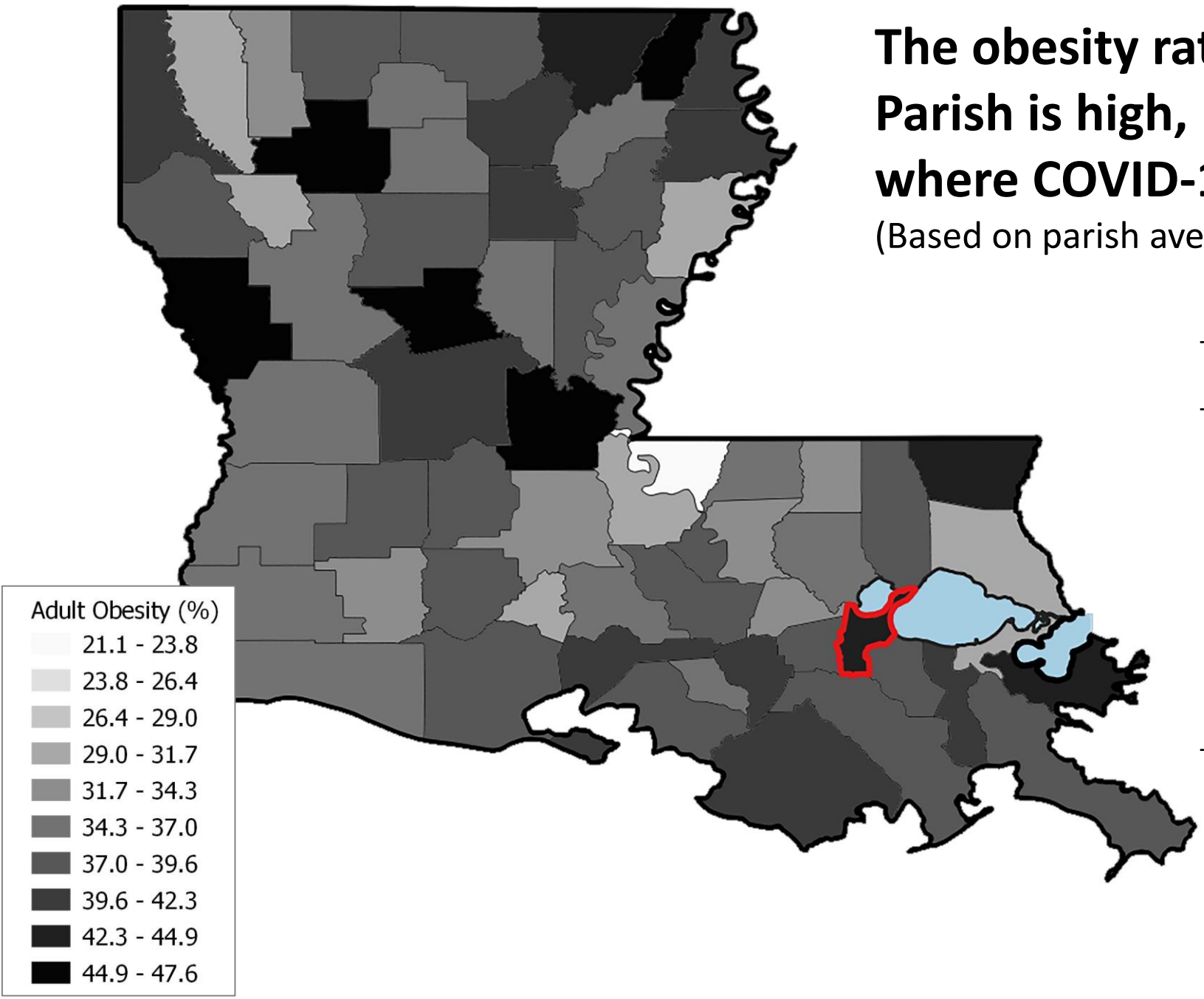


St. John the Baptist Parish has one of the lowest diabetes rates in the state.

(Based on parish averages.)

Diabetes Rank	Parish	Adults with Diabetes (%)
1	West Carroll	24.8
2	Bienville	23.9
3	Washington	23.0
4	Winn	22.1
5	Claiborne	20.6
6	Grant	20.5
7	Evangeline	20.1
8	Cameron	19.4
9	Tensas	19.4
10	Allen	19.2
…		
60	St. John The Baptist	10.0

DATA SOURCE: 2016 CDC data, crude rates, adults (aged 20+)
https://gis.cdc.gov/grasp/diabetes/DiabetesAtlas.html#

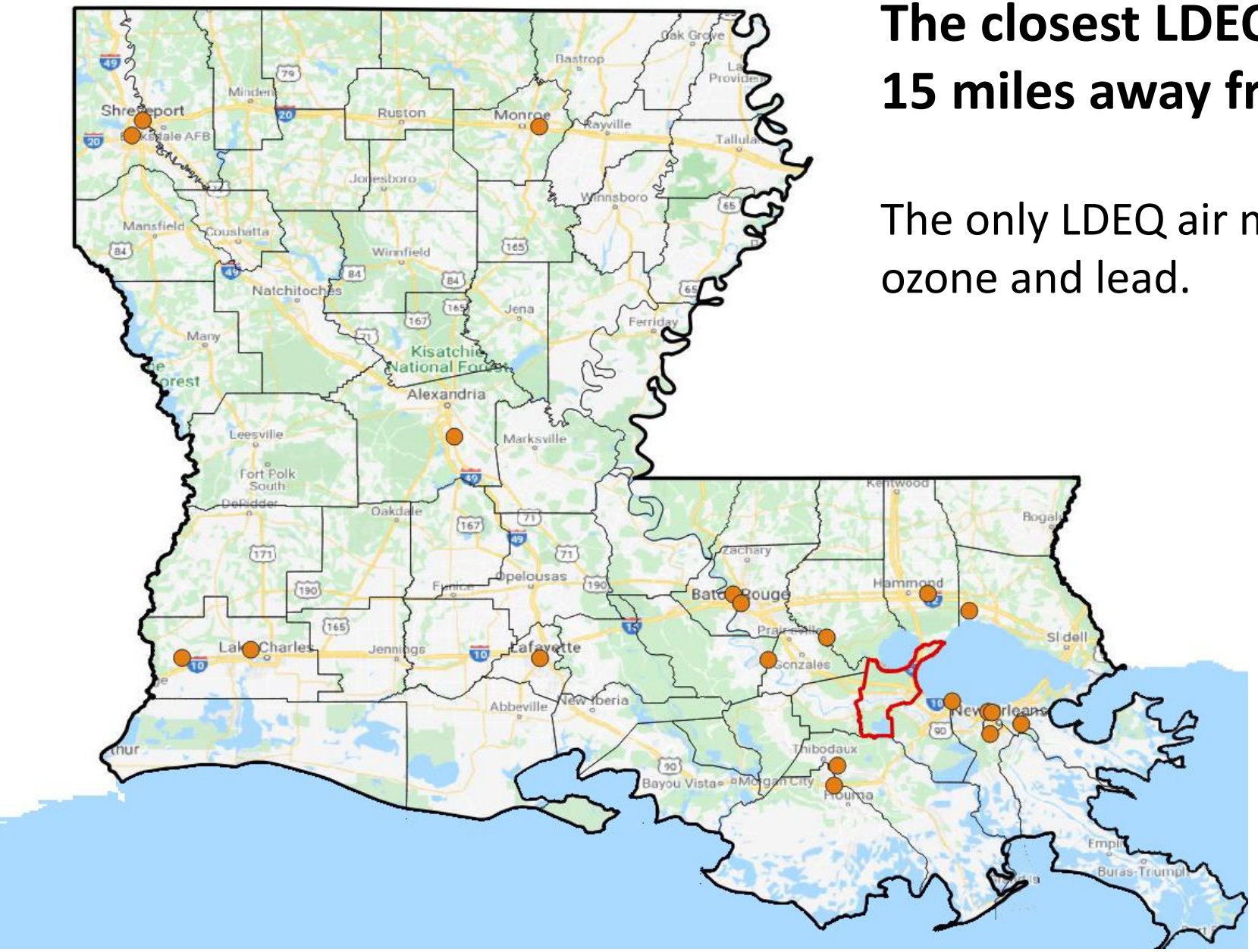


The obesity rate in St. John the Baptist Parish is high, but similar to other parishes where COVID-19 death rates are far lower.

(Based on parish averages.)

Obesity Rank	Parish	Adults with Obesity (%)	COVID-19 Death Rate
1	Grant	47.4	0
2	West Carroll	46.8	0
3	Sabine	45.8	0
4	Bienville	45.3	6.8
5	Avoyelles	44.7	0.8
6	**St. John**	**43.3**	**12.4**
7	Morehouse	43.2	0.8
8	Washington	42.8	2.4
9	St. Bernard	42.5	2.3
10	Grant	47.4	0

DATA SOURCE
https://gis.cdc.gov/grasp/diabetes/DiabetesAtlas.html#



The closest LDEQ air monitor for PM 2.5 is 15 miles away from Denka/Dupont.

The only LDEQ air monitors in St. John Parish are ozone and lead.

Louisiana Department of Environmental Quality (LDEQ) PM 2.5 Monitor

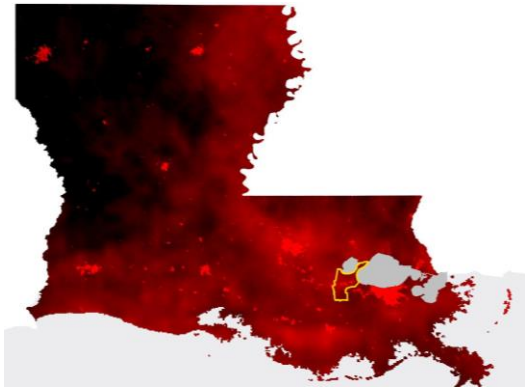
DATA SOURCE
https://www.deq.louisiana.gov/page/air-monitoring-sites

Louisiana improved air quality from 2000-2015, but is now losing ground.

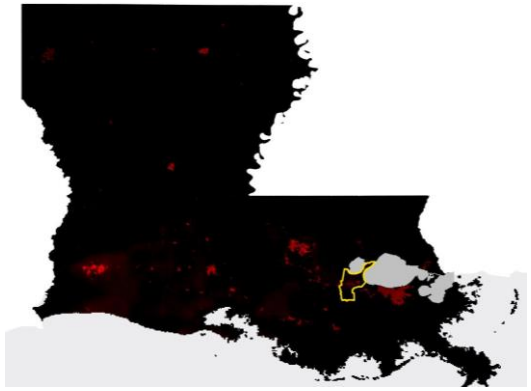
2000

2005

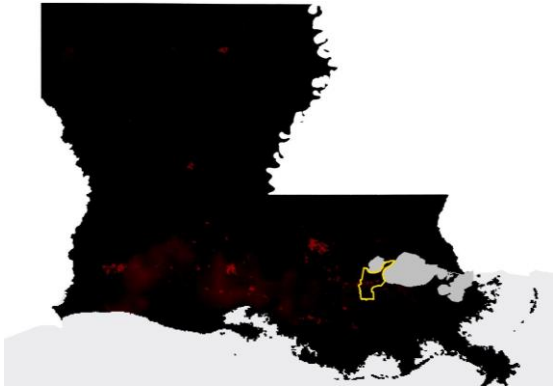
2010



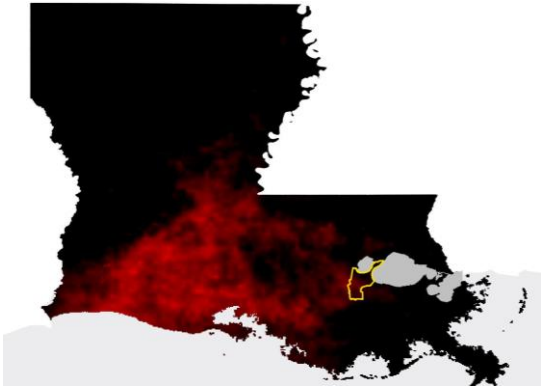
2015



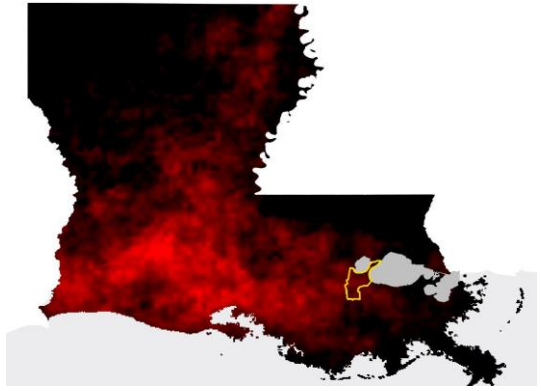
2016



2017



2018



PM 2.5 Pollution ($\mu g/m^3$)

0

11.03 +

8.4

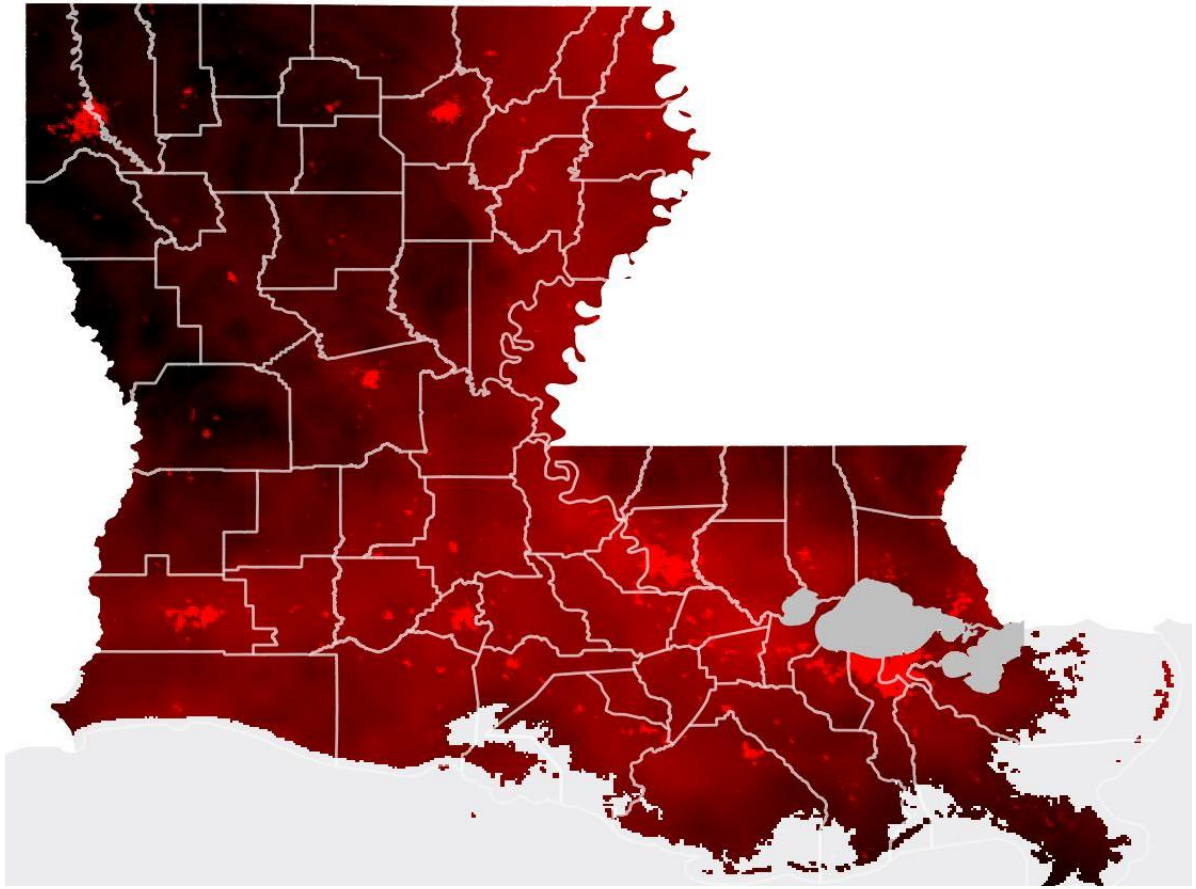
(U.S. Average)

DATA SOURCE

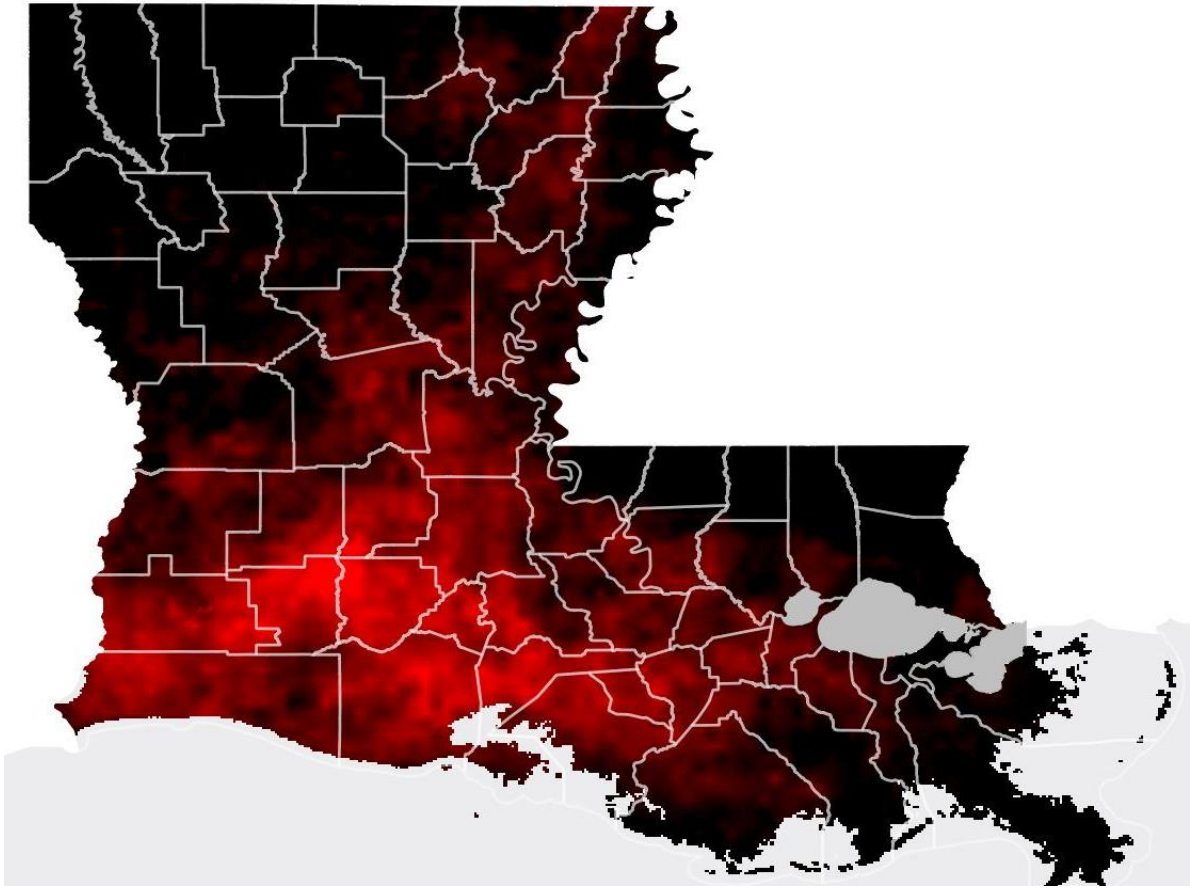
PM 2.5 concentrations (2000 – 2016), presented relative to the overall U.S. mean (8.4 $\mu g/m^3$). From: van Donkelaar, A., R. V. Martin, et al. (2019). Regional Estimates of Chemical Composition of Fine Particulate Matter using Combined Geoscience-Statistical Method with Information from Satellites, Models, and Monitors. Environmental Science & Technology, 2019, doi:10.1021/acs.est.8b06392. [Link]

Industrialized communities in south Louisiana are overburdened by pollution and the resulting health risks, including COVID-19 mortality. Based on recent pollution trends, this disparity will continue and may worsen.

2000 - 2016



2018



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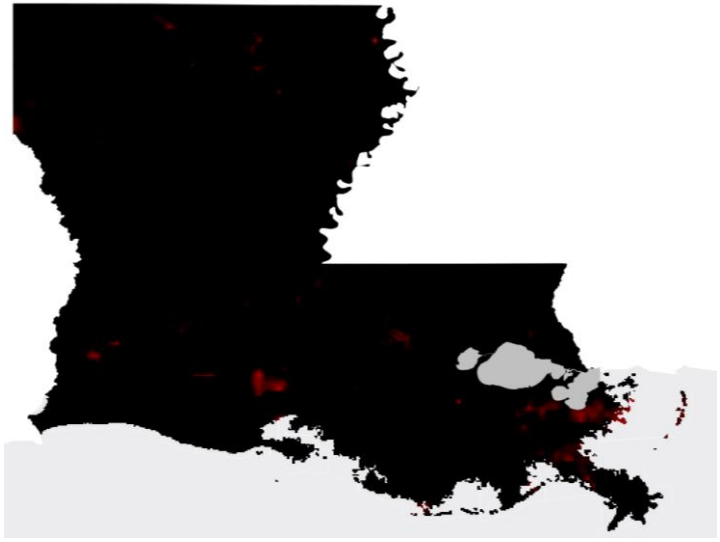
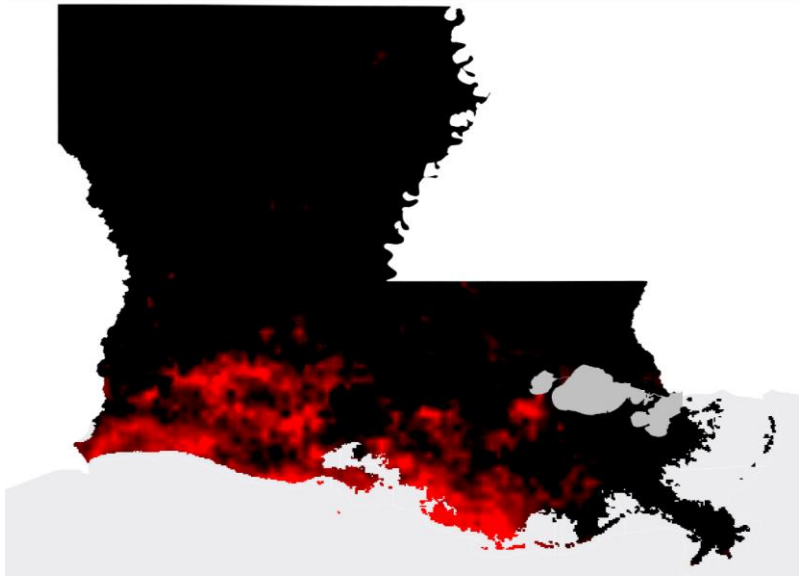
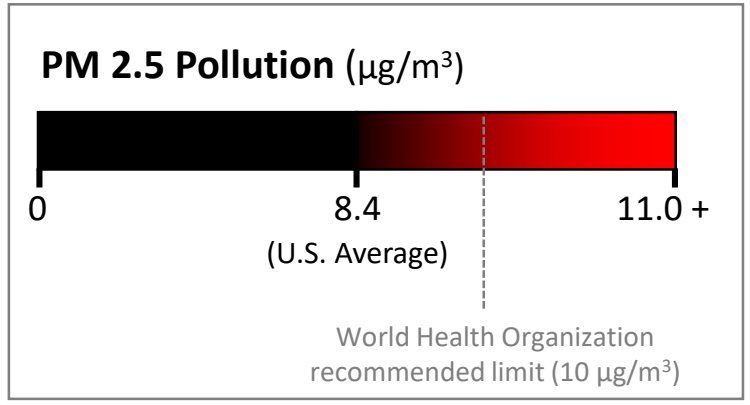
BONUS SLIDE – Seasonal changes in PM 2.5 in Louisiana in 2017

Feb 2017

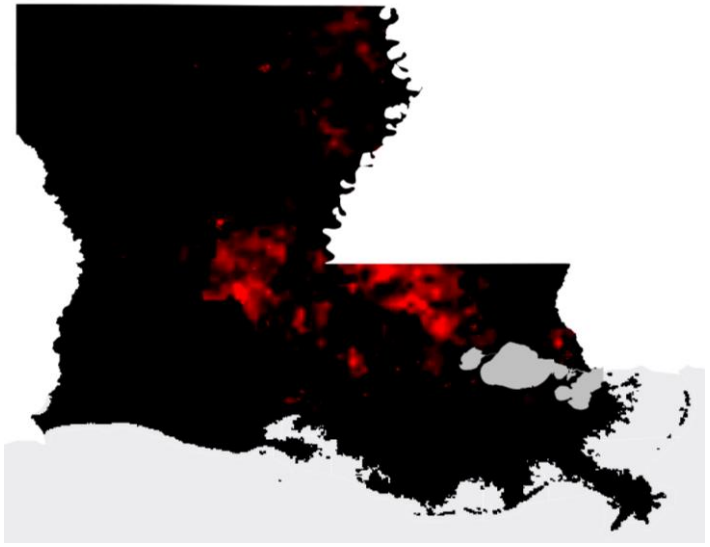


May 2017

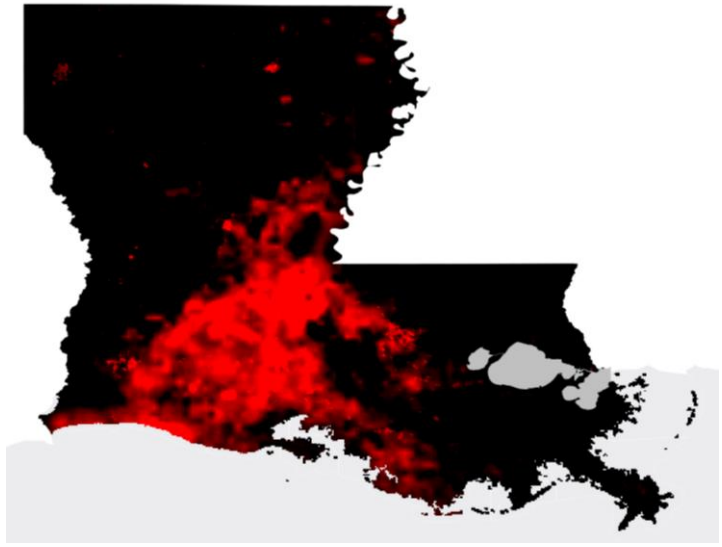




Aug 2017



Nov 2017



2017 overall