

# London Air Quality Pre and Post ULEZ

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# Changes to levels of PM<sub>10</sub> and Nitrogen Dioxide in Central London before and after the introduction of the Ultra-Low Emissions Zone (ULEZ)

# What is $\text{NO}_2$ and $\text{PM}_{10}$ ?

- Nitrogen Dioxide ( $\text{NO}_2$ ) is produced by burning of fuel, especially diesel-run engines
  - Causes irritation in respiratory system
  - Particles smaller than about 10 micrometers or  $\text{PM}_{10}$  (**dust, rubber** and **metal** from engine wear)
  - Can settle in the airways and lungs, worsening heart and lung diseases
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# The Research



# Our hypotheses are:

1. The introduction of ULEZ (8th April 2019) decreased the amount of  $\text{NO}_2$  in the Central London by at least 42%
2. The introduction of ULEZ was at least 25% more effective than the introduction of LEZ (4th February 2008) in reducing  $\text{NO}_2$  levels in the Central London
3. The introduction of ULEZ decreased the amount of  $\text{PM}_{10}$  in the Central London by at least 33%
4. The introduction of ULEZ was at least 25% more effective than the introduction of LEZ in reducing  $\text{PM}_{10}$  levels in Central London

# Methodology and data

Took King's College London Air quality data from the following sites for the following pollutants:



NO<sub>2</sub>

PM<sub>10</sub>

CT3 City of London, Sir John Cass School

CT3 City of London, Sir John Cass School

KC1 Kensington and Chelsea, North Kensington

CT8 City of London, Upper Thames Street

HK6 Hackney, Old Street

MY7 Westminster Marylebone Road FDMS

CT6 City of London, Walbrook Wharf

HK6 Hackney, Old Street

WM6 Westminster, Oxford Street

WM6 Westminster, Oxford Street

# Methodology and data

- Sampled data for two months of years 2006, 2007, 2018, 2019 to get normal distributions
- Welch T-test
- Final outcome: Cohen's d effect size



The introduction of ULEZ (8th April 2019) decreased the amount of NO<sub>2</sub> in the City of London by at least 42%

- rejected Null Hypothesis
- Effect size difference is - 6.759
- Cohen's power is 1.0

The introduction of ULEZ was at least 25% more effective than the introduction of LEZ (4th February 2008) in reducing NO<sub>2</sub> levels in the City of London

- Reject Null Hypothesis
  - Effect size difference is - 6.727
  - Cohen's power is 1.0
  - P value of 0.00
  - Alpha of 0.05
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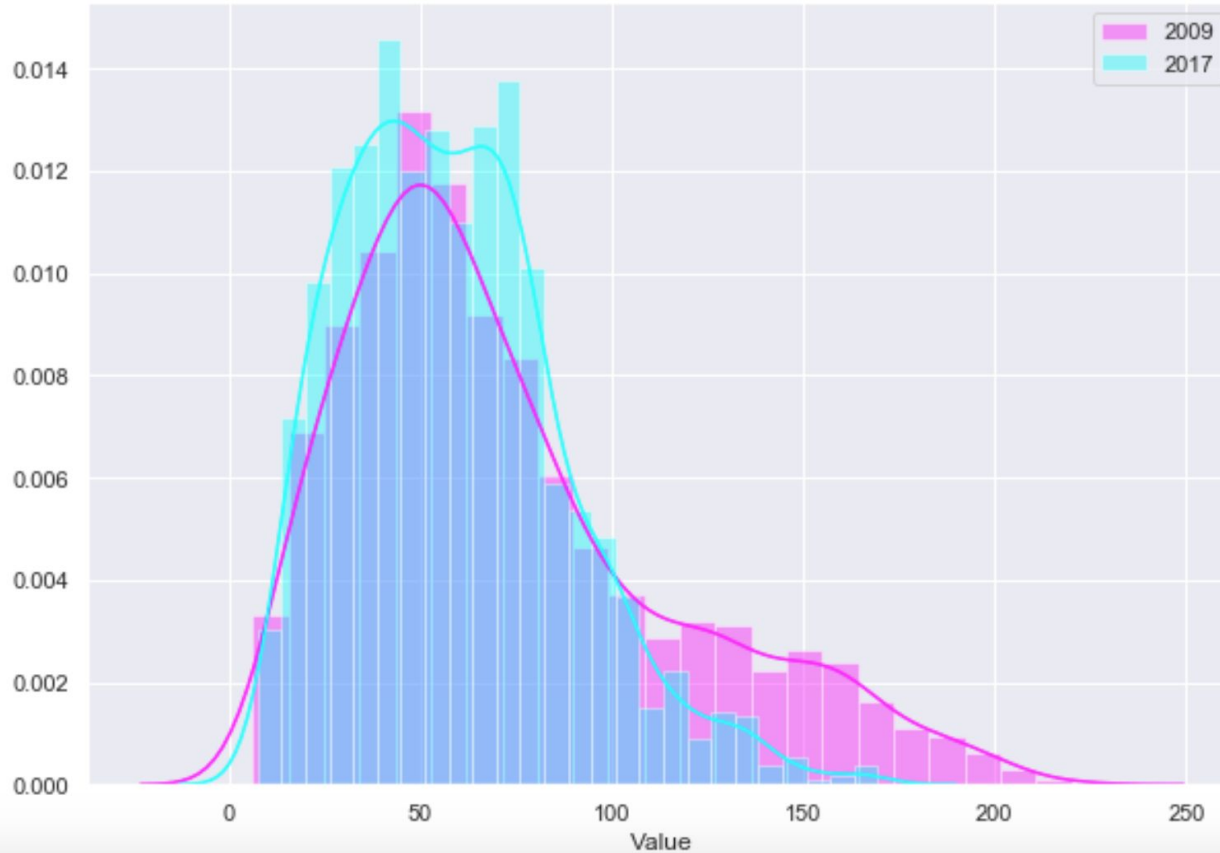
The introduction of ULEZ decreased the amount of PM10 in the City London by at least 33%

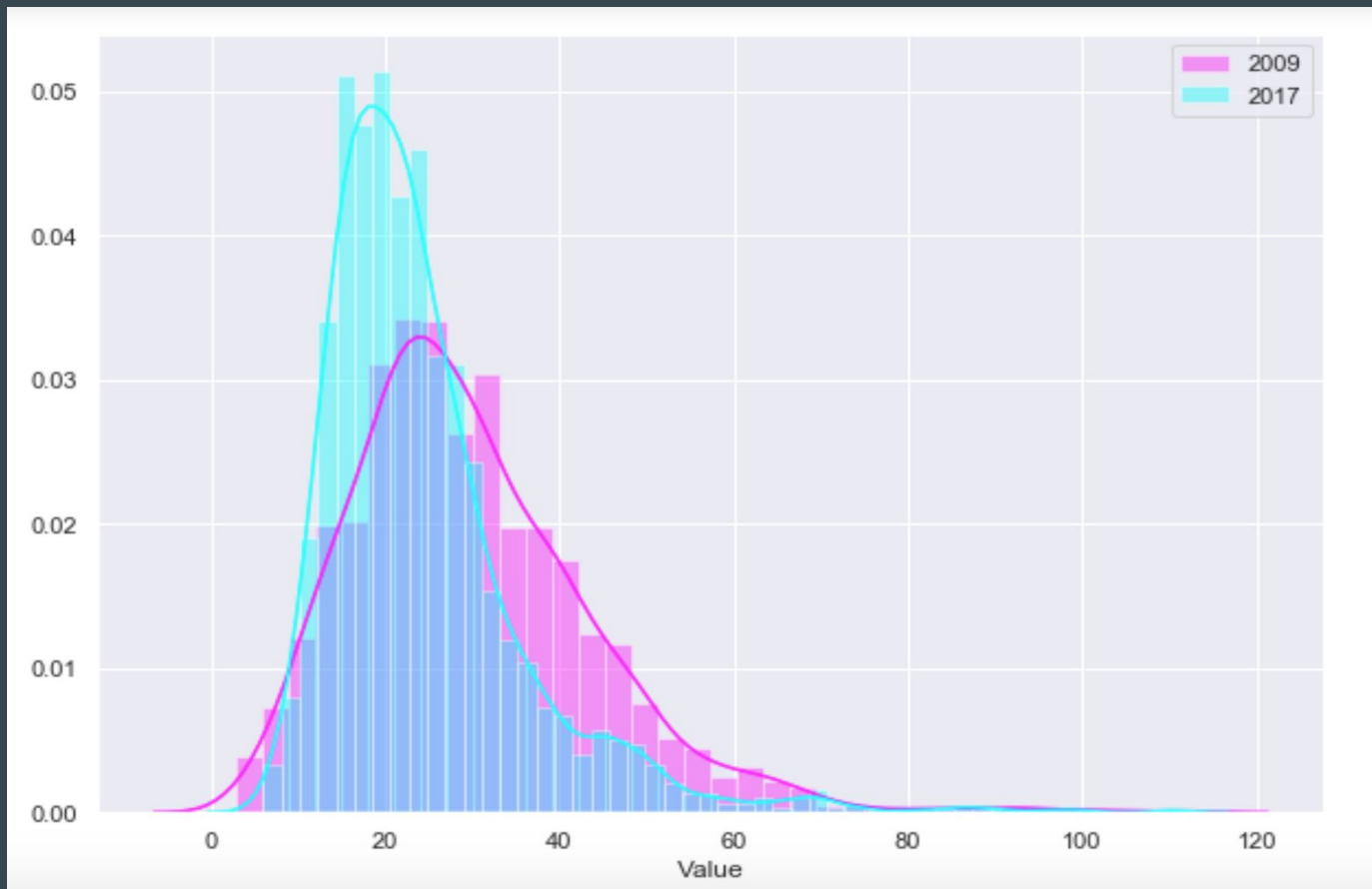
- reject Null Hypothesis
- Effect size difference is - 3.107
- Cohen's power is 1.0

The introduction of ULEZ was at least 25% more effective than the introduction of LEZ in reducing PM10 levels in Central London

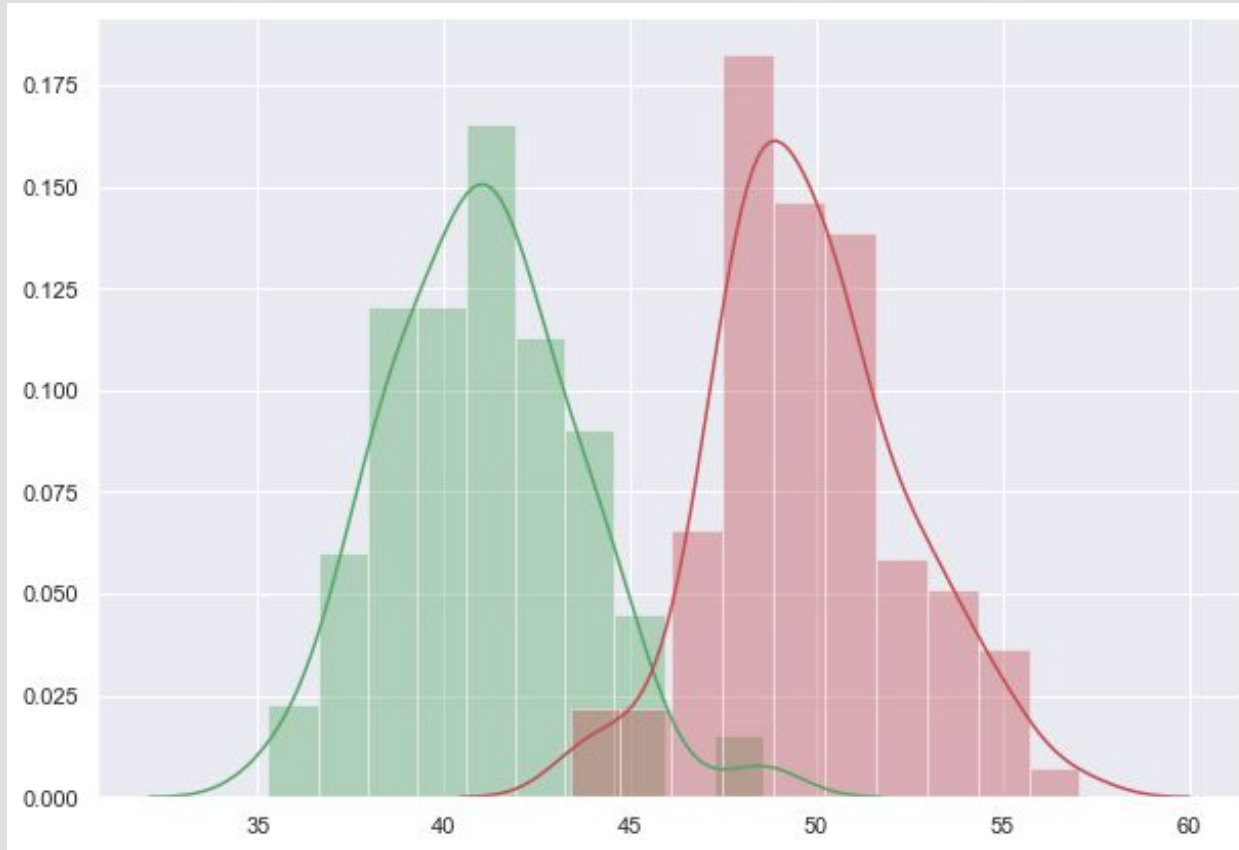
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# N02 Values For 2009 And 2017

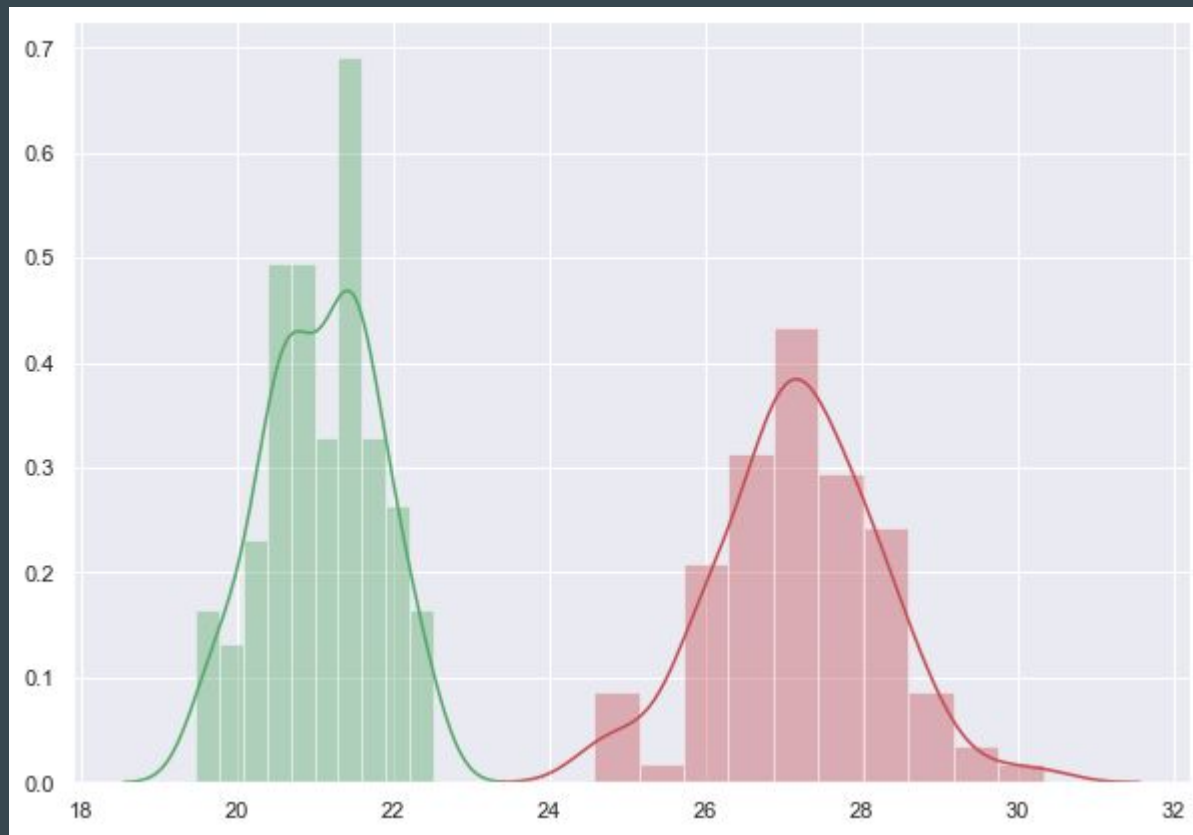




PM10  
Values  
For  
2009  
And  
2017



**NO<sub>2</sub>  
Samples  
pre- and  
post-ULEZ**



PM<sub>10</sub>  
samples  
pre- and  
post-ULEZ

# Going forward:

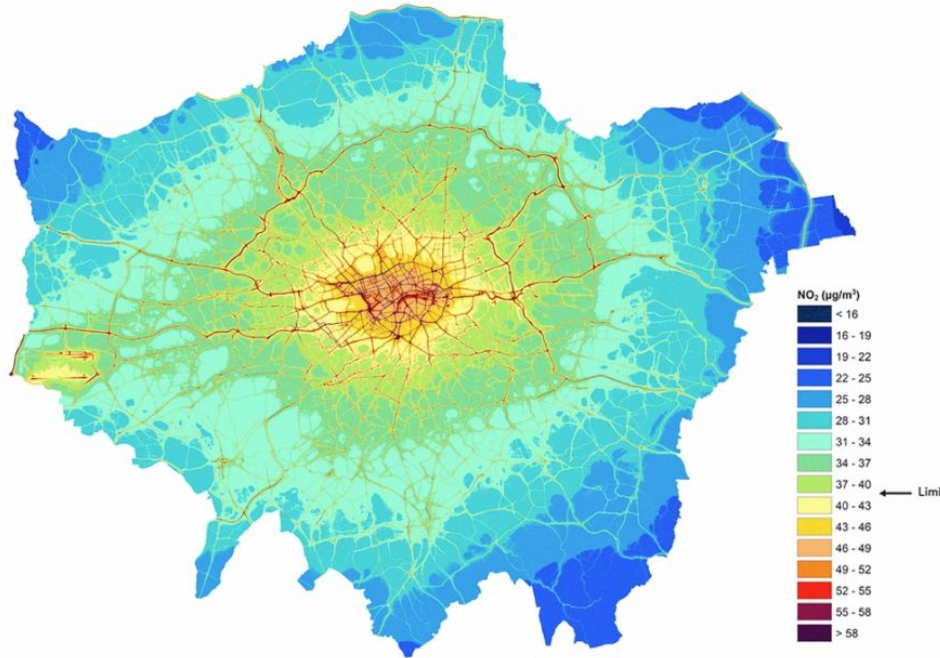
## Limitation of our results:

- Smaller population of data for post-ULEZ
- Unevenly distributed data for the Central London sensors

## Next steps:

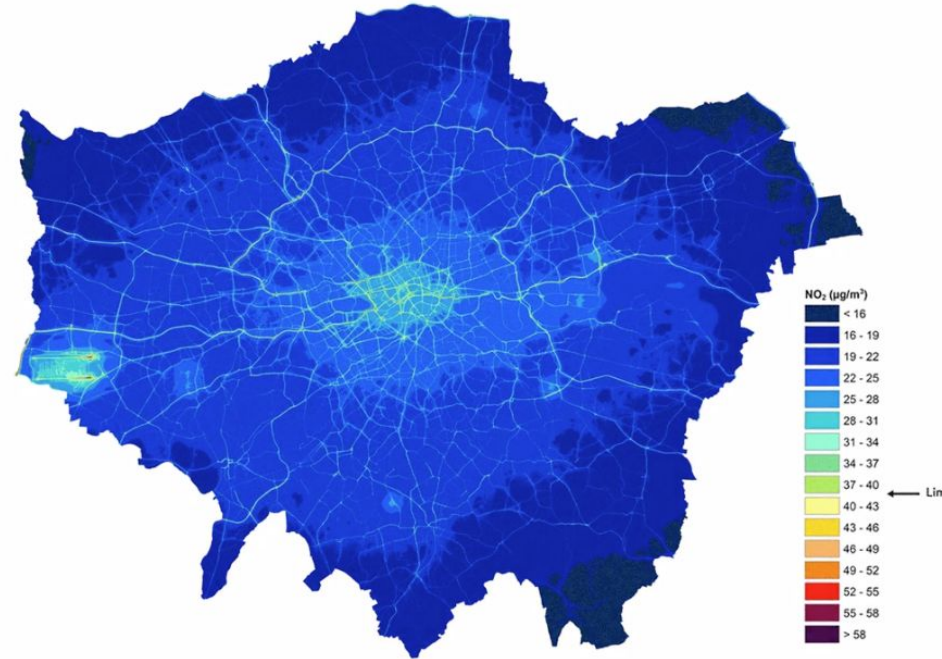
- Repeating sampling and analysis for other pollutants (PM<sub>2.5</sub> and CO)
- Choosing Inner & Outer London sites for testing impact of LEZ

## London's air pollution before ULEZ



Reference: LAEI, 2016

## And in 2025, after ULEZ and the Mayor's other actions



Reference: London Environment Strategy, 2018

# Conclusion

Our research shows that ULEZ was effective in reducing  $\text{NO}_2$  and  $\text{PM}_{10}$  levels by a significant margin.

Interestingly, ULEZ was significantly more effective in reducing  $\text{PM}_{10}$  than LEZ was, whereas LEZ had a moderately larger impact on  $\text{NO}_2$  than ULEZ.