

2nd Expert Panel on Clean Air in Cities  
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**IOŚ-PIB**  
INSTITUTE OF ENVIRONMENTAL PROTECTION  
NATIONAL RESEARCH INSTITUTE

# Trends of air quality-related mortality in major cities in Poland a 10-year assessment, based on AirQ+

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#ŚrodowiskoŻyciem

# Outline

- Motivation – poor air quality in Polish cities
- Assumptions and data used
- Results and analysis
- Mortality assessment based on AQ modelling
- Summary and future work



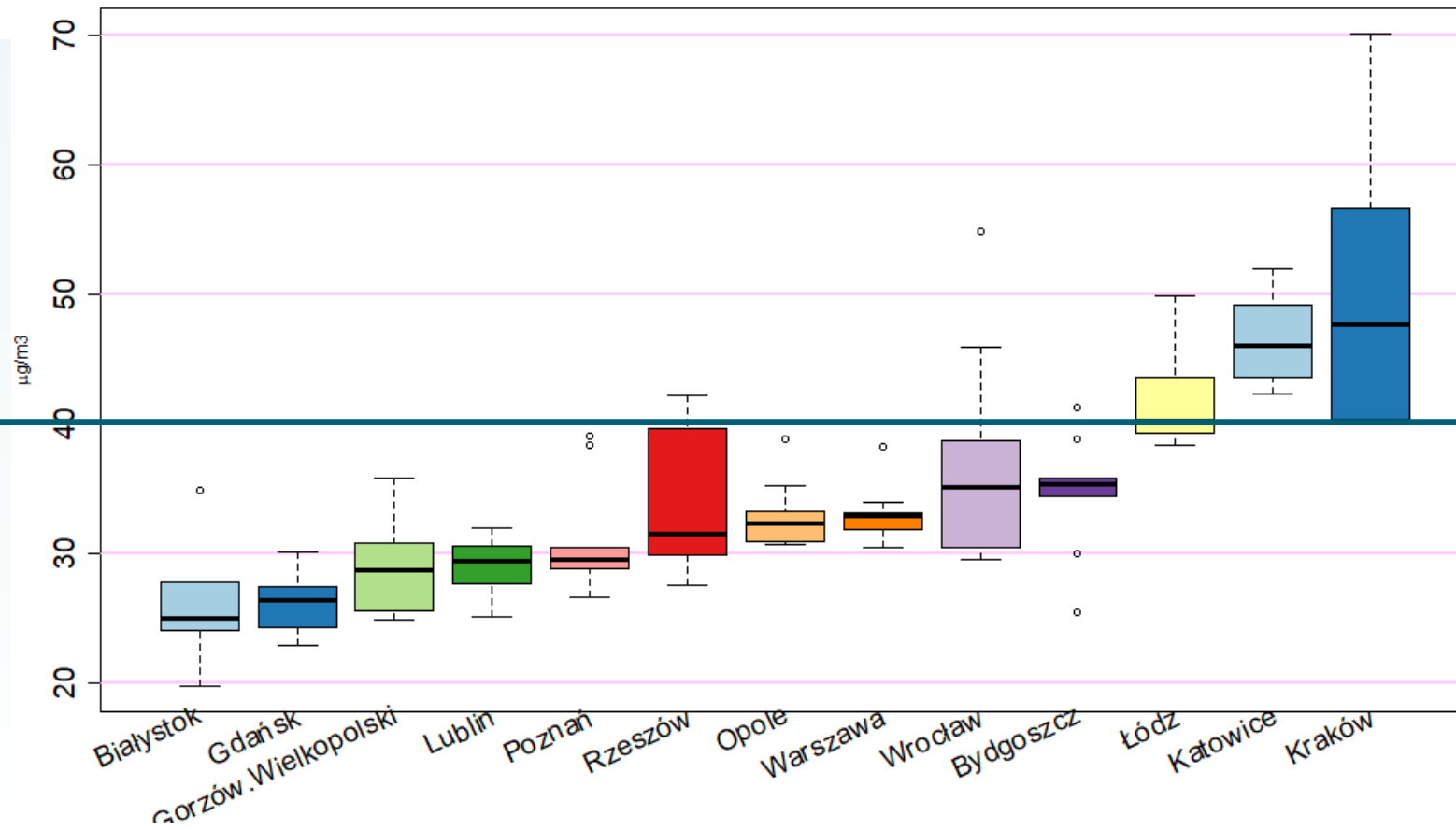
# Assumptions

- 13 cities selected
- PM<sub>10</sub> and NO<sub>2</sub>
- AQ stations (reference 24h)
- Annual data (2010-2018):
  - AQ measurements (annual average)
  - Number of inhabitants
  - Number of vehicles
  - Bronchitis cases
  - Mortality

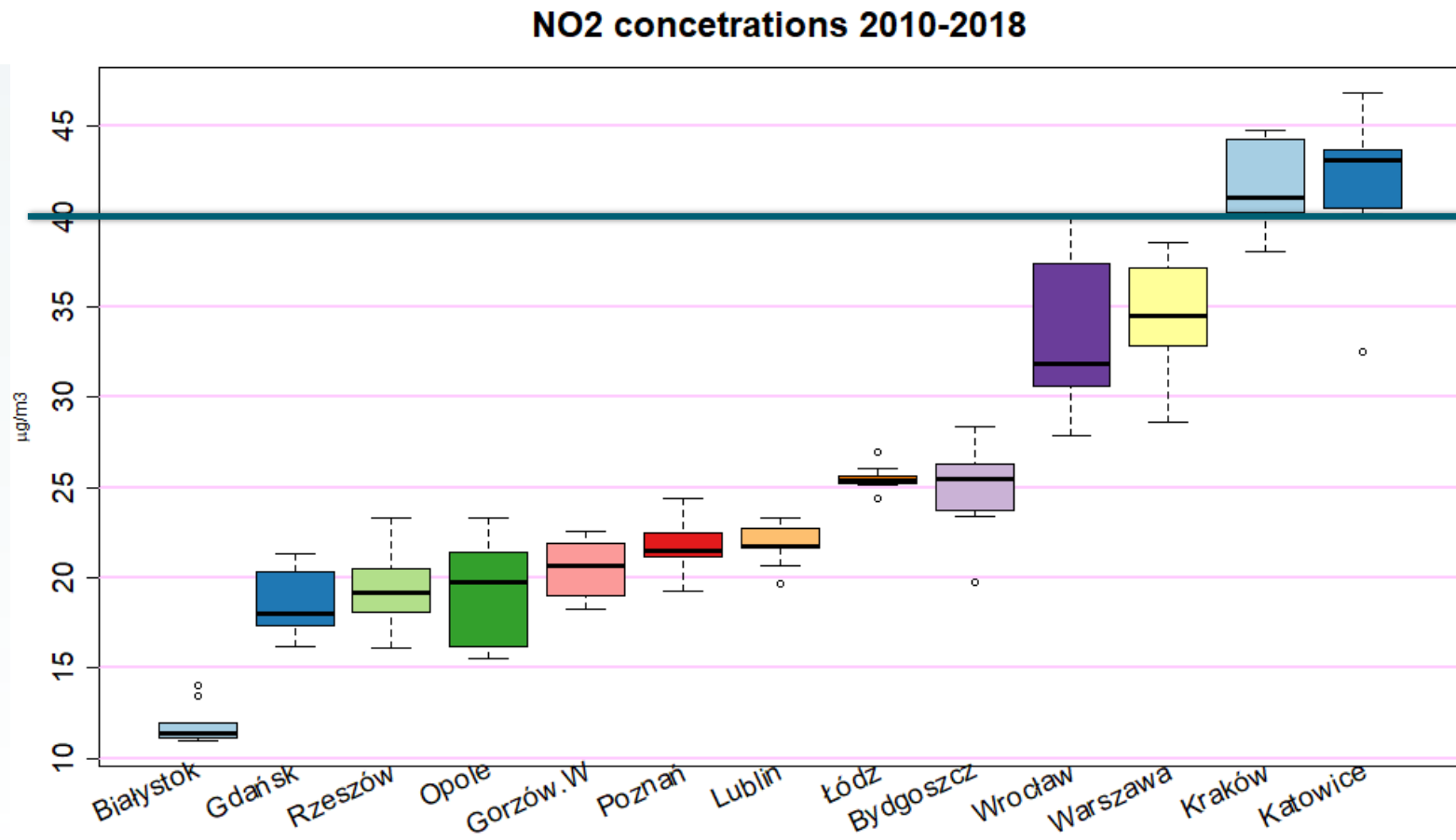


# Mean PM<sub>10</sub> concentrations

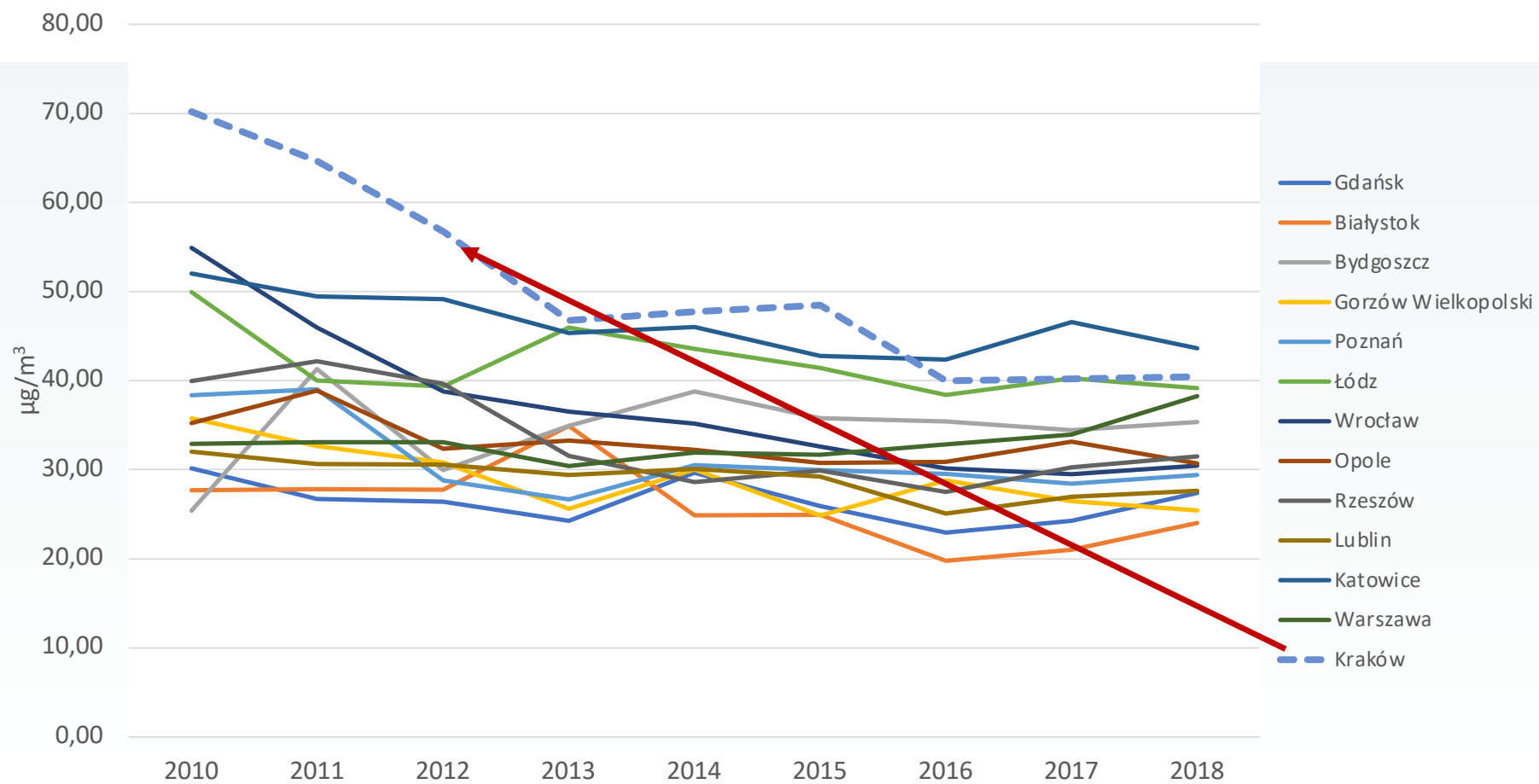
PM10 concetrations 2010-2018



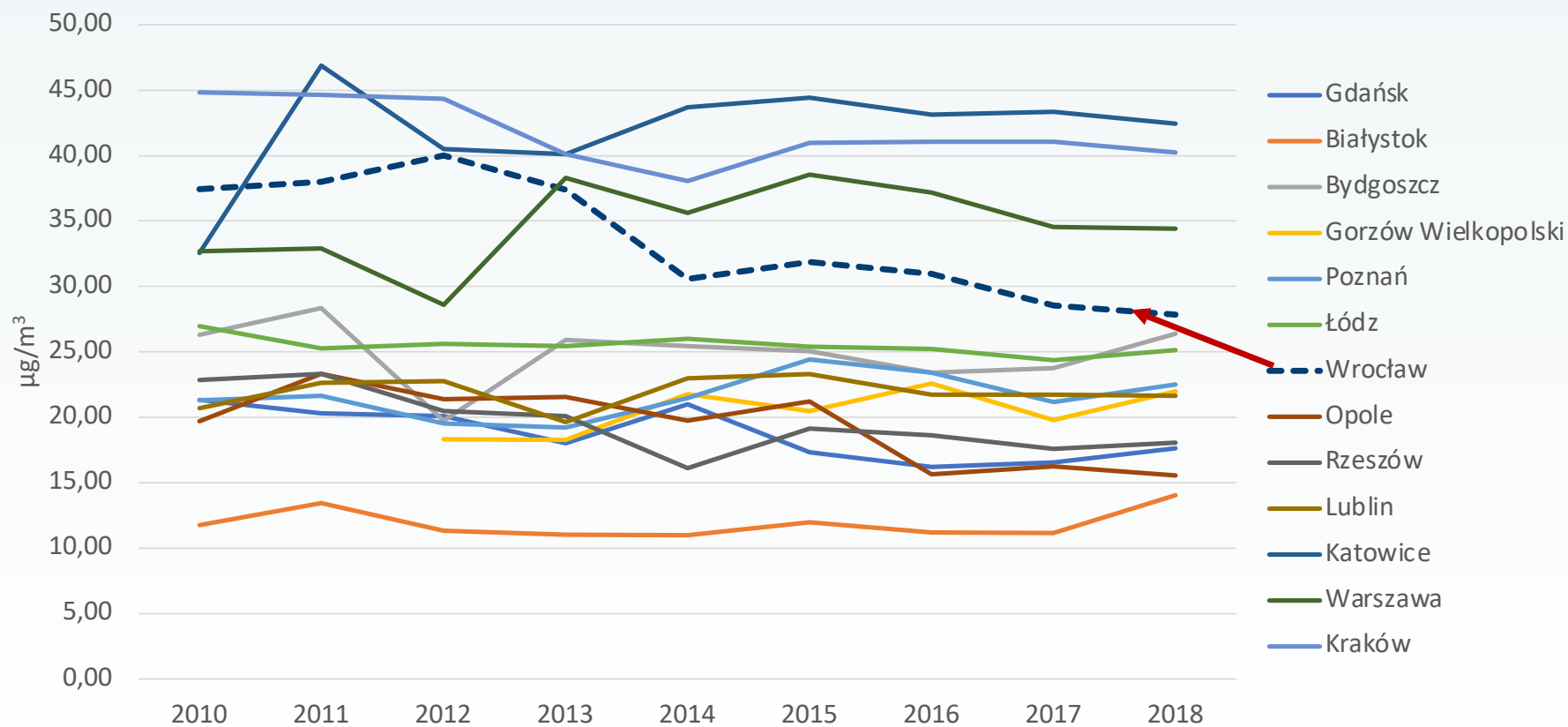
# Mean NO<sub>2</sub> concentrations



# PM<sub>10</sub> trends



# NO<sub>2</sub> trends



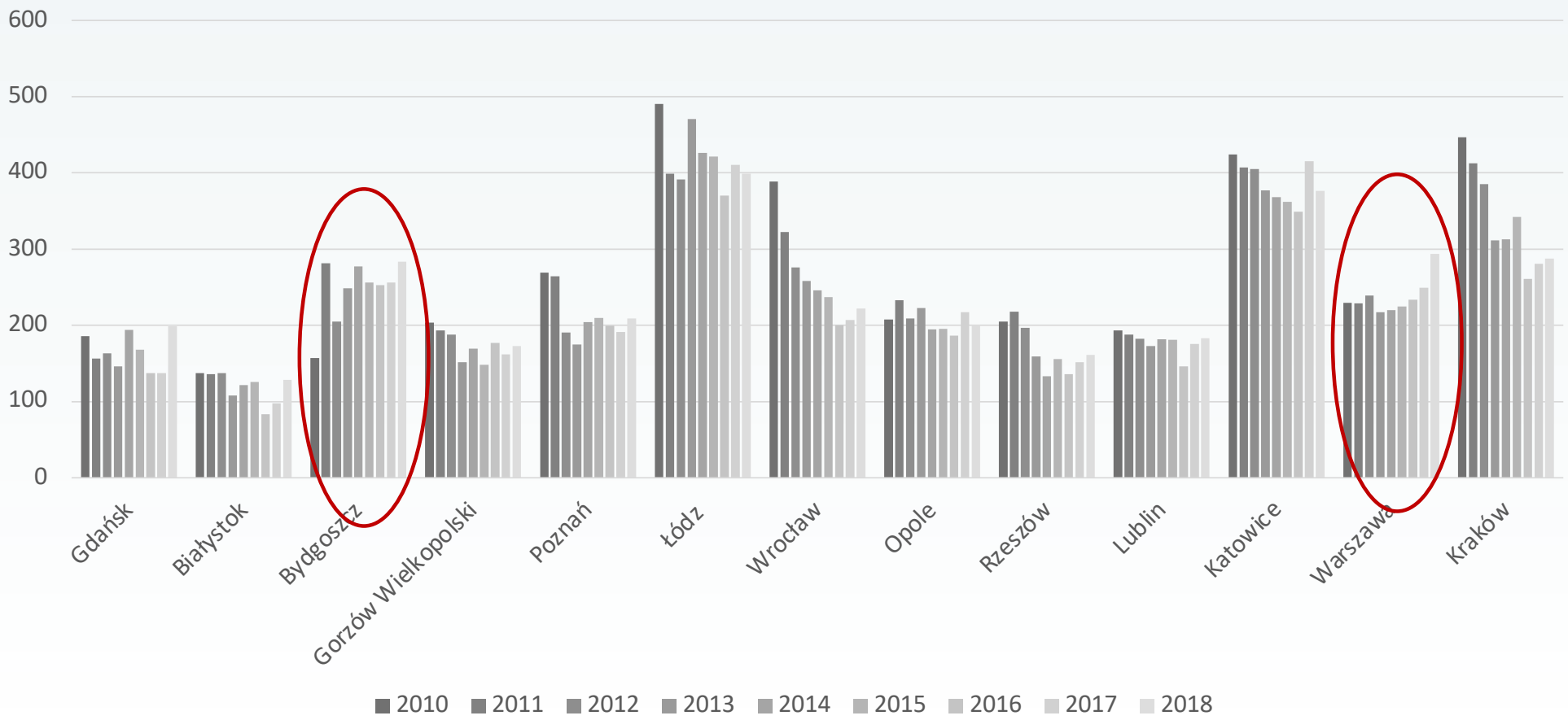
# Air quality related health risk

- AirQ+ model was used to calculate
  - Premature deaths ( $\text{NO}_2$ )
  - Bronchitis cases ( $\text{PM}_{10}$ )
- Parameters analysed:
  - Number of cases per 100K inhabitants (per city)
  - Percent of AQ related cases as part of the total number of cases (per city)
  - Correlation with the annual concentrations

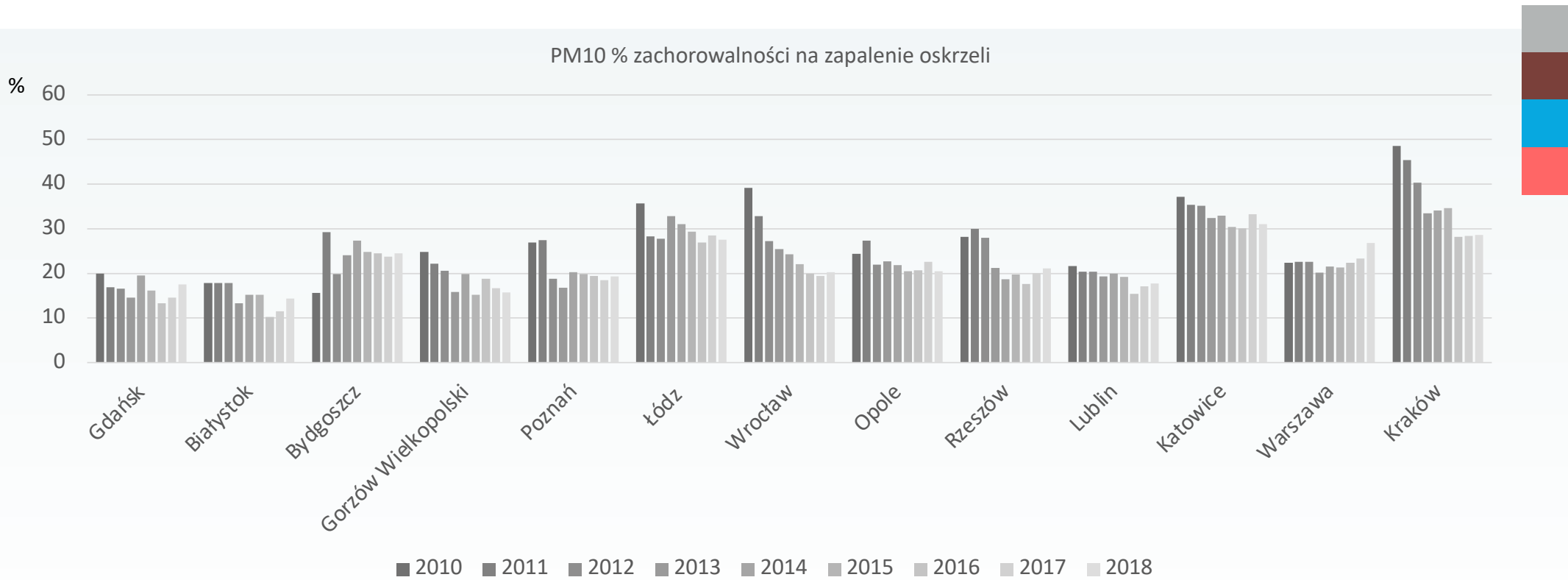




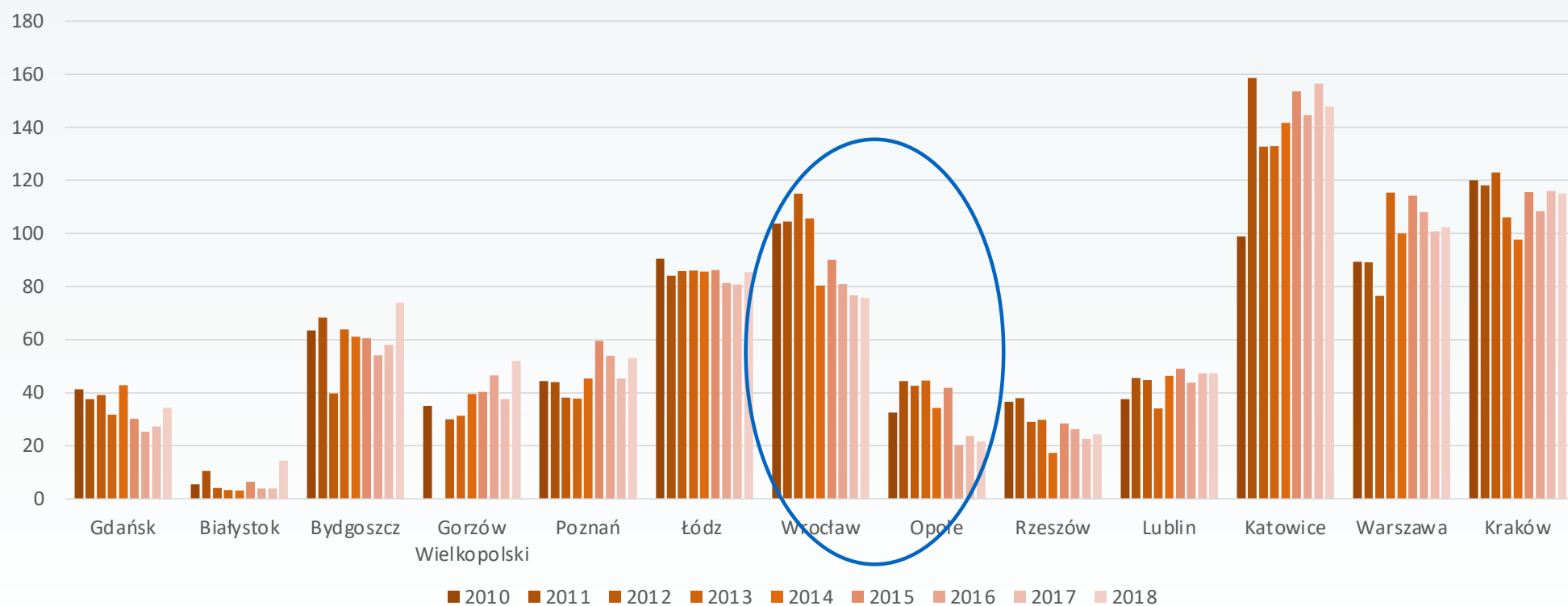
# Bronchitis caused by exposure to high PM<sub>10</sub> concentrations per 100K inhabitants



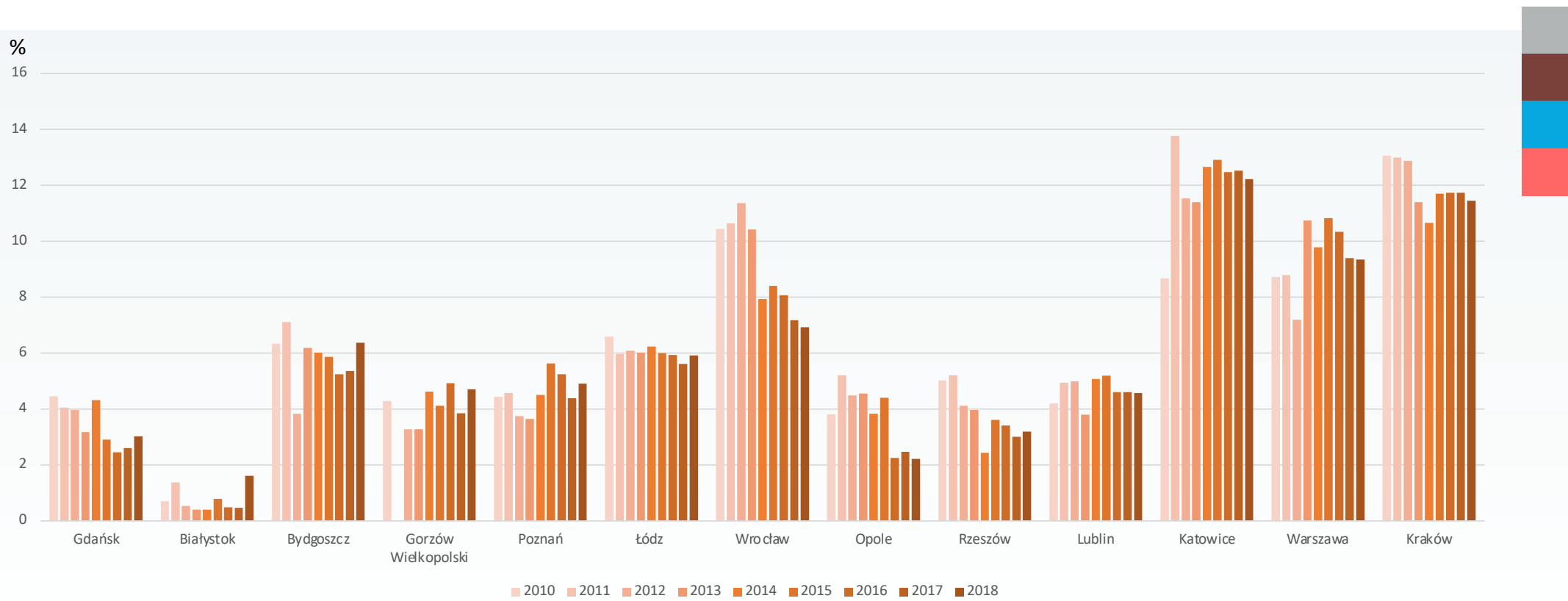
# % of AQ related cases to total number of bronchitis cases



# Premature deaths caused by exposure to high NO<sub>2</sub> concentrations per 100K inhabitants

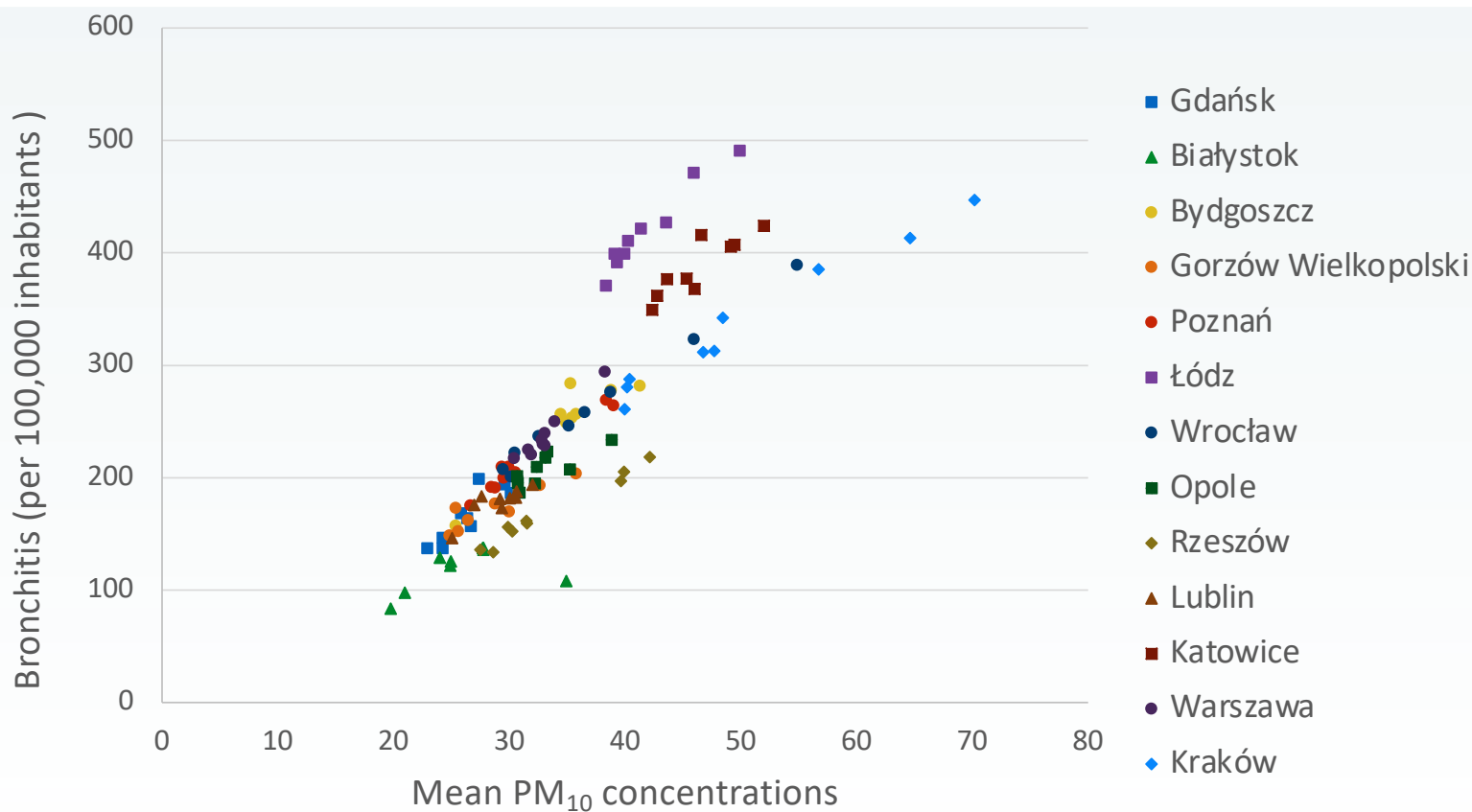


# % of AQ related cases to the total premature deaths (NO<sub>2</sub>)



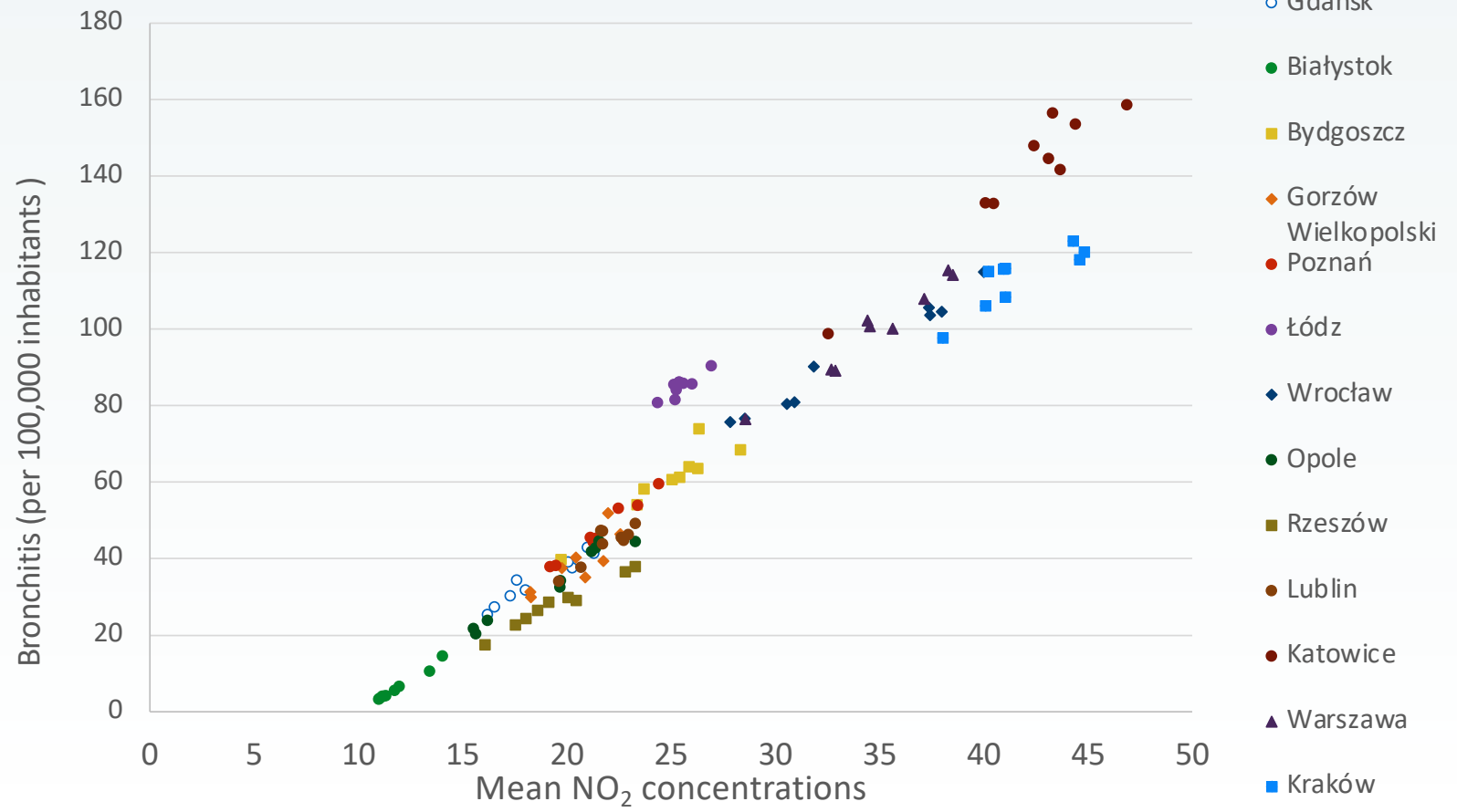
# Correlation of PM10 conc. vs. premature bronchitis morbidity

	PM10
Gdańsk	0,87
Białystok	0,43
Bydgoszcz	0,93
Gorzów Wielkopolski	0,91
Poznań	0,99
Łódź	0,97
Wrocław	1,00
Opole	0,80
Rzeszów	0,99
Lublin	0,84
Katowice	0,89
Warszawa	0,98
Kraków	0,99

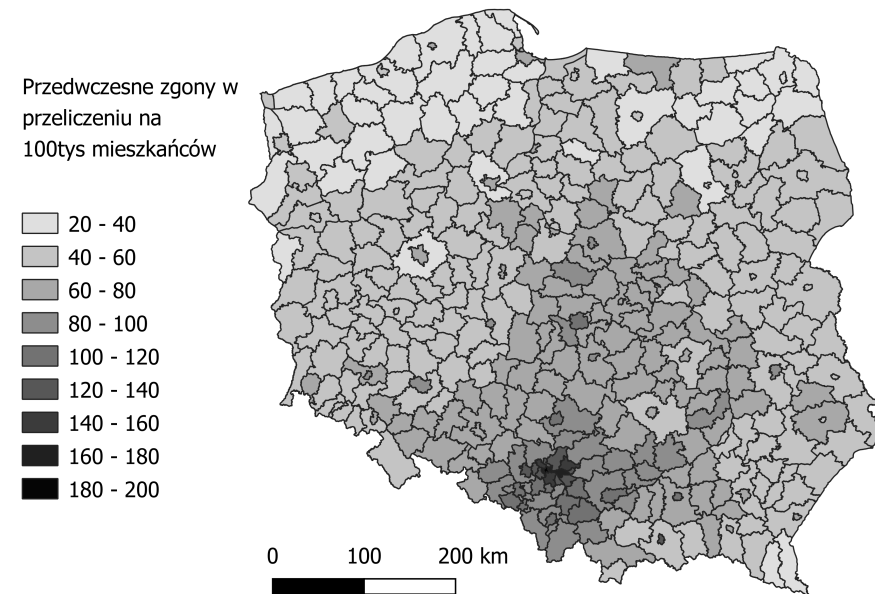
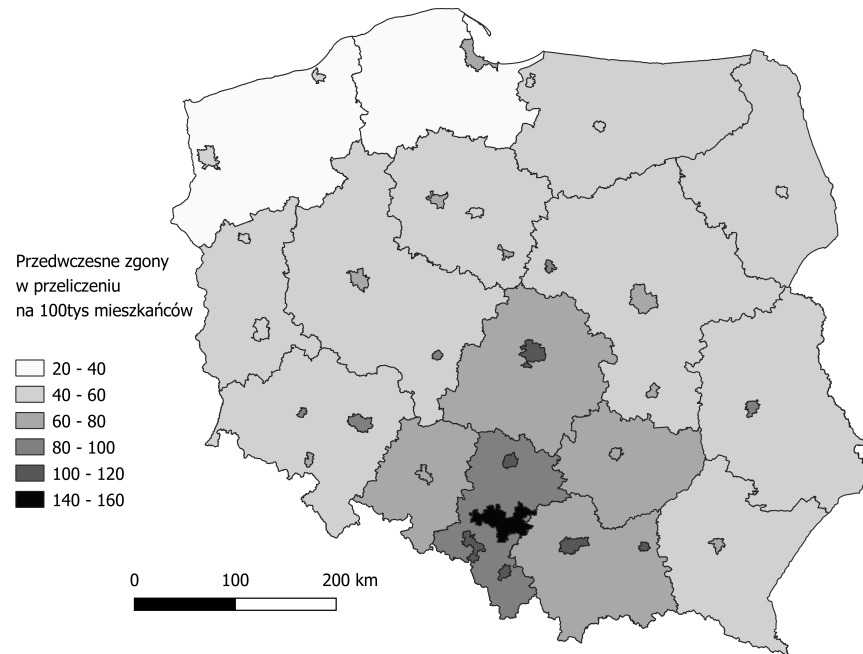


# Correlation of NO<sub>2</sub> conc. vs. AQ related premature deaths

	NO <sub>2</sub>
Gdańsk	0,97
Białystok	0,99
Bydgoszcz	0,93
Gorzów Wielkopolski	0,85
Poznań	0,98
Łódź	0,88
Wrocław	0,99
Opole	0,98
Rzeszów	0,99
Lublin	0,87
Katowice	0,96
Warszawa	0,98
Kraków	0,85



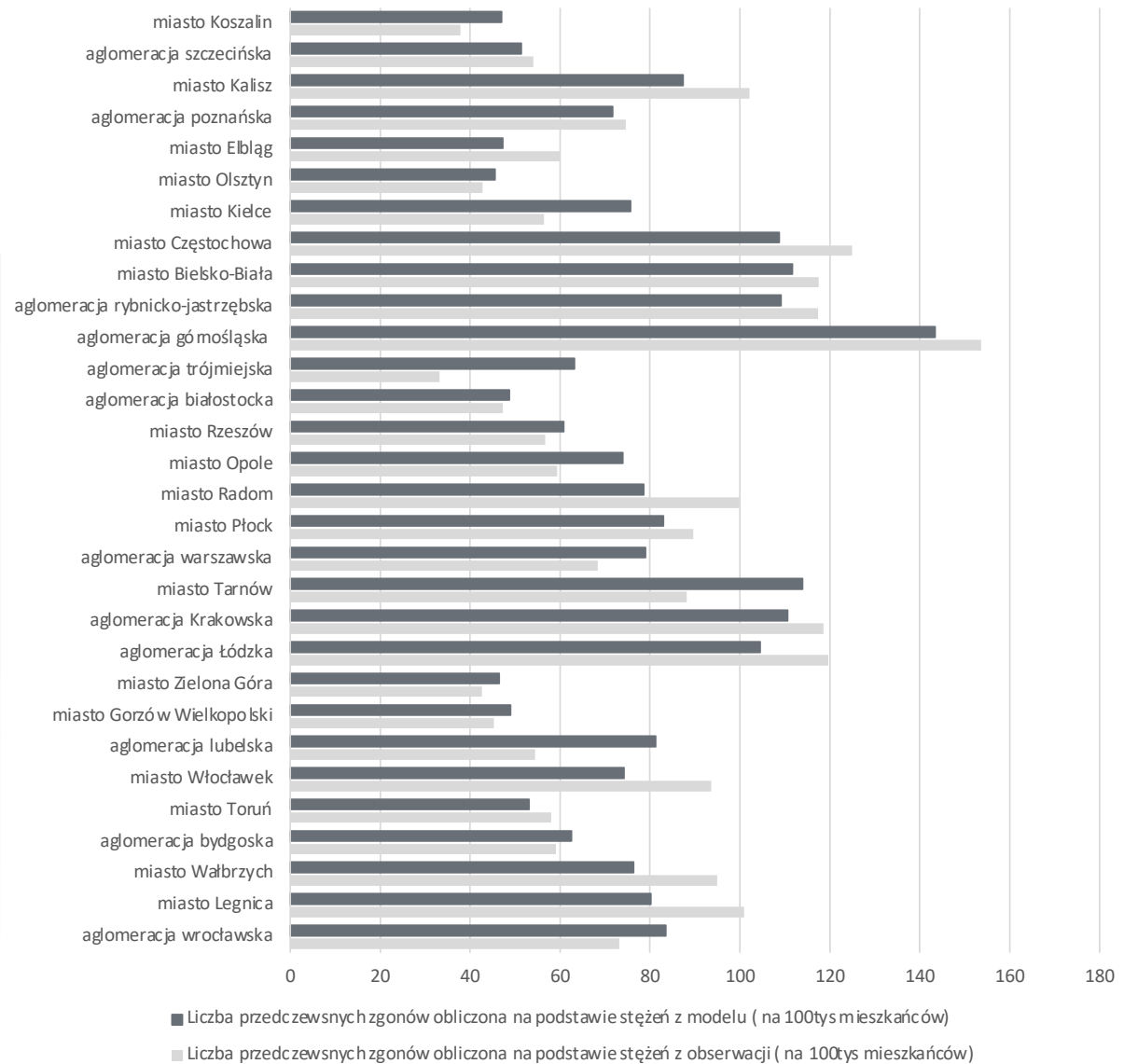
## Number of premature deaths due to exposure to high PM<sub>2.5</sub> concentrations (based on AQ modelling results)



**Total number of deaths in 2018  
due to PM<sub>2.5</sub>  
based on AQ modelling results:**

**Poland: ~ 26 000  
30 largest cities ~10 000**

**Conference paper (in Polish)  
Jagiełło et al. 2020**





# Summary and future work

- Strong decreasing trend of PM<sub>10</sub> concentrations and morbidity observed **in cities with significant air pollution problems**
  - Low-level combustion dominates the PM emission structure → local, regional and national programs to force replacement of ineffective furnaces
  - Increase in Warsaw (growing population and increasing PM concentrations) and Bydgoszcz
  - **Trend was stronger in 2010-2015**
- NO<sub>2</sub> – no trend during the last four years
  - Changes in mortality related to vehicle fleet and changes in the infrastructure
- Despite AQP and national programmes health risk related to AQ in Polish cities does not show decreasing trend



# Future work

- Based on AQ modelling:
  - Potential reduction of health risk in Poland due to the implementation of the “National Clean Air Programme” (report on PMs concentration changes to be submitted to the Ministry of Climate 30.09.2020)
  - Impact of electromobility on health risk in Poland





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**THANK YOU!**

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