Health Burden Relating To Exposure To Ambient Air Pollution In Vietnam: Sciences Evidence For Policy

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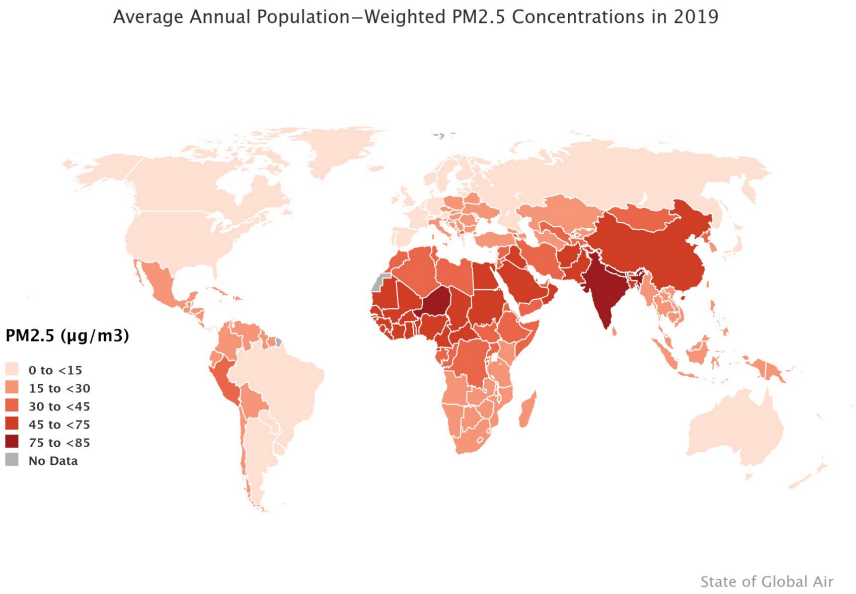
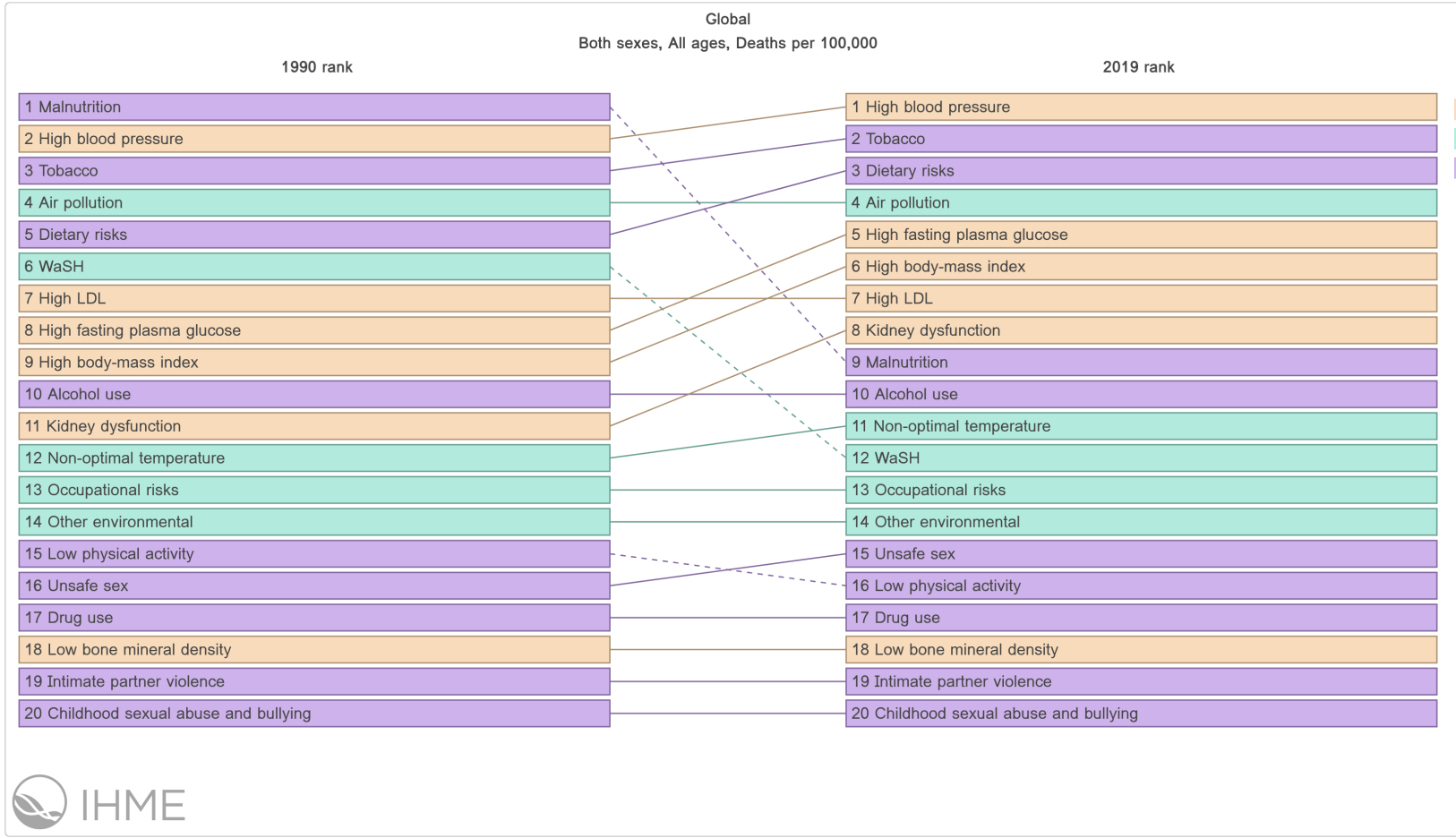
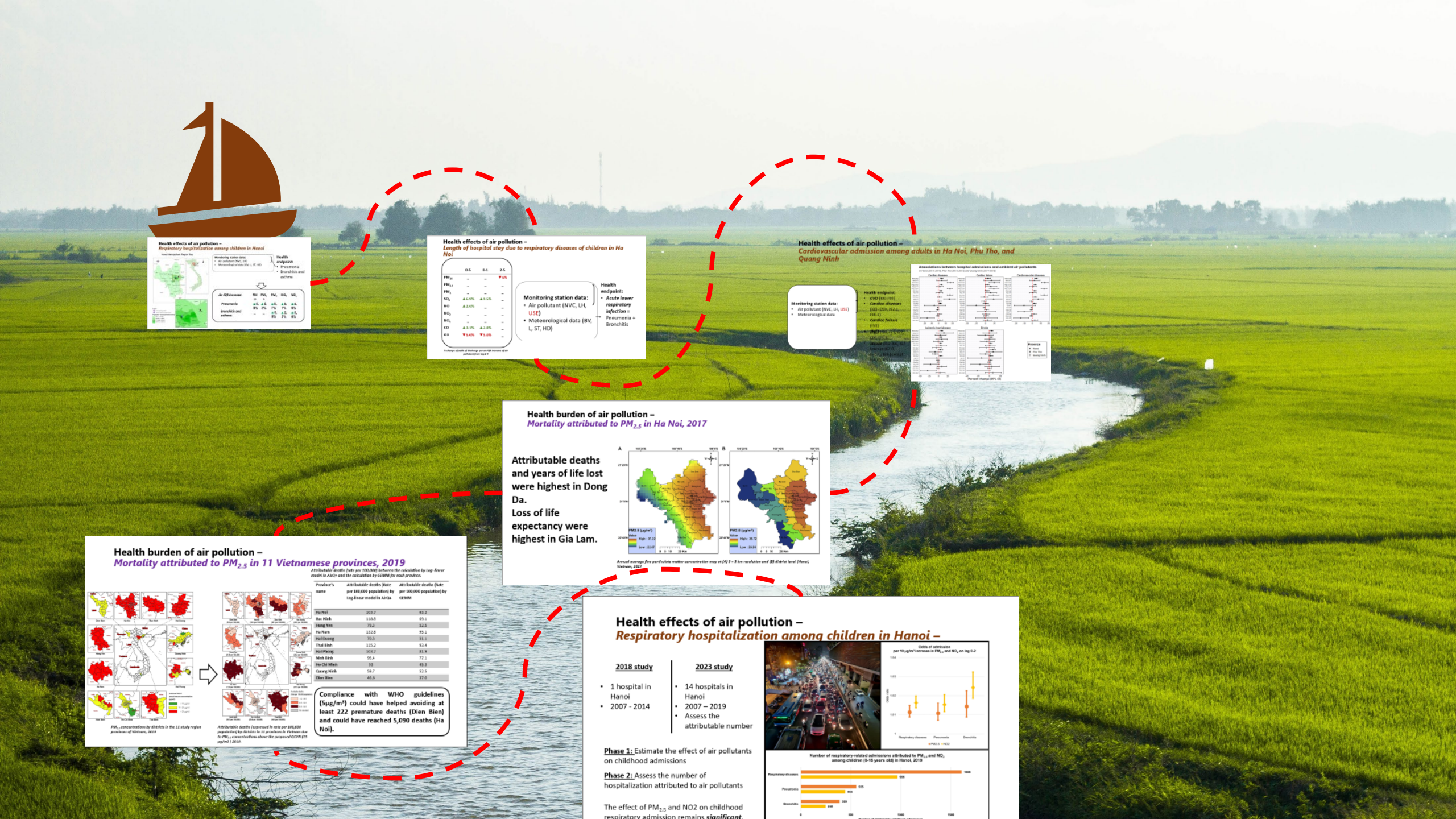
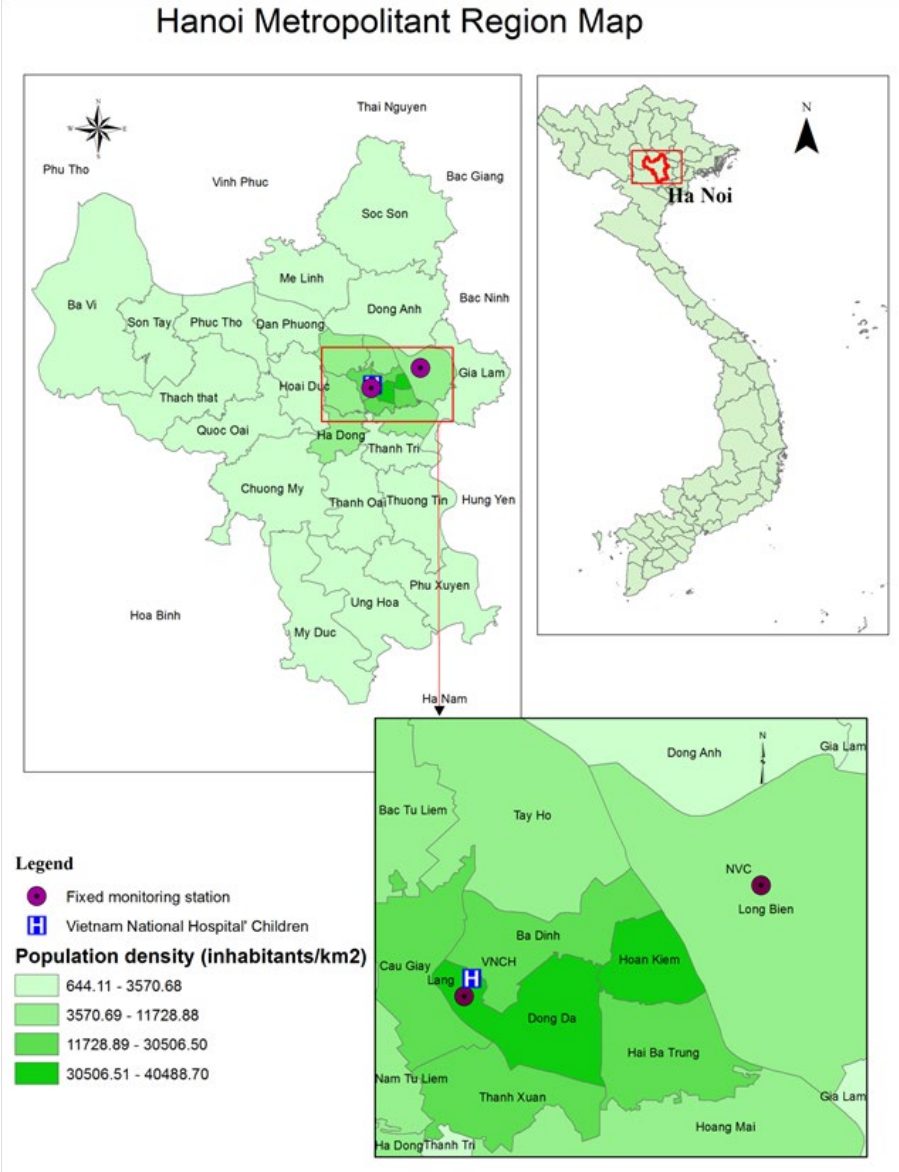




In 2019, approximately 6.67 million deaths attributed to air pollution


Health effects of air pollution –
Respiratory hospitalization among children in Hanoi
Health endpoint:
• Pneumonia
• Bronchitis and asthma
Health effects of air pollution –
Length of hospital stay due to respiratory diseases of children in Ha Noi
Monitoring station data:
• Air pollutant (NVC, LH, USE)
• Meteorological data (BV, L, ST, HD)
Health endpoint:
• Acute lower respiratory infection = Pneumonia + Bronchitis
Health effects of air pollution –
Cardiovascular admission among adults in Ha Noi, Phu Tho, and Quang Ninh
Monitoring station data:
• Air pollutant (NVC, LH, USE)
• Meteorological data
Health burden of air pollution –
Mortality attributed to PM2.5 in Ha Noi, 2017
Attributable deaths and years of life lost were highest in Dong Da.
Loss of life expectancy were highest in Gia Lam.
Health burden of air pollution –
Mortality attributed to PM2.5 in 11 Vietnamese provinces, 2019
Compliance with WHO guidelines (5μg/m³) could have helped avoiding at least 222 premature deaths (Dien Bien) and could have reached 5,090 deaths (Ha Noi).
Health effects of air pollution –
Respiratory hospitalization among children in Hanoi –
2018 study
• 1 hospital in Hanoi
• 2007 - 2014
2023 study
• 14 hospitals in Hanoi
• 2007 – 2019
• Assess the attributable number
Phase 1: Estimate the effect of air pollutants on childhood admissions
Phase 2: Assess the number of hospitalization attributed to air pollutants
The effect of PM2.5 and NO2 on childhood respiratory admission remains significant.

Health effects of air pollution –
Respiratory hospitalization among children in Hanoi



Monitoring station data:

- Air pollutant (NVC, LH)
- Meteorological data (BV, L, ST, HD)

Health endpoint:

- Pneumonia
- Bronchitis and asthma

An IQR increase:	PM$_{10}$	PM$_{2.5}$	PM$_1$	NO$_2$	NO$_x$
Pneumonia	▲5.8%	▲5.3%	▲5.7%	▲6.1%	▲4.6%
Bronchitis and asthma:	–	–	▲5.8%	▲5.5%	▲5,6%

Health effects of air pollution –
Length of hospital stay due to respiratory diseases of children in Ha Noi

	0-5	0-1	2-5
PM_{10}	–	–	▼6%
$PM_{2.5}$	–	–	–
PM_1	–	–	–
SO_2	▲6.9%	▲9.5%	–
NO	▲2.6%	–	–
NO_2	–	–	–
NO_x	–	–	–
CO	▲3.1%	▲2.8%	–
O3	▼5.0%	▼5.0%	–

% change of odds of discharge per an IQR increase of air pollutant from lag 1-4

Monitoring station data:

- Air pollutant (NVC, LH, USE)
- Meteorological data (BV, L, ST, HD)

→ **Health endpoint:**

- ***Acute lower respiratory infection*** = Pneumonia + Bronchitis

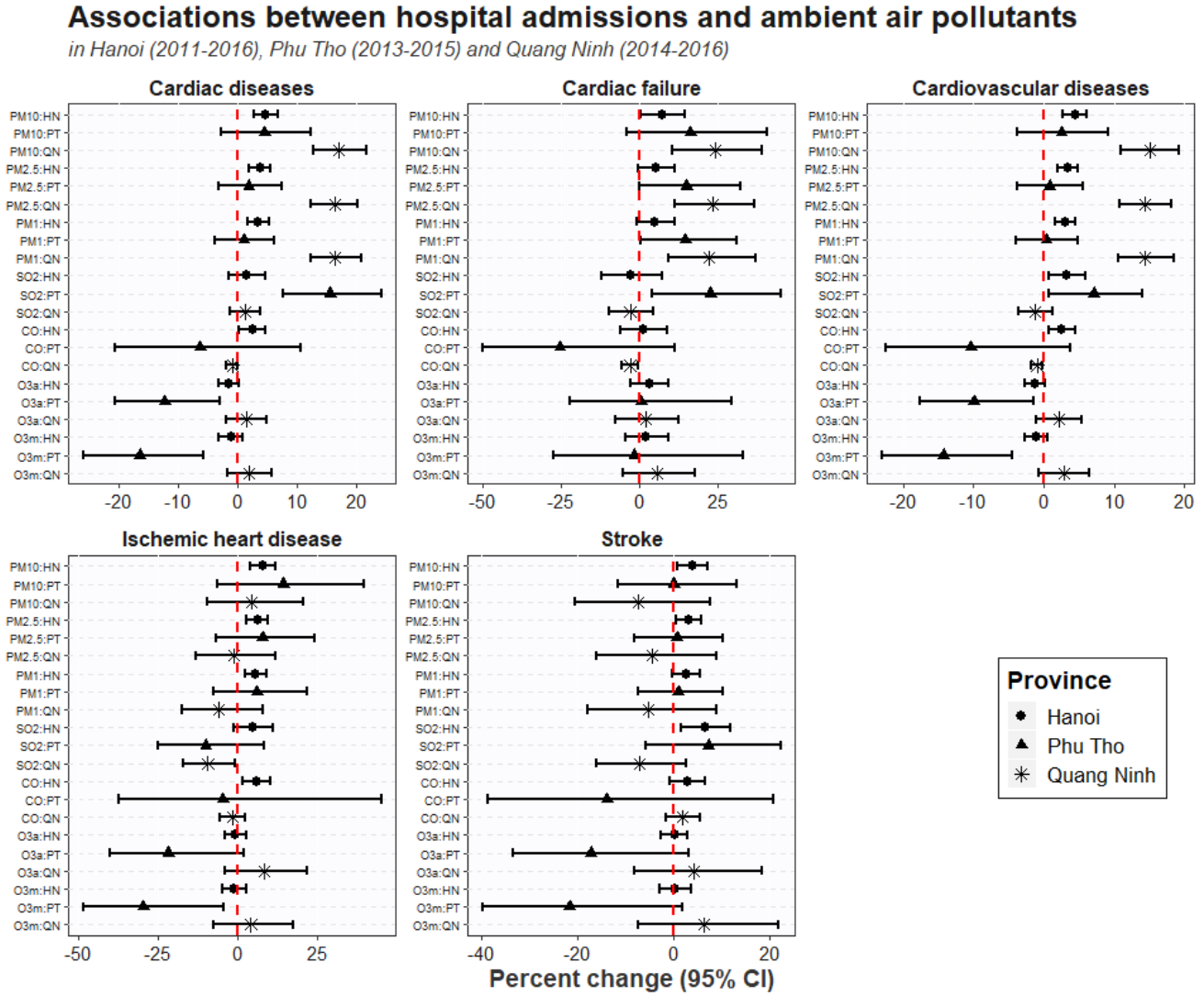
Health effects of air pollution – *Cardiovascular admission among adults in Ha Noi, Phu Tho, and Quang Ninh*

Monitoring station data:

- Air pollutant (NVC, LH, USE)
- Meteorological data

Health endpoint:

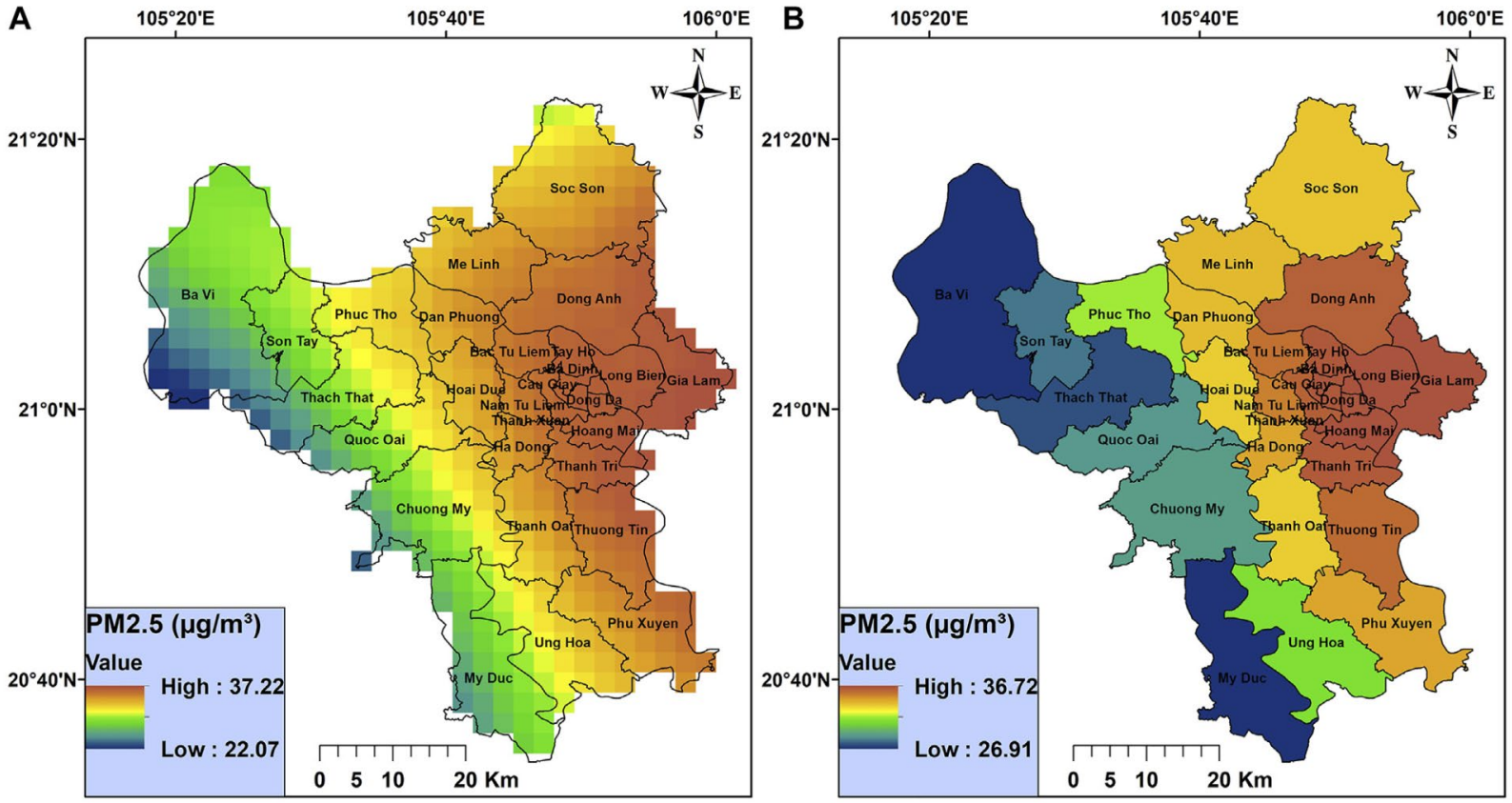
- ***CVD*** (I00-I99)
- ***Cardiac diseases*** (I00-I059, I97.1, I98.1)
- ***Cardiac failure*** (I50)
- ***IHD*** (I20, I21, I22, I24, I25.2)
- ***Stroke*** (I60-I66, I67 (except I67.0, I67.3), I68 (except I68.0), I69))



Health burden of air pollution –
Mortality attributed to $PM_{2.5}$ in Ha Noi, 2017

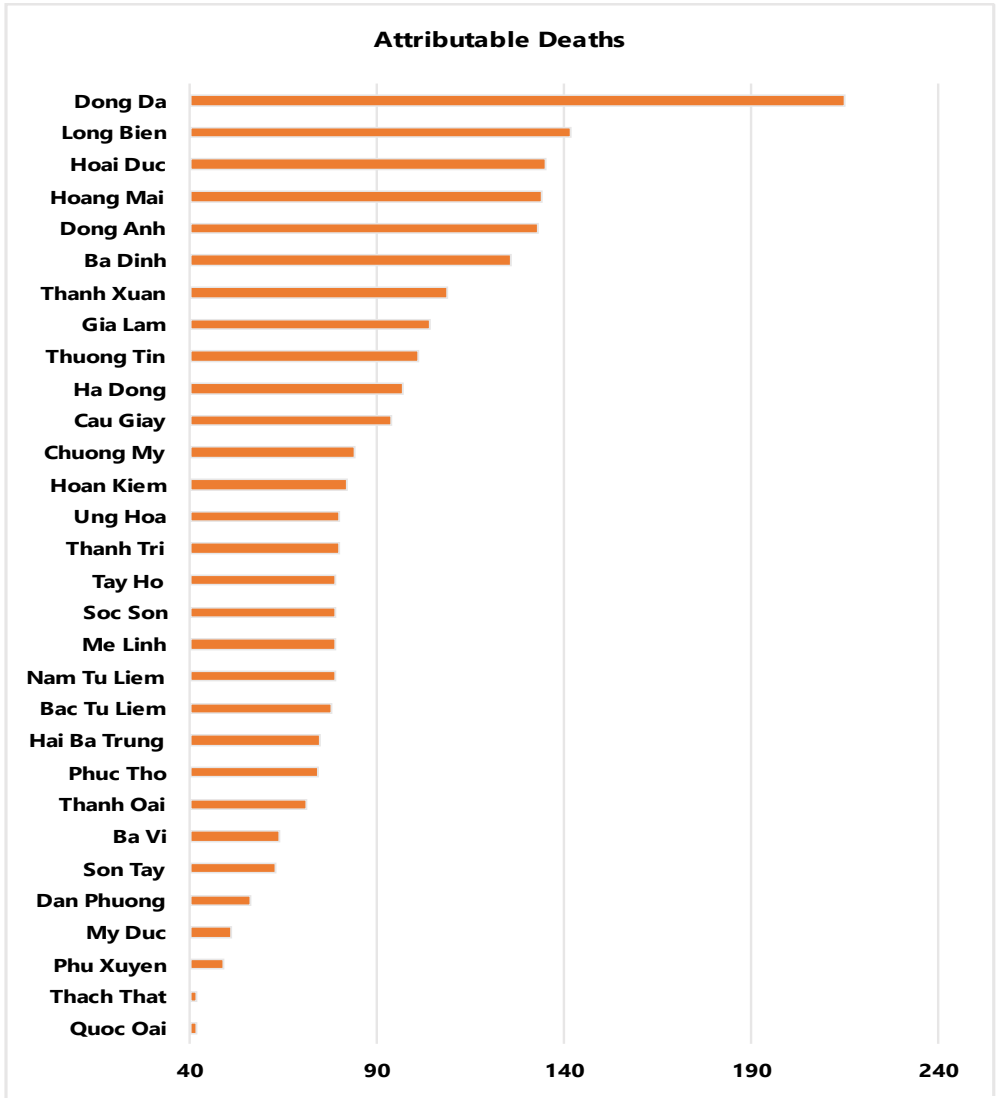
Attributable deaths and years of life lost were highest in Dong Da.

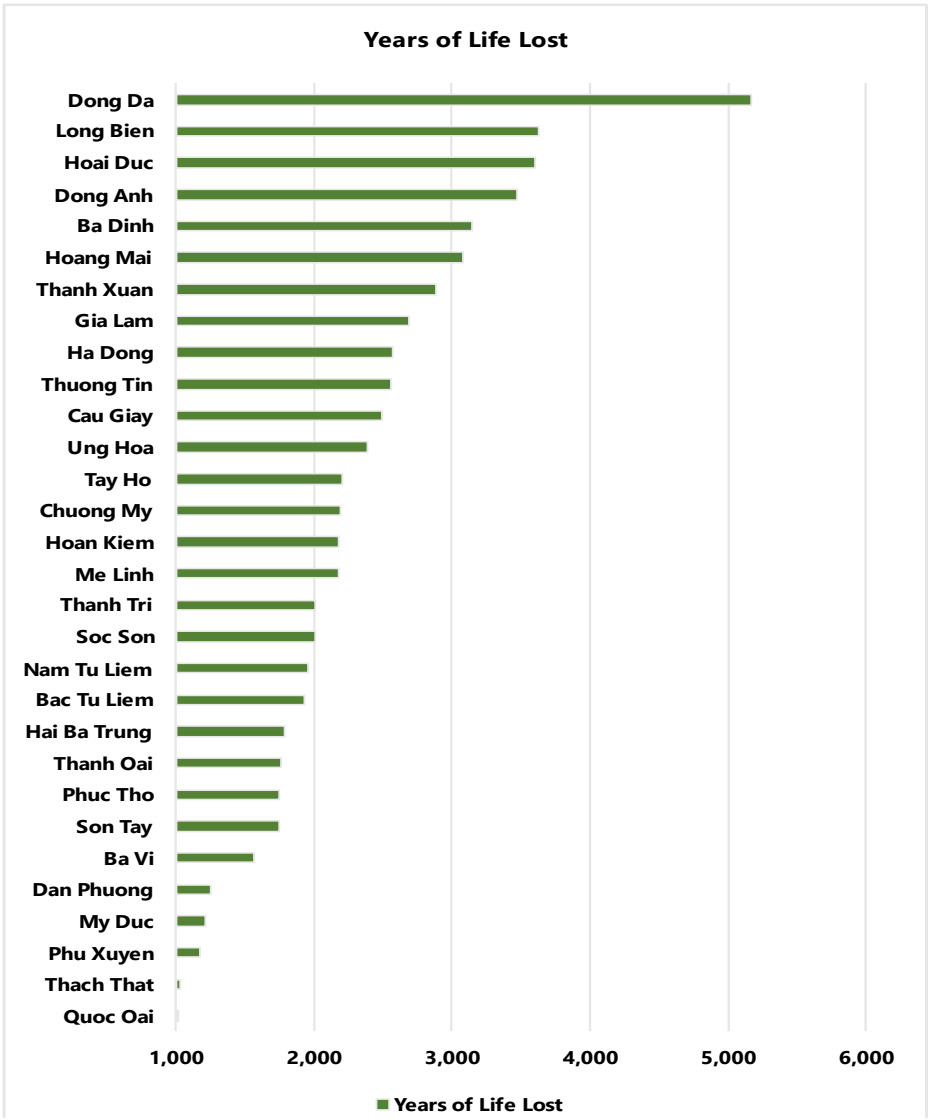
Loss of life expectancy were highest in Gia Lam.



Annual average fine particulate matter concentration map at (A) 3 × 3 km resolution and (B) district level (Hanoi, Vietnam, 2017

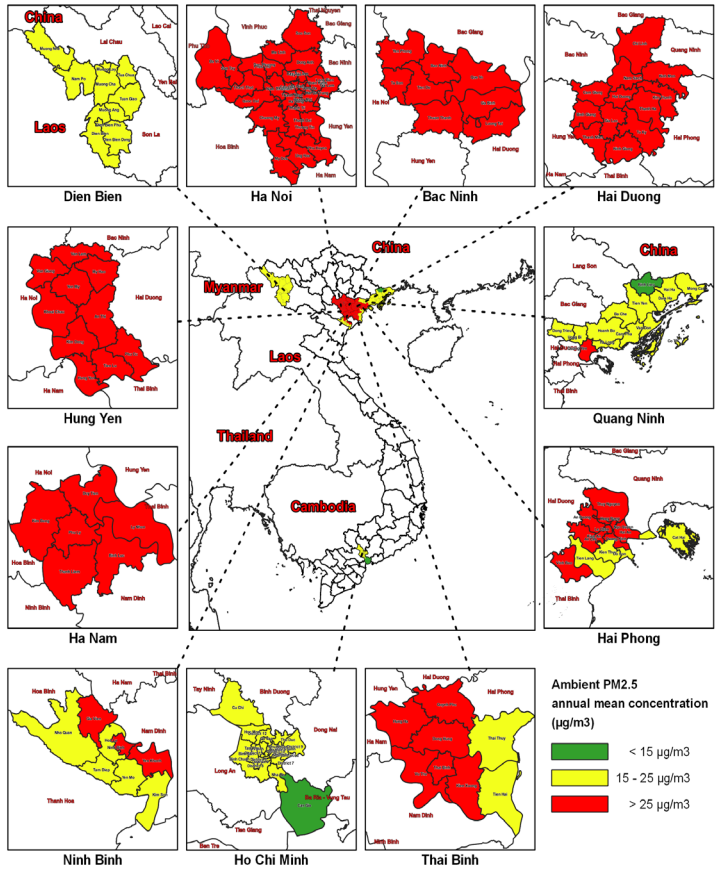
Health burden of air pollution – *Mortality attributed to $PM_{2.5}$ in Ha Noi, 2017*



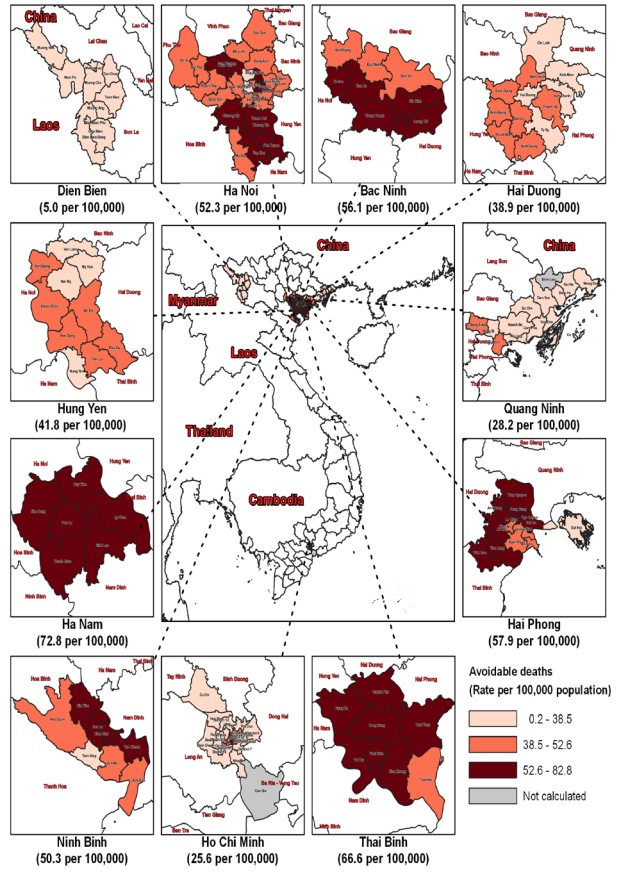


The annual burden of mortality relating to exposure to fine particulate matter (Hanoi, Vietnam. 2017). Counterfactual level is the QCVN 05:2013 (25 µg/m³)

Health burden of air pollution –
Mortality attributed to $PM_{2.5}$ in 11 Vietnamese provinces, 2019



$PM_{2.5}$ concentrations by districts in the 11 study region provinces of Vietnam, 2019



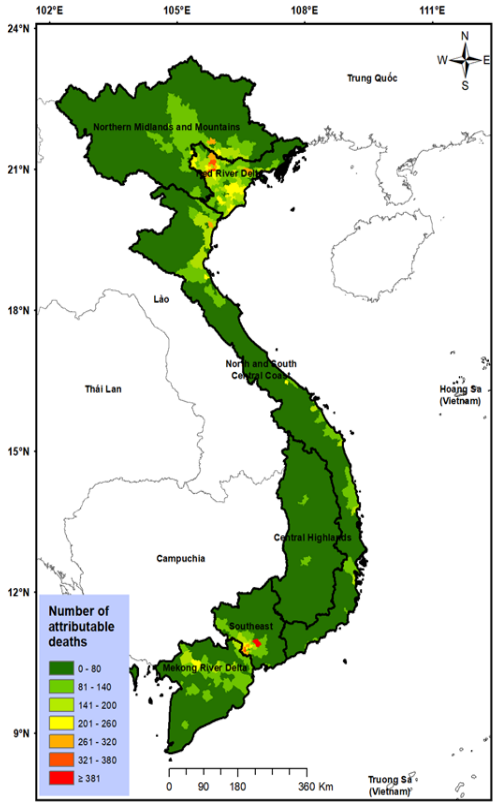
Attributable deaths (expressed in rate per 100,000 population) by districts in 11 provinces in Vietnam due to $PM_{2.5}$ concentrations above the proposed QCVN (15 μg/m3) 2019.

Attributable deaths (rate per 100,000) between the calculation by Log–linear model in AirQ+ and the calculation by GEMM for each province.

Province's name	Attributable deaths (Rate per 100,000 population) by Log-linear model in AirQ+	Attributable deaths (Rate per 100,000 population) by GEMM
Ha Noi	103.7	63.2
Bac Ninh	118.8	69.1
Hung Yen	79.3	52.5
Ha Nam	132.8	95.1
Hai Duong	70.5	51.1
Thai Binh	115.2	93.4
Hai Phong	103.7	81.9
Ninh Binh	95.4	77.1
Ho Chi Minh	53	45.3
Quang Ninh	59.7	52.5
Dien Bien	46.6	37.0

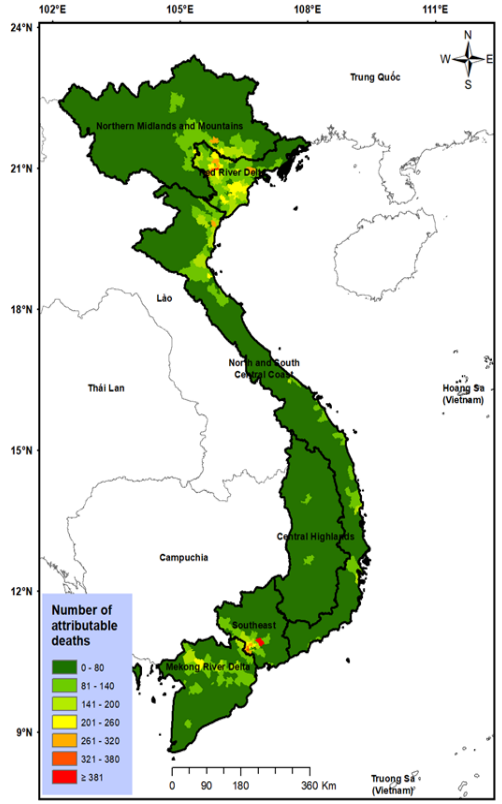
Compliance with WHO guidelines (5μg/m³) could have helped avoiding at least 222 premature deaths (Dien Bien) and could have reached 5,090 deaths (Ha Noi).

Health burden of air pollution –
Avoidable mortality in Vietnam attributed to COVID-19 preventive measures



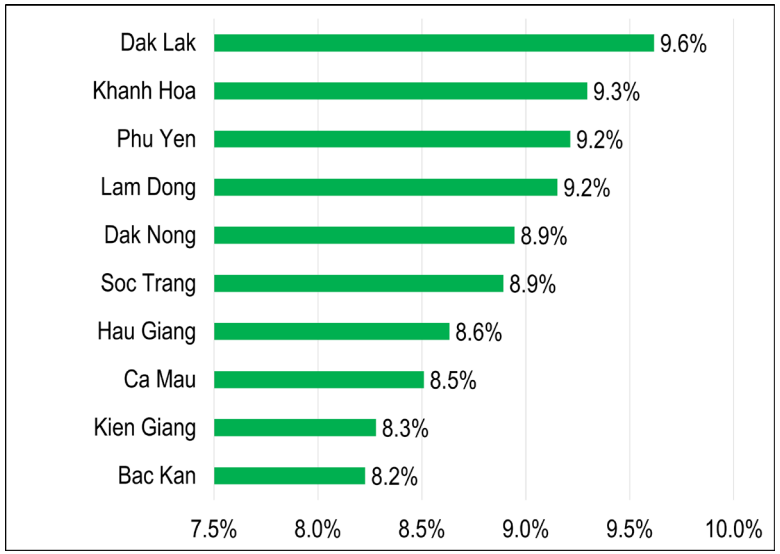
56.808 premature deaths attributed to $PM_{2.5}$ (9,9%)

Number of premature deaths attributed to $PM_{2.5}$ in 2019 in Viet Nam **(using 2019 concentration)**



52.993 premature deaths attributed to $PM_{2.5}$ (9,2%)

Number of premature deaths attributed to $PM_{2.5}$ in 2019 in Viet Nam **(if 2021 concentration had been met)**



List of 10 provinces with the highest percentages of potentially avoidable premature deaths if $PM_{2.5}$ control measures had been implemented

Health effects of air pollution –
Respiratory hospitalization among children in Hanoi –

2018 study

- 1 hospital in Hanoi
- 2007 - 2014

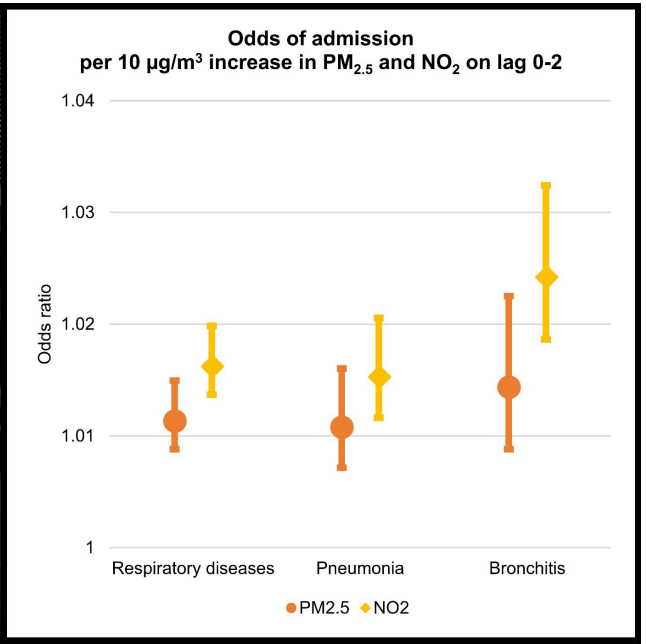
2023 study

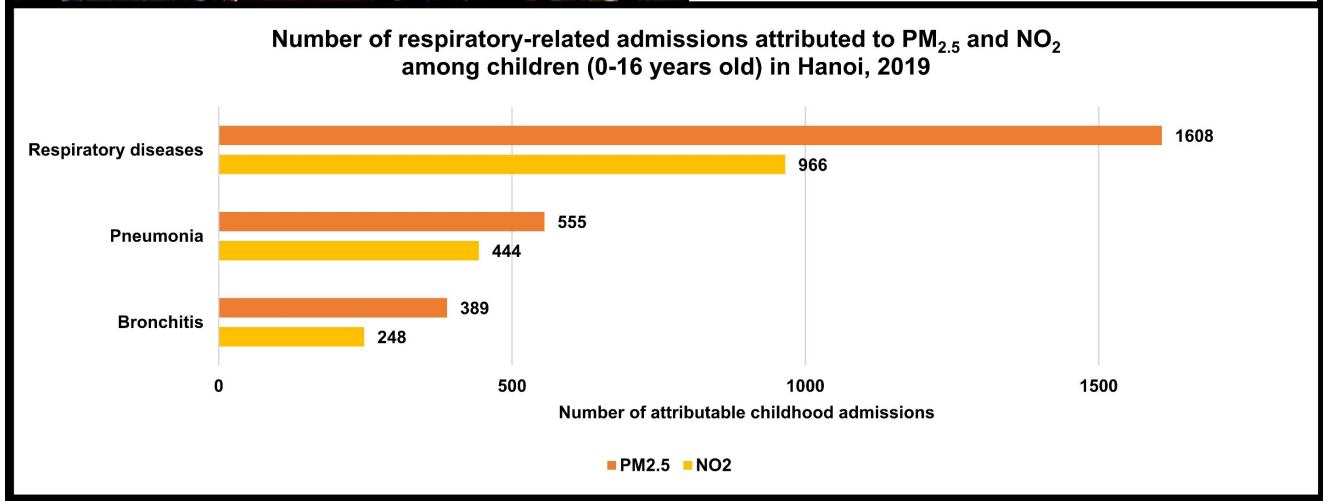
- 14 hospitals in Hanoi
- 2007 – 2019
- Assess the attributable number

Phase 1: Estimate the effect of air pollutants on childhood admissions

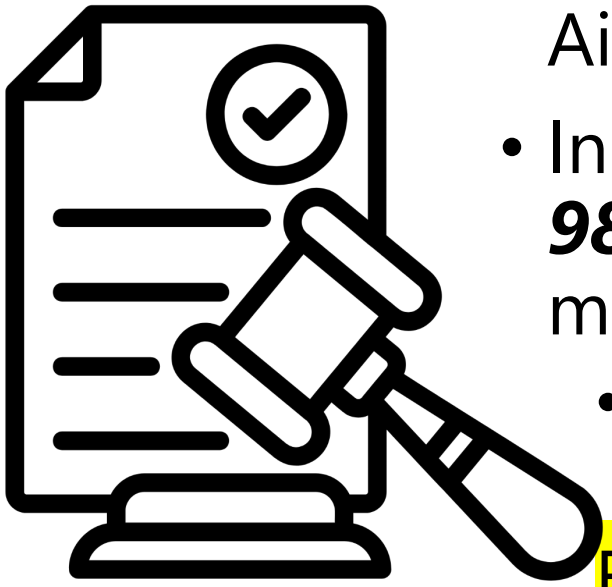
Phase 2: Assess the number of hospitalization attributed to air pollutants

The effect of $PM_{2.5}$ and NO2 on childhood respiratory admission remains ***significant***, even after adjusting for other pollutants





Vietnamese policies for air quality management



- In 2013, National Technical Regulation on Ambient Air quality was born (denoted as ***QCVN 05:2013***).
- In 2016, government issued ***Decision No 985a/QĐ-TTg***: "National Action Plan on air quality management by 2020 including a vision for 2025"
  - Focusing on emissions control and ambient air quality monitoring

Environmental Law 2020

Vietnamese policies for air quality management

- In 2021, many legal documents was born:
  - ***Directive No 03/CT-TTg*** on enhancing air quality management.
  - ***Decision No 1973/QĐ-TTg*** "National Action Plan on air quality management during 2021-2025". This document enhanced the previous goal and focus on research to provide information via early warning system.
  - ***The Official Dispatch No 3051/BTNMT-TCMT*** on the technical guidelines of building air management plan at provincial level ➔ Emphasized the important of Health Impact Assessment of air pollution and recommended using AirQ+

Vietnamese air quality standard and WHO guidelines

		QCVN 05:2013 (µg/m³)	WHO air quality guidelines (2005) (µg/m³)	WHO air quality guidelines (2021) (µg/m³)
$PM_{2.5}$	Annual average	25	10	5
	24-hour average	50	25	15
PM_{10}	Annual average	50	20	15
	24-hour average	150	50	45
O_3	8-hour average	120	100	100
NO_2	Annual average	40	40	10
	24-hour average	100	_	25
SO_2	24-hour average	125	20	40
CO	24-hour average	_	_	4

Conclusion

- Crowed cities and provinces, with high concentration of air pollution, experienced heavy burden of mortality and morbidity attributed to $PM_{2.5}$.
- Hanoi Children are highly susceptible to air pollutants. More than 1000 childhood respiratory admission attributed to ambient $PM_{2.5}$ in 2019.

Next?

- Data of concentration of other pollutants such as NO2, CO2, SO2, back carbon, Noise and Light
- Length of data: more than 10 years for any long-term effect investigation
- Resolution(small scale)

Thank you for listening

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