PART II

HEALTH IMPACT IN VIET NAM 2019 ATTRIBUTABLE TO $PM_{2.5}$

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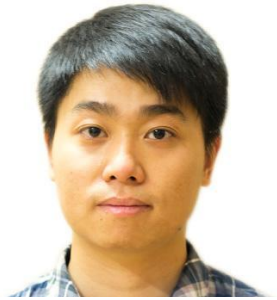

Le Tu Hoang

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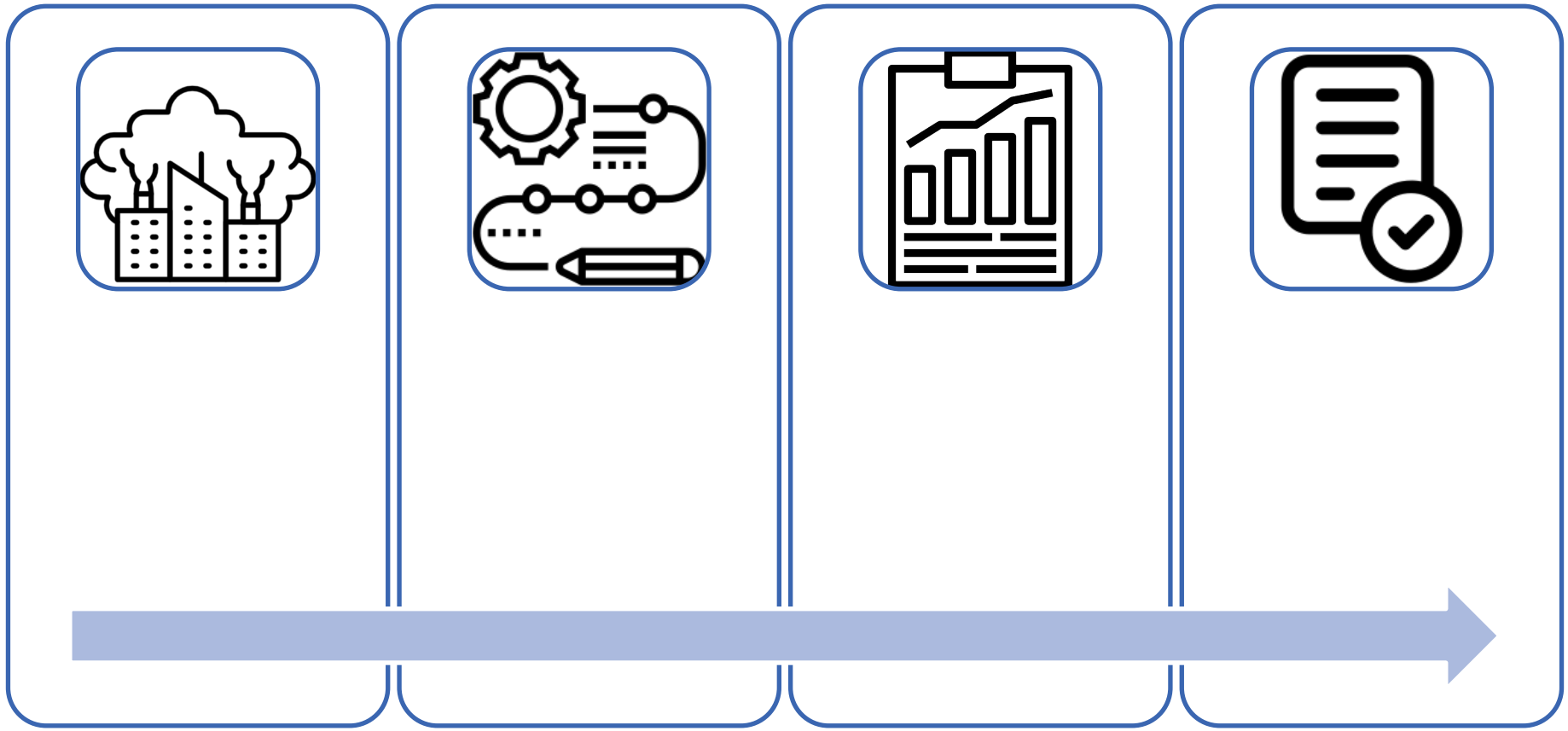
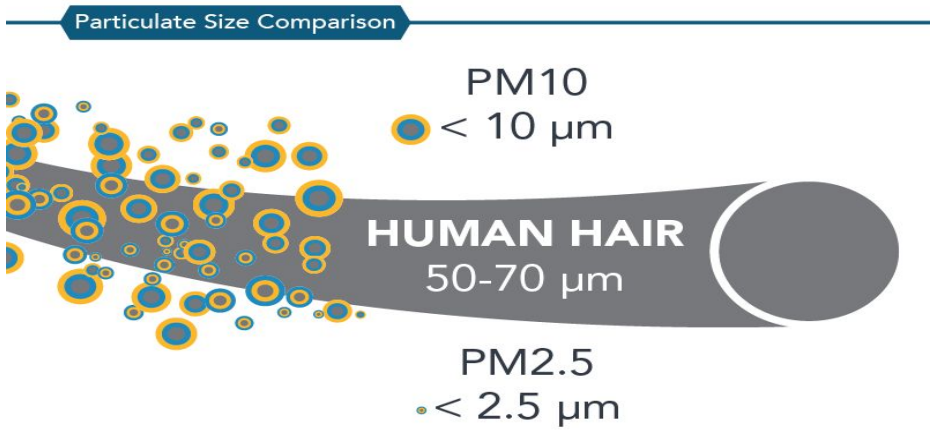


Introduction

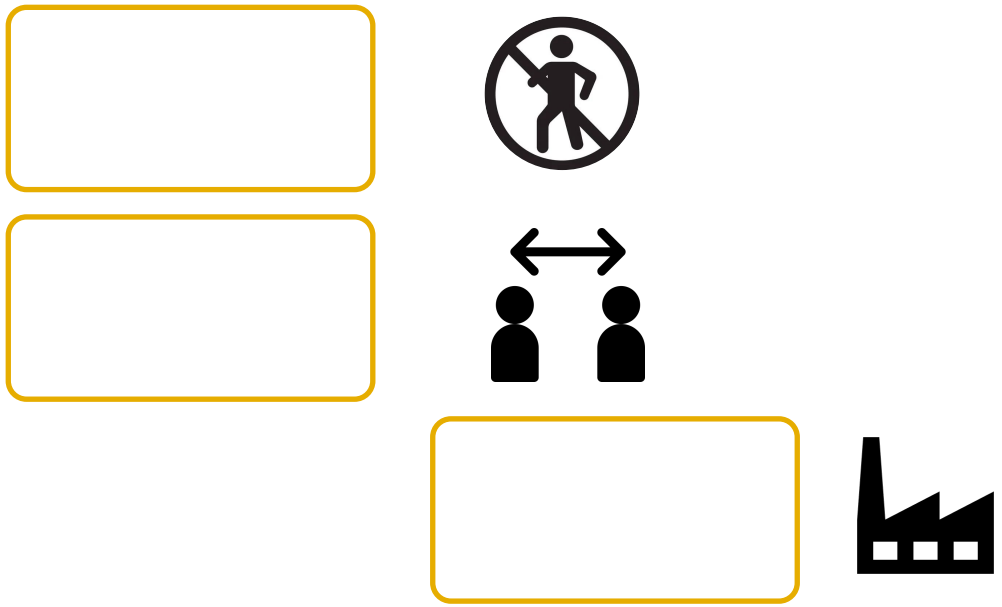
- **$PM_{2.5}$** – refers to the particulate matter with aerodynamic diameter smaller than 2.5 µm. $PM_{2.5}$ can infiltrate the alveoli and cause negative impact to health.
- Each year, about **7 million deaths** attributed to air pollution (WHO)
- In 2019, more than **90% of the global population** were exposed to excessive $PM_{2.5}$ comparing to WHO old air quality guidelines **(10 µg/m³)**, according to IHME (2020). If the new guidelines had been applied **(5 µg/m³)**, this number could have been higher.



Minh họa kích thước của bụi $PM_{2.5}$

Nguồn: *https://ww2.arb.ca.gov/resources/inhalable-particulate-matter-and-health*

Interventions to reduce COVID-19 contagion



Hypothesis:

Before 2019, if Viet Nam had applied the same interventions as those in 2020

→ **$PM_{2.5}$ concentration in 2019 could have been equal to the concentration in 2021**

→ **The number of premature deaths in 2019 would have been avoided**

Method

DATA SOURCES

The 2019 Viet Nam Population and Housing Census

Total population in 2019 (by district, per age group)

$PM_{2.5}$ concentration in 2019 and 2021

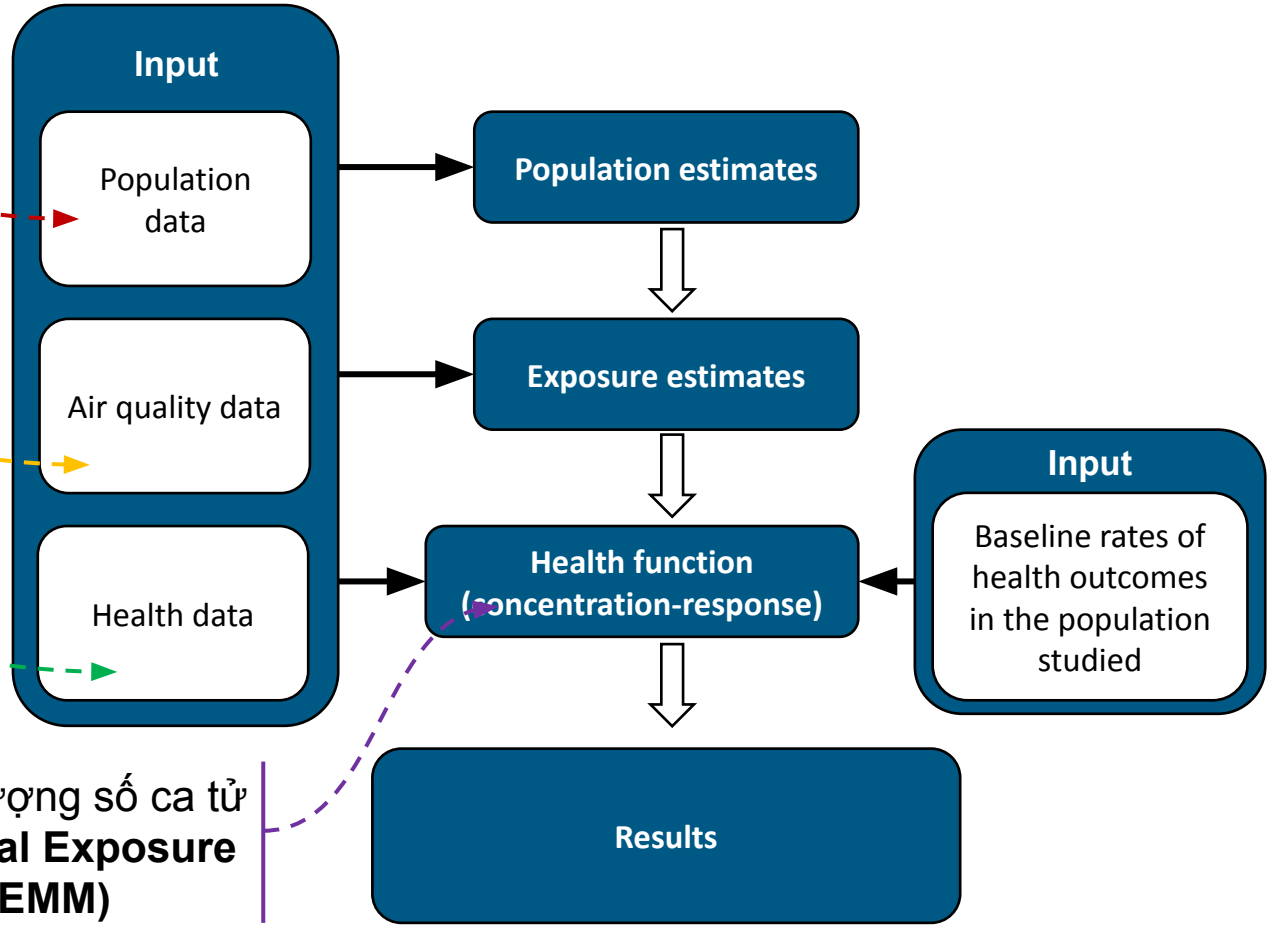
General Statistics Office

Crude mortality rate

Viet Nam Injury Survey (VNIS)

Injury-related mortality rate

APPROACH (WHO guidelines, 2016)



Phương pháp ước lượng số ca tử vong toàn cầu **(Global Exposure Mortality Model – GEMM)**

Method

Results

1. **Scenario 1:**

Premature mortality deaths attributed to excessive $PM_{2.5}$ exposure comparing to World Health Organization guidelines (WHO- 5 µg/m^3).

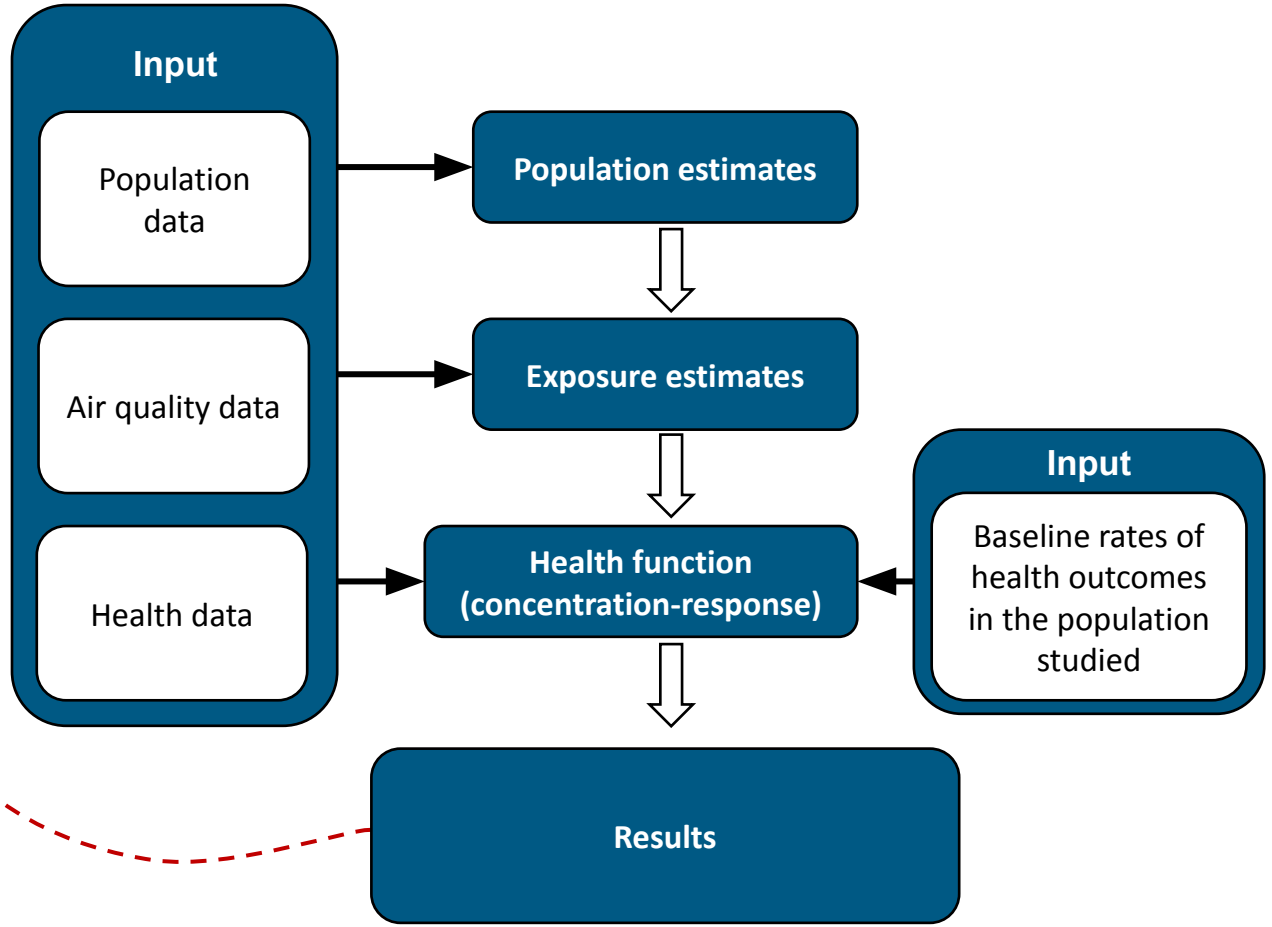
2. **Scenario 2:**

Premature mortality deaths in 2019 due to people exposing to $PM_{2.5}$ concentration higher than the WHO guidelines would have been, if Viet Nam manage the same concentration as during the pandemic.

3. **Level of difference:**

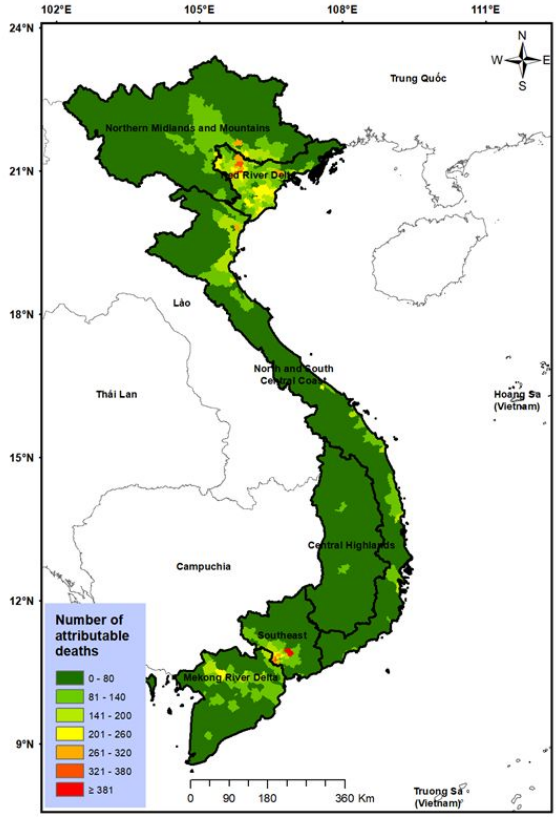
The reduction percentages if Viet Nam had applied the interventions in 2019, so that $PM_{2.5}$ concentration in 2019 reduced to $PM_{2.5}$ concentration in 2021.

APPROACH (WHO guidelines, 2016)



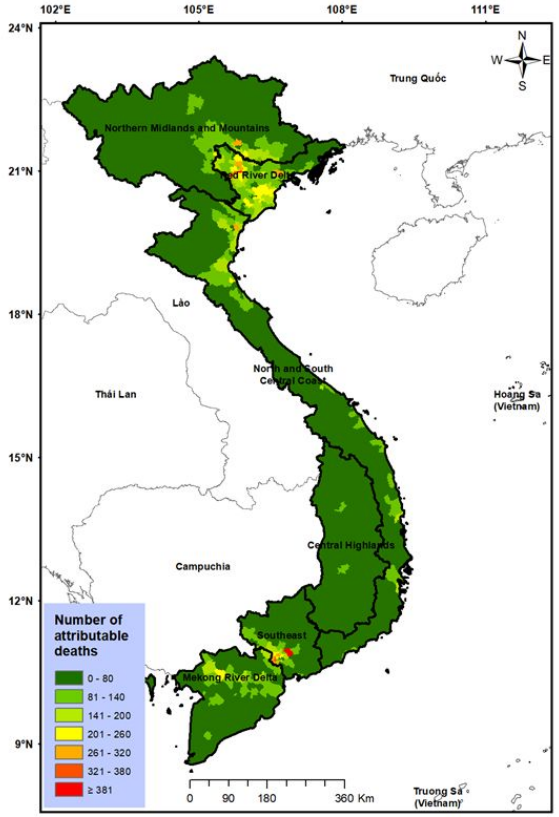
Results

National level



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 **(scenario 1)**



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

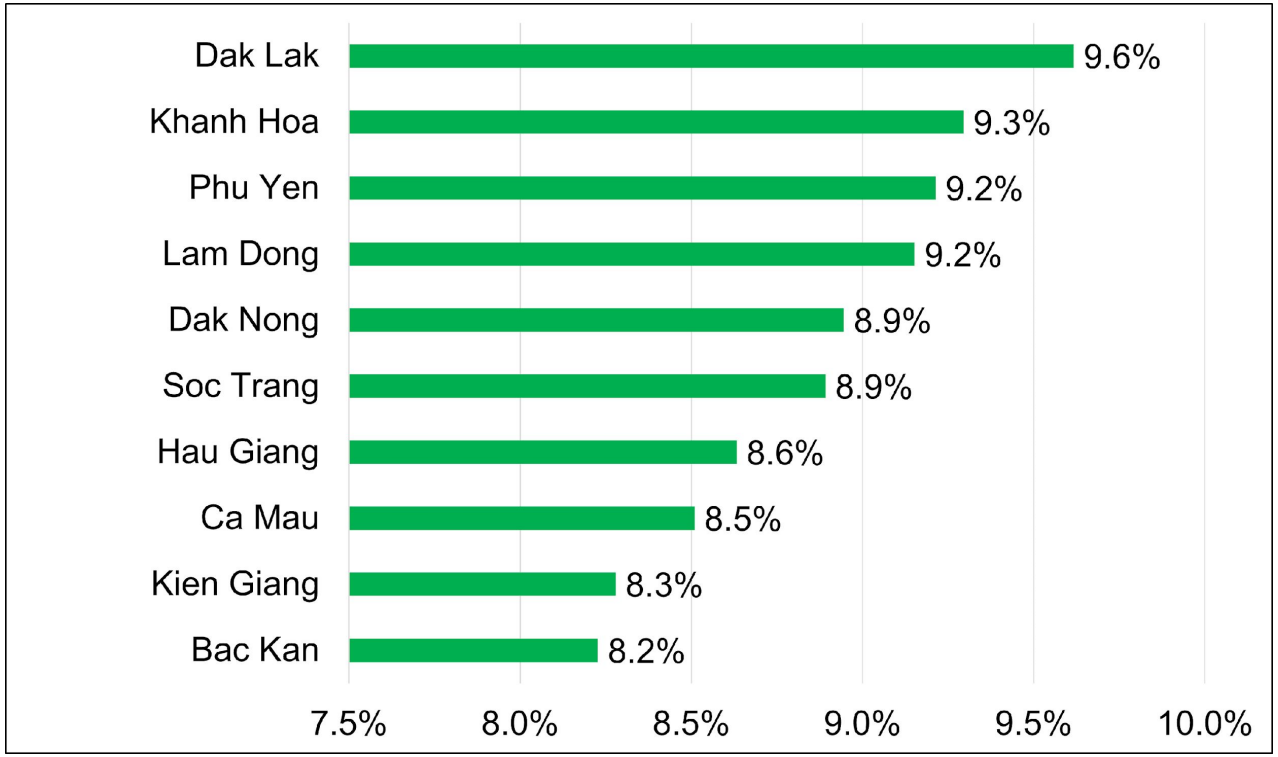
Number of premature deaths attributed to $PM_{2.5}$ in 2019 in Viet Nam **(scenario 2)**

Results

National level

Percentage of change in attributable deaths

- Ranging from 4,7% to 9,6% across the provinces
- The highest percentages were observed in Dak Lak (9,6%), Khanh Hoa (9,3%), and Phu Yen (9,2%)



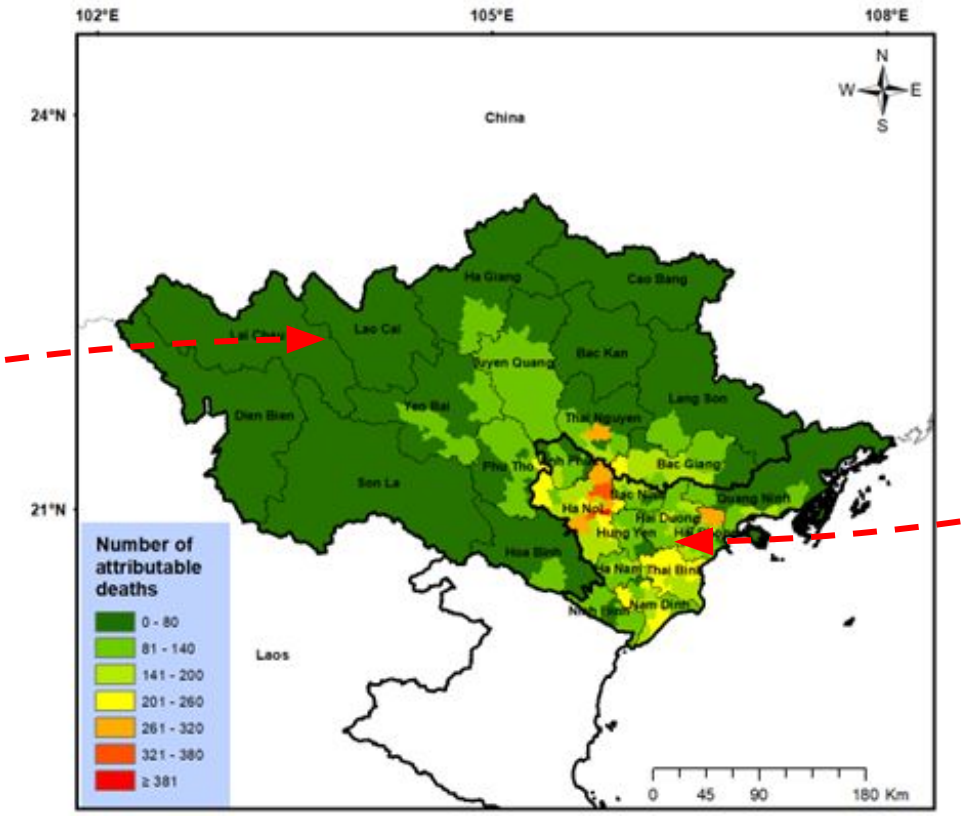
List of 10 provinces with the highest percentages of premature deaths attributed to excessive $PM_{2.5}$ exposure, when comparing scenario 2 and scenario 1, in 2019

Results

Northern region

Northern Midlands and Mountains:

Bac Giang (**1.419 cases**) and Phu Tho (**1.372 cases**) Had the largest number of premature deaths attributed to $PM_{2.5}$



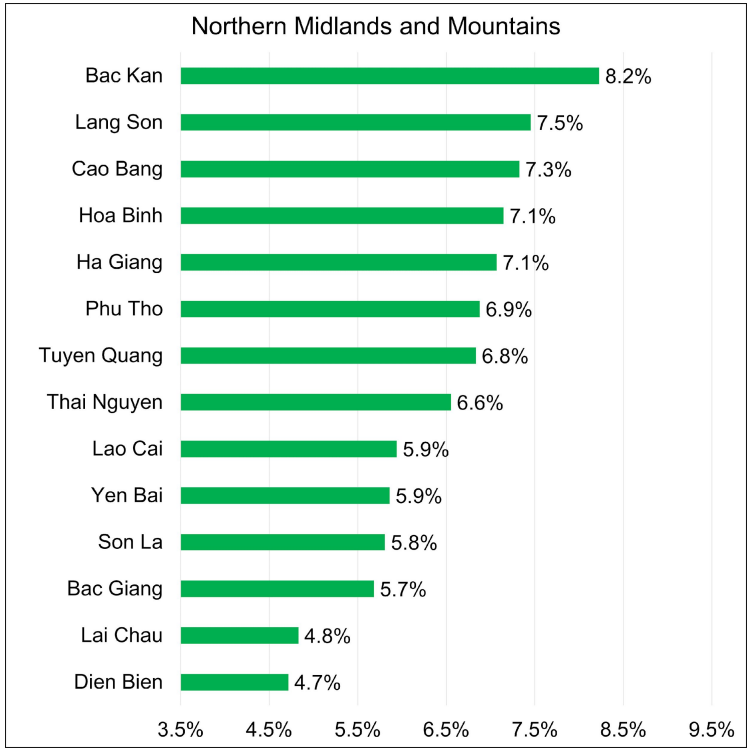
Red River Delta:

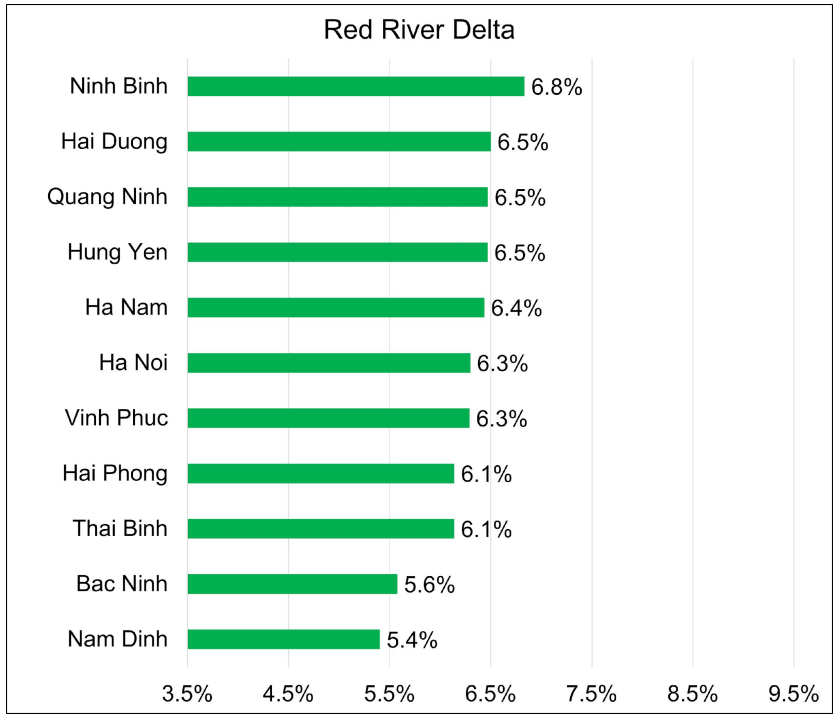
The number of premature deaths attributed to $PM_{2.5}$ in Ha Noi city (**6.726 cases**) were 3.8 times higher than those in Hai Phong city (**1.761 cases**) .

. Number of attributable deaths due to excessive level of $PM_{2.5}$ exposure, compared to WHO, in the **Northern Midlands and Mountains** and **Red River Delta** in 2019

Results

Northern region

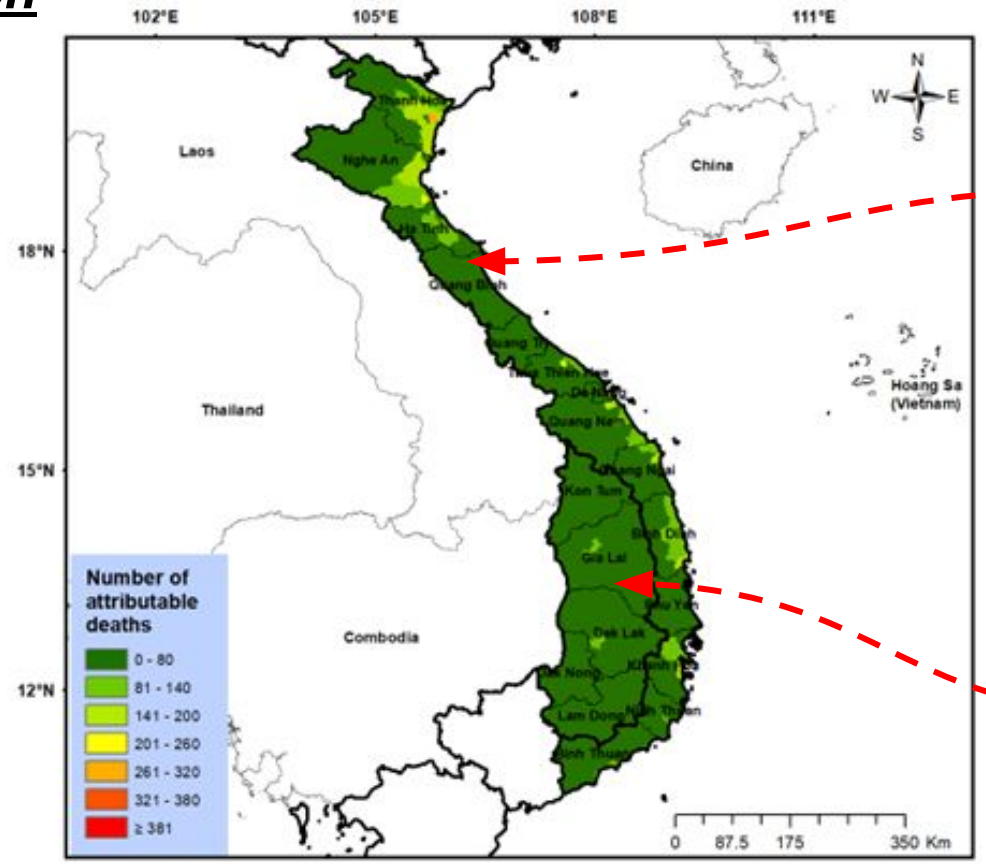




Reduction percentage of attributable deaths due to excessive $PM_{2.5}$ exposure in **Scenario 2** compared to **Scenario 1** in the **Northern Midlands and Mountains and Red River Delta** in 2019

Results

Central region



The number of attributable deaths due to excessive level of $PM_{2.5}$ exposure, compared to WHO, in **North-Central and South-Central Coast** and **Central Highlands** in 2019

North-Central and South-Central Coast:

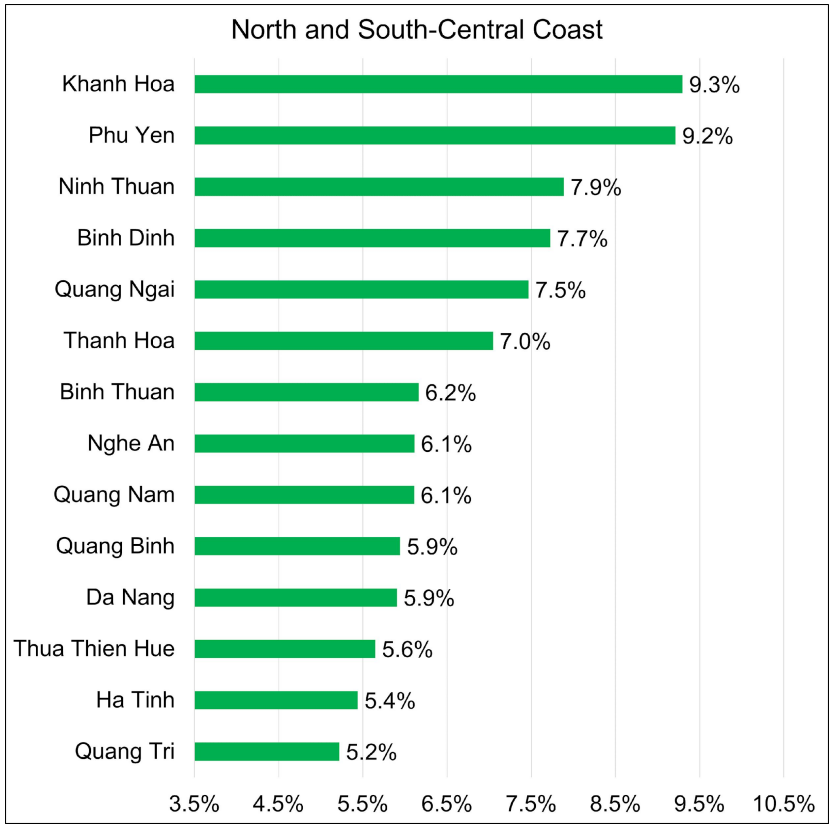
There were **11.161** premature deaths attributed to $PM_{2.5}$. A majority of provinces in this region had the attributable deaths smaller than 700 cases.

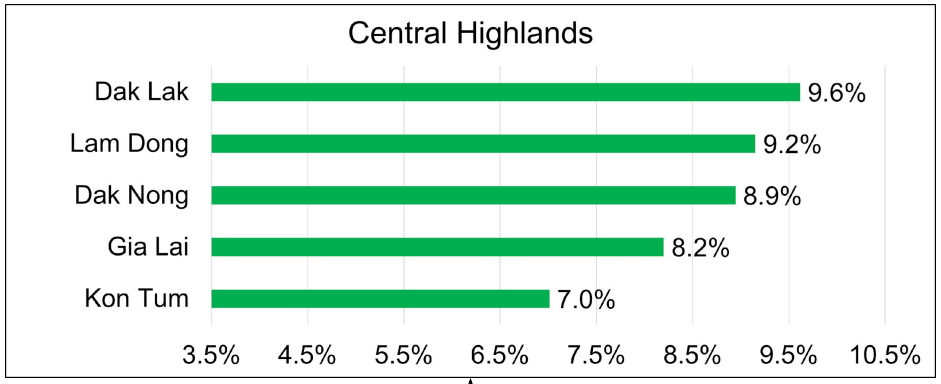
Central Highlands:

There were **1.795** premature deaths attributed to $PM_{2.5}$. Kon Tum had the lowest number of premature deaths attributed to $PM_{2.5}$, with162 cases.

Results

Central region





Reduction percentage of attributable deaths due to excessive $PM_{2.5}$ exposure in **scenario 2** compared to **scenario 1** in **North-Central and South-Central Coast** and **Central Highlands** in 2019

Results

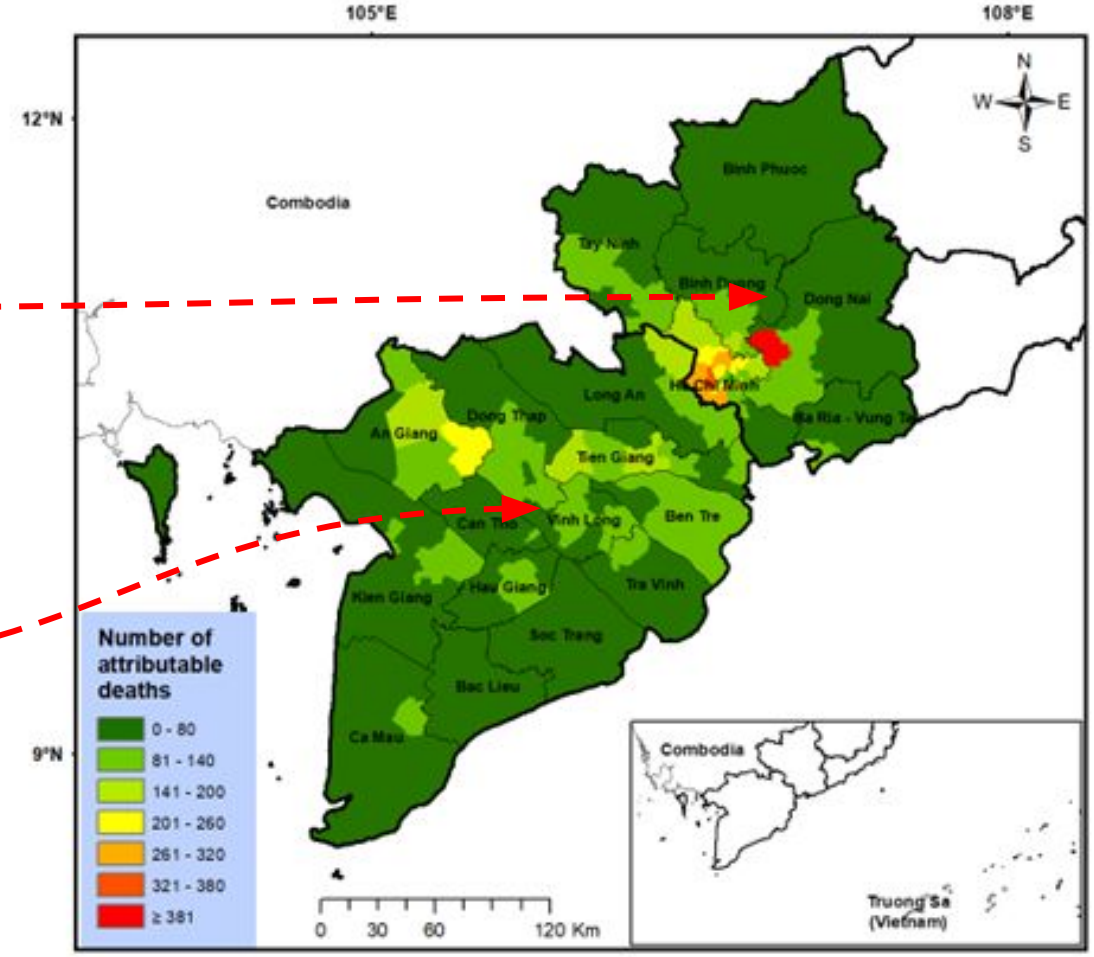
Southern region

Southeast Region:

The total number of premature deaths attributable in $PM_{2.5}$ in the Southeast Region were **7.378 cases**.

Mekong River Delta:

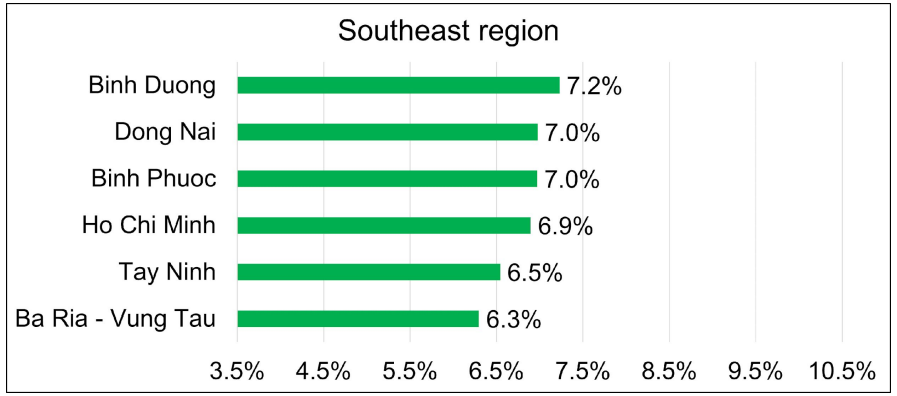
The total number of premature deaths attributable in $PM_{2.5}$ in the Mekong River Delta were **9.406 cases**.



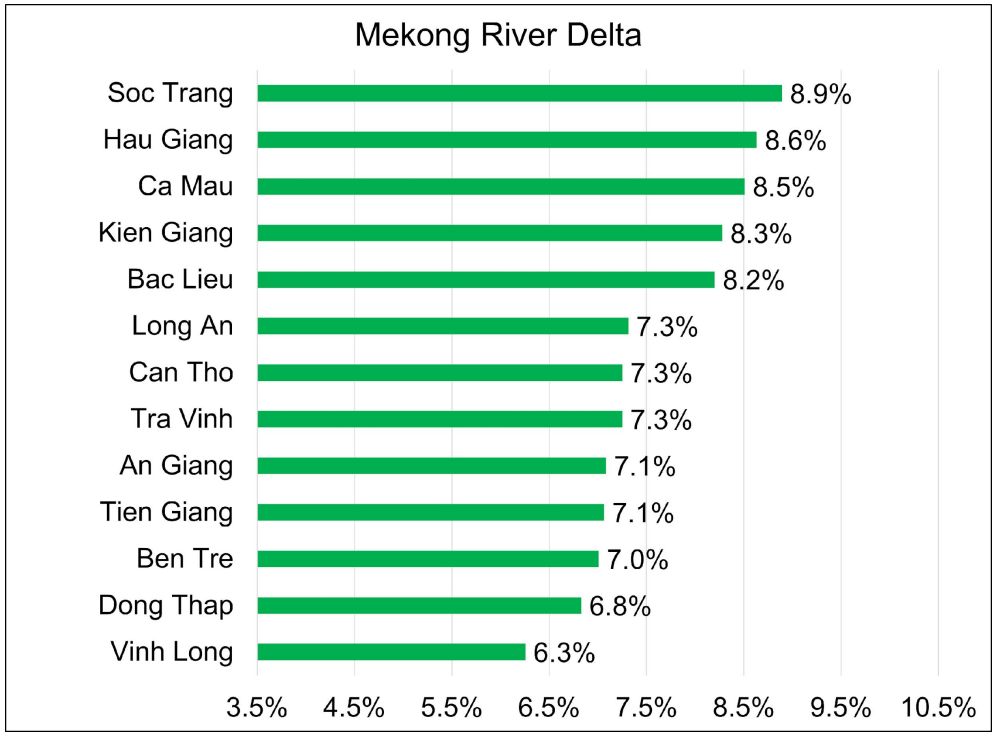
The number of attributable deaths due to excessive level of $PM_{2.5}$ exposure, compared to WHO, in **Southeast region** and **Mekong River Delta** in 2019

Results

Southern region



Reduction percentage of attributable deaths due to excessive $PM_{2.5}$ exposure in **scenario 2** compared to **scenario 1** in **Southeast region** and **Mekong River Delta** in 2019



Conclusions

- The number of premature deaths in 2019 attributed to excessive $PM_{2.5}$, comparing to WHO, accounted for 9,9% the total number of national mortalities.

- If Viet Nam had implemented the interventions to control the $PM_{2.5}$ concentration, the total number of avoidable deaths would have accounted for 6,7% total number of deaths attributed to $PM_{2.5}$.

- Regions with great changes include **Red River Delta**, and **North-Central and South-Central Coast. Central Highlands** had the lowest number of premature deaths attributed to $PM_{2.5}$.

- Ha Noi city and Ho Chi Minh city still observed the highest number of premature deaths attributed to $PM_{2.5}$ in the country (details in full report).