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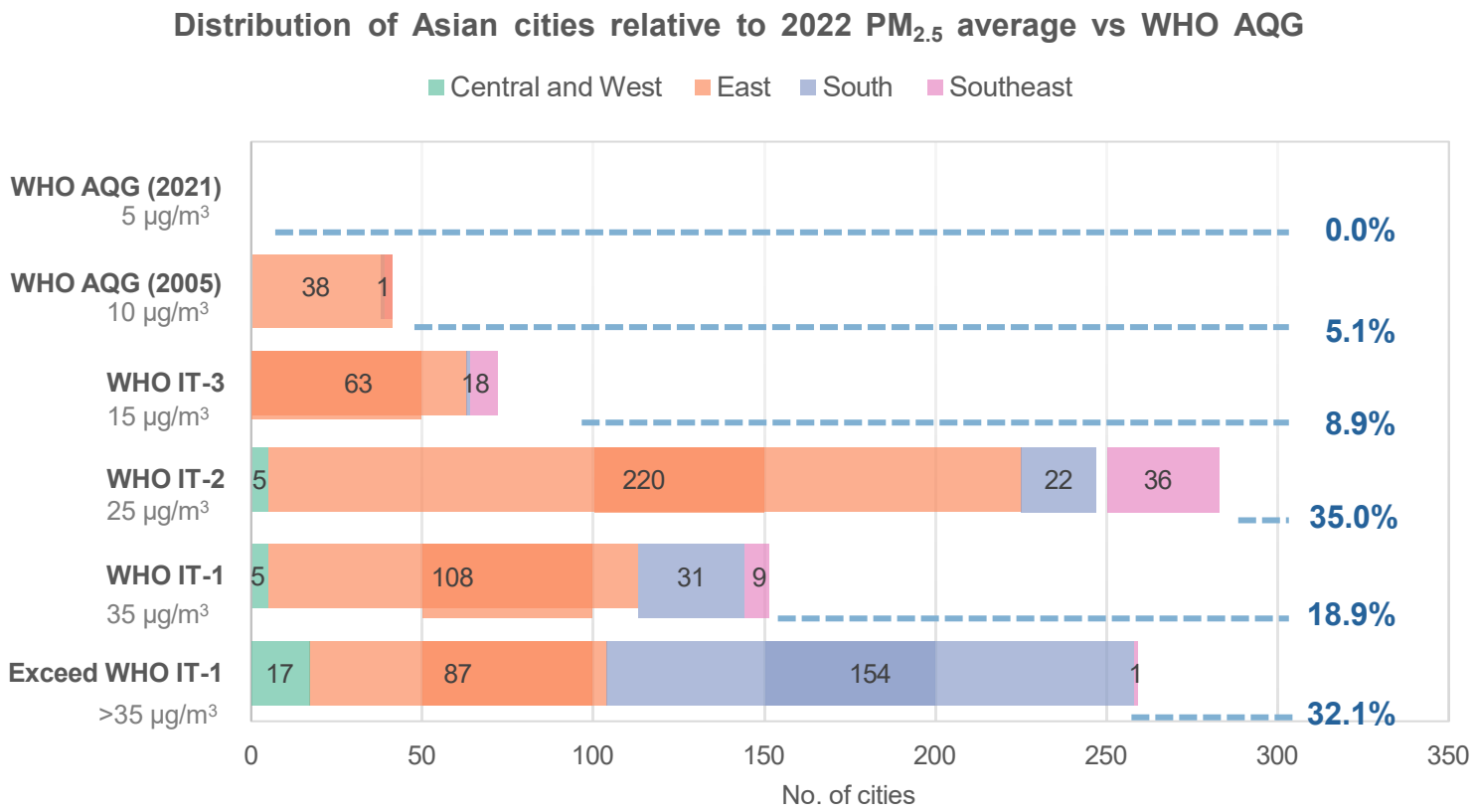
Transport, Air Pollution, and Health: Challenges, Opportunities, and Solutions in Asia

Dang Espita Casanova

Associate Program Director

Asian cities are still at risk from the health impacts of $PM_{2.5}$ exposure



*Based on Clean Air Asia database on annual average $PM_{2.5}$ concentrations in Asian cities
*849 cities with publicly accessible and official government data

Only 2 of the 849 cities included in the study meet the $PM_{2.5}$ WHO AQG (2021)

- **46 cities meet the 2005 WHO AQG**, majority from East Asia.
- **Majority of Asian cities** (esp. East and SEA) **meet WHO IT-2**.
- Majority of South Asian cities are unable to meet the WHO IT-1.

Transport-related air pollution (TRAP) and health impacts

- TRAP led to an estimated 800 premature deaths per day globally in 2019
- Lower and middle-income economies in Asia account for 96% of premature regional deaths and 92% of global premature deaths due to TRAP
- $PM_{2.5}$ and ground-level ozone from road transport are the primary culprits, responsible for 79% of the health burden in Asia

Source: (McDuffie et al., 2021)

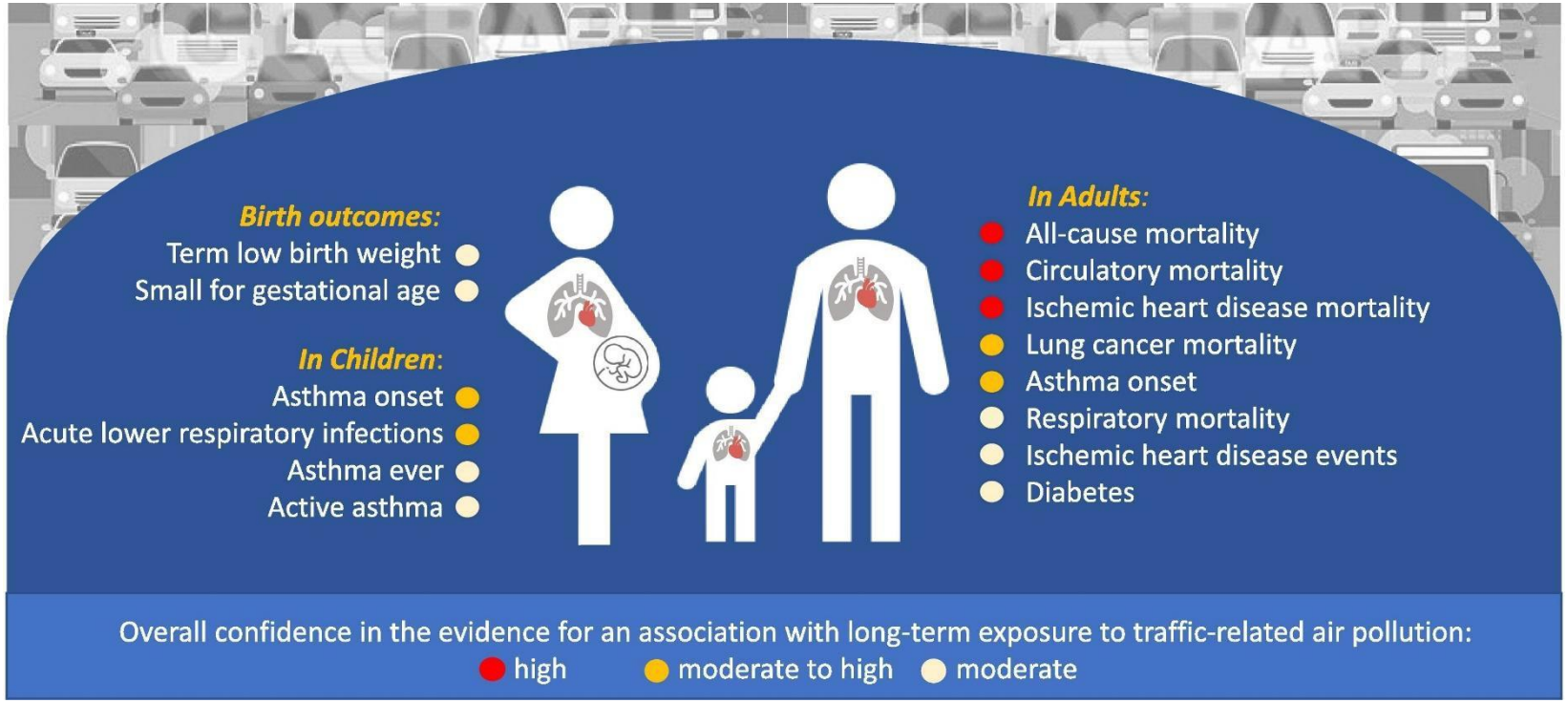


Image from Boogaard, H. et al (2022). Long-term exposure to traffic-related air pollution and selected health outcomes: A systematic review and meta-analysis.

Transport as main contributor in national emission inventories

Data based on official national air pollution inventories and published journals

The transport sector is identified as the top source of air pollution ($PM_{2.5}$) in most national inventories and local studies

Desert dust plays a key contribution in CW Asia; For all regions there is a need for more comprehensive emissions inventories and source apportionment studies that are city- or airshed specific, not just national.

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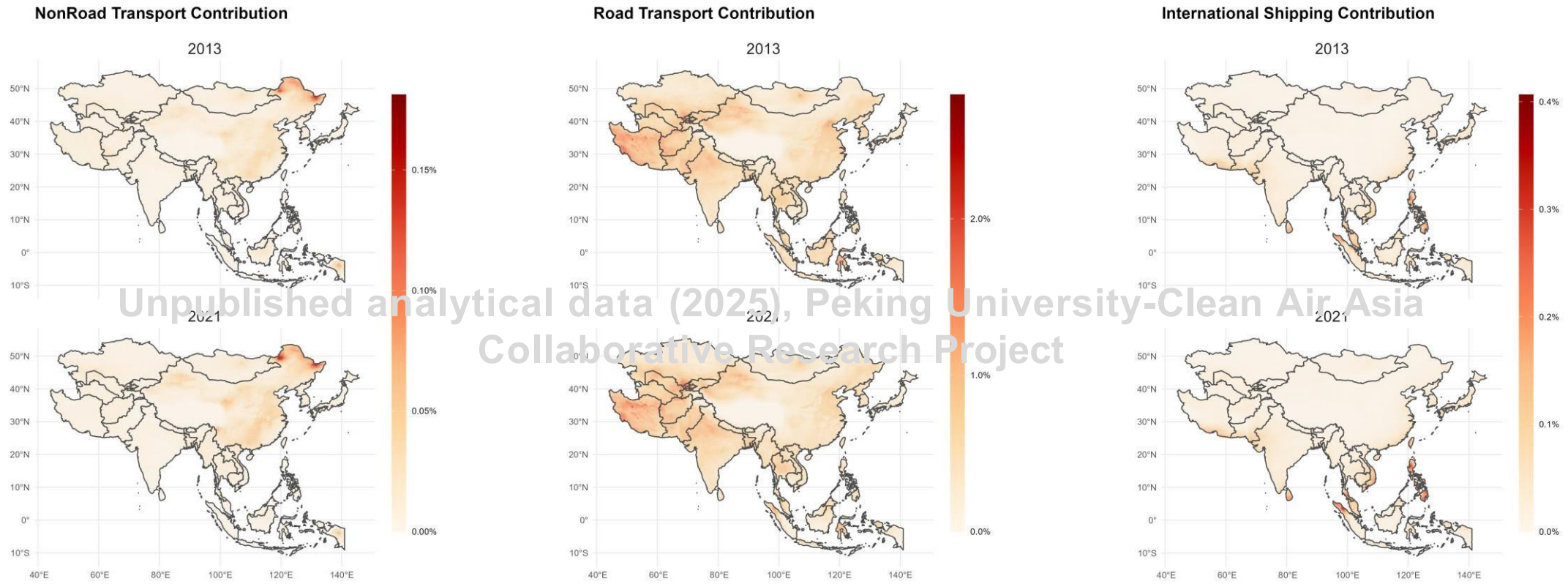
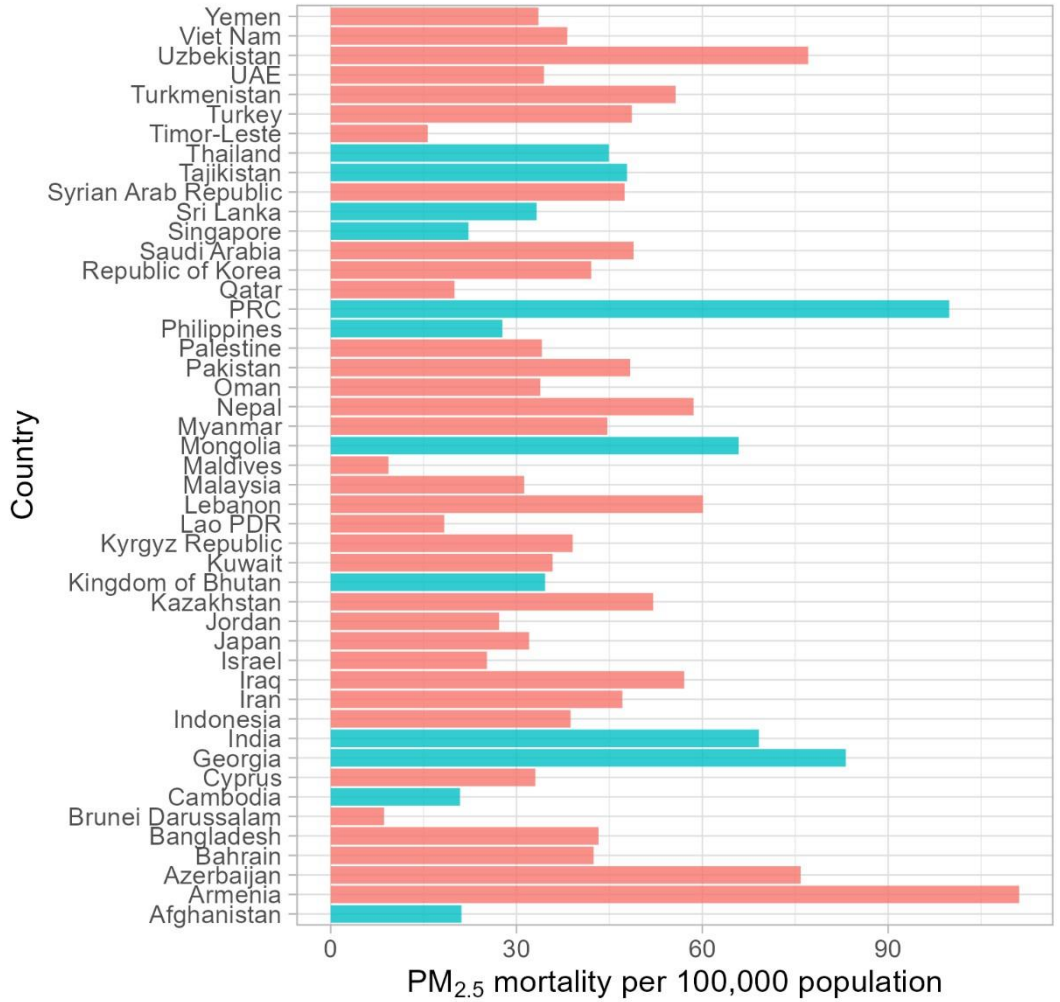
Spatial distribution of $PM_{2.5}$–related mortality in Asia, per transport type

- Among transportation-related sources of $PM_{2.5}$, **road transport** exhibits the highest contribution to attributable mortality, especially in **South Asia**, where the attributable risk proportion commonly exceeds 1%.
- **Non-road transport** contributes more substantially in **East Asia**, whereas **international shipping** has a comparatively greater impact in **Southeast Asia**.

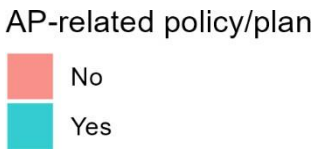


$PM_{2.5}$-related mortality and policies/plans recognizing air pollution health impacts



While all countries have some form of a clean air act or air pollution policy/standards, most countries **do not have policies which directly aim to understand air pollution health impacts or national health action plans which recognize the health impacts of poor air quality**

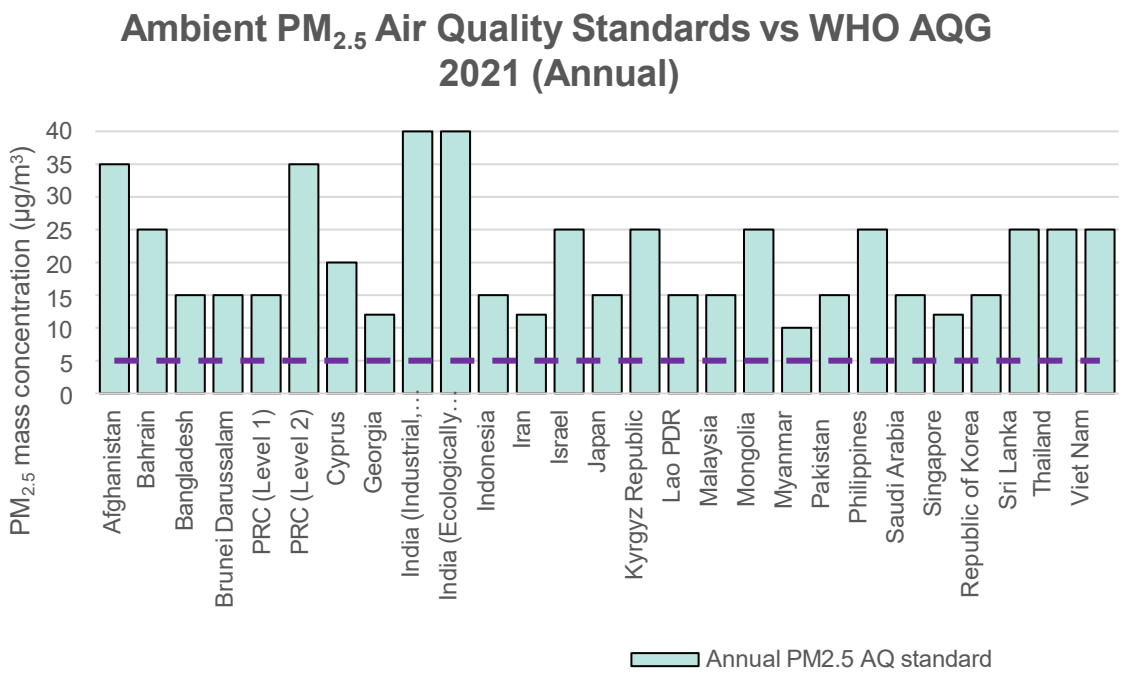
- Only 12 out of 48 have any of the following: *Health and Pollution Action Plan; Environment and Health Action Plan; Environmental Health Strategy; Healthy City Action Plan; Air Quality Action Plans with specific health targets; or something similar*

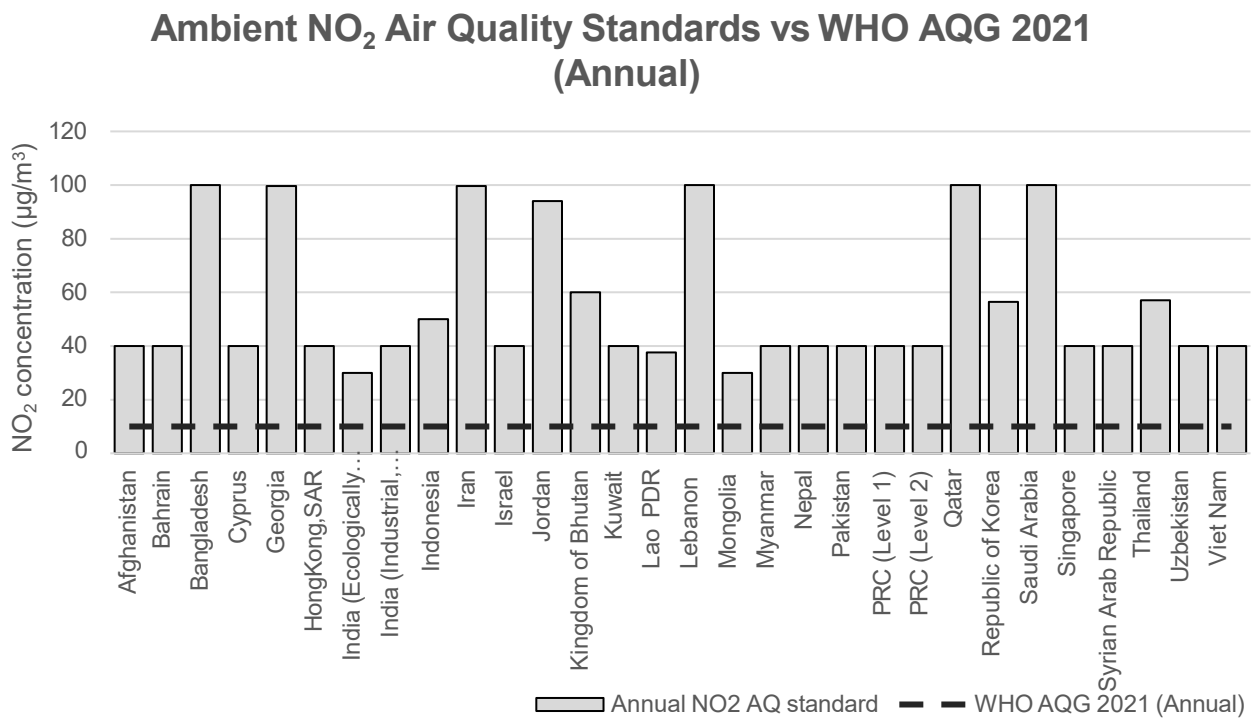


Mortality data from Health Effects Institute. 2020. State of Global Air 2020. Data source: Global Burden of Disease Study 2019. IHME, 2020.

Policy data from accessible official government websites, documents, and reports.

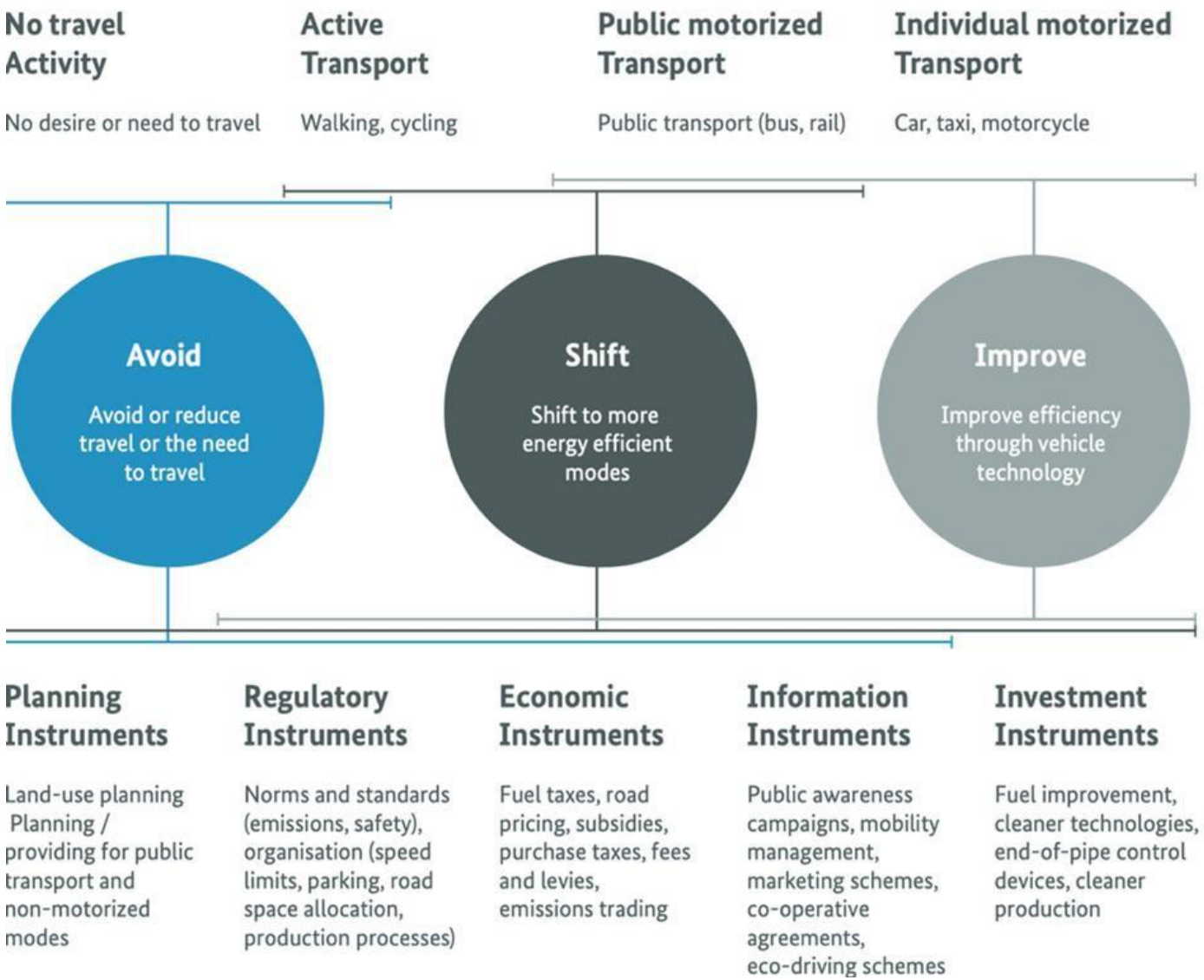
Alignment of Annual $PM_{2.5}$ and NO_2 national standards with WHO AQG





**Based on Clean Air Asia database of air quality standards and guidelines in Asian countries; data accessed as of November 2023*

Avoid-Shift-Improve Framework for reducing transport emissions



Source: TUMI (2019) Sustainable Urban Transport: Avoid-Shift-Improve (A-SI) GIZ, Eschborn, Germany.

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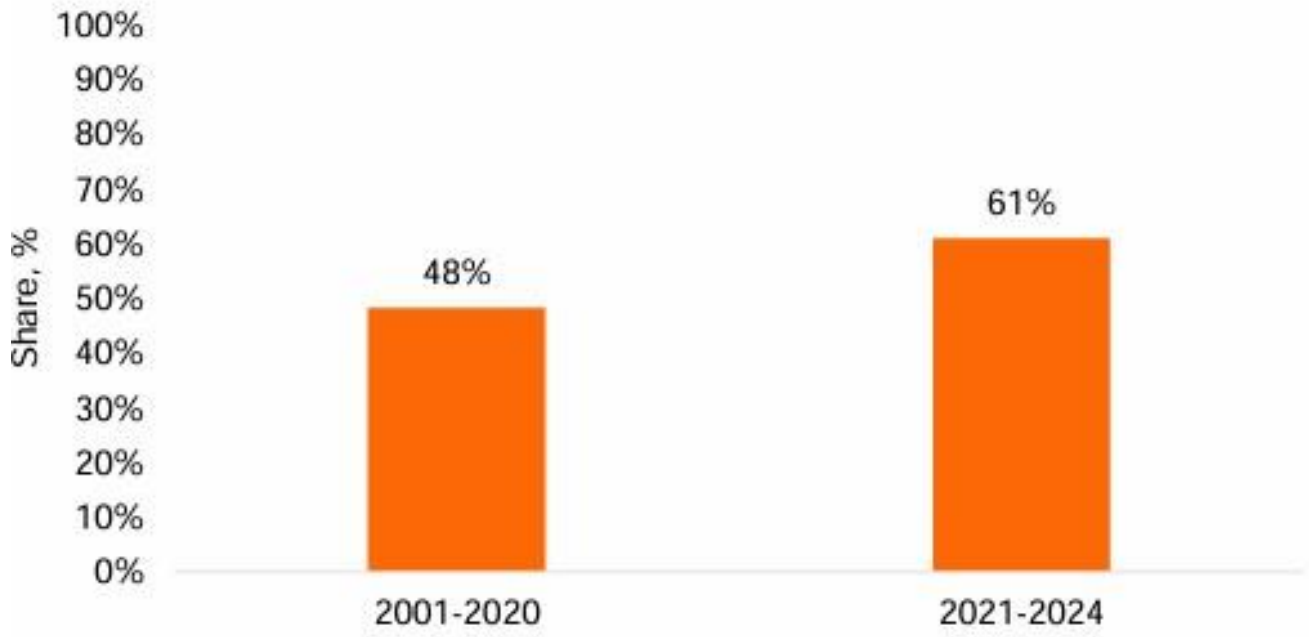
TRAP Policy Landscape in Environmentally Sustainable Transport Forum-participating countries

SDGs, Paris Agreement and NDCs, Aichi Declaration, increased awareness of transport externalities

- Shift from an infrastructure and connectivity-driven ambitions to a more holistic policy paradigm
- Resulted in inherent synergy between climate change and air pollution policies
- Air pollution is now being indirectly addressed in various policy documents.



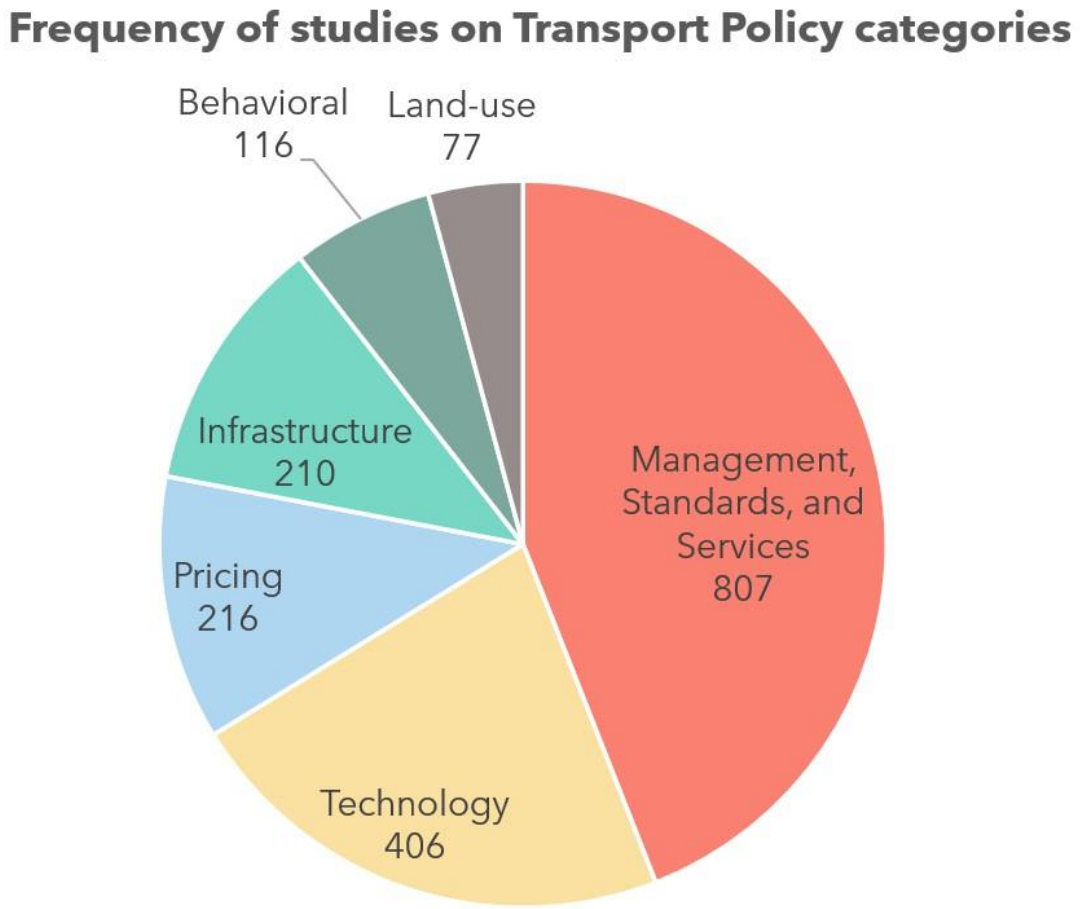
Share of policy documents in EST participating countries with explicit air pollution policy measures (Asian Transport Outlook, n.d.)

Urban policy interventions to reduce traffic emissions and air pollution

- A **systematic evidence map** (SEM) examined peer-reviewed evidence on urban level policy interventions aimed at reducing traffic emissions and/or TRAP from on-road mobile sources

- **376** papers, with **58** unique policy interventions, and a **1,139** unique policy scenarios

- **Most studied interventions**:
  - Alternative fuel technology
  - Vehicle emission regulation



Source: Urban policy interventions to reduce traffic-related emissions and air pollution: A systematic evidence map (Khreis, et al. 2023)

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Urban policy interventions to reduce traffic emissions and air pollution

Pricing
(policies that involve a monetary charge, tax, price increase, fee, or incentive)

Parking charges
Road pricing
Congestion charging

Infrastructure
(policies that relate to the built environment)

Bus rapid transit or mass rapid transit
Public transportation infrastructure
Active transportation infrastructure

Technology
(policies that implement innovative and technological advances)

Alternative fuel technology
Vehicle retrofitting
Alternative vehicle technology

Land use
(focus on development and planning; increased centralization and mixed development)

Development density and mixed developments
Transit-oriented development
Urban sprawl

Behavioral
(involve a change in individuals' behavior or practices)

Public transit promotion or shift
Active or non-motorized transport (i.e., bike or walk) promotion or shift
Flexible work arrangements

Management, standards, and services
(relate to regulations, restrictions, optimization, or other established rules)

Vehicle emission regulation
Vehicle use restriction
Vehicle retirement or replacement

Source: Urban policy interventions to reduce traffic-related emissions and air pollution: A systematic evidence map (Khreis, et al. 2023)

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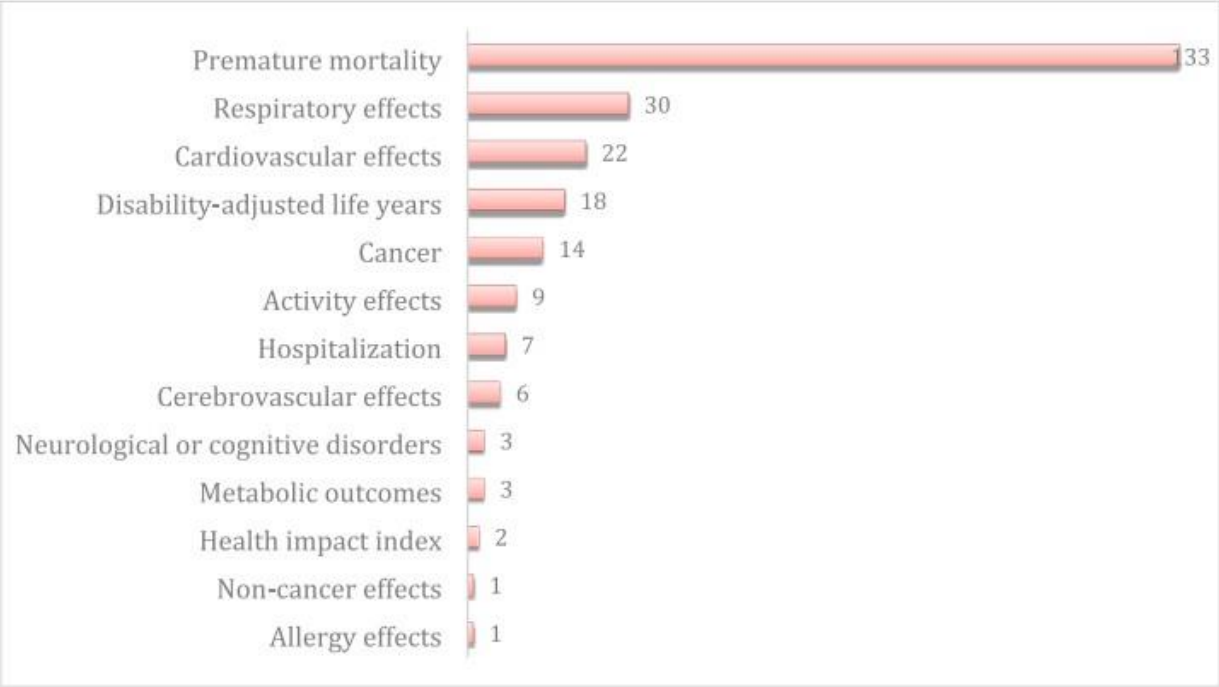
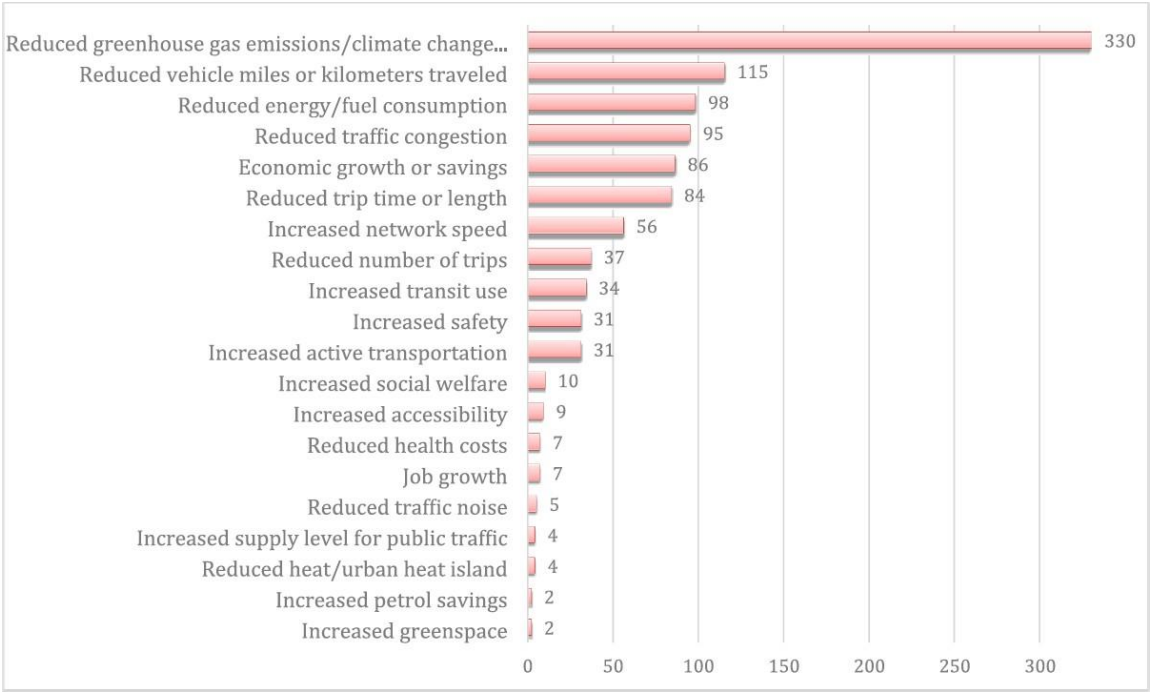
Co-benefits reported with the studied traffic policies





Source: Urban policy interventions to reduce traffic-related emissions and air pollution: A systematic evidence map (Khreis, et al. 2023)

Only 131 **(12%) reported human exposures** while 148 **(13%) of the policy scenarios reported health impacts**; mostly focused on particulate matter.

This is linked with the availability of health data and highlights the siloes between transportation and health disciplines.

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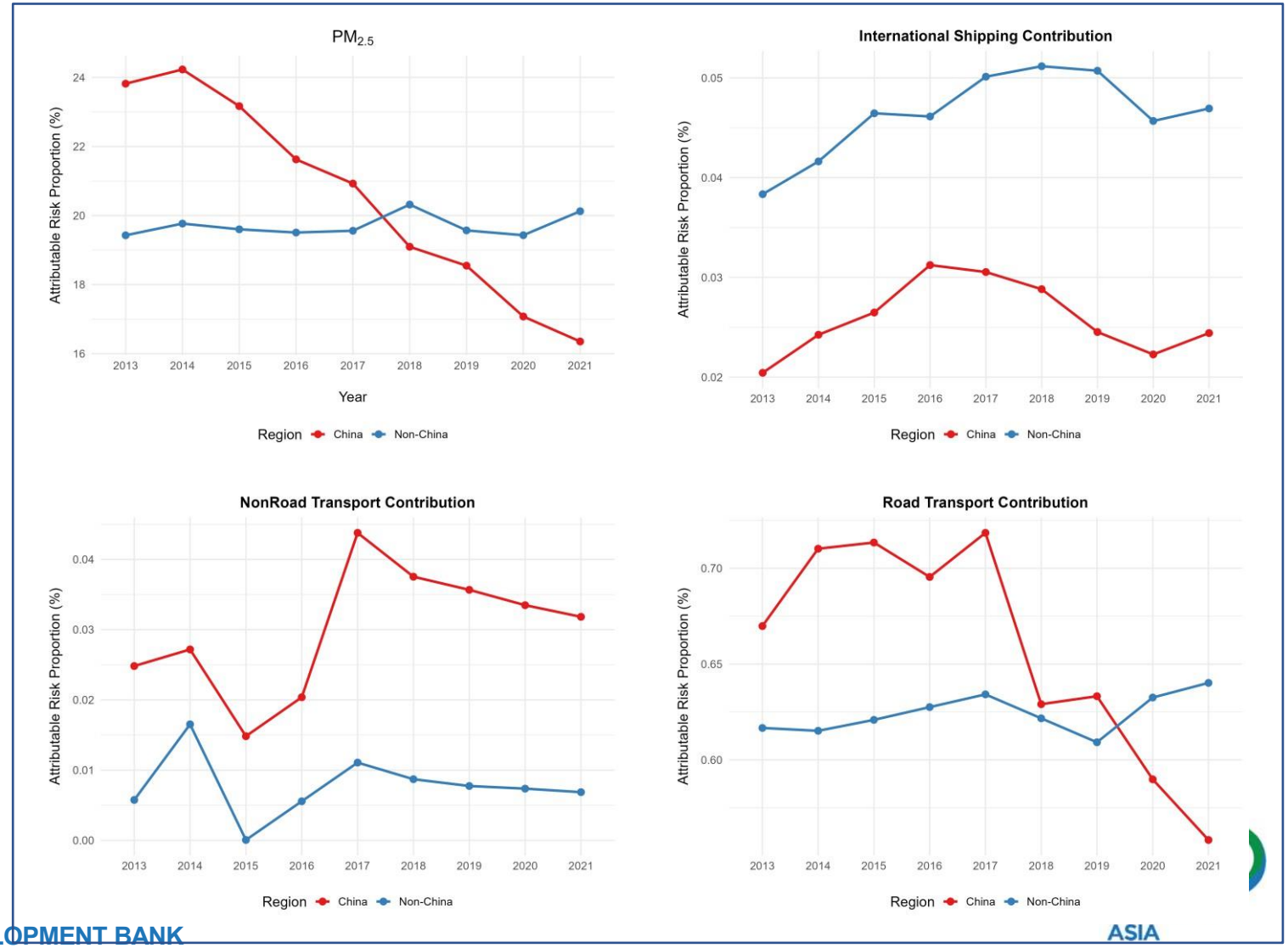
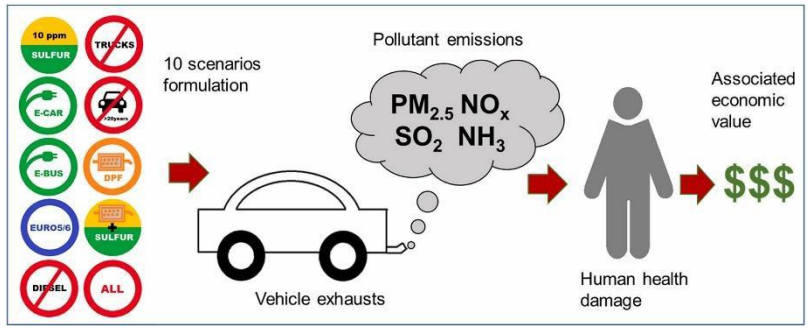
Comparison of Mortality Burden Between the PRC and other Countries

- Compared to other Asian countries, PRC has experienced a continued decline in $PM_{2.5}$-related health risks, with the attributable risk proportion decreasing from 24% in 2013 to 16% in 2021.
- This improvement is largely driven by the reduced contribution from **road transport sources**. Before 2019, PRC exhibited higher health risks attributable to $PM_{2.5}$ from road transport compared to other countries. However, this trend reversed after 2019, with PRC's attributable risk proportion falling below that of its counterparts.



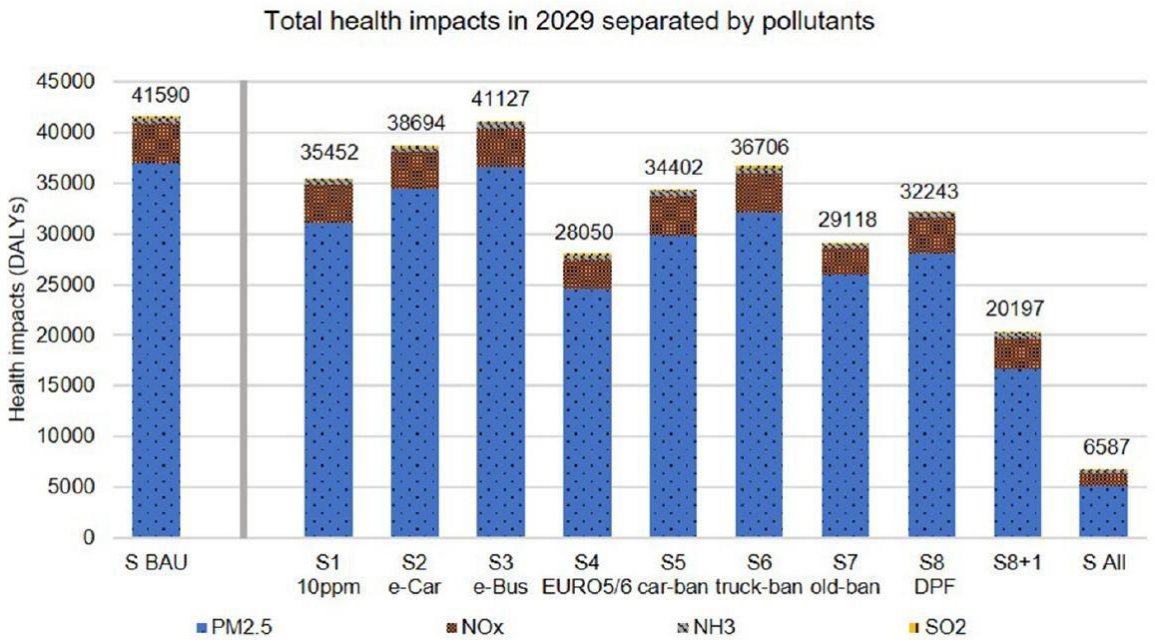
Health impacts and costs of $PM_{2.5}$ formation from road transport in Bangkok Metropolitan Region, Thailand

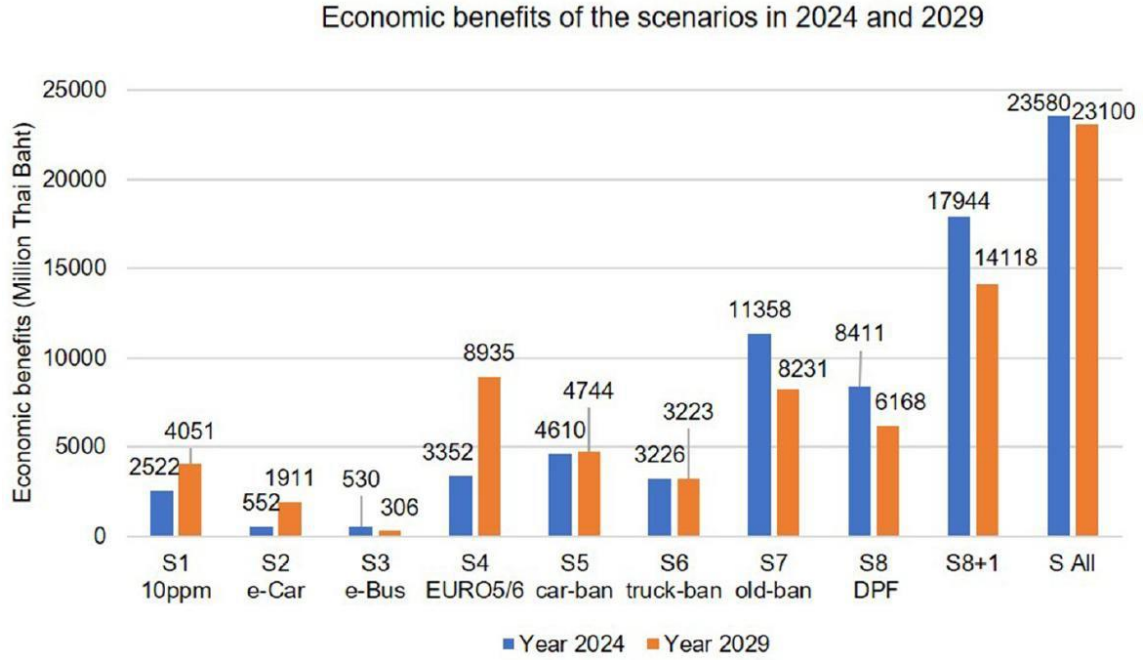


Scenarios formulated from PCD operating guidelines to estimate total pollutant emissions in BMR in 2024 and 2029.

Scenarios	Description
Scenario 1 (10 ppm-S)	Sulfur <10 ppm fuel used nationwide
Scenario 2 (e-car)	Electric car sales gradually make up to 50% of all new vehicles registered in 2024, and remain at this proportion onwards until 2029.
Scenario 3 (e-bus)	All Bangkok Mass Transit Authority (BMTA) public buses are changed to electric vehicles in the year 2022
Scenario 4 (EURO 5/6)	The EURO 5 standard is enforced to new vehicles registered in 2021 and the EURO 6 standard enforced in 2022
Scenario 5 (car-ban)	All diesel private vehicles, except EURO 5 and EURO 6, are banned from Bangkok city, assuming removed vehicles are added to the roads of 5 surrounding provinces with equal distribution
Scenario 6 (truck-ban)	All diesel trucks, except EURO 5 and EURO 6, are banned from Bangkok city, assuming removed trucks are added to the roads of 5 surround provinces with equal distribution
Scenario 7 (old car-ban)	Age limit of on-road vehicles is set, banning vehicles 20 years old and above from BMR.
Scenario 8 (DPF)	All Diesel vehicles < EURO 4 are fitted with Diesel Particulate Filter (DPF).
Scenario 8 + 1 (DPF+10 ppm S)	All Diesel vehicles < EURO 4 are fitted with Diesel Particulate Filter (DPF), and Sulfur <10 ppm fuel is also enforced nationwide.
Scenario S-All	All the proposed recommendations from Scenario1-8 are carried out simultaneously.
Scenario BAU	Business-As-Usual

(Source: Chavanaves, 2021)





Tactical urbanism pilot in Baguio City

SMMR – City of Baguio Cooperation Background

Since November 2023, the SMMR project has been supporting three cities in the Philippines, including the **City of Baguio**, in developing sustainable mobility concepts and strategies based on the **AVOID-SHIFT-IMPROVE** framework.

For Baguio, SMMR has tailored its approach to emphasise **active mobility** and **road safety**, working collaboratively to develop a project aimed at **improving safety at school zones** in the city.

To achieve this, SMMR has been supporting the development of activities related to:

Capacity Building

Active mobility trainings on:

- Non-Motorised Transport
- Transforming Streets using Tactical Urbanism
- Star Ratings for Schools (SR4S)
- Designing Streets for Kids

Data Measurement & Management

- **Qualitative data** citizen dialogues to understand local perceptions and opinions.
- **Quantitative data** traffic counts and geometric data collection

Institutional Development

- Supporting the creation of **governance structures** to enable sustainable mobility project development through the signing of a Memorandum of understanding (**MOU**).

Design of Pilot Projects & Action Plans

- **Action Plans:** to guide future project phasing and development.
- **Pilot Projects:** deployment of pilots to demonstrate the implementation workflow.

Communication & Advocacy

- Supporting the development of project-related **communication** and **advocacy material** to enhance the potential for participatory planning and to build public consensus.

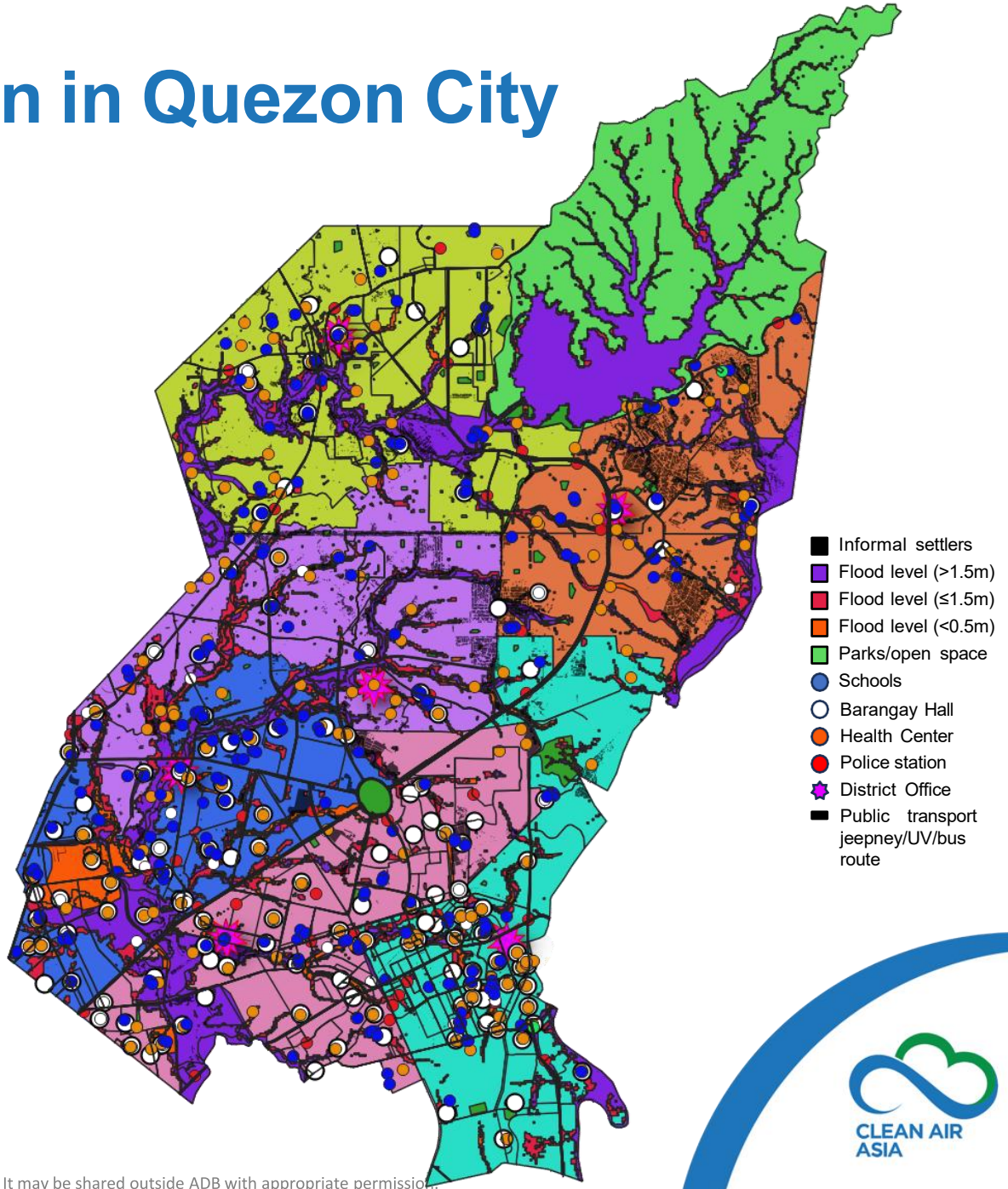
Proposed EV Charging Transition in Quezon City

Charging Station Site Preselection

QC Government Properties → Flood risk assessment

Fire safety assessment → Proximity to nearby transport modes

Parking space availability → Solar resource availability



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Key lessons from Clean Air Asia's work with governments in the development and implementation of transport policies

- A **key determinant is leadership and an enabling policy and legal framework**
  - **Capacity building** is crucial for leaders and involved personnel to ensure sustainability of the processes and interventions

- **Partnerships of governments with private, academic, NGO sectors** can provide opportunities to address barriers
  - Academic and NGO sector can provide **technical** and **technological** support
  - Private sector can support/complement **financial** aspect

- There is a **need for co-learning platforms to discuss best practices** from first-hand experiences especially from neighboring cities and countries
  - This enhances confidence in the effectiveness of programs and increases relevance to local or sub-regional contexts.

Key lessons learned from Clean Air Asia's work with governments in the use of data to track transport policy impacts, including for health

People are more responsive to information they find relatable.

There is a need to better communicate the (air, climate & health) benefits of transport policies

Air quality monitoring plays a crucial role in tracking the **benefits of transport policies** – and must be integrated and discussed with climate benefits and other co-benefits

Additional data/analysis that can support transport policy development

- **Health data/risks**
  - Mortality/morbidity cases
- **Emissions data**
  - Direct and modelled measurements
  - Emission inventories (fuel consumption, engine technology, etc.) for all sectors
- **Air quality concentration data**
  - Direct and modelled pollutant concentrations
  - Source apportionment data
  - *Meteorological/weather data and activity data (events/behavior data)
- **Economic benefits/Cost-Benefit Analysis**
  - Investment costs vis-à-vis costs of impacts

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THANK YOU!

For questions, please contact:

dang.espita@cleanairasia.org