Best Practices towards Clean Air

A Catalogue of Urban Transportation Policies to Reduce Traffic-Related Emissions and Air Pollution

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Motivation

• Urban areas and cities are undertaking several “policies”, “actions”, “measures”, “strategies” and “practices” (“policy interventions”) to reduce emissions, air pollution, exposure, and negative health impacts

• Number of available options increasing + technologies emerging → Evidence base is large
Urban policy interventions to reduce traffic emissions and traffic-related air pollution: Protocol for a systematic evidence map

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ABSTRACT

Traffic emissions are a major contributor to air pollution, with adverse health effects. Urban policies that reduce traffic emissions may have the potential to improve air quality and public health. This protocol describes a systematic evidence map to review the evidence on urban policy interventions to reduce traffic-related air pollution (TRAPEM) and their impacts on public health.

Keywords: Urban policy, Traffic emissions, Air pollution, Health outcomes.
Research aims

• Identify and summarize global evidence on urban policy interventions to reduce traffic emissions and/or TRAP

• Recorded direction of impact reported (Increase, Reduction, No Change, Mixed Effect)

• Secondary outcomes
  • Human exposure, Health effect or impact, Co-benefits, Barriers and enablers to implementation
Results

January 1, 2000, and June 1, 2020

- 1,139 unique policy intervention scenarios
- From 376 peer-reviewed articles
- 307 unique urban/urbanized locations
- Most policies studied in Europe (463), Asia (355), North America (206)
- Least in South America (57), Africa (10), Australia (7)
Management, standards, and services – 807
- Vehicle emission regulation
- Vehicle retirement or replacement
- Vehicle use restriction
- Low emission zones

Technology – 406
- Alternative fuel technology
- Vehicle retrofitting
- Alternative vehicle technology

Pricing – 216 studied times
- Parking charges
- Road pricing
- Congestion charges

Infrastructure – 210
- Bus rapid transit infrastructure
- Public and active transportation infrastructure
- Roadway development and intersection alterations

Behavioural – 116
- Public transport mode shift and promotion
- Active transportation mode shift and promotion
- Flexible working arrangements and ride sharing

Land-use – 77
- Development density and mix
- Transit oriented development
- Parking expansion

58 types of unique policies
Results
5. Policy Barriers: Frequency of policy scenarios that document each policy barrier.
6. Co-benefits: Frequency of policy scenarios that document each co-benefit.
7. Analysis Start and End Years: Frequency of policy scenarios that document each start and end analysis year.

**What is the direction of the effect on TRAP?**

**What is the direction of the effect on Traffic Emissions?**

<table>
<thead>
<tr>
<th>TRAP Pollutant</th>
<th>Ammonia</th>
<th>Black Carbon</th>
<th>Carbon Monoxide</th>
<th>Hydrocarbons</th>
<th>Nitric Oxide</th>
<th>Nitrogen Dioxide</th>
<th>Nitrogen Oxides</th>
<th>Other</th>
<th>Particulate Matter 1</th>
<th>Particulate Matter 2.5</th>
<th>Particulate Matter 10</th>
<th>Particulate Matter X</th>
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<tbody>
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<td>Emission reduction</td>
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</table>
Most studied policies with recorded emissions and air pollution reductions

- **Alternative fuels technologies (n=52)**
  - Bioethanol mixtures, natural gas, liquefied petroleum gas, petrol versus diesel, hydrogen

- **Vehicle retrofitting (n=29)**
  - Particles filters, exhaust catalysts: three-way catalytic converters, continuously regenerating trap (CRT), exhaust gas recirculation (EGR), selective catalytic reduction (SCR)

- **Road pricing (n=28)**
  - Cordon toll, road user charging

- **Low emission zones (n=28)**
  - In isolation and as part of SUMPs

- **Parking charges (27)**
  - Doubling parking charge
Most studied policies with recorded emissions and air pollution reductions

- Vehicle emissions regulations (n=25)
- Public transportation regulation (n=22)
  - Improvement of bus speed + reduction of travel time
- Vehicle retirement and replacement (n=12)
- Public transportation mode shift and expansion (n=12)
- Vehicle use restrictions (n=10)
  - Odd/even day traffic restriction schemes, car free areas or days, HGV ban or recirculation incl. in rush hour, restriction on construction activities and vehicles, restriction on access to city centres

Little published evidence on alternative vehicle technologies (n=4)
Packages of policies may work best

- 380 policy scenarios (33.4%)
- Development of packages of policy measures, in which each measure can be expected to support the others by making it more effective or easier to implement (May et al., 2018)
Packages of policies may work best

• “Central and inner London inbound road user charging, all day £2 across central London, and peak charge of £2 across Inner London, Workplace parking levy throughout London of £1500 per annum, Central and inner London public parking charges doubled, 20% reduction in travel times for radial PT movements to/from central London, 50% of buses, 25% HGVs and 5% of CLVs converted to LPG, 100% of buses fitted with particle traps, Central and Inner London LEZ, allowing EURO3+cars and EURO3+CV”
Packages of policies may work best

Glazener et al., 2021
Multiple policies improve multiple pathways

→ land-use and behavioural policies are very promising!

• Effects of other pathways, comparable to – or with larger impact than - air pollution e.g. physical inactivity, motor vehicle crashes (Mueller et al., 2015)

Example

• 50-70% statistically significant reduction in injuries in London Low Traffic Neighbourhoods (LTN) (Laverty et al., 2021; Goodman et al., 2021)

• Physical activity from walking + cycling increased by 2 hours/week in LTN residents after 2 years (Aldred and Goodman, 2021)

• 5.7-8.9% ambient NO₂ reduction effect (Yang et al., 2022)
Co-benefits Recorded (raw data included in the database): reported a total of 1,047 times in 204 unique articles

- Reduced greenhouse gas emissions/climate change: 330 times
- Reduced vehicle miles or kilometers traveled: 115 times
- Reduced energy/fuel consumption: 98 times
- Reduced traffic congestion: 95 times
- Economic growth or savings: 86 times
- Reduced trip time or length: 84 times
- Increased network speed: 56 times
- Reduced number of trips: 37 times
- Increased transit use: 34 times
- Increased safety: 31 times
- Increased active transportation: 31 times
- Increased social welfare: 10 times
- Increased accessibility: 9 times
- Reduced health costs: 7 times
- Job growth: 7 times
- Reduced traffic noise: 5 times
- Increased supply level for public traffic: 4 times
- Reduced heat/urban heat island: 4 times
- Increased petrol savings: 2 times
- Increased greenspace: 2 times
Interactive visualization tool (online) and database for decision-support
New evidence map and tools launched to support policies to reduce traffic-related air pollution

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