## AIR POLLUTION AND HEALTH: TAKING STOCK OF THE PROPOSED **REVISION TO THE** AMBIENT AIR QUALITY DIRECTIVE

## **CLEAN AIR IN EUROPE FOR ALL**









## Solutions – National and local level perspectives towards clean air

**Chairs: Evi Samoli (University of Athens) and Iana Markevych** (Jagiellonian University)



## **Clean air in Europe for all**

Paris : city-specific actions towards clean air

(Wednesday, May the 24th)



#### Sommaire



Low Emission Zone Decreasing speed limitation



#### **Urban planning**

Bicycle paths

- Schools streets
- « Paris respire » areas
- « Paris respire » day



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#### **Next steps**

Low Emission Zone's next step

Limited Traffic Zone

Updating the Territorial Plan for Climate Air and Energy





#### **Policies**

Low Emission Zone Decreasing speed limitation





#### 2 PARIS

#### **Policies**

#### Decreasing speed limitation

**Ring road**, « le périphérique » : 10/01/2014 Max speed : 80km/h down to 70km/h

**Paris intra-muros** : 30/08/2021 Max speed : 50km/h down to 30km/h Few axis remain limited at 50km/h 60% of city was limited at 30km/h

Opinions (poll) about the passage to 30km/h :

Parisians	59% for	39% for generalisation	· 39% against
		20% with some axis at 50km/h	
Region inhabitants	36% for	16% for generalisation	61% against
		20% with some axis at 50km/h	





As for any restriction, a part of population is against, but eventually gets used to.





### **Urban planning**

Bicycle paths Schools streets « Paris respire » areas « Paris respire » day



#### **Urban planning**

#### **Bicycle paths**



Rue de Rivoli (one of main the streets, longing the city hall) :



Évolution

+3%



#### Urban planning Schools streets

Closing streets (or almost...)

around kindergartens and elementary schools

ightarrow Safer, saner environment





#### <u>How</u>

By planning pedestrian areas, planting, urban design... If impossible to : urban design (obstacles) forcing a low speed



Some streets can't be closed : mass transit lines, presence of public parking lots, or too busy and whose traffic can't be reported on other streets

ightarrow Urban design (obstacles) to slow down the speed

For residents : most of all are favorable, public meetings help obtaining a general approval





#### **Urban planning**

« Paris respire » areas – « Paris respire » day

#### Map of the main « Paris respire » areas

Areas allowing only pedestrians and bikes, on specific days, depending on the zone (saturdays, sundays, free days)

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8th « Paris Respire » day (Sunday 18th of september)





A Sunday, usually on September, from 11h to 18h Cars and motorcycles banned (except buses, cabs, emergency cars...) NO2 levels down by 30% versus a regular sunday

City of Pantin joins the event in 2021 with « Pantin sans voiture »





#### Trends

NOx, PM<sub>2.5</sub> Trafic decreasing











#### **Trends** Trafic decreasing



Traffics annual evolution in Paris intra-muros

Blue : vehicle.km by hour between 7:00 and 21:00 Red : average speed between 7:00 and 21:00

#### Traffics annual evolution on the ring road



Blue : vehicle.km by hour between 7:00 and 21:00 Red : average speed between 7:00 and 21:00





#### Next steps

Low Emission Zone's next step Limited Traffic Zone Updating the Territorial Plan for Climate Air and Energy



#### **Next steps**

Low Emission Zone's next step – Limited Traffic Zone – Updating the Territorial Plan for Climate Air and Energy

#### Low Emission Zone's next step

Step 3 has been postponed from july 2022 to july 2023, then to 2025 at best

- to prepare social impact as it concerns 380.000 cars (communication campaign, financial helps,...)
- to install control system (by Registration Plates Automatic Read)



Some national representatives tried to cancel Low Emission Zones in France, in vain.

#### **Limited Traffic Zone**

First districts of center of Paris will ban local through traffic. Only public services, cabs, emergencies, deliveries and residents cars will be allowed. Due to first semester of 2024.

#### Updating the Territorial Plan for Climate Air and Energy

City of Paris is updating its Territorial Plan for Climate, Air and Energy (due to 2024). This document sets up the guidelines for environmental actions. For air quality, our department pleas for sensible measures on wood burning (first PM emitter in Paris).



A prefectorial order almost banned all wood burning in Paris (and its region) in 2015. Since, only main heating is banned in Paris.





## Merci







## **Best Practices towards Clean Air**

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

Haneen Khreis, Senior Research Associate

University of Cambridge, School of Clinical Medicine

Public Health Modelling Group, MRC Epidemiology Unit



## 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  $\rightarrow$  **Evidence base is large**

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#### Urban policy interventions to reduce traffic emissions and traffic-related air pollution: Protocol for a systematic evidence map

Kristen A. Sanchez<sup>a,b</sup>, Margaret Foster<sup>c</sup>, Mark J. Nieuwenhuijsen<sup>d,e,f</sup>, Anthony D. Mav<sup>g</sup>. Tara Ramani<sup>a</sup>, Joe Zietsman<sup>a</sup>, Haneen Khreis<sup>a,d,e,f,\*</sup>

<sup>a</sup> Center for Advancing Research in Transportation Emissions, Energy, and Health (CARTEEH), Texas A&M Transportation Institute (TTT), TX, USA b Texas A&M School of Public Health, TX, USA <sup>c</sup> Texas A&M University, Medical Sciences Library, College Station, TX, USA <sup>d</sup> ISGlobal, Centre for Research in Environmental Epidemiology (CREAL), Barcelona, Spain e Universitat Pompeu Fabra (UPF), Barcelona, Spain <sup>f</sup> CIBER Epidemiologia y Salud Publica (CIBERESP), Madrid, Spain 8 Institute for Transport Studies (ITS), University of Leeds, Leeds, UK

ARTICLE INFO	ABSTRACT	
Handling Editor: Paul Whaley	Introduction: Cities are the world	
Keywords:	hot spots for human exposure t	
Urban	continues to grow, a greater of	
City	therefore also risk adverse heal	
Policy	through targeted urban policy in	
Intervention	used for a systematic evidence	
Emissions	ventions that can be implement	
Traffic-related air pollution	mobile sources, thus reducing h	
Health	Methods: Articles will be search criteria. A variety of databases	

d's engines of economic growth, innovation, and social change, but they are also to air pollution, mainly originating from road traffic. As the urban population uantity of people risk exposure to traffic-related air pollution (TRAP), and th effects. In many cities, there is scope for further improvement in air quality nterventions. The objective of this protocol is to detail the methods that will be map (SEM) which will identify and characterize the evidence on policy interted at the urban-level to reduce traffic emissions and/or TRAP from on-road numan exposures and adverse health impacts.

hed for and selected based on a predetermined search strategy and eligibility will be searched for relevant articles published in English between January 1, 2000 and June 1, 2020 to encompass the interdisciplinary nature of this SEM, and articles will be stored and screened using Rayyan QCRI. Predetermined study characteristics will be extracted and coded from included studies in a Microsoft Excel sheet, which will serve as an open access, interactive database, and two authors will review the coded data for consistency. The database will be queryable, and various interactive charts, graphs, and maps will be created using Tableau Public for data visualization. The results of the evidence mapping will be detailed via narrative summary.

Conclusion: This protocol serves to increase transparency of the SEM methods and provides an example for researchers pursuing future SEMs.

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Systematic Evidence Map

Urban policy interventions to reduce traffic-related emissions and air pollution: A systematic evidence map

#### Haneen Khreis<sup>a,\*</sup>, Kristen A. Sanchez<sup>b,c</sup>, Margaret Foster<sup>d</sup>, Jacob Burns<sup>e</sup>, Mark J. Nieuwenhuijsen<sup>f,g,h</sup>, Rohit Jaikumar<sup>b</sup>, Tara Ramani<sup>b</sup>, Josias Zietsman<sup>b</sup>

<sup>a</sup> MRC Epidemiology Unit, School of Clinical Medicine, University of Cambridge, Box 285 Institute of Metabolic Science, Cambridge Biomedical Campus, Cambridge CB2 OQQ, United Kingdom

<sup>b</sup> Center for Advancing Research in Transportation Emissions, Energy, and Health (CARTEEH), Texas A&M Transportation Institute (TTI), TX, USA <sup>c</sup> Texas A&M School of Public Health, TX, USA

<sup>d</sup> Texas A&M University, Center for Systematic Reviews and Research Syntheses, College Station, TX, USA

<sup>e</sup> Institute for Medical Information Processing, Biometry and Epidemiology, Ludwig Maximilian University of Munich, Munich, Germany <sup>f</sup> Barcelona Institute for Global Health (ISGlobal), Barcelona, Spain

<sup>8</sup> Universitat Pompeu Fabra (UPF), Barcelona, Spain

h CIBER Epidemiologia y Salud Publica (CIBERESP), Madrid, Spain

#### ARTICLE INFO

#### ABSTRACT

Handling Editor: Paul Whaley Keywords: Urban City Policy Intervention Emissions Traffic-related air pollution Exposure Health Climate Co-Benefits

Background: Urban areas are hot spots for human exposure to air pollution, which originates in large part from traffic. As the urban population continues to grow, a greater number of people risk exposure to traffic-related air pollution (TRAP) and its adverse, costly health effects. In many cities, there is a need and scope for air quality improvements through targeted policy interventions, which continue to grow including rapidly changing technologies.

Objective: This systematic evidence map (SEM) examines and characterizes peer-reviewed evidence on urbanlevel policy interventions aimed at reducing traffic emissions and/or TRAP from on-road mobile sources, thus potentially reducing human exposures and adverse health effects and producing various co-benefits.

Methods: This SEM follows a previously peer-reviewed and published protocol with minor deviations, explicitly outlined here. Articles indexed in Public Affairs Index, TRID, Medline and Embase were searched, limited to English, published between January 1, 2000, and June 1, 2020. Covidence was used to screen articles based on previously developed eligibility criteria. Data for included articles was extracted and manually documented into an Excel database. Data visualizations were created in Tableau.

Results: We identified 7528 unique articles from database searches and included 376 unique articles in the final SEM. There were 58 unique policy interventions, and a total of 1,139 unique policy scenarios, comprising these



## Research aims

- Identify and summarize global evidence on urban policy interventions to reduce <u>traffic</u> <u>emissions</u> and/or <u>TRAP</u>
- 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

## Results



Image from carteeh.org



## 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 (<u>May et</u> <u>al., 2018</u>)



## Packages of policies may work best

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

## Packages of policies may work best

Glazener et al., 2021



## Multiple policies improve multiple pathways

- $\rightarrow$  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) (<u>Laverty et al</u>, <u>2021</u>; <u>Goodman et al., 2021</u>)
- Physical activity from walking + cycling increased by 2 hours/week in LTN residents after 2 years (<u>Aldred and</u> <u>Goodman, 2021</u>)
- 5.7-8.9% ambient NO<sub>2</sub> reduction effect (<u>Yang et al., 2022</u>)





Co-benefits Recorded (raw data included in the database): reported a total of 1,047 times in 204 unique articles



## Interactive visualization tool (<u>online</u>) and <u>database</u> for decision-support



Thank you! Email: <u>hrk38@cam.ac.uk</u>

Twitter: @HaneenKhreis

New evidence map and tools launched to support policies to redutraffic-related air pollution

February 15, 2023

## Air Quality and Health in Southeastern Europe to Inform Policy Action

Brussels Meeting on Air Pollution and Health: Taking stock of the proposed revision to the Ambient Air Quality Directive

Brussels | May 24, 2023

#### Pallavi Pant, PhD

Health Effects Institute

ppant@healtheffects.org



#### Medical University Plovdiv, Bulgaria

Dr. Angel Dzhambov

## University of Novi Sad, Serbia

Dr. Nataša Dragic

Dr. Elizabet Paunovic

Dr. Michal Krzyzanowski









There are huge disparities in exposure to air pollution and associated health impacts across Europe.

(Local) evidence on health effects of air pollution in Southeast Europe is limited but growing.

Need for further mobilization as well as targeted, bold action on clean air at regional, national, and local levels.





More than 95% of the population in the region in areas where the  $PM_{2.5}$  exposures exceed the WHO guideline for healthy air (5 µg/m<sup>3</sup>);

~70% live in areas that don't meet the current EU Limit Value (25 µg/m<sup>3</sup>)



#### Sofia has the highest average PM<sub>2.5</sub> exposure among capital cities in the EU

Annual Average PM2.5 Exposure in Capital Cities in the EU 124.5 Sofia , Bulgaria 23.5 Warsaw, Poland --18.8Vienna , Austria -18.6 Bratislava, Slovakia -18:5 Bucharest, Romania -Budapest, Hungary --17.716.4 Praque, Czechia -16 Nicosia, Cyprus -15.7Amsterdam , Netherlands -15.5 Zagreb , Croatia -15.4 Rome , Italy -15.4 Ljubljana , Slovenia -15 Paris , France -14.8 Athens, Greece --14.5Vilnius , Lithuania --14.5Berlin, Germany -Brussels, Belgium -13.1 11.6 Copenhagen , Denmark -11.2 Luxembourg, Luxembourg -10.9 Riga, Latvia -10.6 Valletta , Malta -9.9 Madrid , Spain • 9.25 Helsinki, Finland -Stockholm , Sweden -62 Dublin, Ireland -Lisbon , Portugal -6:0 4.48 /HO Guideline Tallinn , Estonia · EU Limit Value 20 10 30 Population Weighted PM2.5 Exposure Based on data for 2019



#### Stark differences in health impacts linked to air pollution across the EU





## What does evidence from the region tell us?



Increases in respiratory, **cardiovascular**, gastrointestinal, and **neurological** disease-related outpatient and hospital emergency services in Bulgaria *(Simidchiev et al 2020)*, more patients were admitted for **stroke** on days when ozone levels are higher *(Knezovic et al 2018)* 



positive associations between **type 2 diabetes** and PM<sub>2.5</sub> and polycyclic aromatic hydrocarbons (PAHs) (Dzhambov and Dimitrova 2016)

correlation between acute **COPD** aggravations and average  $PM_{10}$  in the previous six days (Krachunov et al 2017)



association between higher  $PM_{10}$  and COPD exacerbation and longer hospitalizations (Doneva et al 2019)

increased ambient concentrations of polycyclic aromatic hydrocarbons increased risk of lifetime **lung cancer**, especially during heating season (*Radonic et al 2017*)





### Various efforts are underway to improve air quality







https://maps.sensor.community/#7/43.268/24.478

https://air4health.eu/en/lekari/

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### Expanding public engagement on air quality and health



*Targeted campaigns on air quality during the 'pollution' or 'heating' season- Western Balkans* 

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*Community monitoring of nitrogen dioxide- various cities in the EU* 





*Nudging for clean air action – Skopje, North Macedonia* 



https://www.balkanfund.org/general-news/laying-all-cards-about-air-quality-on-the-table https://www.duh.de/no2airpollution/

https://www.undp.org/north-macedonia/blog/behavioral-change-activities-reduce-air-pollution-skopje

#### Sectoral interventions: [Upcoming] Low emissions Zone in Sofia, Bulgaria













## Thank you!

### Email

ppant@healtheffects.org

Twitter@HEISoGA | @HEIresearch

Website www.stateofglobalair.org | www.healtheffects.org



## How are these estimates produced?



https://www.stateofglobalair.org/

health effects of air pollution



STATE OF

## Producing the air quality estimates; gaps in data

#### Satellite data



Ground monitoring data



Limited ground monitoring data from Africa >> higher uncertainties in exposure estimates



Source: 2022 Open Air Quality Data: The Global Landscape, OpenAQ

#### Minimum risk exposure level



## Estimating health impacts; gaps

#### Concentration-response relationship



Epidemiology studies on health effects of air pollution Baseline disease rates

Limited studies on health effects of air pollution in highpollution environments, no studies from Africa in the integrated concentration-response functions

Limited availability of baseline disease rates



https://www.stateofglobalair.org/

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## Since 1990, air pollution emissions have

Sectors with the largest contributions to emissions in 2017 were **residential** (37%), **on-road transportation** (19%), **and energy** (15%).

"Transport is absolutely dominant source of  $PM_{10}$  pollution in the central city area (Sofia) and along the roads with heavy traffic during both cold and warm season" (Dimitrova and Velizarova 2021)



# Thank you and keep in touch!







