Systematic review of selected health effects of long-term exposure to traffic-related air pollution

A bird's eye overview

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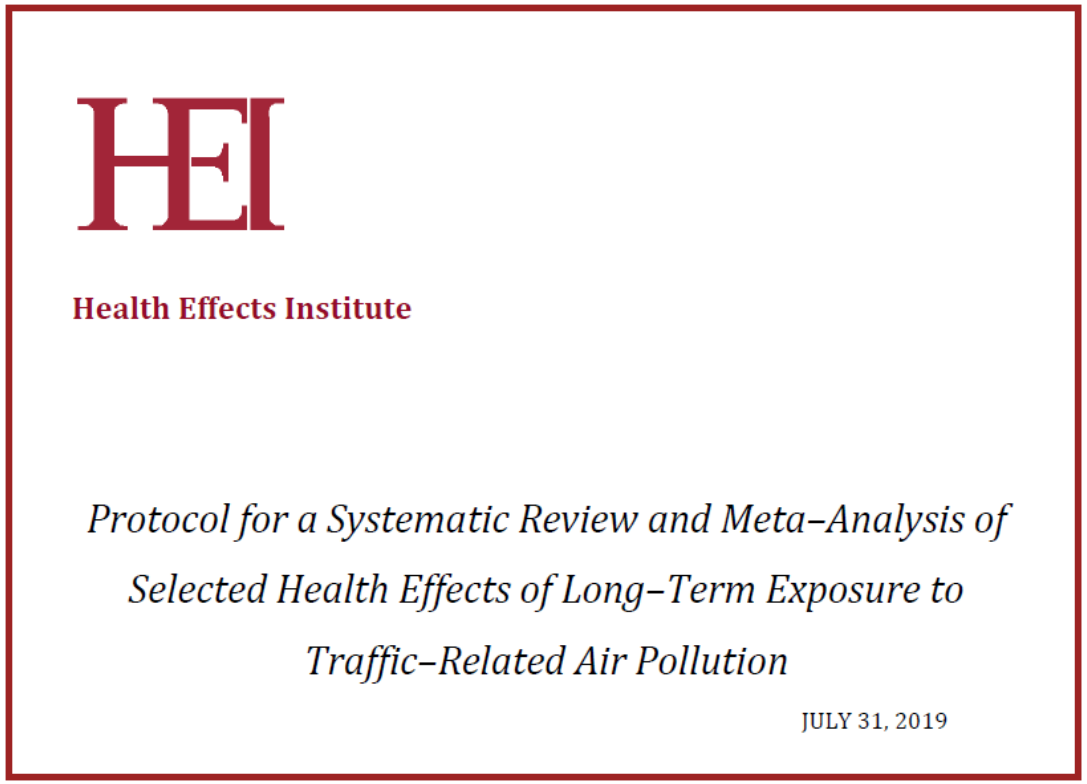
A Systematic Review

- ✓ Use methods largely based on standards set by Cochrane Collaboration, World Health Organization, and the National Institute of Environmental Health Sciences
- ✓ Summarize epidemiological results quantitatively, where possible
- ✓ Include an evaluation of the risk of bias in individual studies
- ✓ Reach conclusions about the confidence in the quality of the body of evidence and with assessing the level of confidence in the presence of an association.



The review protocol was published in July 2019 on the HEI website* and registered with Prospero**

* https://www.healtheffects.org/announcements/panel-publishes-protocol-review-traffic-related-air-pollution
** https://www.crd.york.ac.uk/PROSPERO/display_record.php?RecordID=150642

Meta-analyses

Conducted meta-analyses when at least three studies were available

- Random effects model
- Exposure increments same as ESCAPE study
- Estimates from single pollutant models

When multiple estimates reported on the same cohort

- Selected main model according to authors when it met inclusion criteria
- Preferred larger sample size and more 'traffic specific' exposures
- Included both analyses when reported for both individual cohorts and combined cohorts (e.g., ESCAPE) IF different exposure assessment methods

Sensitivity and subgroup analyses included traffic specificity, geographical region, risk of bias, and publication year

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Important Methodological Features of the Traffic Review

Conducted largest effort of this type to date.

- Evaluates the epidemiologic literature only.
- Focuses on a selected set of health outcomes chosen *a priori,* including mortality, cardiovascular and respiratory morbidity and birth outcomes.

Applies a new exposure framework.

- Considers only long-term exposure to traffic-related air pollution.
- Considers exposure contrasts in near-roadway and neighborhood environments.

Assesses confidence in the evidence for an association.

- 2 complementary methods with ratings of very low, low, moderate, or high for traffic-related air pollution mixture, not individual pollutants.

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Confidence Assessments

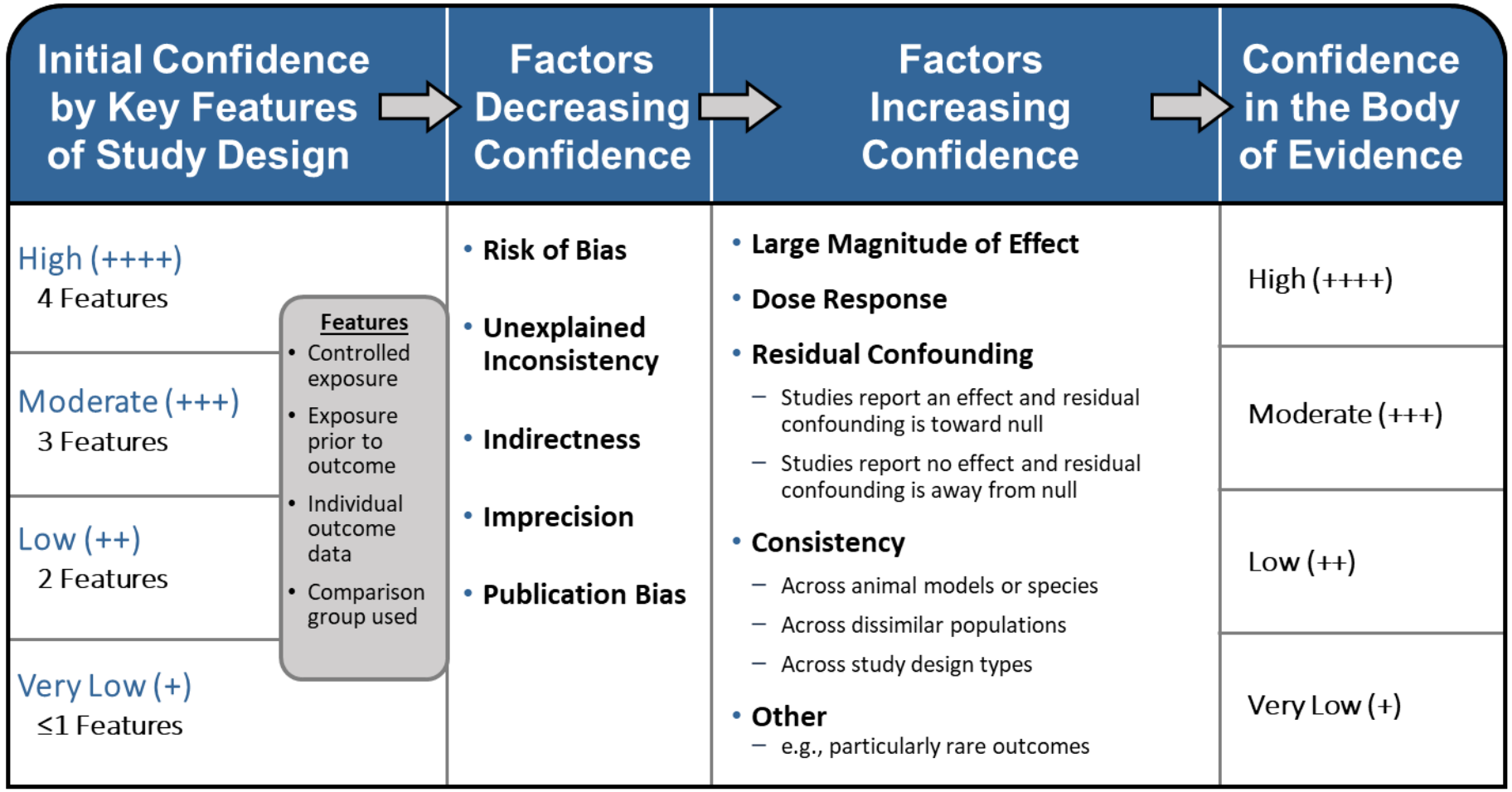
Separate assessments for confidence
in the quality of the body of evidence (modified OHAT) and
in the presence of an association (narrative)
(high, moderate, low, and very low)

For each exposure-outcome pair by study design → For each exposure-outcome pair → For each health outcome

↓

Overall confidence

Methods for Confidence in the Quality of the Body of Evidence (Modified OHAT* – or GRADE**-type approach)



- ✓ Initial rating based on study design features
- ✓ Upgrade or downgrade based on certain factors
- ✓ The Panel did not apply the methods in a "mechanistic" way

*Office of Health Assessment and Translation (OHAT), 2019. Handbook. National Toxicology Program, National Institute of Environmental Health Sciences, U.S. Dept of Health and Human Services.

**Grading of Recommendations Assessment, Development and Evaluation (GRADE). 2013. Handbook

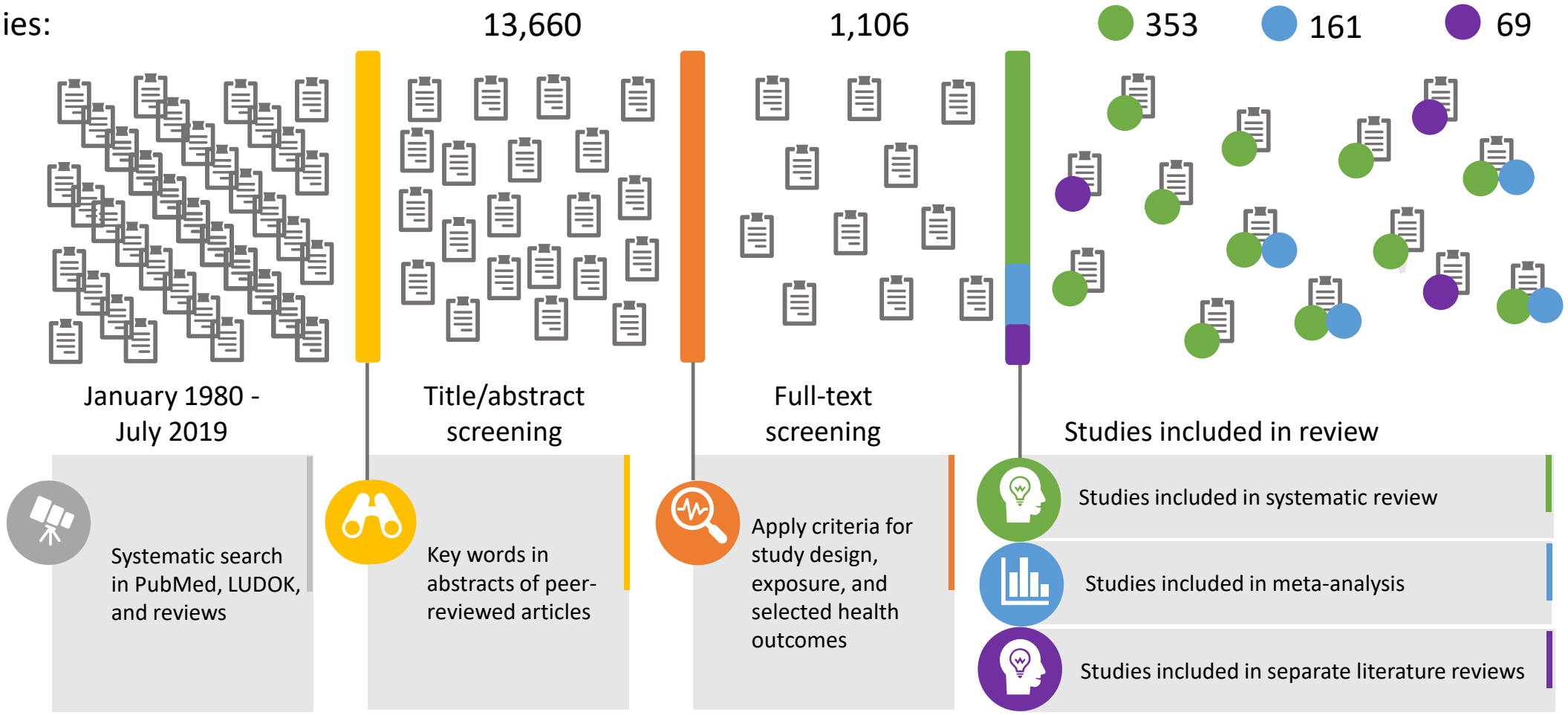
Addition of a Broader "Narrative" Approach to Maximize What can be Learned from Observational Studies

- ✓ GRADE-type assessments focus on the quality of the body of evidence rather than the presence of an association.
- ✓ Those assessments are heavily geared towards studies entering a meta-analysis.
- ✓ Hence, the Panel deemed it necessary to accompany the GRADE-type assessment with a broader ''narrative'' assessment.

Comparison	Narrative Assessment	Modified OHAT Assessment
Number, location, and size of the evidence base	Yes	Partial
Study design	Yes	Yes
Study population (generalizability)	Yes	No
Magnitude and direction of the association	Yes	No*
Risk of bias (confounding, selection bias, exposure assessment, outcome assessment, missing data, selective reporting)	Yes	Yes
Consistency of the findings (e.g., across locations, time periods, study designs, different pollutants and exposure metrics, across meta-analyzed and non-meta-analyzed studies)	Yes	Partial
Unexplained inconsistency	Yes	Yes
Imprecision (chance)	Yes	Yes
Publication bias	No	Yes
Exposure–response	Yes	Yes
Residual confounding	Yes	Yes

*OHAT has an upgrading factor for "large magnitude of effect" that applies only if the effect size is large or very large (i.e., large RR > 2 or very large RR > 5) because residual confounding is then less likely. However, the Panel consider a "large" effect to be both ambiguous to define and unlikely to occur as effect estimates in well-conducted epidemiological studies of environmental factors are generally small. Thus, the Panel has decided not to consider this specific upgrading factor.

Number of studies identified

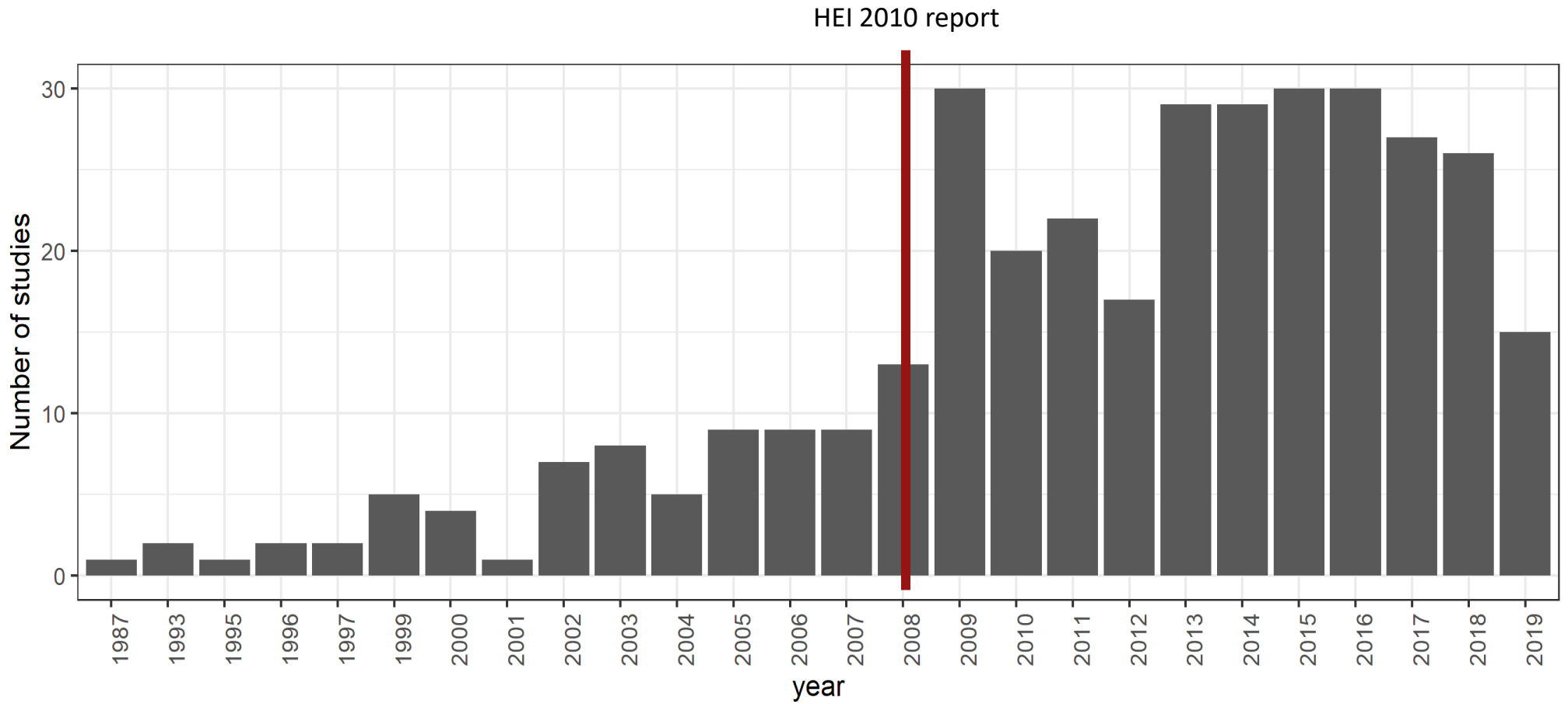


Systematic review on the health effects of long-term exposure to traffic-related air pollution

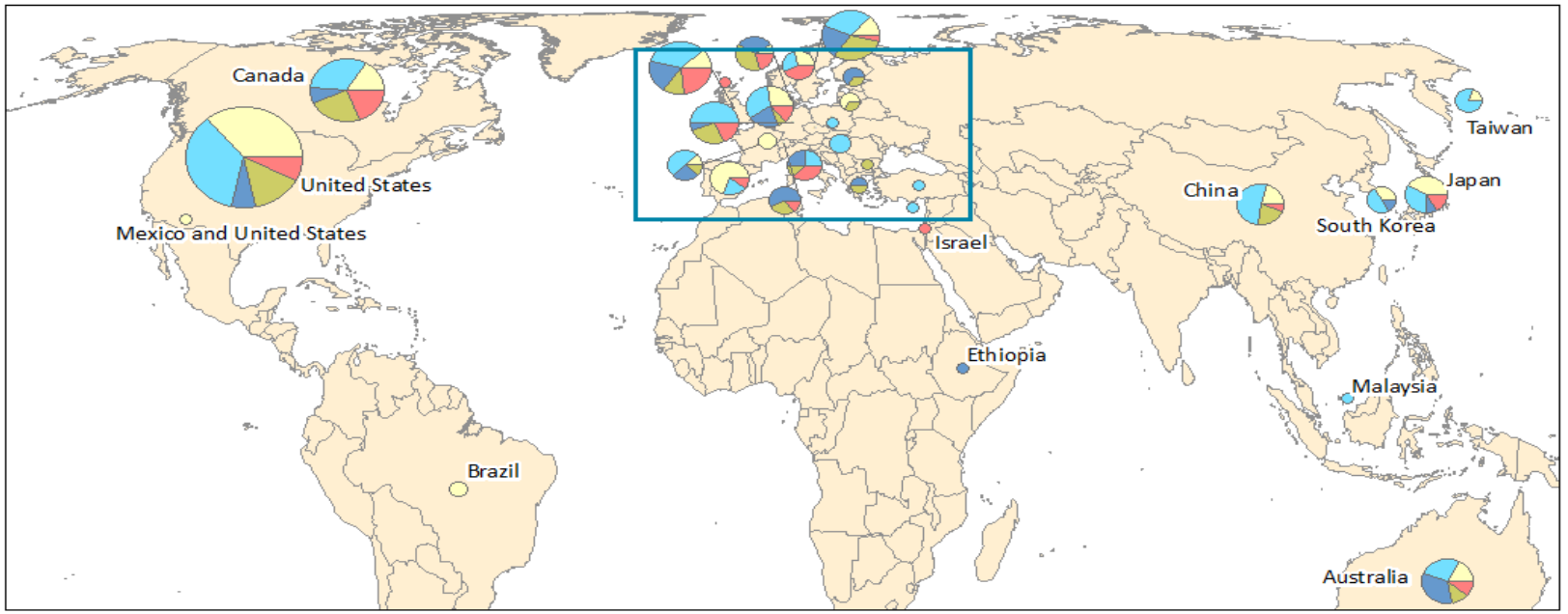
Literature Search Results

353 studies included

Health outcome Category	Total number of studies
Birth outcomes	86
Respiratory outcomes - children	118
Respiratory outcomes - adults	50
Cardiometabolic outcomes	57
Mortality	48



Geographical Location of the Studies



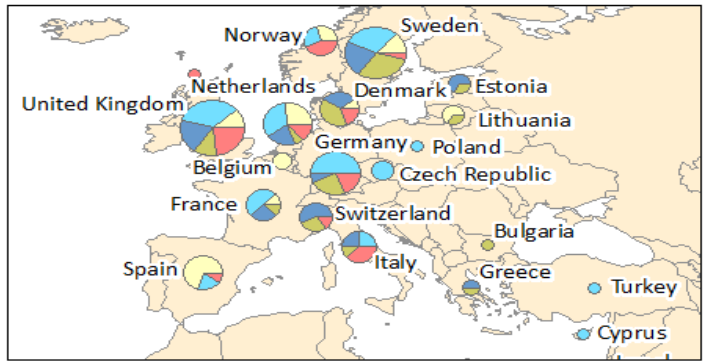
Studies in World Countries

Legend

28 Circle size indicates total studies for country
Range: 1 to 91

Health outcomes studied

- Birth outcomes
- Respiratory outcomes - children
- Respiratory outcomes - adults
- Cardiometabolic outcomes
- Mortality



Studies in European countries

Region	Total number of studies
Europe	163
North America	130
Asia	41
Other regions	19

Number of Studies by Outcome and Pollutant