Keywords: meta-analysis; outdoor air pollution; childhood leukemia; traffic.

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TRAFFIC-RELATED AIR POLLUTION AND RISK OF CHILDHOOD LEUKEMIA: A META-ANALYSIS

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Background and Aims

Childhood leukemia is overall a rare occurrence, however it is the most frequent malignancy affecting children under 15 years of age. The majority of these cases are acute lymphoblastic leukemia (ALL), followed by acute myeloid leukemia (AML); chronic forms of childhood leukemia are relatively rare. To date, the etiology of childhood leukemia remains largely unknown. Few risk factors (genetic disorders, early infections, ionizing radiation, etc.) have been established, but these factors explain only a small proportion of childhood leukemia. Environmental risk factors among different examined include radon, pesticides, electromagnetic fields and outdoor air pollution, but they have been found to be weakly and inconsistently associated with either form of acute childhood leukemia. Here we review epidemiological studies including outdoor air pollution exposure and risk of childhood acute leukemia.

Biological Plausibility

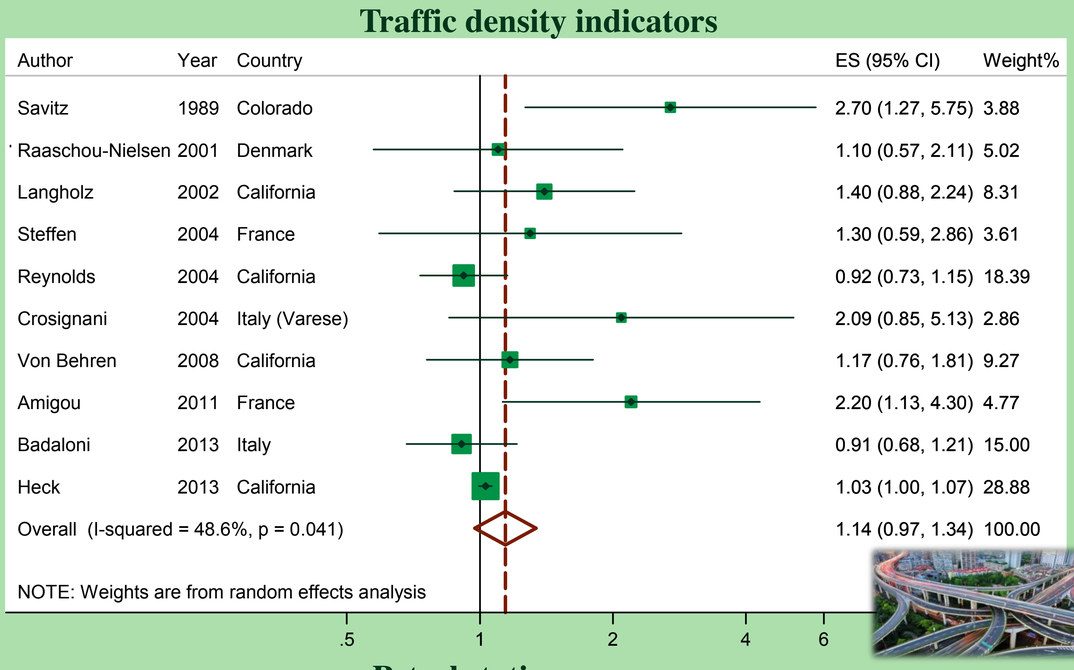
Outdoor air environment could be contaminated by any chemical, physical and biological agent that modify its natural characteristic: air pollutants of major public health concern include particulate matter, nitrogen dioxide, benzene and polycyclic aromatic hydrocarbons. One of the major source of these contaminants is motor vehicle emissions and IARC recently classified diesel engine exhaust in Group 1 (carcinogenic for humans) and gasoline exhaust in Group 2A (probably carcinogenic).

Methods

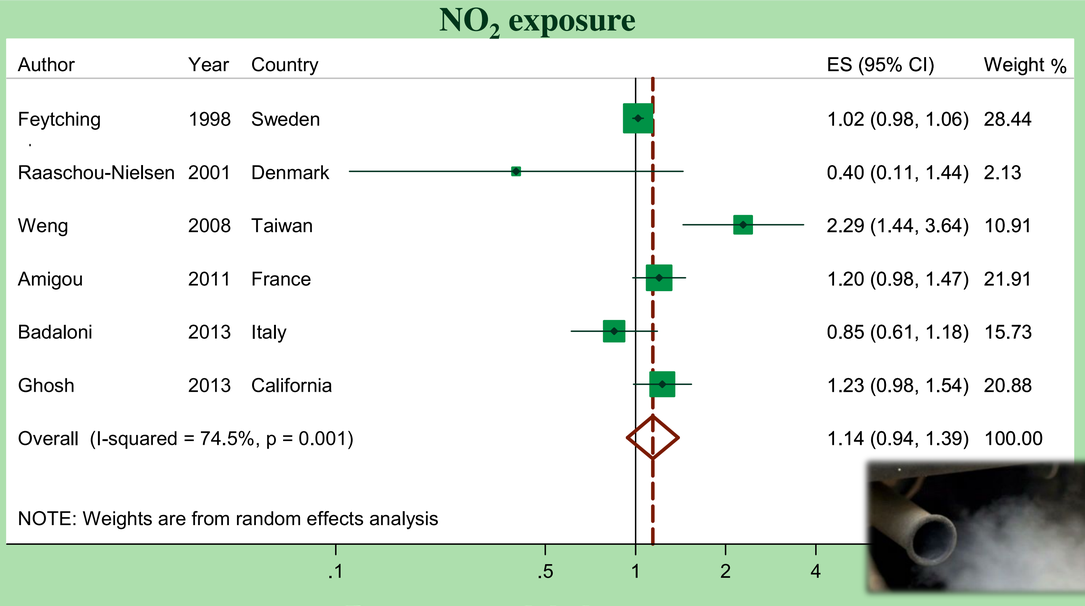
All studies examined in this review were all readily available in the published scientific literature (Pubmed, etc.). Search keywords and MeSH terms included childhood leukemia, acute lymphoblastic leukemia, risk, air pollution, outdoor air pollution, traffic and they were used in a variety of different combinations in June and July 2014. The electronic search was limited to articles published and indexed till June 2014. References from each paper were scanned for additional studies. The search procedure was stopped when no further useful study dealing specifically with the question of interest could be found. We identify three ecological studies and nineteen case-control studies. For all studies considered the full text was retrieved.

Then we reviewed the methodologies used to assess exposure to traffic-related air pollutants, such as the number of vehicles per day characterizing the roads close to subjects' residence, proximity to main roads, or the individual measured or modeled exposure to selected air contaminants, with the aims to perform targeted analysis.

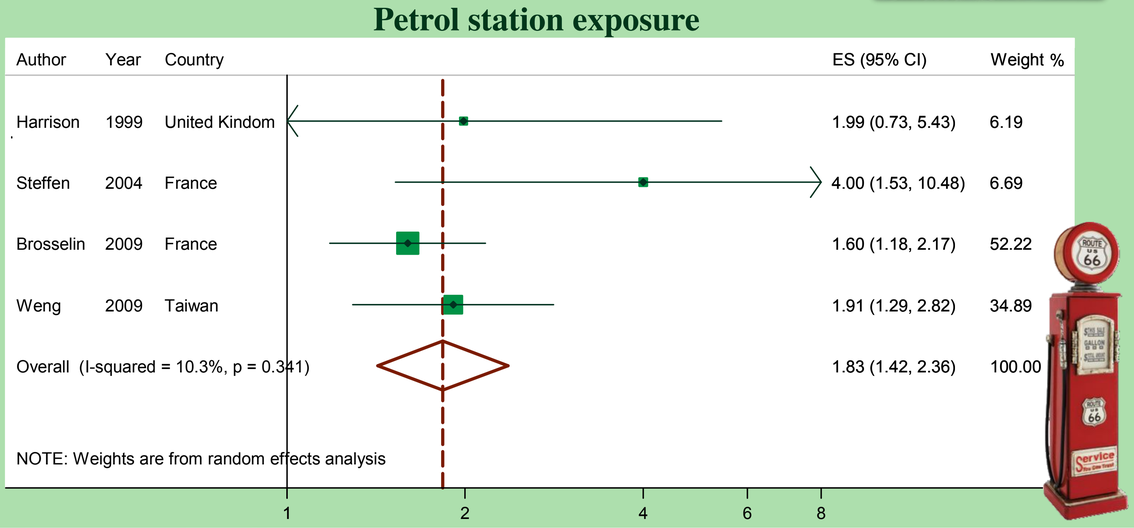
Traffic density indicators



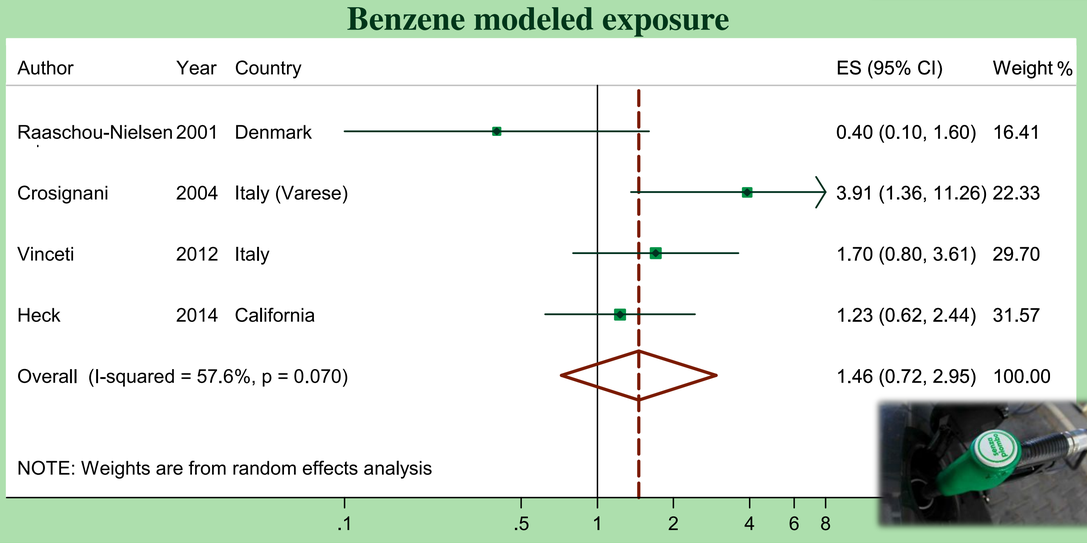
NO_2 exposure



Petrol station exposure



Benzene modeled exposure



Results

Depending on exposure assessment methodology, the meta-analysis yielded different overall odds ratios (OR), generally indicating an increased risk of childhood leukemia or specific subtypes of the disease, and these results were strengthened after removing studies at risk of selection bias. Summary ORs of the pooled analysis were 1.14 (95% CI 0.97 – 1.34) for traffic density indicators, 1.14 (0.94 – 1.39) for nitrogen dioxide exposure, 1.83 (1.42 – 2.36) for petrol station exposure and 1.46 (0.72 – 2.95) for benzene modeled exposure. Analysis of a specific subtype alone (ALL) get an OR of 1.22 (0.95 – 1.60) for traffic density indicators, furthermore if we consider only studies with NOS≥7 overall OR were 1.20 (0.98 – 1.47) for traffic density indicators and 1.21 (0.97 – 1.52) for nitrogen dioxide exposure. A possible source of difference in effects could be the country where studies were conducted: stratified analysis between American studies and European ones give OR 1.08 (0.88 – 1.33) and 1.56 (1.08 – 2.25) respectively.

Conclusions

Despite the limitations of this meta-analysis, such as the differences in the assessment of exposure to outdoor air pollutants, the risk of confounding and the statistical imprecision of the point estimates, results of the study appear to suggest a direct association between traffic-related air pollution and risk of childhood leukemia.

Bibliograpy

- Snyder R. Overview of the toxicology of benzene. Journal of toxicology and environmental health Part A. 2000 Nov;61(5-6):339-46.
- Buffler PA, Kwan ML, Reynolds P, Urayama KY. Environmental and genetic risk factors for childhood leukemia: appraising the evidence. Cancer investigation. 2005;23(1):60-75.
- IARC. A review of human carcinogens: chemical agents and related occupations. IARC Monographs on the Evaluation of Carcinogenic Risks to Humans. 2012;100F:1-599.
- Tung EW, Philbrook NA, Macdonald KD, Winn LM. DNA double-strand breaks and DNA recombination in benzene metabolite-induced genotoxicity. Toxicological sciences. 2012 Apr;126(2):569-77.

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