Carpi, 27-30 October 2016
Annual Ramazzini Days

Risk of childhood leukemia and exposure to outdoor air pollution. Updated review and dose-response meta-analysis

Tommaso Filippini[1], Alessio Crippa[2], Nicola Orsini[2], Marco Vinceti[1]
[1]CREAGEN - Environmental, Genetic and Nutritional Epidemiology Research Center, University of Modena and Reggio Emilia, Reggio Emilia, Italy.
[2]Department of Public Health Sciences, Karolinska Institutet, Stockholm, Sweden.

Background

Leukemia is the most frequent malignant disease of childhood. Most epidemiologic studies have suggested that exposure to traffic pollutants may increase the risk of childhood leukemia. We updated our previous review and meta-analysis as some recent studies have now available, and we also performed a dose-response meta-analysis using traffic estimators.

Methods

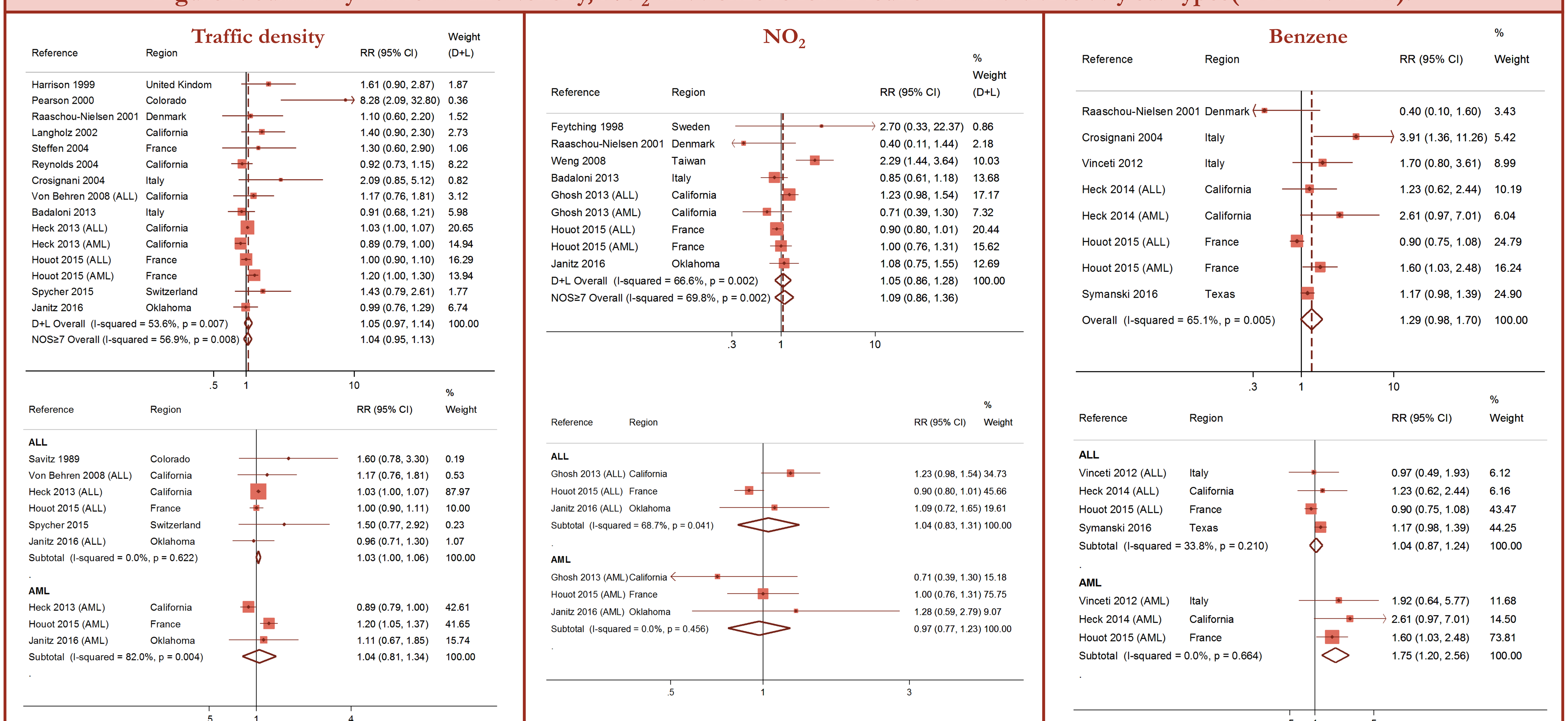
We performed a systematic PubMed search in July 2016, including as MeSH Terms "childhood leukemia", "traffic" and "benzene". We extracted the following data: study estimates, type of exposure assessment (traffic density, generally coded as numbers of vehicles per day, distance and/or length of major roads near subjects address; benzene exposure) and leukemia subtype (ALL: acute lymphoblastic leukemia, AML: acute myeloid leukemia). We used the highest versus the lowest category estimates for meta-analysis of the effect of traffic density and benzene exposure on disease risk. For dose-response meta-analysis the number of vehicles per day was used as continuous estimator of traffic exposure.

Results

Summary RR (sRR) associated with traffic density were 1.05 (95% CI 0.97 to 1.14) for all leukemia, 1.03 (1.00 to 1.06) for ALL and 1.04 (0.81 to 1.34) for AML. For benzene, sRR were 1.29 (0.98 to 1.70) for all leukemia, 1.04 (0.87 to 1.24) for ALL and 1.75 (1.20 to 2.56) for AML. sRR for NO_2 were 1.05 (0.86 to 1.28) for all leukemia, 1.04 (0.83 to 1.31) for ALL and 0.97 (0.77 to 1.23) for AML). Finally sRR for 1-3 butadiene was 1.45 (1.08 to 1.95).

Sensitivity analysis removing alternatively one study from each summary estimate did not alter substantially the results. A dose-response meta-analysis indicated an approximately linear association between number of vehicles per day and disease risk. Similar results were found for NO_2 estimator with increasing risk approximately from 40 μg/m³ level, and for benzene for which risk star increasing after 3 μg/m³.

Figure 1. Summary RR for traffic density, NO_2 and benzene for all leukemia and divided by subtypes(ALL and AML).



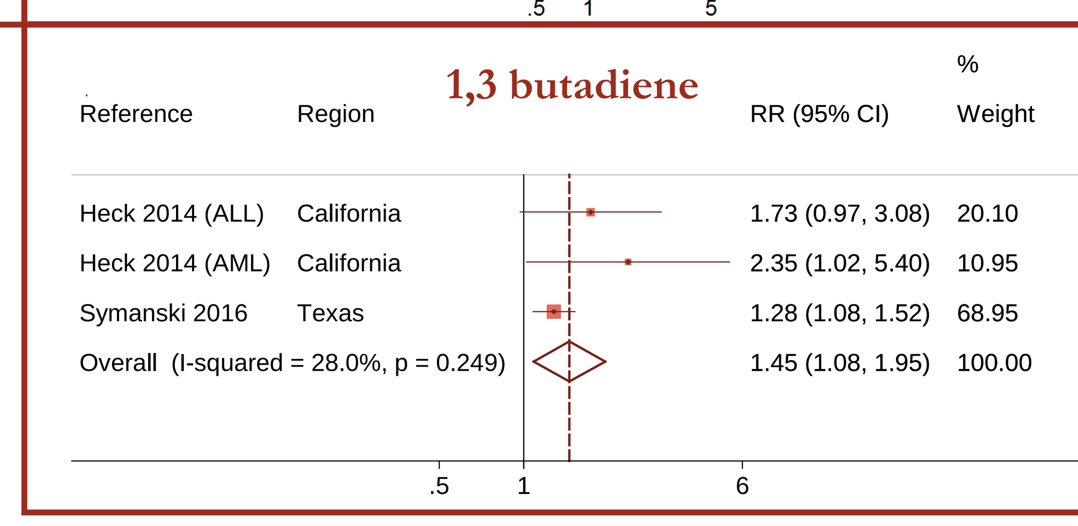
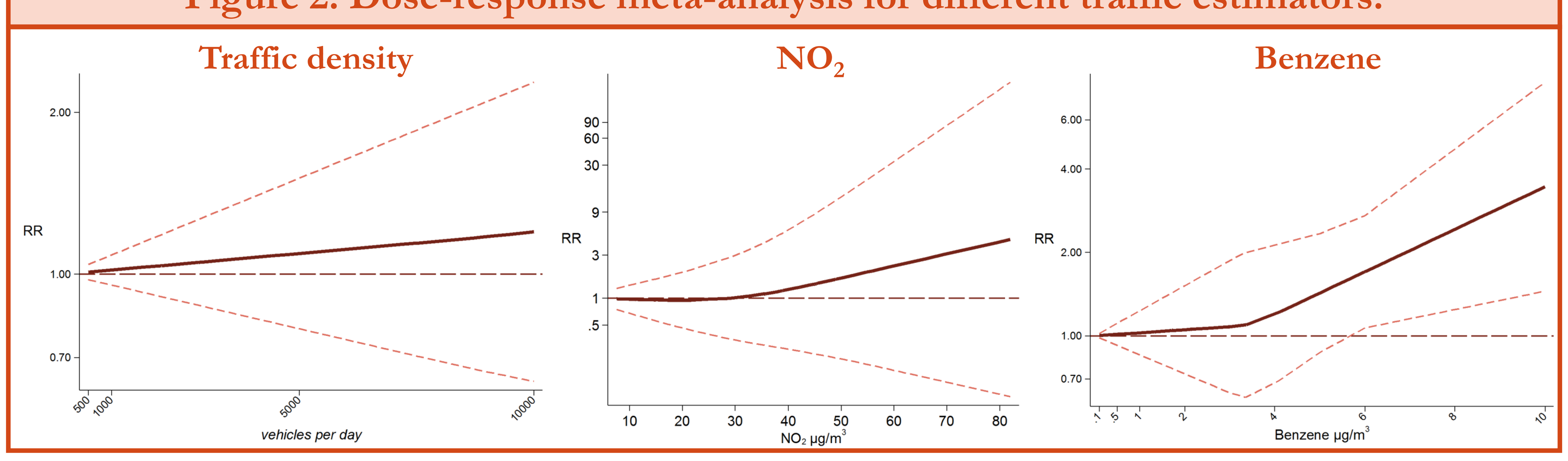


Figure 2. Dose-response meta-analysis for different traffic estimators.



Conclusions

Our results confirmed previous findings about an excess risk of childhood leukemia in area with high traffic density, especially for the ALL subtype. When considering specific pollutants, both benzene and 1,3 butadiene increased leukemia risk, especially AML risk for benzene. Dose-response analysis revealed a linear risk increase for exposure air pollutants, namely nitrogen dioxide and benzene.

Bibliography

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Mail to Prof. Marco Vinceti, University of Modena and Reggio Emilia, Via Campi, 287 – 41125 Modena.
marco.vinceti@unimore.it

UNIVERSITAS STUDIORUM MUTINENSIS ET REGIENSIS 1175
UNIMORE UNIVERSITÀ DEGLI STUDI DI MODENA E REGGIO EMILIA
Creagen Environmental, Genetic and Nutritional Epidemiology Research Center
COLLEGIUM RAMAZZINI
ASEOP Associazione Sostegno Ematologia Oncologia Pediatrica Onlus