

Residential heavy traffic exposure, onset of chronic respiratory diseases, and health burden in 10 European cities.

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Abstract

Some recent studies suggest a causal role of heavy trafficked streets exposure in the development of asthma and chronic obstructive pulmonary disease (COPD). If such effects are true, a substantial burden of ambient air pollution has been unaccounted with current risk assessment methods. For 10 European cities, population city specific "proximity" distributions and other background health information were combined with existing concentration-response functions to obtain population attributable fractions and estimate (1) the number of cases of asthma and COPD attributable to residential local exposure to traffic captured by living at proximity to heavy traffic; and (2) the number of exacerbations of these diseases (i.e. hospitalizations) due to urban air pollution.

Background

Current air pollution risk assessment methods have focused only in evaluating the burden of exacerbation of chronic disease by this exposure. We applied a revised risk method to 10 European cities to integrate novel evidence suggesting that traffic-related air pollution (represented by living at proximity of heavy traffic, "proximity") may also cause onset of asthma and COPD (Künzli, Perez et al. 2008).

Methods

We expanded traditional methods of air pollution health impact assessment (HIA) to include the burden among those that have the chronic disease due to "proximity" but that may suffer exacerbations due to other causes than air pollution (Fig. 1-Box D).

1. We estimated the number of people that lived at 75m and 100m of a busy roads (road with more than 10,000 vehicles per day) using a standardized protocol for distributing population across cities
2. Applying this exposure and published risk functions for onset of asthma and COPD and living at proximity of busy roads (Graph 1), we evaluated the number of attributable cases of asthma in children (0-17y) and COPD in elderly (65+) due to "proximity".
3. Assuming an hypothetical scenario where current city PM₁₀ concentration annual levels were reduced to levels recommended by the WHO (20 µg/m³) in each city, and using published risk functions (Graph 1), we derived air pollution attributable fractions (Afs) for asthma and COPD hospitalizations following our revised approach.

Results

-Between 18% and 65% of the 10 city's population was estimated to live at 'proximity to heavy traffic' (≤100m). (Tab.1)

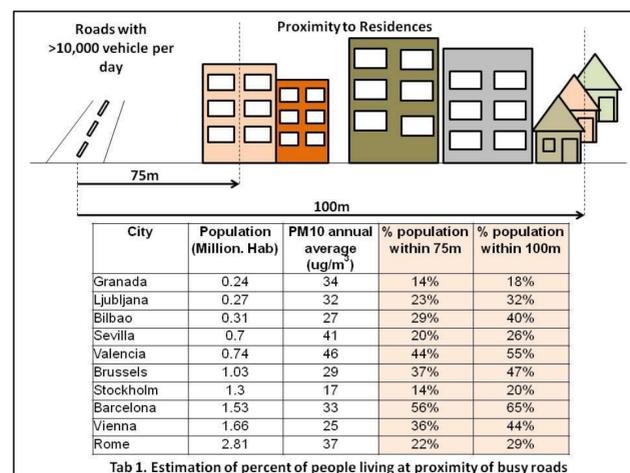
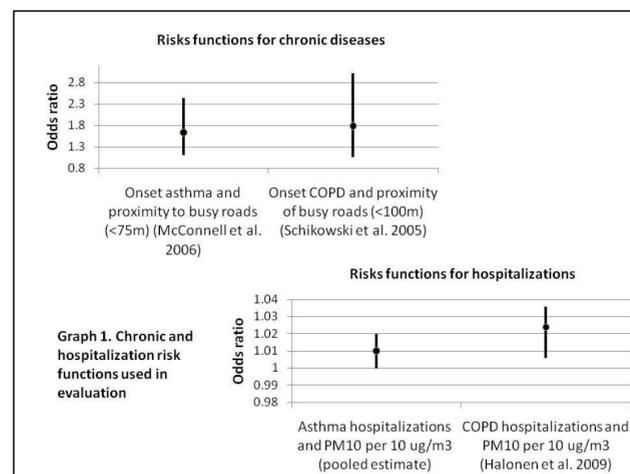
-An average of 16% (95%CI: 11%-20%) of asthma and 22% (95%CI: 14%-29%) of COPD cases was estimated attributable to "proximity" (Fig. 3)

-In total, 268 hospitalizations for asthma (average of 15% total hospitalizations) and 3164 hospitalizations for COPD (average of 25% total hospitalizations) were attributed to air pollution. (Fig. 4)

-In addition to the unaccounted chronic cases attributable to "proximity", the revised approach shows that hospital admission burden accounting also for those was 10 times larger than the usually reported burden attributable to air pollution of standard HIAs. (Tab 2)

Conclusion

The contribution of traffic-related exposure to the development of chronic diseases should not be neglected in the assessment of the air pollution related burden of acute exacerbations of respiratory diseases.



Outcome		Standard HIA	Revised HIA
		(air pollution only causes exacerbation of existing chronic disease)	(air pollution cause onset of chronic disease AND exacerbations)
Onset Chronic disease	Asthma	0	12,374
	COPD	0	17,953
Exacerbations	Asthma hospitalizations	22	267
	COPD hospitalizations	268	3,164

Tab 2. Comparison of results between the standard and revised methodology in this health impact assessment (HIA), when considering a causal association between air pollution and onset of asthma and COPD. Number represent the total attributable cases for the 10 cities evaluated.

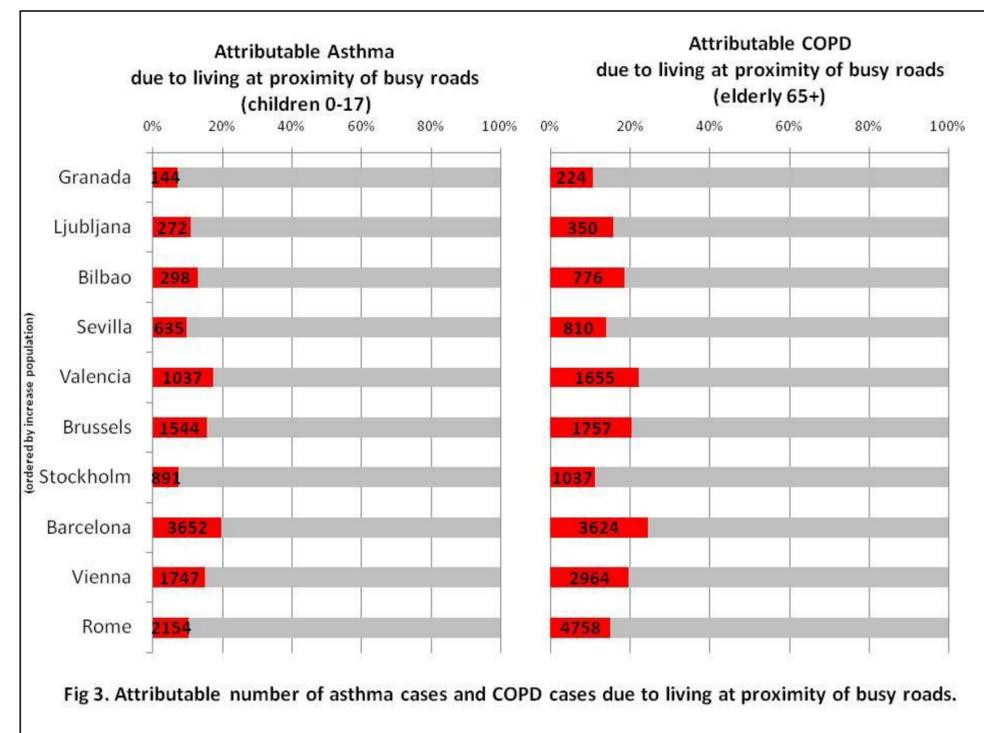


Fig 3. Attributable number of asthma cases and COPD cases due to living at proximity of busy roads.

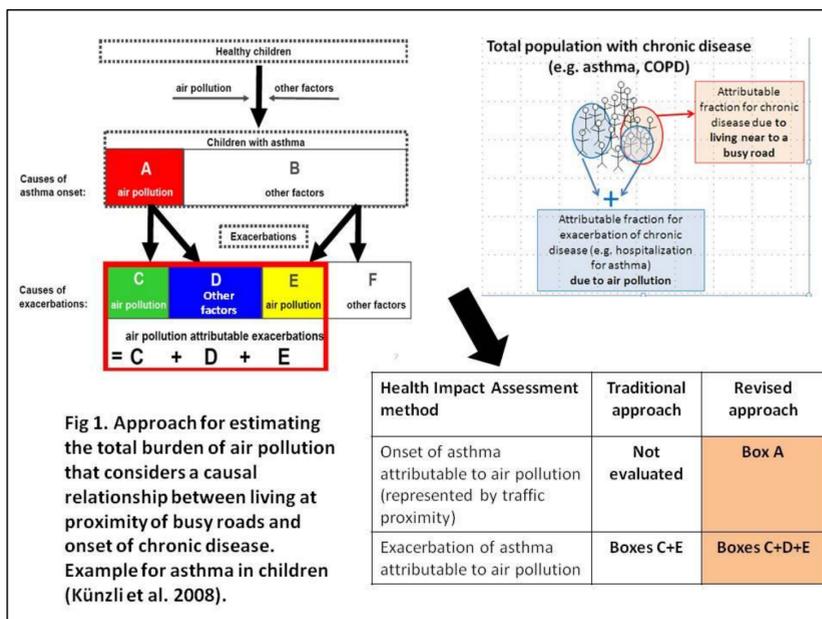


Fig 1. Approach for estimating the total burden of air pollution that considers a causal relationship between living at proximity of busy roads and onset of chronic disease. Example for asthma in children (Künzli et al. 2008).

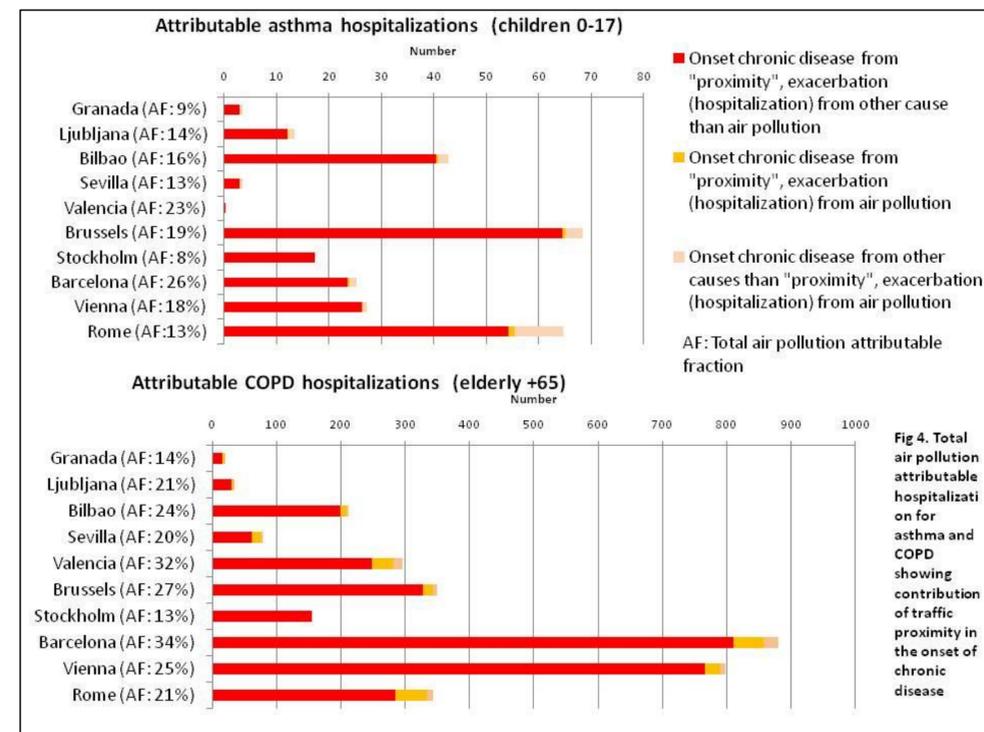


Fig 4. Total air pollution attributable hospitalizations on for asthma and COPD showing contribution of traffic proximity in the onset of chronic disease.

References
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