



## Tool for assessing health and equity impacts of interventions modifying air quality in urban environments



Yuri Cartier<sup>a,b</sup>, Tarik Benmarhnia<sup>a,b,c</sup>, Astrid Brousselle<sup>b,d,\*</sup>

<sup>a</sup> Ecole des Hautes Etudes en Santé Publique (Sorbonne Paris Cité), Rennes, France.

<sup>b</sup> Canada Research Chair in Evaluation and Health System Improvement, Canada

<sup>c</sup> Département de santé communautaire, Université de Montréal, Montréal, Québec, Canada

<sup>d</sup> Département des sciences de la santé communautaire, Centre de Recherche de l'Hôpital Charles-LeMoine, Université de Sherbrooke, Longueuil, Québec, Canada

### ARTICLE INFO

#### Article history:

Received 3 October 2014

Received in revised form 3 July 2015

Accepted 5 July 2015

Available online 9 July 2015

#### Keywords:

Air pollution

Health

Equity

Policy

Evaluation

Assessment

### ABSTRACT

**Background:** Urban outdoor air pollution (AP) is a major public health concern but the mechanisms by which interventions impact health and social inequities are rarely assessed. Health and equity impacts of policies and interventions are questioned, but managers and policy agents in various institutional contexts have very few practical tools to help them better orient interventions in sectors other than the health sector. Our objective was to create such a tool to facilitate the assessment of health impacts of urban outdoor AP interventions by non-public health experts.

**Methods:** An iterative process of reviewing the academic literature, brainstorming, and consultation with experts was used to identify the chain of effects of urban outdoor AP and the major modifying factors. To test its applicability, the tool was applied to two interventions, the London Low Emission Zone and the Montréal BIXI public bicycle-sharing program.

**Results:** We identify the chain of effects, six categories of modifying factors: those controlling the source of emissions, the quantity of emissions, concentrations of emitted pollutants, their spatial distribution, personal exposure, and individual vulnerability. Modifiable and non-modifiable factors are also identified. Results are presented in the text but also graphically, as we wanted it to be a practical tool, from pollution sources to emission, exposure, and finally, health effects.

**Conclusion:** The tool represents a practical first step to assessing AP-related interventions for health and equity impacts. Understanding how different factors affect health and equity through air pollution can provide insight to city policymakers pursuing Health in All Policies.

© 2015 The Authors. Published by Elsevier Ltd. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

### 1. Introduction

Air pollution is a major contributor to the global burden of disease and mortality (Balakrishnan, Cohen, & Smith, 2014; Brauer et al., 2011) and is estimated to cause 1.3 million deaths worldwide each year (Smith et al., 2014). Urban ambient air pollution is a priority for action as the world population becomes increasingly urbanized (World Health Organization, n.d.-a) and as urban environments concentrate industrial and transport activities affecting air quality. Furthermore, interventions aiming at improving health may paradoxically increase health inequities and it is now recognized both should be addressed in order to

maximize the positive impacts of policies and interventions (Benach, Malmusi, Yasui, & Martínez, 2012). It is therefore still necessary to include the assessment of equity in policy evaluation. The recognition that policies and interventions, in sectors other than the health sector, have an important effect on air quality and ultimately health, increases the need to provide managers and policy agents, in various occupational sectors, with tools and information to help them better assess the impact of interventions. In fact, public health is becoming more deeply integrated within city policymaking and programming, and is likely to gain even more importance in the coming years with such movements as Health in All Policies (HiAP) (World Health Organization & Government of South Australia, 2010) and the WHO's Healthy Cities networks (World Health Organization, n.d.-b) emphasizing the need for increasing positive impacts on health but also on social inequities. Both movements push for greater intersectoral collaboration within governments in order to achieve health objectives, and guidance is needed to help anticipate and assess the

\* Corresponding author at: Department of Community Health Sciences, Charles LeMoine Hospital Research Centre, University of Sherbrooke, 150 Place Charles LeMoine, Room 200, P.O. Box 11, Longueuil, QC, Canada J4K 0A8.

E-mail address: [astrid.brousselle@usherbrooke.ca](mailto:astrid.brousselle@usherbrooke.ca) (A. Brousselle).

impact of interventions on air quality and health in urban environments (Benmarhnia et al., 2014). Some academic literature has highlighted different policies that can be implemented to reduce air pollution levels in urban areas. The policies that have been documented include for instance pollutant regulations (e.g. lead banning), low emission zone implementation, or speed limitation. Yet there is still a lack of studies evaluating the health and equity impacts related to policies aiming to reduce air pollution (Giles et al., 2011; Henschel et al., 2012; Wang, Xing, Zhao, Jang, & Hao, 2014) and further evidence in relation to the effectiveness of policies described above is still needed.

The objective of this article is to propose a tool, designed primarily for non-health experts (though public health experts may also find it useful), to support them in the health and equity assessment of policies and interventions affecting air pollution. This tool aims at identifying the various modifiable factors that can be mobilized to increase positive impacts of policies and interventions. It can be used by urban planners, health policy decision makers, and other municipal authorities who may not necessarily have or need sophisticated epidemiological models.

Three domains of research were mobilized to build the tool: public health, with its long standing analysis on health determinants; air pollution research, which analyzes contributors to pollution and their impacts on health and equity; and evaluation, with its important work on logic analysis. The tool has been tested on two interventions: the Low Emission Zone in London, and the public bike sharing system in Montreal.

## 2. Methods

To build the tool, the authors first conducted a scoping review of the literature of air pollution with a broad perspective, including sources of air pollution, air pollution interventions, and complementary subjects such as exposure measurement, green spaces, and behavior. Keywords, titles, and abstracts were searched in PubMed, Cochrane Library and Embase to identify relevant publications (see Supplemental material for keywords). The abstracts of all studies were reviewed to determine inclusion. In addition, the reference sections of studies identified in this way were hand-searched for additional studies. No restrictions were put on date, geographical location, or language of publication.

We used an iterative process to identify a basic causal path for air pollution in urban areas from sources to health and then to equity effects, incorporating all types of pollutants and for both acute and chronic health effects. The tool can be assimilated to a conceptual framework in direct logic analysis (Brousselle & Champagne, 2011; Rey, Brousselle, & Dedobbeleer, 2012; Tremblay, Brousselle, Richard, & Beaudet, 2013). Logic analysis usually encompasses three steps: (1) the building of the logic model of the intervention; (2) the building of the conceptual framework based on scientific knowledge; (3) the comparison of the logic model to the conceptual framework, with the objective to improve the intervention and to orient the evaluation. Therefore, the tool, which corresponds to step 2 of logic analysis (i.e. building the conceptual framework), represents the causal path from emitting sources to health effects and the modifying factors. This process was iterative as we drafted, based on our first readings, a framework that was used to analyze the next articles. There was an iterative process of brainstorming among the three researchers and review of the literature to improve the model through several cycles. We also identified, during our readings, various interventions affecting air quality. An analysis of these interventions was systematically conducted to challenge and complement the categories that were identified in the causal path as having an influence on health and equity (see Table 1).

**Table 1**

Classification of various urban interventions affecting outdoor air pollution-related health, according the factors they target and the level of their action.

Levels of action	Factors targeted	Interventions
Sources	Regulatory context	- Ban on ingredients or technologies - Ban on energy source (e.g. coal)
	Demand	- Energy pricing - Fuel pricing - Ecotaxes
	Urban design	- Limiting sprawl (mixed-use neighborhoods) - Developing public transport
Emissions	Behavior	- Car buyback incentives - Low emission zones
	Regulatory context	- Air quality monitoring - Air quality standards - Fuel emission standards - Industrial emission standards - Engine retrofitting
	Urban design	- Limiting sprawl - Low emission zones
Concentration	Behavior	- Car pools, walking, biking, public transport initiatives - Discourage engine idling - Low emission zones - Speed limits
	Topography/weather	
	Architecture	- Build lower buildings - Set buildings back from roads - Increase density of green spaces - Favor shrubs and trees
Spatial distribution	Green spaces	
	Urban design	- Traffic routing/calming measures - Zoning
	Behavior	- Situate green spaces in highly polluted areas - Restrict solid fuel burning in densely populated zones
Exposure	Behavior	- Voluntary information systems - Walking/biking paths separated from routes
Vulnerability	Age	
	Comorbidities	- Physical activity interventions - Nutrition interventions
	SES	- Employment/education interventions - Occupational interventions
Health effects (endpoint)	Other exposures	
		- Secondary prevention - Health care interventions

This tool can be used first, to design the logic model of the intervention (step one of logic analysis); second, to identify relevant questions for the evaluation of the intervention; and third, to identify awareness-provoking questions for the improvement of the intervention. In order to test its applicability, the tool was applied to two interventions in urban areas. The first, the London Low Emission Zone, covers most of Greater London and imposes a daily charge on heavy vehicles that do not meet emission standards (Transport for London, n.d.). Its principal objective is to reduce air pollution. The other intervention, whose principal objective is encouraging active transport but which could have an indirect impact on air pollution, is the Montreal bicycle-sharing program "BIXI" (BIXI, n.d.). BIXI allows subscribers to borrow and return bicycles from stands located throughout the city. These interventions were

Download English Version:

<https://daneshyari.com/en/article/6792977>

Download Persian Version:

<https://daneshyari.com/article/6792977>

[Daneshyari.com](https://daneshyari.com)