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OPINION

Poor Children and Air Pollution Exposure: Time for Action

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Air Pollution, a Major Public Health Issue

Despite considerable improvements in terms of prevention, management, and regulation, air pollution remains a major public health issue worldwide. In 2019, the World Health Organization (WHO) estimated that about 99% of people breathe polluted air and/or live in places where air quality levels exceed the WHO recommended limits [1]. While the health risk related to air pollution is relatively low compared to other risk factors related to population behavior (such as alcohol or tobacco consumption, for instance), the number of people who can be affected is significant. Therefore, according to the Lancet Commission report published in 2019, about 4.5 million deaths were related to ambient air pollution exposure [2].

Air pollution affects all of us, but certain groups of population are known to be more vulnerable to environmental nuisances exposures; it the case of children. Indeed, children breathe faster than adults and their growing bodies are much more sensitive to air pollution than adults. This exposure to air pollution can lead to respiratory and immune problems, but also pathologies such as diabetes, obesity or depression. According to the WHO report published in 2018, about 93% of children live in environments with air pollution level exceeded WHO guidelines [3]. In addition, they warned that both outdoor and indoor air pollution significantly contributed to respiratory tract infections leading to about 540 000 deaths of children less than 5 years old worldwide in 2016. Several of these health events could be avoid or minimize if air quality was improved.

This is especially important as it is known that the consequences of these pathologies related to air pollution consequences extend beyond childhood period and will increasingly affect their health over the course of their lives.

Poor Children more Vulnerable to Air Pollution

Children are not a homogeneous and uniform group of population. Different factors, such as poverty, are particularly damaging. For example, it is more difficult for poor people to escape from unfavorable living conditions mainly because of their lack of

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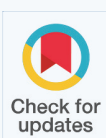
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sufficient resources; therefore, they are more likely to accumulate several harmful exposures (poorer indoor air quality [4,5], greater exposure to noise, heat [6,7], etc.) from the different places they daily met.

In addition, many epidemiological studies demonstrated that socio-economically disadvantaged areas have fewer green spaces [8], parks, playgrounds and recreation areas, or other resources [9] to counterbalance less favorable living conditions. This accumulation of harmful exposures has direct consequences on the vulnerability of children and can lead to an increase of various pathologies risks. Poor children are thus victims of a double penalty: they are more vulnerable to air pollution as any child and this vulnerability is exacerbated by the socio-economic status of their parent and of their place of residence.

Case study – Lyon metropolitan Area-France-UNICEF Report (October 2021) [10].

The analysis carried out in the Lyon metropolitan area, located in the west part of France investigated the relationship between the socioeconomic status of primary school and the level of NO₂ concentrations. To categorize the French school according to their socioeconomic status, we used the Priority Education Networks classification (REP classification meaning Réseaux d'Éducation Prioritaire). Characteristics of social disadvantage, such as the rate of socio-professional disadvantaged categories, the rate of pupils receiving scholarships or the rate of pupils residing in a priority neighborhood according to the city policy are taken into account to establish their classification. The spatial analysis of the geo-localization of the schools at the sub-municipal level revealed that the proportion of deprived schools is three times more likely to exceed the limit value of 40 mg/m³ than the more privileged schools.

Few Public Policies Address this Double Penalty

National plans covering multiple domains (nutrition, environment, cancer, etc.) seeks to achieve one common objective the improvement of population's health. But all fail to consider the health risk differential relating to individual socioeconomic status or the socioeconomics of the residential place.

Air pollution control policies mainly pursue a health objective of reducing concentrations of atmospheric pollutants. However, they also have

multiple impacts that go beyond the health field alone and which are still poorly documented and integrated into decision-making. The distribution of health benefits of these policies according to socio-economic category and age, for example, has received very little attention. Therefore, actions and regulations aiming to improve air quality could constitute one lever to fight social inequalities. Based on these scientific findings, it is time to propose solutions to ensure that policies combating air pollution, do not inadvertently contribute to increase social inequalities in health, particularly against poor children [11].

Public Health Recommendations

Several recommendations could be formulated to tackle social inequalities in health related to the reduction of air pollution, with a particular attention for children.

- Strengthen the consideration of social issues in the elaboration and, then in their application of air pollution policies; more particularly in the studies of health impact assessment related to air pollution reduction. In the same line, encourage health impact assessment studies among children population taken into account not only the level of exposure at the place of residence but also and, especially around and in the school. Actions aiming to improve air quality should be proportionated to the level of pre-existing socioeconomic deprivation of the parents as Sir Marmot defined in 2010.
- Target interventions among the poor and vulnerable populations at the residential place as at school, the second most frequently place for children.
- Apply social justice requirements to road traffic reduction measures or other measures aiming to improve air quality: ensure that the health gains of interventions, as for instance the Low Emission Zones, benefit to all but mostly to the most vulnerable populations.
- Prioritize the most exposed schools and most vulnerable children for urban plannings such as school streets or other projects.
- Better protect the health of the youngest by strengthening the requirements applicable to establishments receiving them, including the school: ensure that new buildings are at a appropriated distance from sources

of atmospheric pollutant emissions, with appropriated ventilation system, and suitable manufacturing materials that do not emit pollutants (or at a few level).

- Improve the consideration of children in the development of environmental health policies and increase knowledge about children's exposure to air pollution.

Recommendations from a Practical Point of View

Most specifically, recommendations can be formulated maximizing health benefits toward the children, all children but mostly the poorest.

- Provide social support for changes in mobility: increase investment program to support the development of public transport services, increase the cycle tracks especially linking cities and promote carpooling. Facilitate and encourage local authorities to develop car-sharing schemes.
- Strengthen financial incentives for the purchase of clean cars for the poorest households.
- Encourage the definition of buffer around schools where cars could be not allowed. At least, limit the speed of, and access to, vehicles close to establishments for children by putting in place such as traffic-calmed areas, school streets and traffic-calmed zones. Where a school street is not feasible or insufficient to fight air pollution, encourage renovations to limit the penetration of air pollutants into the school building.
- Generalize learning to ride a bike by ensuring that all children have benefited from a school program and by developing schemes to help adults, particularly those in socio-economic difficulty, to become mobile by bicycle socioeconomically disadvantaged.
- Secure home-school journeys by encouraging the development of school travel plans including most specifically co-travel systems as pedibus or bike-bus.

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