

## GLOBAL HEALTH AND GLOBAL POLLUTION: PRESENT AND FUTURE CHALLENGES

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### Глобальное здоровье и глобальное загрязнение: настоящие и будущие вызовы

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The article examines the relationship between public health and pollution in the perspective of a globalized world in which environmental and health problems go beyond national borders, demanding global cooperation for a sustainable society. It also describes the factors that have influenced the increase in pollution, its current situation and prospects for the future.

*Keywords: environmental pollution; air pollution; global health; health; malaria; international cooperation.*

В статье рассматривается взаимосвязь между общественным здравоохранением и загрязнением в перспективе глобализованного мира, в котором проблемы окружающей среды и здоровья выходят за рамки национальных границ, требуя глобального сотрудничества в интересах устойчивого общества. В нем также описываются факторы, которые повлияли на увеличение загрязнения, его нынешнюю ситуацию и перспективы на будущее.

*Ключевые слова: загрязнение окружающей среды; загрязнение воздуха; глобальное здоровье; здоровье; малярия; международное сотрудничество.*

Global Health is a very new term and it causes some confusion with International Health term. While International Health deals with health issues that transcend one's own country, and it means a binational cooperation, Global Health deals with health issues that are more globalized, that transcends national boundaries and it requires a global cooperation. Global Health is concerned with sustainability and with human rights and equity.

According to Wernli et al. (2016), Global Health in academic terms, refers to the spatial reach of health issues and its determinants in the context of globalization. «It is a system-based, ecological and transdisciplinary approach to research, education, and practice which seeks to provide innovative, integrated, and sustainable solutions to address complex health problems across national boundaries and improve health for all».

Global pollution began in the 20<sup>th</sup> century. This century represented a turning point in terms of population growth and waste released into the environment. Data from the United Nations show that population growth was very rapid after the Industrial Revolution (1750) when there was about 0.8 billion people, reaching 1 billion in 1800 and in the 20<sup>th</sup> century accelerated even more, from 2 billion in 1927 reaching 6 billion people by the end of the 20<sup>th</sup> century. By 2020 the world population

is expected to be around 7.6 billion. Therefore, in just 93 years there would be an increase of 5.6 billion people on the planet. By 2050 it is estimated that the population reaches 9.7 billion people.

A larger population means greater pressure on ecosystems, mainly due to the need to produce more food and energy. However, the world population growth rate has been falling since 1970, when it reached the maximum value, 2.1% per year, to the present day when the rate is less than 1.2% per year and it will be less than 0.6% per year in 2050.

At the same time, the population pyramid is changing its format, with more and more old people at its top and fewer children at its base. The median age of population was about 22 years in 1970 and now is about 30 years. In 2050 the median age is projected to be 36 years.

Therefore, as life expectancy increases, this means a longer time of exposure to environmental factors and a greater likelihood of diseases that require longer latency, such as cancer. In addition, there will be greater demand for health services and higher costs resulting from the need for greater infrastructure of health services.

Another aspect related to population is its increasing concentration in cities by the process of urbanization. Today, the most urbanized regions include

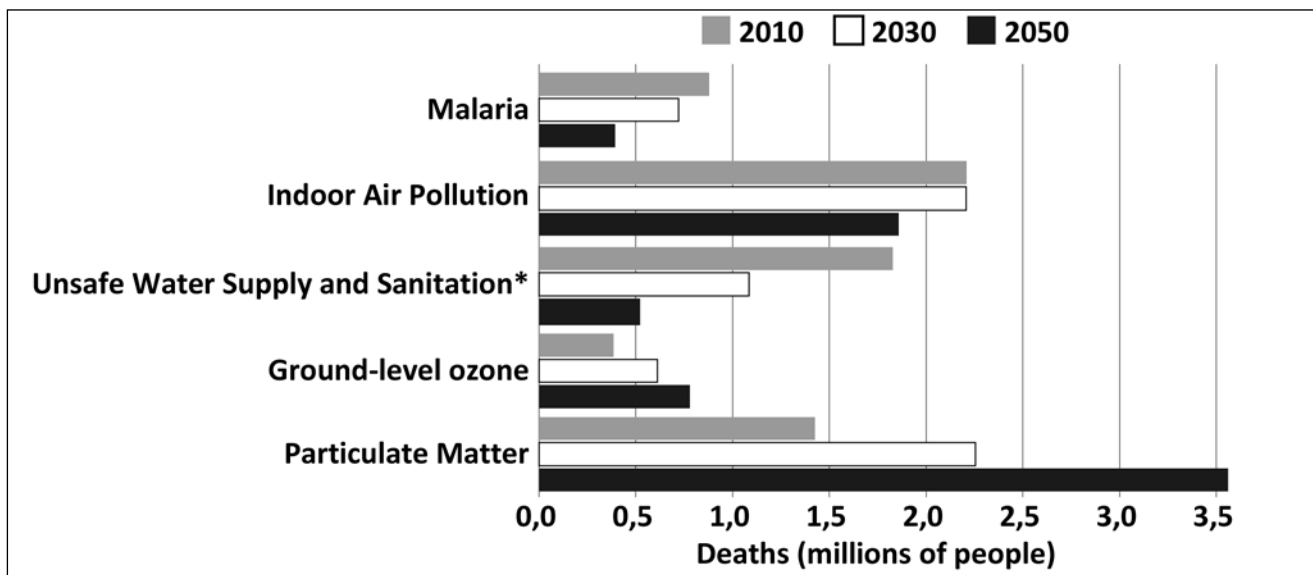


Fig. 1. Global premature deaths from selected environmental risks in 2010, 2030 and 2050. Source: OECD (2012)

Northern America (82 per cent living in urban areas in 2014), Latin America and the Caribbean (80 per cent), and Europe (73 per cent). In contrast, Africa and Asia remain mostly rural, with 40 and 48 per cent of their respective populations living in urban areas. Africa and Asia are urbanizing faster than the other regions and are projected to become 56 and 64 per cent urban, respectively, by 2050. High urbanization rates are likely to create more mobility problem, with heavy traffic and to increase air pollution levels.

During the past decades, with the spread of Western lifestyles, and the increasing globalization of the chemical manufacturing industry, toxic chemicals, highly hazardous pesticides, and chemical wastes that previously were found only in high-income settings have been rapidly penetrating in low-and-middle-income countries too.

As a result, pollution has taken on a global scale; waste from the industrialized world is sent to be recycled in Asian and African countries, and it is actually disposed of in these countries and generally inadequately, causing contamination of soil, water, air and disease in the local population. Waste from the industrialized world, in very small concentrations, has also been found in remote regions such as the Arctic and Antarctica. The situation with regard to pollution that crosses country borders is so serious that several international agreements have been signed to deal with the problem. Examples are: the Montreal Protocol (1987) on ozone-depleting gases, the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Deposit (1989), the 1997 Kyoto Protocol on Climate Change and Greenhouse Gases, Stockholm Convention on Persistent Organic Pollutants 2001, Minamata Convention on Mercury 2013.

Climate change has been the most talked environmental issue and it is likely to be a result of anthropogenic actions in the last decades and are closely linked to population growth, uncontrolled consumption of goods and services and intense use of energy for the production of goods and services and for the movement of millions of vehicles and for food production. As a result, there is the emission of an immense amount of greenhouse gases from the burning of fossil fuels, the change of land use and the burning of vegetation, which has been changing the temperature of the planet. Currently, China, USA and India, in this order, are the three largest emitters of greenhouse gases on the planet.

Air pollution is projected to be one of the major problems in the coming decades, according to Figure 1. It is predicted that indoor air pollution caused deaths will drop 14% by in 40 years. Indoor pollution results mainly from the burning of coal and biomass for food cooking in lower income countries. Deaths resulting from lack of basic sanitation tend to decline dramatically in the coming decades, approximately 72% in forty years, while malaria deaths should be reduced by 55% by 2050.

According to WHO (2017), in 2016, an estimated 216 million cases of malaria occurred worldwide, compared with 237 million cases in 2010 and 211 million cases in 2015. Most malaria cases in 2016 were in the WHO African Region (90%), followed by the WHO South-East Asia Region (7%) and the WHO Eastern Mediterranean Region (2%). Of the 91 countries reporting indigenous malaria cases in 2016, 15 countries — all in sub-Saharan Africa, except India — carried 80% of the global malaria burden. The incidence rate of malaria is estimated to have decreased by 18% globally, from 76 to 63 cases per 1000 population at risk, between 2010 and 2016. The WHO South-East Asia Region

recorded the largest decline (48%) followed by the WHO Region of the Americas (22%) and the WHO African Region (20%). Despite these reductions, between 2014 and 2016, substantial increases in case incidence occurred in the WHO Region of the Americas, and marginally in the WHO South-East Asia, Western Pacific and African regions.

Also according to WHO (2017), the number of deaths from malaria globally in 2016 was estimated to be 445 000 deaths, compared to 446 000 estimated deaths in 2015. Fifteen countries, all in the sub-Saharan Africa, accounted for 80% of global malaria deaths in 2016. Malaria is moving toward elimination globally: in 2016, 44 countries reported fewer than 10,000 malaria cases, compared to 37 countries in 2010. Insecticide-treated bed nets (ITNs) has been shown to reduce malaria illness, severe disease, and death due to malaria in endemic regions. Resistance to pyrethroids — the only insecticide class currently used in ITNs — is widespread. The proportion of malaria endemic countries that monitored and subsequently reported pyrethroid resistance increased from 71% in 2010 to 81% in 2016. The World Health Organization still consider that ITNs continue to be an effective tool for malaria prevention, even in areas where mosquitoes have developed resistance to pyrethroids.

Before pyrethroids, Dichlorodiphenyltrichloroethane, commonly known as DDT, an organochlorine, was widely used to control malaria, and it caused an important adverse environmental effect. This product is a persistent organic pollutant regulated by the Stockholm Convention on POPs, and it is known by its adverse effects on humans and animals. Health effects of DDT include: a poisoning hazard to children from accidental ingestion, temporary damage to nervous system, possible carcinogenic effects (such as liver cancer, pancreatic cancer, testicular cancer, breast cancer, leukemia and lymphoma), development effects, negative effects on the hormonal system and male and female reproductive effects.

Increasing the availability of potable water for developing countries and basic sanitation measures — sewage collection and treatment — the result of specific programs to stimulate global practice and the work being done by the World Health Organization, has resulted in a decline in infant mortality and a decrease in the incidence of waterborne diseases.

New technological options and new products have changed the lifestyles of the planet's inhabitants in basically a century. Apparently, nothing was done with a previous verification of possible impacts. The invention of the automobile at the end of the 19th century and its mass introduction during the 20th century created one of the greatest environmental impacts on the planet. By 2016 the global fleet of vehicles was 1.32 billion cars

and trucks, accounting for twice the volume 20 years ago, when vehicles-in-operation (VIO) totaled 670 million in 1996. This was the same growth from 1976 to 1996 when the fleet roughly doubled the 1976's 342 million vehicles.

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The density of people per vehicle varies a lot on the Planet, while in the US it is at 1.2 people per vehicle, India is at 28.8 people per vehicle, China at 7.1 and it is increasing at a fast rate, about 12% increase per year. Brazil holds by far the largest volume of cars in operation in South America, with a VIO of 43 million 4.9 and Russia that holds the title for largest vehicle volume in operation with 52 million fleet has a rate of occupation of 2.8. In Europe the occupation rates vary from 2.8 persons-per-vehicle in Eastern Europe, while in Western Europe the average is 1.6<sup>1</sup>.

Although there is still room for growth in the world fleet of vehicles, especially in Asia and Africa, there is a shift in the position of the younger population relative to the automobile. In the city of São Paulo, the one with the largest fleet of vehicles in Brazil, local young residents have postponed the decision to obtain the driver's license, changing the profile of the driver of the city. The number of people who take the driver's license after the age of 30 has increased 77% in ten years and doubled from 2002 to 2015. Following this trend, the average age of those taking driver's license for the first time rose from 21.1 to 26.5 years in the same period. The reasons for the change may be of an economic order, for the cost involved to the new habits of urban youth, but among those who postponed the decision, many find it more practical and cheap to travel by public transportation mode, bicycle or taxi, and some are beginning to develop an awareness about mobility.

<sup>1</sup> <http://wardsauto.com/analysis/world-vehicle-population-rose-46-2016>

Currently, transportation with mobile phone applications (app) has modified the habits of the population in Brazil and maybe this is a worldwide trend, instead of moving by its own car they use transport with applications that comes cheaper than taxi. Another important factor is the possibility to carry out activities in a virtual way, that is, work at home instead of going to the office, doing this with the use of the computer via the Internet. All this tends to change the use and growth of the vehicle fleet, with a positive impact on emissions and air quality. In addition, new car technologies have been introduced in the market in a stronger way in recent times, such as hybrid cars and electric cars. In Europe there is already a movement to ban diesel-fueled cars and even all fossil fuel cars due to climate change problem. There is also the possible introduction of the autonomous car, including heavy vehicles. This will have a strong influence on vehicle emissions. Therefore, a major change in the situation in the coming decades can be expected, with less growth in the impact of vehicles on air quality.

Environmental awareness seems to be gaining momentum and this came after intense environmental movements and the action of UN entities such as United Nations Environment Programme (UNEP) and World Health Organization (WHO). A light went on to reduce environmental degradation. However, this degradation has already spread all over the globe. Human activities have already damaged 75% of the earth's surface and only 25% remain free of substantial impacts from the presence of human activity. The forecast is that only 10% remains free of impacts in 2050. Currently plantations and pastures cover 1/3 of the land surface<sup>2</sup>.

In addition to the long-term effect of environmental degradation, immediate health effects mainly affect the world's poorest and especially children, particularly for the world's poorest. According to The Lancet Commission on Pollution and Health, diseases caused by pollution were responsible in 2015 for an estimated 9 million premature deaths — 16% of all deaths worldwide — three times more deaths than AIDS, tuberculosis, and malaria combined; and fifteen times more than all wars and other forms of violence. It kills more people than smoking, hunger and natural disasters. In some countries, it accounts for one in four deaths. Nearly 92% of pollution-related deaths occur in low- and middle-income countries. Diseases caused by pollution were responsible in 2015 for an estimated 9 million premature deaths — 16% of all deaths worldwide — three times more deaths than AIDS, tuberculosis, and malaria combined; and fifteen times more than all wars and other forms of violence. It kills more people than smoking, hunger and natural disasters. In some countries, it accounts for one in four deaths. Nearly 92%

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In 2012, WHO estimated that exposures to polluted soil, water, and air contributed to an estimated 8.9 million deaths worldwide. Of these deaths, 94% (8.4 million deaths) were in low-and-middle-income countries. Different pollutants are linked in children to non-communicable diseases (such as asthma), cognitive disorders, and perinatal defects, and, among adults, to heart disease, stroke, and cancer. The worst pollutants—lead, mercury, cadmium, radium and radioactive isotopes, chromium and pesticides, persistent organic pollutants — are major drivers of chronic diseases and cancers that cut lives short by decades.

In the world's poorest countries, the predominant forms of pollution have been indoor air pollution and contaminated drinking water (PAHO 2012). Pneumonia and diarrhea are their principal consequences. By contrast, ambient air pollution, toxic chemicals, pesticides and hazardous wastes are the predominant environmental hazards in richer countries. They are linked to non-communicable diseases—to asthma, neurodevelopmental disorders and birth defects in children, and to heart disease, stroke, and cancer among adults (PAHO 2012).

Pollution can be controlled. High-income countries have identified and controlled many of their worst problems of environmental pollution. They have developed feasible, cost-effective and replicable strategies that have reduced incidence and prevalence of the diseases caused by pollution. An example of successful action is air pollution in large cities. In these almost two decades of the 21<sup>st</sup> century you can see the results of actions taken in many once very polluted countries such as USA, Japan and England. Air pollution, which has been a major public health problem in large cities in the US and Japan and also in Europe, is now much less polluted. Some examples of heavily polluted cities in the 20<sup>th</sup> century were New York, Chicago, San Francisco, Los Angeles, Pittsburgh, Tokyo, London, Mexico City, Santiago in Chile, and Sao Paulo — Brazil. Data from the World Health Organization shows that of the 500 most polluted cities in the world from 2008 to 2015 by fine particles (PM<sub>2.5</sub>), none of the cities that were heavily polluted in the 20<sup>th</sup> century cited are part of the list of 500. In Brazil, the only one cited is a small city impacted by ceramic industries and not the city of São Paulo. Of the 500 most polluted cities in the period 2008–2015, 179 (35.8%) were located in China, 97 in India (19.4%) and 50 in Turkey (10%). It is therefore seen that the struggle to improve air quality in the most polluted cities of the 20<sup>th</sup> century has had an effect. However, industrialization and economic growth in emerging countries, especially in Asia, resulted in a sharp deterio-

<sup>2</sup> IPBES assessment report, on global land degradation and restoration, 2018.

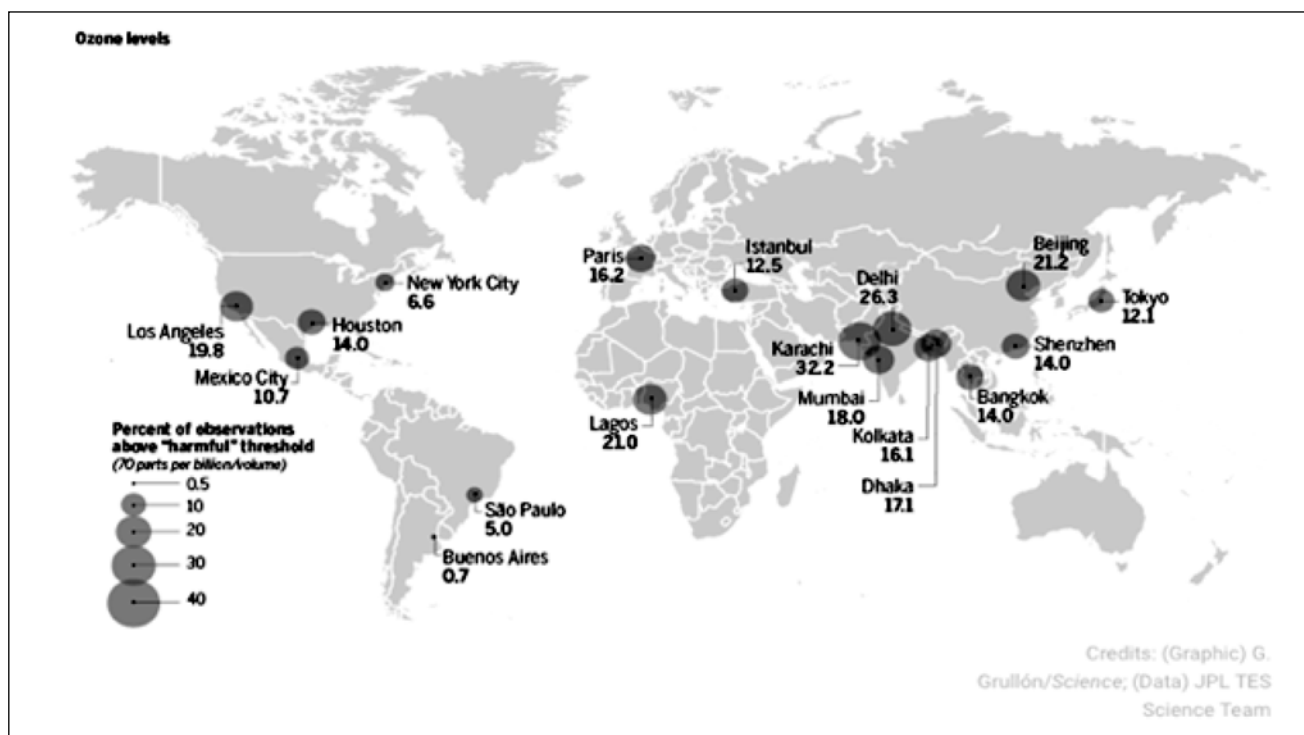


Fig. 2. Ozone levels in megacities around the world in 2013 (ppm). Source: Kornei K. 2017.

ration in air quality. The interesting thing is that no lessons have been learned, the emerging countries in terms of industrial production walk in the same direction as those who made the polluted world of the 20<sup>th</sup> century. That is, the maxim of first growing economically at any cost to then take action remains valid.

Tropospheric ozone is another air pollution problem plaguing the planet. It has been faced in the industrialized countries, but still resists a total solution. This is a pollutant formed in the atmosphere by complex photochemical reactions involving pollutants emitted by anthropic emission sources, especially combustion, and with some influence from natural emissions from vegetation. In the case of ground level ozone, despite the efforts made in the developed countries, high levels still exist, but they are not the highest levels in the world considering megacities (Figure 2). Of the five highest levels of ground level ozone detected in 2013 by tropospheric emission spectrometer aboard NASA's Aura satellite measurements, three were in Asia, in the cities of Karachi — Pakistan, Delhi — India, Beijing — China; one in Africa in Lagos — Nigeria, one in the USA, in Los Angeles — California. The latter city is known for its photochemical pollution due to its huge fleet of vehicles and geographic and climatic conditions conducive to the formation of pollutants.

### Final Considerations

Pollution is well linked to global health. The problem is serious, and no short-term solution can be envisaged. The problem is also complex because it is not just a

matter of technology; it also involves social, economic and cultural aspects. Industrialized societies are taking care of some of the pollution and in some cases, they have been successful, but other countries also want to have a better economic situation. This is the case of China and India, and they are using the same model already used by the industrialized world and with the same consequences. There are a few examples of societies that want to move toward a low-carbon economy, such as the European Union countries, but they are just a few and are starting to move in that direction.

Although environmental pollution is reaching worrying proportions worldwide, it remains a neglected problem in several national policies and international development agendas. International agreements are of particular importance in dealing with global pollution situations such as the Stockholm Convention on POPs and the Minamata Convention on Mercury.

What is the importance of having an international agreement? Firstly, we have cooperation between countries and the exchange of experiences. Second, it forces a country to implement it if the country wants to join the agreement. Third, there are fewer opposing forces within the country, as it is an international agreement. Fourth, technical assistance and financial support to poor countries helps them to implement the activities necessary to achieve the goals of the specific agreement.

Brazil is an example of good experience in implementing the Stockholm Convention and is now initiating activities towards the implementation of the Minamata Convention on Mercury.

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