Environmental Degradation: Critical Appraisal Of Air Pollution

Introduction

How long will humans keep up with a careless attitude until planet Earth gives up? The desire to have an easier life has led to overproduction and consumerism, creating solutions that devastate the only place in the universe called “home”. Environmental degradation has been increasing over the years in high-income countries (HICs) and developing countries(1). It is a problem that concerns not only governments and organizations but every citizen of the world, therefore must be dealt with at a local level to make a positive impact in communities, cities, countries and consequently worldwide.

The risk factors for Global Environmental Changes (GECs) are caused directly by humans or by nature itself. But the constant deterioration of our ecosystems is due to human activity rather than nature in great proportion hence it can be preventable(2). Human beings are entirely dependent on environment for continued survival, it’s important to maintain it in a sustainable way for the next generations, leaving behind a “grow now, clean up later” approach that endangers the lives of 2.2 billions of children around the world(3).

The increasing prevalence of Non-Communicable Diseases (NCDs) and a poor quality of life (QOL) are directly linked to climate change, stratospheric ozone depletion, forest clearance and land cover change, land degradation and desertification, wetlands loss and damage, biodiversity loss, freshwater depletion and contamination, urbanisation, damage to coastal reefs and ecosystems(4). All these unhealthy but preventable environments cause nearly 13 million deaths of the global population, a shocking figure that if countries partner up and tackle wisely will undoubtedly lower(5).

The association of each of these environmental hazards and highly prevalent NCDs such as ischemic heart disease, chronic respiratory diseases and cancer will depend mainly on the demography in each country, its geographical location, their accessibility to basic services, and their economical standing. Developing countries face a bigger challenge than high income countries (HICs) because they must deal with NCDs on top of the onset burden of infectious diseases, poor compliance of their health systems and poverty(6). Innovation and an integrated approach are needed to address this problematic.

The deterioration of the environment did not happen overnight, over the years human development has carried consequences on Earth. Every step-forward in history and technology will bring benefits but also a hindrance to a society. A perfect example of this statement is the period of the Industrial Revolution (IR) when many innovative machines were created and more educational opportunities arose, concurrently the burning of coal or oil was the main source of air pollution. For this reason, IR was a trigger that contributed to environmental degradation(7).

To this day air pollution is a giant trigger to human health. Recent data released by the World Health Organization (WHO) show that air pollution has a vast and terrible impact on child health and survival. Globally, 93% of all children live in environments with air pollution levels above the

WHO guidelines. More than one in every four deaths of children under 5 years is directly or indirectly related to environmental risks(8). This public health crisis is receiving more attention, but one critical aspect is often overlooked: how air pollution affects children in uniquely damaging ways.

Children are society's future. But they are also its most vulnerable members. The immense threat posed to their health by air pollution demands urgent action. Although more rigorous research into how air pollution affects children's health will continue to be valuable, there is already ample evidence to justify strong, swift action to prevent the damage it clearly produces.

Governments, non-Profit Organizations, health professionals and societies must come together to address this threat as a priority, through collective, coordinated efforts(9). For the millions of children exposed to pollute air every day, there is little time to waste and so much to be gained.

The focus on this essay will be mainly on air pollution, its types, related NCDs, statistical damage worldwide, possible interventions and solutions to tackle the current situation in HICs and LMICs.

Critical Appraisal

Air Pollution (AP)

Nowadays the average family home is producing indoor AP in an accumulative manner. Many people spend large portion of time in enclosed environments where air circulation may be restricted. Without knowing the high exposure to pollutants such as dust mites and other allergens from carpets, fumes from candles, volatile organic compounds (VOC's) from cleaning products, hairspray, perfumes, gas stoves, CO2 from fires, tobacco smoke, asbestos, among many more(10).

On the other hand, there are pollutants such as particulate matter (PM), nitrogen dioxide, ozone and sulphur dioxide in open space that cause outdoor pollution, these are released mainly during industrial processes, construction work, emissions caused by combustion from diesel or petrol engines, dust from road surfaces, and friction from brakes. The size of the PM will determine whether will end up trapped in the nose or eyes causing irritation and inflammation, or the airways and the alveoli causing Chronic Obstructive Pulmonary Disease (COPD), asthma and bronchitis; ultrafine particles may even cross into the bloodstream causing lung cancer. Heart disease and strokes have also been associated with exposure(11)(12).

The degree to which these two types of AP affect the health of human being is extremely alarming. Research shows worldwide estimation of seven million deaths every year, ranking fourth place as a risk factor for death, and fifth place as a risk factor for disease burden in 2017. These estimates do not affect every individual equally; the elderly, individuals with a compromised immune system or with multiple comorbidities, pregnant women, children and people who exercise outdoors are more likely to get a disease correlated to air pollution. The consequences will depend on the time exposure to these air pollutants, whether short or long term.

However, death rates from total AP are falling mainly due to improvements in indoor pollution.

Since 1990 the number of deaths per 100,000 people have nearly halved, whilst improvements in outdoor pollution have been much more modest(5). Although due to some recent interventions trying to control the coronavirus pandemic, the quality of air has improved in countries with major lockdowns around the world such as China, Northern Italy and UK. According to satellite images, reductions in concentrations of pollutant nitrogen dioxide were significantly lower. But, is too early to say if these reductions in AP will directly drop associated mortality rates.

Every country has a lot to do towards improving quality of air across their cities, especially urban areas. Developing countries specifically are more susceptible in many ways. First, they have the most populated cities in the world: India, Pakistan, and China for example, according to the 2019 World Air Quality Report. Secondly, a large population live under poverty which consequently leads to a lack of clean fuels for cooking, instead they rely on coal. Thirdly, there is an inconsistency in policymaking, hence multinational companies capitalise on lax clean air regulations. Emergent nations face then an immense socio-political-economical challenge to tackle this public health crisis.

For instance, the standard Air Quality Index (AQI) for a healthy living is 60 ug/m3 (PM2.5). According to research carried out in 2017, India's mean AQI was 89.9 ug/m3 across the country and 1.24 million deaths were attributable to AP(13). For this reason, some prospective cohort studies have been sponsored in India to understand better the long-term health impact of AP on cardiovascular disease, respiratory disease, and birth weight. Although these studies are currently on-going, some government entities have already started remarkable initiatives. For example, Ministry of Urban Development by enhancing the availability of public transport and the Ministry of Environment by setting emission standards for the brick manufacturing industry and facilitating management of agricultural residues to reduce stubble burning. Despite the effort already stablished, short and long-term interventions must be implemented throughout the country to change the current data positively.

Another country that has started to face change towards a more sustainable and healthy way is China. Which according to reports listed second place to have the world's highest number of pollution-related deaths, after India. This country's rapid economic growth, affected directly the air quality by obtaining energy from coal burning. The energy industry aims to shift to non-polluting, renewable energy sources, and to nearly triple its solar capacity by 2020(14). These ambitious strategies can definitely improve the air quality, but the interventions can be very costly. According to some cost-benefits studies it is estimated that the cost of measures in all sectors to reach near-zero emissions amounts to US$48.6–68.6 billion, and in 2040 they could reach up to US$10.1 billion/year(15).

In addition, Mexico is one LMIC that is putting words into action to tackle air pollution and the prevalence of NCDs. This country has nearly 20 million people in its capital and is considered an economically ascendant city. For the past 10 years, Mexico city has implemented major interventions to improve the air quality conditions, the transportation system and the quality of life of the citizens. Some of these interventions are switching from using an individual motor vehicle to public transportation (Metrobus), ecobici a public bike-sharing programme, revitalizing their 680 hectare public park, hosting a once a week event where roadways are shut down to cars and open for jogging, strolling and bicycling and added protected bicycle lanes. All of these actions have improved not only the air quality, but the physical daily activity among citizens(16).

The picture for HICs is a little different but they still face some level of air pollution and health-related problems to it. These countries have access to more reliable-updated data and economical resources, also they have the opportunity to boost innovation and enhance competitiveness in the field of green technologies(14). For example, just recently Northern Ireland had the opportunity to invest £4 million in their first 3 hydrogen-fuelled buses supported by the government's Office for Low Emission Vehicles. It is a first step towards investing in zero carbon technology because water is the only exhaust emission from these buses, which means that improves climate change and air quality in Belfast, where they will be stationed.

Moreover, HICs have to be compliant with policies and standards if not their economy could be threaten. For example, the European Union (EU) follows the National Emission Ceilings Directive which sets objectives for emission reduction to be reached in 2020 and 2030 compared to the emission levels into 2005. It doesn't always reach the targets, in 2018 according to reports across the 28 EU member states there were nearly half a million premature deaths in 2015 because of exposure to air pollutants. Such impacts correspond to an estimated cost of 330–940 billion euros which is approximately 3-9% of EU Gross Domestic Product (GDP)(17).

As mentioned before with each LMIC and HIC strategy, benefits of pollution control include upgrading public transportation, improving active transport (walking and cycling), reducing sulphur content of motor fuels, promoting use of low and zero-emission vehicles, restricting car and trucks from city centres, therefore, decreasing traffic, improving air quality, reducing childhood asthma, reducing incidence of cardiovascular disease, stroke and diabetes and enhancing the quality of urban life.

Conclusion

Air pollution is the fourth-largest threat to health; therefore, is an important determinant of health in lower, middle and high-income countries that needs to be assessed periodically to achieve a significant change in world data statistics and sustainable development goals by 2030(18).

NCDs related to air pollution have been proven by evidence-based medicine. In adults, associations with cardiorespiratory mortality and morbidity have been found, also AP exposure and lung cancer has been observed in several studies. With children, research has shown correlation of prenatal exposure to AP and early fetal loss, preterm delivery and lower birth weight(19). Furthermore, clinical trials have linked AP to serious asthma exacerbation and to pneumonia exacerbation. Also, many of these studies have provided important assessments of whether environmental policies and individual air quality actions have contributed global public health.

On the other hand, the evidence for other cancers related to air pollution is far less conclusive, also a caveat in statistical measurements is using fixed-site monitoring data that assumes everyone in the area had the same exposure. It should be noted that measurements of exposure and confounders can change overtime and long-term data are needed. Subsequently, air pollution epidemiology rarely if ever uses personal measurements of exposure for reasons of cost and feasibility. These reasons can lead to many types of biases that will compromise the ability to detect an association(6).

What it is important to realize is that science can provide knowledge, but humans need to provide the solutions to the actual global burden of air pollution. It is not a simple task because strong partnerships, strategies, plans and implementations must be followed to achieve the desirable goals. Air pollution is a modifiable risk that can be tackled prioritizing smartly short-term, mid-term and long-term interventions based on assessments of health effects, environmental damages, and cost-effectiveness of control of various pollution sources. This can only be achievable with the correct implementation of policies, having political and social support. Also, stakeholders need to have in mind the importance of accountability; ongoing monitoring data, achieving targets and timetables need to be made accessible to every citizen at all times, research shows that If people are aware of variations in the quality of the air they breathe they will show motivating changes in their individual behavior(4).

Cleaning the air in every country is possible through an expansion of best-practice measures for pollution control but this will not happen overnight. Significant change will lead to a substantial cost, but it would be societally beneficial. Every country has to remember the agenda of leaving no one behind. Countries can help to implement WHO’s indoor Air Quality Goals by creating incentives and opportunities to ensure citizens have access to sustainable, clean and healthy energy solutions in homes and public places. Cities and communities need to ensure a healthy indoor environment especially in childcare facilities, kindergartens, schools and public recreational settings(18).

Finally, self-reflection is pertinent especially to know one’s personal contribution to environmental degradation in order to assess areas of change and be willing to give it up. This needs to happen in order to improve the health of the population and the ecosystems. We invests in what matters to us. The behavior of neglecting actions towards protecting future generations from environmental health risks needs to stop. We need to adapt a person-centred approach in our daily lives that the environment may be preserved for the next generations.