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GLOBAL POLLUTION – A PUBLIC HEALTH PROBLEM THE EFFECTS OF POLLUTION ON THE RESPIRATORY SYSTEM

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Atmospheric and environmental pollution represents an urgent public health problem due to the widespread high morbidity and mortality determined by multiple conditions and diseases directly produced by pollution. Air and environmental pollution causes millions of deaths/year, being considered the second cause of death by non-communicable diseases WHO. Larger or smaller, even invisible particles penetrate through inhalation, digestion or at the level of the skin and produce multiple damages on different organs and systems, especially on respiratory (asthma, COPD, infections), cardiovascular and neurological systems, being also the leading cause for allergies and cancers. The purpose of the review lies in identifying the main causes of environmental and indoor pollution that lead to health problems and highlight the importance of taking action in preventing and reducing the harmful effects of it. The causes of the increased environmental and domestic pollution are varied and complex. Environmental pollution is mainly caused by chemical industry (emissions of particulate matter PM2.5 and PM10, gases – NO_2, SO_2, and CO, CO_2 or plastic and microplastic), textiles, plastic materials, construction materials and demolition, cars or other consumer goods that developed at an alert pace without pollution prevention measures. Pollution resulted also from agriculture waste, carbon emissions animal husbandry, salts from irrigation water, biofuel crops, crops for animal feed. Smoking, e-cigarettes and VOCs associated by inadequate ventilation produces indoor air pollution in homes, cars, schools, offices. The climate changes resulting from environmental pollution affect the geographical distribution of many infectious diseases, so as natural phenomenon. It is important to raise public awareness and develop a multidisciplinary approach including national and international organizations, medical and scientific experts for sustainable methods.

Keywords: air pollution, environment, COPD, asthma, smoking.

INTRODUCTION

Atmospheric and environmental pollution represents an urgent public health problem due to the widespread high morbidity and mortality determined by multiple conditions and diseases directly produced by pollution. Larger or smaller, even invisible particles penetrate through inhalation, digestion or at the level of the skin and produce multiple damages on different organs and systems, especially respiratory, cardiovascular, renal, liver, allergies, cancers, dementia, vascular accidents, etc. The WHO estimates that exposure to pollution causes 10% of cancers in Europe[1,2].

In 2021, 97% of the population in cities and 99% of the world's population was exposed to pollution above the limits considered acceptable by the WHO[3,4] and the measures taken for air hygiene.

In 2019, 90% of deaths occurred in countries with low incomes (large amount of poverty) and imperfect health policies, especially in the Middle East, Southeast Asia and the West Pacific region[1]. In Eastern Europe and Central Italy, the highest concentrations of polluting particles resulted from industry and from the combustion of biomass in the domestic environment[3].

Air and environmental pollution causes millions of deaths/year, being considered the second cause of death by non-communicable diseases WHO (1). It is appreciated that in 2019 outdoor and indoor pollution caused 9 million deaths/year[1,4]. The number in deaths due to pollution has increased in the last 20 years by 66%[5].

Atmospheric pollution is accentuated by indoor pollution. Use of toxic products also called carcinogens and toxins from indoor air pollution cause 17% of deaths duet to lung cancer[6]. Approximately 2.4 billion people worldwide use for cooking – open fires, kerosene, biomass (wood, crop-waste) and coal. All these generate indoor pollution with an amount of deaths of 3.2 million earth/year in 2020 including children under 5.[6]

Mortality due to cardiovascular diseases related to outdoor pollution was cited in 2019 at 37% (ischemic cardiopathy, stroke). Atherosclerosis increased[7] due to respiratory diseases to 51% (13% due to COPD, respiratory infections 27%, 11% due to bronchopulmonary cancer). Low respiratory infections determine 27% of deaths/year by indoor pollution[4].

The loss of human lives due to pollution is also associated with those due to climate change and extreme weather events: storms, hurricanes, floods, fires, atmospheric inversion.

CAUSES OF POLLUTION

The causes of the increased environmental and domestic pollution are varied and complex[4–19].

Chemical industry, textiles, plastic materials[7], construction materials, cars or other consumer goods developed at an alert pace without pollution prevention measures. Industry is the biggest polluter with emissions of particulate matter PM2.5 and PM10, gases – NO_2, SO_2, and CO, CO_2 or plastic and microplastic[7]. Increasing pollution also resulted from agriculture: pesticides, fertilizers, carbon emissions from animal husbandry, burning stubble and farm residue, agricultural waste, and salts from irrigation water, biofuel crops, crops for animal feed[8–10]. Widespread use of antibiotics in animals, led to increased antibiotic resistance[11].

Uncontrolled urbanization, with construction and diversification of building materials and at the same time demolition of some constructions releases particles, dust, volatile organic compounds. Also smoking and VOCs associated by inadequate ventilation produces indoor air pollution in homes, cars, schools, offices[12,13].

High population density with domestic activities causing indoor pollution including the use of different cleaning products and cosmetics plays today an important role in developing lung diseases and dermatological problems, also with systemic implications[14–16].

Other sources of indoor pollution are:

- Fossil fuels use for heating, cooking, smoking, different furniture materials, paints, indoor hobbies, furnaces, coal powered heaters, mold-infected untreated walls[14–16];
- Deforestation and overpopulation[14,17];
- The increase in the use of plastic products and the lack of their proper recycling[18];
- The lack of reduction in active and passive smoking, especially in cities[19];
- Petrol/gasoline to produce energy for electricity or for transportation (emission of CO, hydrocarbons, nitrogen oxide, and articulated matter (PM2.5 and PM10 – many of them with oncogenetic risk) and the intense use of air and land transport that uses traditional fuels[20];
- Lack of application of guideliness recommended by the WHO and other competent bodies regarding the permissible limits of pollution with different substances[21];
- The lack of compliance with the WHO waste recycling guidelines and the lack of joint global policies regarding respect for the environment[22–26];

Pollution affects people of any age, being more aggressive in children, the elderly and those with pre-existing diseases and intensive exposure. The effect of pollution also depends on the lack of compliance with some limits imposed by the WHO for suspended particles (*e.g.* PM 2.5, PM 10), gases (ozone, nitrogen dioxide NO_2, sulfur oxides, carbon dioxide, particle emissions and toxic gases from agriculture)[1,3,4,9]. Pollution means the huge combination of wastes released into the air, water and land, wastes that pose a huge danger to the health and well-being of people, animals, plants, the environment and the health of the planet[5].

Pollutants originating from human industrial activities, from agriculture, transport or domestic activities are of several categories and frequently associated with[2,5,7,8,10,13]:

• Telluric radiation and from various research laboratories or devices used for investigation and imaging treatment with x-rays or radioisotopes;

Metals – mercury, lead, components from electronic devices, copper, iron, gold, silver, platinum, aluminum, cobalt, zinc, arsenic (area of origin: mining and metal processing environment, industry, waste processing, agriculture, painting , constructions);

• Gases, various chemical substances especially volatile organic compounds (VOC): (ozone, nitrogen dioxide NO_2, sulfur oxides, carbon monoxide, pesticides, drug or chemical industry residues, perfumes);

• Particles in suspension (PM10 and PM 2.5);

• Plastic (with visible dimensions or microspheres);

• Germs (viruses, bacteria, fungi, parasites).

THE EFFECT OF POLLUTION ON THE RESPIRATORY SYSTEM

Pollution affects the whole body, mainly on the respiratory system (all pollutants especially traffic related air pollution, cigarette smoke, heating sources and molds)[1,4, 12, 19, 27–35], but cand be a leading cause for cancers[13, 36–39, 49,65–66], cardiovascular diseases[2,7, 50–54,58], liver (PM10, PM 2.5, NO)[55], kidney (main pollutant PM2.5 and NO_2)[56] and skin problems (ultraviolet radiation, polycyclic aromatic hydrocarbons, cigarette smoke)[57].

The most common effects on the respiratory system include elevated general morbidity, higher frequency of emergency department visits and hospital admissions, reduction in respiratory functions and an increased risk of mortality:

– Acute irritations of the nose, throat, sinuses, conjunctiva;

– Increased airway inflammation and responsiveness;

– Acute bronchitis;

– It is a direct risk factor for the occurrence of non-atopic asthma and a contributor to the occurrence of atopic bronchial asthma and asthmatic exacerbations[27,28, 29,30];

– Development of COPD[31,32,33, 59–60];

– Development of bronchiectasis[35];

– Exacerbation of asthma, COPD, bronchiectasis and fibrosis;

– Determining factor in the pathogenesis of lung cancer[36–39, 48];

– High frequency of pneumonia (especially after excess ozone but also smog with combined particles that stumble muco-cilliary clearance and local immunity at the respiratory level[40];

– Increased risk of upper and lower respiratory tract infections (viral, fungal, tuberculosis, COVID[41];

– Cause of respiratory dysfunction, respiratory failure and deaths (by 2026 a risk of 9 million premature deaths is estimated);

– Faster spread of epidemics (during the COVID epidemic people with exposure to noxes)[42].

Asthma-determining mechanisms – allergic and irritant rhinitis, increased irritation, bronchial inflammation and bronchial hyperresponsiveness, worsening of pre-existing inflammation, increased sensitization to allergens, lower asthma control. Pollution is thus a major trigger of asthma and a trigger of exacerbations with increased presentations to the emergency room, and the severity of attacks.

COPD – increase neutrophilic irritation and inflammation, increase sputum production, increase risk of infections and exacerbations, decreased mucociliary clearance.

Many studies show a significant link between air pollution and COVID infection[41–47].

Many studies have shown that pollution weakens the body and the respiratory system during the COVID infection and at an increased degree of its severity. Mortality due to COVID increases by 11% for every microgram/m^3 increase in pollution, especially in those with pre-existing respiratory conditions[42]. A Dutch study shows that the increase in PM 2.5 concentrations led to a 9.4-fold increase in COVID cases, their severity with the need for hospitalization and 2.3-fold more deaths[45].

In Italy, industrial pollution in the north of the country contributed to the severity of COVID cases and an increase in fatality by 11%[47].

Many studies show the correlation between pollution and the incidence of lung cancer[36–39, 48]. Particulate matter (PM) from outdoor and indoor pollution are included in Group I of carcinogens concerning development of lung cancer (International Agency for Research on Cancer)[49]. In addition with pollution and exposure to radiation, smoking (active and passive) occupies the top risk for lung cancer, being related to the determination of 85% of lung cancer[49,65,66].

THE MAIN AIR POLLUTANTS

The suspended particles are made up of very small solid or liquid pieces with a complex composition. Inhalable pollution particles could be large, visible particles or invisible particles:

- PM10: inhalable particles (diameters around 10 micrometers or smaller);
- PM2.5: fine inhalable particles (diameters around 2.5 micrometers or smaller). They are 30 times thinner than hair strokes[5,8,58].

The smaller particles reach the distal regions of the respiratory tract causing chronic inflammation or absorption into the blood, carrying toxic and carcinogenic substances[8,65].

The concentration of suspended particles is an indicator of air pollution. Inside the particles you can find toxic gases, toxic molecules such as sulfates, ammonium, carbon dust, pollens, mineral dust, water, salts. Negative effects appear directly proportional to increased values of PM10 and PM 2.5 particles above 100 micrograms/m^3.[9,13,44].

The aerial spread of particles are either through direct emission from constructions, industries, from burning wood or fires, from the combustion of means of transport and the grinding of rubber wheels, or after numerous chemical reactions with other substances released into the atmosphere (fireworks, organic substances)[65].

Burning fossil fuels release CO_2, SO_2, CO, mercury (from coal-fired power stations). Women and children, active smokers, or erderly are more affected by the exposure to particles, especially if the indoor pollution (exposure to biomass smoke) that is combined with the outdoor one[58–60].

P**lastic pollution** represents one of the most damaging types of pollution due to its negative effects on both human, animals, plants, foods, waters and the environment. The wide use of plastic in industry becomes a great part of the waste polluting waters and fishes and can end up in humans through the food human chain. Plastics often contain additives, colorants, stabilizers or flame-retardants and other chemical substances which are toxic and may be harmful to the animal or human (it has even been found even placentas)[24, 61,62].

Plastic waste is spilled in the air, soil, waters contaminating all the environment (19 – 23 tones upon United Nation Environment Program)[62]. In many regions plastic are burned (40% releasing dangerous toxin in the atmosphere with increasing risk for respiratory diseases, cardiovascular, nervous system and cancers)[63–66].

Lead pollution. Sources of Pb[68–72]:

- Food, crockery, fertilizers, toys, cosmetics;
- Water from old pipes or from contaminated surface waters;
- Lead from industrial or workplace waste;
- Gasoline with Pb.

Severe effects – responsible for 5.5 million deaths in 2019 due to cardiovascular diseases. The negative effects of exposure are manifested especially in children (encephalitis symptoms, psycho-intellectual retardation, cognitive decline, increased blood pressure). Exposure to Pb and other chemicals causes 1.8 million deaths/year[70,72]. The most vulnerable people are people with pre-existing respiratory conditions such as asthma, chronic bronchitis and emphysema, those with cardiovascular diseases, pregnant women, growing children, especially those with cystic fibrosis[71,72].

Other particles from natural phenomenon: gases from volcanic activity, plant pollen, sandstorms, soil particles or water brought in by floods or fires.

Effects on the human health and society of suspended particles[65–71,73]:

- Eye irritation, conjunctivitis, rhinitis, sinusitis, bronchitis;
- Development and exacerbation of bronchial asthma, chronic bronchitis, emphysema, bronchiectasis;
- Decrease of local immunity at the level of the respiratory system favoring infections including tuberculosis;
- Increased risk for cancers in the hole body;
- Development and worsening of cardiovascular diseases (atherosclerosis, arrhythmias, cardiac or cerebral ischemic accidents);
- Chronic exposure of pregnant women can lead to premature births and reduced birth weight of newborns;
- Increase in emergency room presentations and hospitalizations;
- Decrease in quality of life and life expectancy;
- Decrease in atmospheric visibility; contributes to the degradation of crops and plants; emphasis acid rain effects.

Ozone (O_3) is a highly reactive unstable gas. O_3 in the distant atmosphere has a protective effect against ultraviolet rays. Ozone from the ground is an important component of smog and is transformed under the action of sun rays into harmful irritating particles[74,75].

At the level of the respiratory system O_3 can determine:

• Conjunctivitis, rhinitis, acute bronchitis, pharyngitis;

• Exacerbation of bronchial hyperreactivity of asthma and chronic bronchitis;

• Increases the risk of respiratory infections;

• Increasing number of hospitalizations;

• Decreased lung function and increased deaths.

Nitrogen oxide is a reactive gas resulting mainly from industry, exhaust gases (especially from old vehicles), the burning of some fuels, agriculture (waste from animals and soil fertilization), from the preparation of some foods (cooking gas), cigarette smoke (active but also passive "second-hand" "and third-hand" smoking). Contributes to the formation of ozone and suspended particles[76]. The gas is associated with methane and nitrous oxides and is considered more toxic than CO.

Effects on the respiratory system are most significant in children but also in adults[77]:

increase in respiratory symptoms, being an irritating gas, decreased lung function, conjunctivitis, exacerbation of COPD and bronchial asthma. Other secondary effects after prolongued NO_2 exposure. Increases the risk of transmission of respiratory infections in the upper and lower airways including COVID and presentations to the emergency room[78,79].

NO_2 determines acid rain, through the interaction with water, oxygen and other chemical substances from the atmosphere (with effects for people, animals, but also on flora and waters – with a late effect and with a decrease in visibility, causing malfunctions of road and air transport[80].

Carbon monoxide (CO) is a treacherous gas that has no smell or taste. It results from the incomplete combustion of fossil fuels (wood, oil, coal, methane gas, kerosene) especially when burning in closed spaces without ventilation[81]. It results in large quantities in the industry of burning cast iron and other metals, from the level of exhaust gases but also from the cigarette smoking[7,9]. The effect on the respiratory system and the whole body are particularly severe at even low concentrations in children, pregnant women, elderly, anemics, smokers and patients with pre-existing cardiovascular and respiratory conditions[18,82].

Inhalation of CO causes the formation of carboxyhemoglobin COHb in the lungs which prevents the binding of O_2 and its transport to the tissues resulting in hypoxemia and tissue hypoxia. At the level of the respiratory system, it causes chest pain, severe dyspnea and respiratory failure. Neurological symptoms are severe: headache, dizziness, weakness, confusion, fatigue, loss of attention and concentration, coma, permanent brain damage, death. Cardiovascular disorder are dangerous: rhythm and conduction disorders, angina pectoris and myocardial infarction[83,84]. Chronic exposure to CO due to chronic smoking causes COPD, bronchial asthma and their exacerbations, and increase the risk of respiratory tract infections.

Sulfur dioxides are highly reactive gases with an irritating and foul-smelling effect. They result from the burning of fossil fuels (coal, oils) in industry and vehicles transport but also in households and agriculture. They can be released into the atmosphere and waters from different industries (especially of fertilizers and extracting metal from ore) and from natural sources such as volcanoes eruption. They have a big contribution to the formation of particulate matter (below 3 microns) and smog[85].

Effects of sulfur dioxides on the respiratory system[85–87]:

• Rhinitis, acute and chronic conjunctivitis;

• Worsening of chronic bronchitis, COPD and asthma;

• Decreased lung function;

• Aggravation of some cardiovascular conditions.

Sulfur dioxides increases daily morbidity and mortality. It is well known the episodes of extreme pollution in Donora (Pennsylvania), London, and New York in the 1940s, 1950s, and 1960s[87].

Climate changes

Impact of environmental and climate changing on human body and collectivities is more present and visible involving intrinsic factors[88–90]:

- Air and water pollution (with particles, chemical substances, germs and plastic), global warming, soil erosion and sea level rise, increasing the "carbon footprint", fires, floods, devastating rains and storms/hurricanes, wars;
- Extreme heat – aggravates respiratory and cardiovascular conditions and causes drought and lack of food in multiple areas of the globe[89];
- Environmental degradation – can cause migration, civil or armed conflicts;
- Floods and water pollution – diarrheal diseases and other epidemics, severe cholera, leptospira, Legionella infections, the multiplication of some toxic algae, the decrease of normal fauna and flora[91];

- Winds cause air currents that carry allergens and pollution particles over long distances and penetrate houses causing exacerbation of asthma attacks, chronic bronchitis, epidemics of respiratory infections[92];
- Changing the environment and biocenoses leads to infections with hard-to-control germs – West Nile virus, Dengue fever, Lyme disease, hantaviruses, malaria etc.[93,94];
- Storms can have a special psychological impact and cause trauma in human collectivities.

Water pollution comes from dissolving of toxic substances (metals, chemical molecules, VOC, solvents, sludge, solved gases, germs) from farms, towns (including toilets), and industries (distillery industry, tannery, paper industry, textile and food industry, iron and steel industry, nuclear industry), commercial activities[96,97]. Polluted water is a major cause of human disease, poverty and death. World Health Organization reports around 4 million children deaths every year as a result of diarrhea caused by water-borne infection[98].

Smoking is widely recognized as a major cause of morbidity and mortality. Smoking (in active mode, second-hand and third-hand passive smoking) is worldwide spread and contributes to indoor and outdoor pollution and many diseases, despide the effort made by the anti-smoking campaings. Third-hand smoking, or ultra-passive smoking represents the air pollution linked to particles of tobacco that remain in the air or are deposited on the surrounding objects once the cigarette is finished. Although all the damages caused by smoking are known, in many countries the phenomenon is not limited or even out of control. Tobacco smoke is a mixture of 90% gas and 10% particles that are bound to aerosol particles or are free in the gas phase. They include over 7000 different compounds from which a significant part are toxic, allergenic, irritative or are carcinogenic[99]. In 2021, 11.5% of U.S. adults (an estimated 28.3 mil. people) smoked cigarettes[100]. The same study showed that active smoking and second-hand smoking, represents the second-largest risk factor for death and disability globally, responsible for 8.3 mil. deaths in 2017, nearly three times that of outdoor air pollution[100].

Respiratory effects of smoking are:

COPD and emphysema

Smoking (active or passive) remains one of the most important risk factors for COPD worldwide. Cigarette smokers have a higher chance in developing respiratory symptoms, with lung functional changes, a higher rate in FEV1 decline with age, with higher COPD mortality compared to non-smokers[101–104]. Children exposure to maternal smoking leads to a significant reduction in lung development. In utero, the fetus exposure to tobacco also contributes to an important reduction of postnatal lung function[101]. Long-therm smoking leads to chronic inflamation of the respiratory system. The inflamation has multiple components: neutrofils, macrofages, lymphocytes infiltration, epithelial cilia inhibition and decreased mucocilliary clearance and elastic tissue decomposition, squamous metaplasia of the epithelium (risk for lung cancer), mucus glands hyperplasia and fibrosis with thickening of the bronchial mucosa and obstruction[105–107].

Nonatopic asthma and exacerbation

Smoking has a crucial role in the determination of nonatopic asthma but also in the exacerbation of all forms of asthma (symptoms are more severe and lung function decreases faster and more)[108,109]. Smoking favors the appearance of the asthmatic – overlap asthma – COPD phenotype which is more full of symptoms, reversibility is lower, more exacerbations and has evolution towards remodeling (structural changes in the bronchial wall)[110].

Irritative effect on respiratory mucous membranes causing: laryngitis, conjunctivitis, and on nasal mucosa (+ passive smoking) increases the risk of respiratory infections including tuberculosis.

Lung cancer. Smoking causes about 20% of all cancers and about 30% of all cancer deaths in the United States[111]. Smoking can cause directly cancer almost anywhere in the human body by the multiple carcinogens included in the burning cigarette (N – nitrosamines, nicotine, polycyclic aromatic hydrocarbons, VOC including aldehydes, aromatic amines, heterocyclic amines, additives, heavy metals, etc).

Numerous representative studies have shown the link between active smoking, passive and third-hand smoking alone or combined with indoor and outdoor pollution, and the etiopathogenesis of cancers[19,39,49, 99,102,103,105,107,111–114]. The most affected organs are the lungs, but other locations for cancer were demontrated: oral cavity, larynx and pharinx, esophagus, kidney, liver, bladder, pancreas, stomach, colon, rectum or myeloid leukemia[116].

Smoking and other dysorder in oral cavity – periodontitis and dental cavities[117].

Obstructive sleep apnea by inflammation of the superior airways and increase in colapsibility[118].

Cardiovascular disorder produced by smoking are severe and frequent: atherosclerosis and its manifestations (ischemic heart disease – angina pectoris, miocardial infarction, heart failure, cardiac arrest, arrhythmias, ischemia and cerebral infarction, peripheral ischemia of a limb or visceral arteries (renovascular HT, mesenteric ischemia, aneurysmal dilatations, blood hypertension and its complications)[7,53,119,120].

Smoking correlates with the severity of subclinical global cerebral atrophy[121]. Smoking accelerates cognitive decline in the elderly without dementia. To pregnant women , smoking could produce intrauterine growth retardation, spontaneous abortions, ectopic pregnancy, bleeding during pregnancy and 25–50% higher mortality rate than on non-smokers, premature birth, sudden infant deaths and even malformation keiloschisis, palatoschisis[122].

In addition to the destructive effect on people's health, smoking (tobacco or e-cigarettes) affects the environment by polluting the air, soil, water with dangerous chemicals, metal residues, pesticides or nicotine.

Several organic substances present in cigarette litter contribute to environmental pollution and pose risks to ecosystems.

Nicotine and other compounts present in the cigarettes and e-cigarettes, such as Polyciclic Aromatic Hidrocarbons (PAHs), cellulose acetate decomposition, heavy metals, microplastics, additives and residues are known carcinogens and can persist in the environment, disrupting the balance of ecosystems and harm organisms at various trophic levels. While not organic, microplastics can have detrimental effects on aquatic life and may enter the food chain when ingested by marine organisms[123,124,1,134,129].

The cumulative effect of these organic compounds from cigarette litter is a complex and multifaceted environmental public issue, also with great impact on public health. It highlights the importance of proper disposal practices and anti-tabacco public awareness campaigns.

Cigarette discarding, as studies suggest, became the second most important litter after food wrappers[125,126].

E-cigarette compounds are also great pollution factors through the plastic and chemical waste they produce. A number of 321.4 million units of e-cigarettes were sold in 2022 and a huge amount of e-waste was generated globally (53.6 metric tons)[127,129]. U.S. collected 894,700 littered e-cigarettes discarded througout the roads and waters[130]. Degradability of filter materials is very long (at least 9 month)[131]. At the same time batteries bring another source of waste – lithium-ion found in e-cigarettes.

Another concern is represented by the deforestation that promotes soil degradation and global warming (5% of all deforestation, with 600 million trees being cut and used every year by the tobacco industry)[132–134].

Some of the methods to reduce air pollution are[1,4,5,11,137–142]:

- Compliance with the WHO Global air quality guidelines;
- Antipollution standardized protocols worldwide with yearly updates;
- Concerted action of the Ministry of the Environment together with medical societies from different specialties in Romania for a correct evaluation/supervision of the harmful effects caused by pollution as well as for compliance with WHO international air quality standards;
- Fighting against smoking or tobacco use in every form;
- Strong national regulations for cigarettes and e-cigarette discarding;
- New technological processes free of pollution in industry, agriculture, transport;
- Development of public transport to reduce emission from the exhausts of personal vehicles;
- Promotion of energy efficient homes and increase the green area in cities;
- The use of non-polluting means of energy (solar, wind, water, etc.) to replace fossil fuels;
- Correct waste recycling policies;
- World vaccination programs accessible in all countries;
- Development of screening policy for diseases related to pollution – cancers, COPD, asthma, cardiovascular and digestive diseases, etc.

In conclusion, air pollution reduction requires important regulatory measurements, combined with technological advacements and individual efforts. It is important to raise public awareness and develop a multidisciplinary approach including national and international organizations, medical and scientific experts for sustainable methods.

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