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REGIONAL OFFICE FOR **Europe**



NONCOMMUNICABLE DISEASES AND **AIR POLLUTION**

WHO EUROPEAN HIGH-LEVEL CONFERENCE ON NONCOMMUNICABLE DISEASES

Time to Deliver: meeting NCD targets to achieve
Sustainable Development Goals in Europe
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➔ ABSTRACT

Air pollution is the second leading cause of deaths from noncommunicable diseases (NCDs), after tobacco-smoking. In 2018, the third United Nations high-level meeting on NCDs recognized household and outdoor air pollution as a risk factor for NCDs, alongside unhealthy diets, tobacco-smoking, harmful use of alcohol and physical inactivity. More than 550 000 deaths in the WHO European Region in 2016 were attributable to the joint effects of household and ambient air pollution. The main NCDs associated with air pollution include ischaemic heart disease, stroke, chronic obstructive pulmonary disease and lung cancer. Substantial epidemiological evidence links air pollution with diverse health outcomes, with extensive research conducted to advance understanding of the underlying mechanistic pathways. Among the complex mixture of air pollutants, particulate matter is of prime public health concern. Interventions to reduce exposure to air pollution and improve air quality have huge potential in protecting health and contributing to reducing the burden of NCDs. Creating healthier environments for reducing NCDs can result in multiple co-benefits for health, climate change and the environment.

➔ KEYWORDS

AIR POLLUTION
NONCOMMUNICABLE DISEASES
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STROKE
CHRONIC OBSTRUCTIVE PULMONARY DISEASE
LUNG CANCER
COMMUNITY-LEVEL INTERVENTIONS

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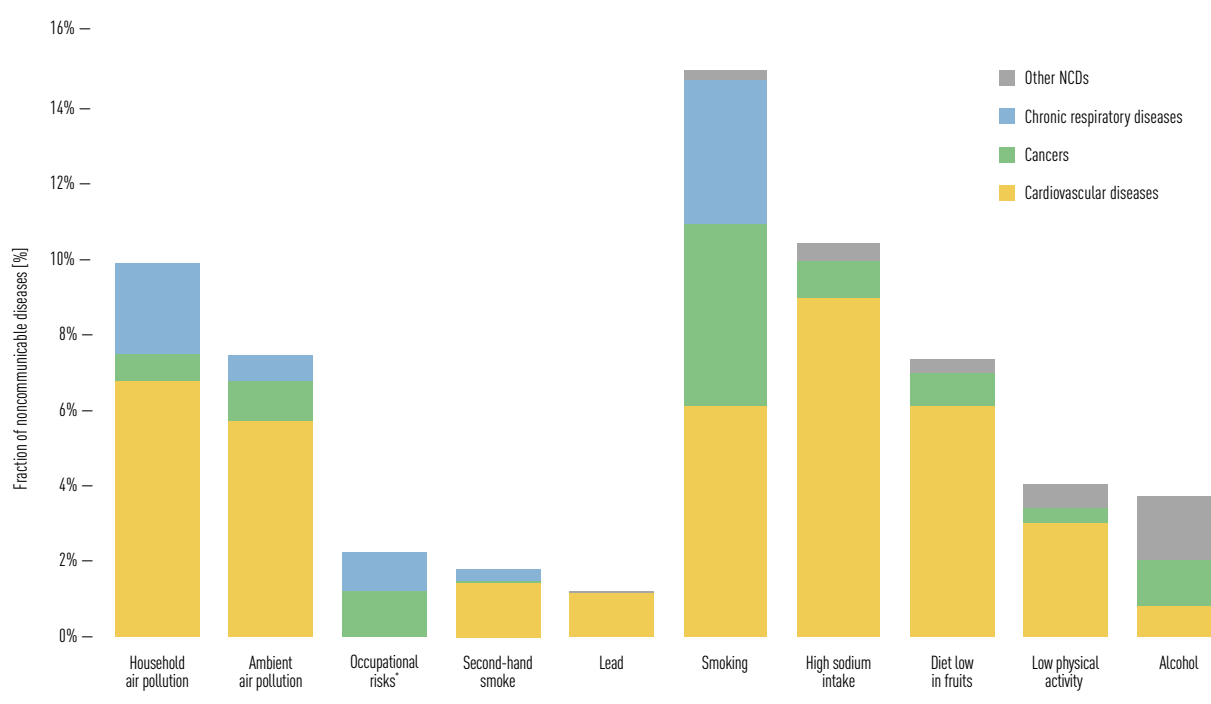
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→ THE ESTIMATED BURDEN OF DISEASE DUE TO AMBIENT AND HOUSEHOLD AIR POLLUTION

Air pollution is the second leading cause of deaths from noncommunicable diseases (NCDs) after tobacco-smoking (Fig. 1). In 2018, household and outdoor air pollution was recognized as one of the risk factor for NCDs, alongside unhealthy diets, tobacco-smoking, harmful use of alcohol, and physical inactivity (1).

Fig. 1. Fraction of NCDs deaths attributable to selected risk factors



Note: * Selected occupational risks, including exposure to carcinogens, asthmagens, airborne particulate matter, gases and fumes, noise, ergonomic factors and injuries.

Sources: WHO (2), air pollution: for 2012; other risks: for 2015

Globally, household and ambient air pollution causes 7 million premature deaths each year, including more than 5 million due to NCD (data for 2016) (3). More than 550 000 deaths in the WHO European Region were attributable to the joint effects of household and ambient air pollution in 2016, with over 500 000 being due to ambient air pollution and more than 50 000 to household air pollution (4–6).

The main NCDs associated with air pollution include ischaemic heart disease (IHD), stroke, chronic obstructive pulmonary disease (COPD) and lung cancer. Based on data from 2012, globally, 2.8 and 3.7 million NCD deaths were due to ambient and household air pollution, respectively. Ambient and household air pollution caused, respectively, nearly 480 000 and 120 000 NCD deaths in the WHO European Region from IHD, stroke, COPD and lung cancer (2) (Table 1).

Table 1. Deaths from main NCDs attributable to environmental risks in 2012

Disease and their risk factors	Africa	Americas	Eastern Mediterranean	Europe	South-East Asia	Western Pacific	World ^c
Ischaemic heart disease							
Household air pollution ^a	96 000	30 000	51 000	56 000	495 000	366 000	1 095 000
Ambient air pollution ^b	51 000	73 000	91 000	263 000	304 000	297 000	1 079 000
Second-hand tobacco smoke	16 000	27 000	54 000	64 000	113 000	110 000	384 000
Lead	9 000	30 000	44 000	56 000	67 000	32 000	239 000
Stroke							
Household air pollution	162 000	27 000	49 000	43 000	498 000	679 000	1 458 000
Ambient air pollution	75 000	37 000	65 000	139 000	273 000	494 000	1 083 000
Second-hand tobacco smoke	9 000	7 000	14 000	18 000	48 000	78 000	175 000
Lead	9 000	13 000	21 000	28 000	47 000	38 000	155 000
Lung cancer							
Household air pollution	4 000	6 000	3 000	10 000	53 000	195 000	271 000
Ambient air pollution	4 000	20 000	10 000	69 000	47 000	251 000	402 000
Second-hand tobacco smoke	1 000	1 000	1 000	2 000	3 000	21 000	28 000
Occupational risks	11 000	62 000	15 000	85 000	42 000	230 000	445 000
Residential radon	3 000	8 000	3 000	26 000	9 000	15 000	64 000
COPD							
Household air pollution	30 000	11 000	25 000	8 000	493 000	339 000	906 000
Ambient air pollution	4 000	3 000	9 000	7 000	126 000	93 000	242 000
Second-hand tobacco smoke	3 000	4 000	5 000	4 000	53 000	44 000	113 000
Occupational risks	16 000	23 000	14 000	12 000	181 000	108 000	353 000

Notes: ^a From cooking with polluting fuels; ^b Outdoor air pollution; ^c Row totals may not add up due to rounding.

Source: WHO (2).

→ THE CONTRIBUTION OF AIR POLLUTION TO NCDs – IHD, STROKE, LUNG CANCER AND COPD

Worldwide, 24% of cases of stroke, 25% of IHD, 28% of lung cancer and 43% of COPD were attributable to ambient and household air pollution in 2016, and evidence on additional NCDs is emerging (7). In the WHO European Region, 15% of IHD, 14% of stroke, 19% of lung cancer and 6% of COPD were attributable to ambient and household air pollution in 2012 (Table 2).

Table 2. Fraction of main NCD deaths attributable to environmental risks by region in 2012

Disease and their risk factors	Africa	Americas	Eastern Mediterranean	Europe	South-East Asia	Western Pacific	World
Ischaemic heart disease							
Household air pollution ^a	31%	4%	10%	3%	31%	20%	15%
Ambient air pollution ^b	16%	9%	18%	12%	19%	16%	15%
Second-hand tobacco smoke	4%	2%	7%	3%	5%	6%	4%
Lead	2%	3%	6%	2%	3%	2%	3%
Stroke							
Household air pollution	37%	6%	15%	3%	35%	25%	22%
Ambient air pollution	17%	8%	20%	11%	19%	18%	16%
Second-hand tobacco smoke	2%	1%	4%	2%	3%	3%	3%
Lead	2%	3%	6%	2%	3%	2%	2%
Lung cancer							
Household air pollution	25%	2%	11%	2%	37%	27%	17%
Ambient air pollution	26%	8%	36%	17%	33%	34%	25%
Second-hand tobacco smoke	1%	<1%	2%	<1%	2%	3%	2%
Occupational risks	28%	21%	30%	21%	25%	31%	26%
Residential radon	8%	3%	6%	6%	5%	2%	4%
COPD							
Household air pollution	35%	4%	25%	3%	39%	31%	29%
Ambient air pollution	5%	1%	9%	3%	10%	8%	8%
Second-hand tobacco smoke	3%	1%	5%	1%	4%	4%	4%
Occupational risks	16%	7%	12%	3%	14%	10%	11%

Notes: ^a From cooking with polluting fuels; ^b Outdoor air pollution.

Source: WHO (2).

→ THE EVIDENCE ON NCD OUTCOMES ATTRIBUTABLE TO AIR POLLUTION

Air pollution is a complex mixture of gaseous and particulate pollutants. Among those, particulate matter, ground-level ozone (O₃), nitrogen dioxide (NO₂) and sulphur dioxide (SO₂), the so-called classical air pollutants, are most extensively studied for their health impacts. Particulate matter, mainly its fine fraction (PM_{2.5}¹) is a prime public health concern. A large number of studies from Europe and elsewhere lend strong support to the wide array of mortality and morbidity outcomes associated with PM_{2.5}.

Epidemiological evidence of long-term effects is supported by large cohort studies, while short-term effects are underpinned by cumulative evidence from many multi- and single-city studies. These show consistent results from a wide range of settings, including a variety of PM mixtures, environments, personal characteristics and health systems. Newer studies provide evidence for a pathophysiological response to current ambient concentrations of PM_{2.5} and plausible biological mechanisms that link short- and long-term exposure to PM_{2.5} with mortality and morbidity, as observed in epidemiological, clinical and toxicological studies.

In addition to cardiovascular and respiratory outcomes, evidence is emerging on other effects of air pollution, such as diabetes, neurological development issues in children and neurological problems in adults (neurodevelopmental and neurodegenerative effects), among others (7,8).

Exposure to PM_{2.5} has also been linked to impaired lung function in children. Evidence is increasing for an association of ambient air pollution, including fine particles, with birth outcomes; for example, a systematic review reported significant associations between exposure to PM_{2.5} and low birth weight, preterm birth and small-for-gestational-age births (8). Exposure to air pollution in early childhood and the risk of developmental and health consequences in later life point to the need for actions to avoid early life exposures and put the prevention of the health impacts of air pollution in the context of the life-course approach.

In addition to epidemiological evidence linking PM pollution to a diversity of health outcomes, there is also extensive research that aims to determine the underlying mechanistic pathways. Mechanistic evidence indicates that PM_{2.5} is associated with oxidative stress, systemic inflammation and alteration of the cardiac electrical processes. Animal studies, complemented by experimental studies in humans (8,9), provide robust evidence of vasoconstriction and systemic proinflammatory responses. The scientific conclusions about the evidence for a causal link between PM_{2.5} and adverse health outcomes from the WHO air quality guidelines in 2005 have been confirmed and strengthened in a WHO review of evidence on health aspects of air pollution, published in 2013 (8).

Fig. 2 and 3 reproduce WHO infographics highlighting the threats of air pollution on children's health and the risks associated with outdoor and household air pollution.

1 PM_{2.5} – particulate matter with an aerodynamic diameter smaller than 2.5 µm.

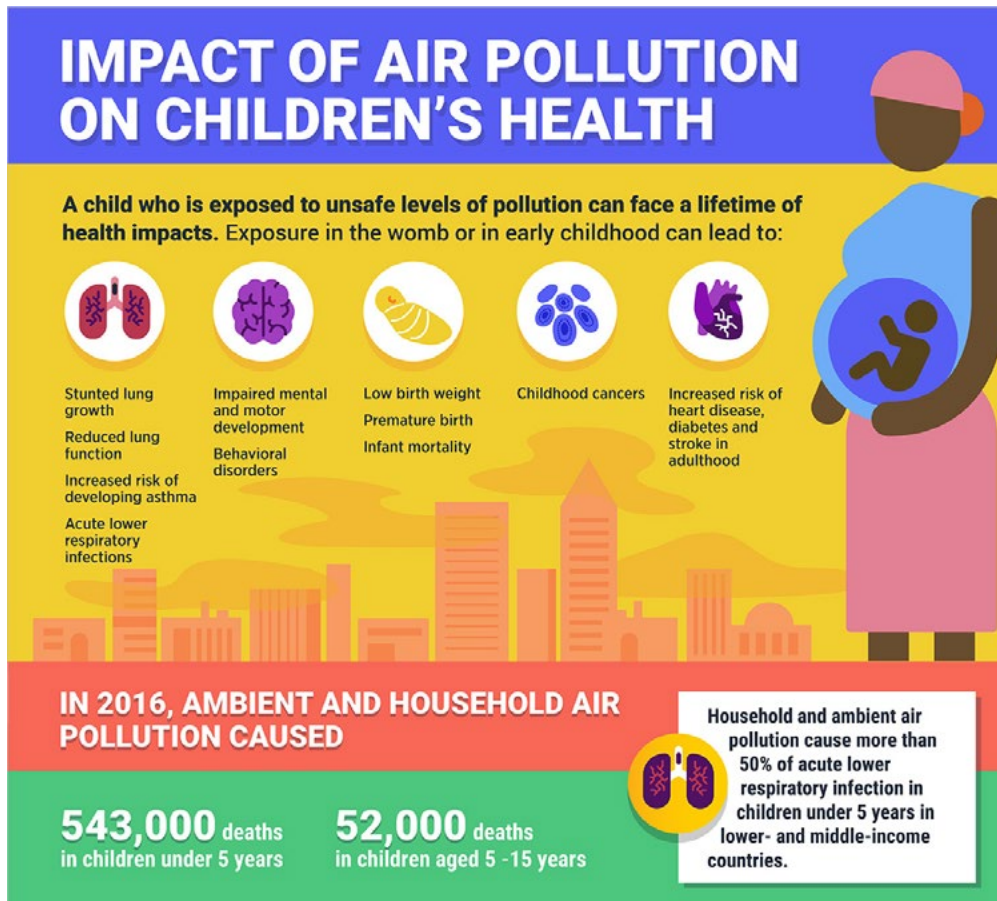


Fig. 2. WHO infographic – impact of air pollution on children's health

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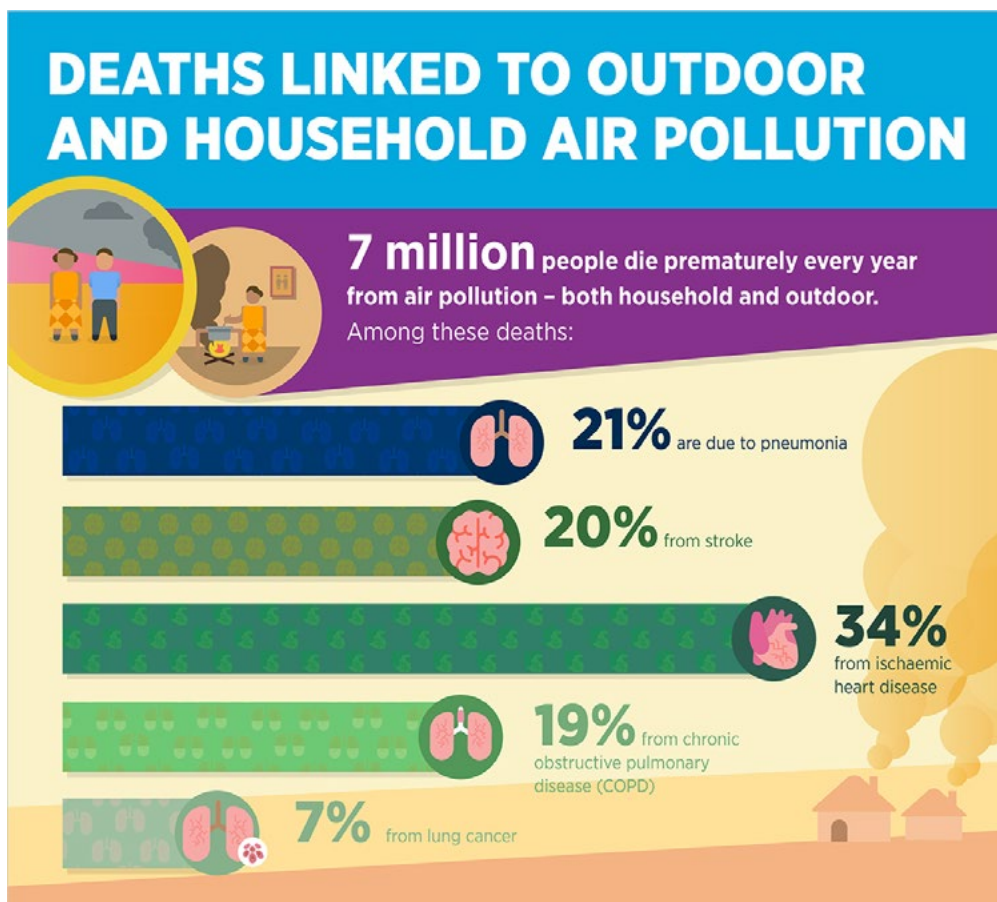


Fig. 3. WHO infographic – deaths linked to outdoor and household air pollution

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→ INTERVENTIONS TO REDUCE AIR POLLUTION AND THE BURDEN OF NCDs

Given the body of evidence on the health effects of air pollution and the magnitude of the public health impact of this environmental risk factor, interventions to reduce exposure to air pollution and improve air quality have huge potential to protect health. They require multidisciplinary and multisectoral approaches, and multilevel governance.

Interventions to reduce exposure to air pollution and, through this, to contribute to reducing the NCD burden range from regulatory measures, through community-level interventions, to interventions directed to individuals. A wide range of interventions is available to improve ambient and household air quality and prevent disease from air pollution. Some examples shown in Table 3 target actions in different sectors and settings (10).

Table 3. Actions in different sectors and settings to combat pollution

Pollution	Actions
Ambient air pollution	<ul style="list-style-type: none"> • Develop healthy and efficient transport options, such as combining rapid transit with walking/cycling • Provide transport network space for pedestrian and cycling infrastructure • Improve land-use systems, leading to reduced travel times • Implement engineering and speed-reduction measures • Regulate and implement industrial emission controls • Select energy options, while considering health impacts and their financial implications
Household air pollution	<ul style="list-style-type: none"> • Provide access to clean fuels and technologies for all cooking, lighting and heating, as defined by WHO guidelines for indoor air quality on household fuel combustion • Avoid use of unprocessed coal and kerosene, as well as the inefficient use of solid fuels, in households • Acknowledge that the switch to clean household energy will take time; prioritize transition fuels and technologies that offer substantial health benefits • Build a larger market ecosystem for clean and modern household energy solutions through innovations in financing and business models for household consumers, stove designers and distributors • Develop health-based national performance and safety standards for household energy fuels and technologies

Community-level interventions and air quality management measures can target specific sources that contribute significantly to air pollution. Examples include change in fuels used in industry, transport and individual households, and urban planning, including green spaces and planning of roads and tracts for non-motorized transportation (such as cycling).

Interventions directed at individuals involve the implementation of established primary, secondary and tertiary interventions (such as controlling hypertension, lowering lipids, reducing obesity, promoting physical activity and smoking cessation) for diseases affected by air pollution exposure. For example, some forms of physical activity, like walking and cycling, instead of using motorized transportation, can positively affect health, as well as contributing to reducing air pollution. Fig. 4 provides some ideas for solutions in infographic form.

Creating healthier environments for reducing NCDs can result in multiple co-benefits. For example, reducing air pollution from coal-fired power plants may not only diminish health risks due to particulate matter, but also prevent mercury from entering the food chain. Many policies to combat air pollution also

mitigate climate change through actions in, for instance, the energy and transportation sectors. Less polluting vehicles, and public transportation combined with walking and cycling, can also facilitate physical activity. Lower red meat consumption can reduce NCDs directly and contribute to mitigating climate change through the reduced emissions of greenhouse gases from livestock (2,7).

Fig. 4. Solutions to air pollution



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The health sector needs to be engaged in leadership and coordination of health-related matters. It plays a crucial role in raising awareness of the health impacts of air pollution and in advocacy activities. It now needs to participate in the development of sectorial policies, in particular those linked to generating environmental risks to health, such as energy or transport. To assume this role, the health sector may need to acquire additional competencies and be supported by new governance mechanisms (7).

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