



PREVENTING NONCOMMUNICABLE DISEASES (NCDs) BY REDUCING ENVIRONMENTAL RISK FACTORS

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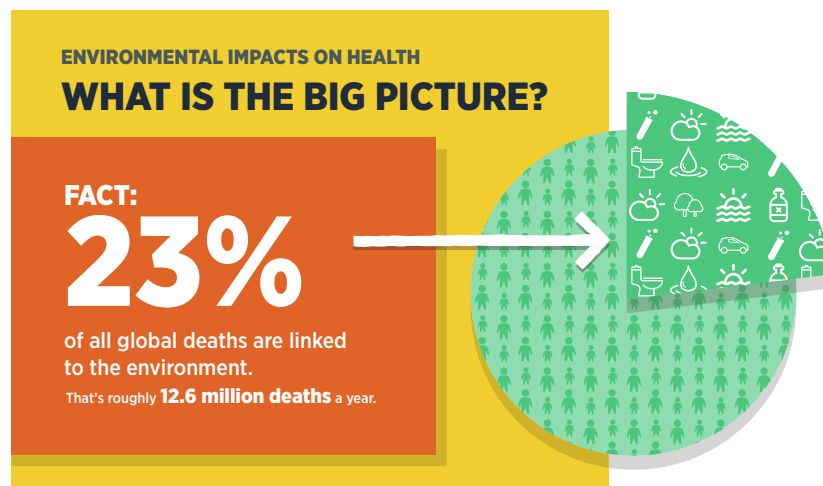
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Introduction

Common, preventable risk factors, such as physical inactivity, unhealthy diet and the harmful use of alcohol and tobacco consumption, have long been recognized risks to health. What is less well known is that environmental factors are also main causes of noncommunicable diseases (NCDs); ambient (outdoor) and household air pollution together caused more than 6 million deaths from cardiovascular diseases, chronic respiratory diseases and lung cancer in 2012. Other important environmental risks include second-hand tobacco smoke, exposure to chemicals, radiation and noise, and occupational risks.

Noncommunicable diseases are now the largest cause of death and disease worldwide, and numbers are on the rise. Ever more people require treatment, and health-care costs are growing. Achieving a healthy and sustainable environment is a key ingredient for preventing disease and enabling viable health care.





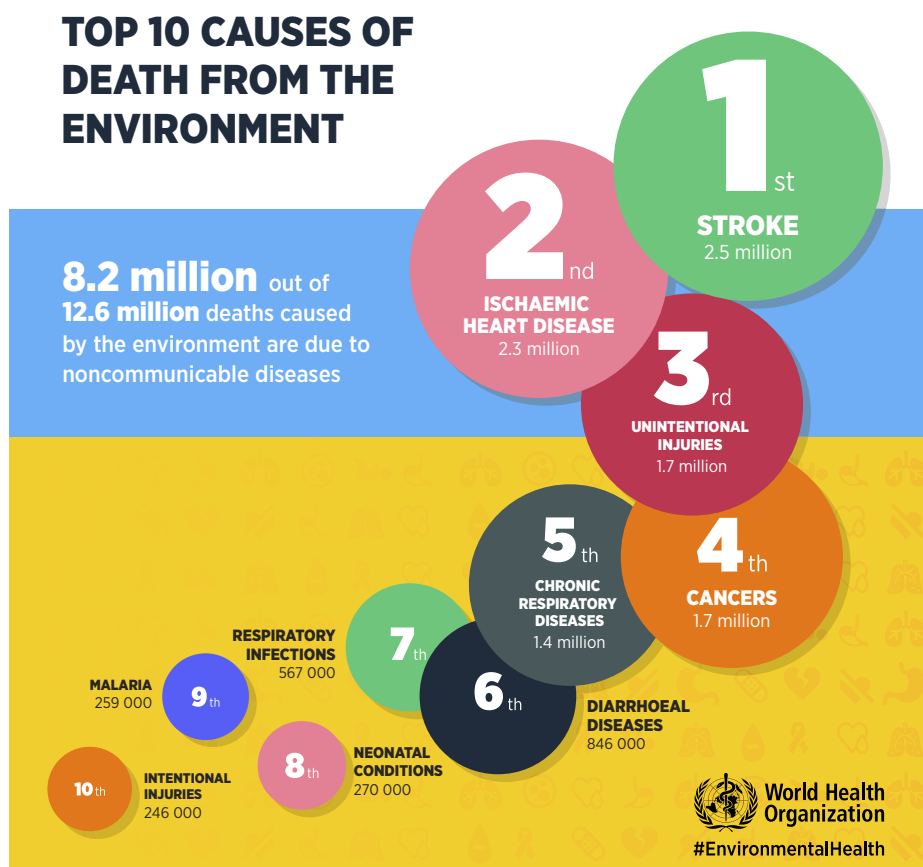
Source: Infographics (4).¹

Key messages

- Globally, **23%** of all deaths could be **prevented through healthier environments**.¹
- Nearly **two thirds** of the 12.6 million deaths caused by the environment each year are due to NCDs.¹
- **Ambient and household air pollution** caused, respectively, 2.8 and 3.7 million NCD deaths from ischaemic heart disease (IHD), stroke, chronic obstructive pulmonary disease (COPD) and lung cancer in 2012.
- Worldwide, almost one third of the **cardiovascular** disease burden is attributable to ambient and household air pollution (13% and 17% respectively), second-hand tobacco smoke (3%) and exposure to lead (2%).
- Globally, 29% of **COPD** deaths are attributable to household air pollution, 8% ambient and 11% in workplaces.
- Growing evidence indicates that **early life exposure** to environmental risks, such as chemicals and air pollutants, might increase NCD risk **throughout the life course**.
- **Strategies** on access to clean **energies**, clean and efficient **transport**, control of **industrial emissions**, the sound use of **chemicals**, and a safe **workplace** should be addressed for the prevention of cardiovascular and chronic respiratory diseases.
- **Reducing air pollution** from transport, energy generation and industrial emissions; and exposures to ionizing and UV **radiation**, and **chemicals**, such as solvents, pesticides, asbestos and formaldehyde, can prevent **lung and other cancers**. Workers in certain occupations are at particular risk.
- Healthier and safer **workplaces** could prevent around 1 million NCD deaths each year, including from COPD, pneumoconiosis, mesothelioma, lung and larynx cancers and leukaemia.

¹ Estimates based on a combination of comparative risk assessments, evidence synthesis, epidemiological calculations and expert evaluation.

Impacts from the environment on noncommunicable diseases



Source: Infographics (4).¹

Of the 12.6 million deaths caused by the environment each year, nearly two thirds are due to NCDs, which have risen sharply over the last decade.⁽¹⁾ Growing evidence indicates that early life exposure to environmental risks, such as chemicals, radiation and air pollutants, might increase NCD risk **throughout the life course**. Current estimates of the disease burden from NCDs due to environmental risks are likely to be underestimated, due to challenges in assessing associations with long lag times, multiple toxic exposures, complex pathways or difficulties in assessing exposures.⁽²⁾

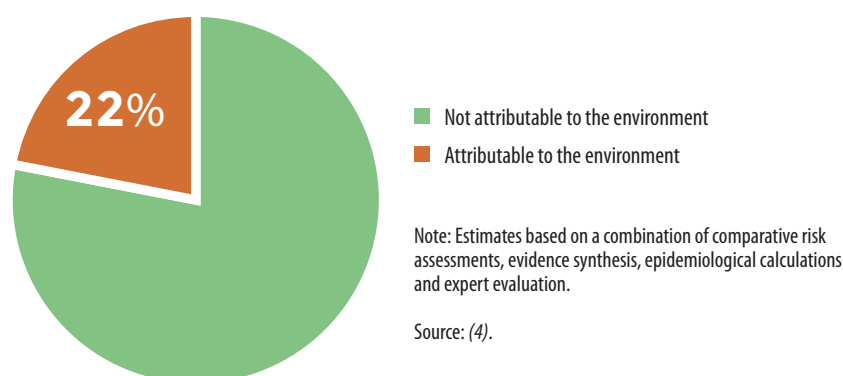
Several **environmental risks** play a key role in the **prevention of NCDs**, with ambient air pollution causing 2.8 million deaths, household air pollution 3.7 million deaths, and occupational risks more than 1 million NCD deaths per year.^(3–5) Reducing environmental health risks from conception onwards would greatly reduce the vast and growing burden of NCDs, and it would be a crucial step in progressing towards achieving both the **Sustainable Development Goals (SDGs)** and the **WHO Global Action Plan for the Prevention and Control of NCDs 2013–2020**. The impact of the environment on NCDs has been increasing since the last decade.^(1,4)

¹ Estimates based on a combination of comparative risk assessments, evidence synthesis, epidemiological calculations and expert evaluation.

CARDIOVASCULAR DISEASES

The environment is a major determinant of **ischaemic heart disease** and **stroke**: ambient air pollution and household air pollution from cooking with polluting fuels are estimated to cause 13% and 17% of cardiovascular diseases,¹ respectively.⁽⁴⁾ Around 3% of cardiovascular diseases are attributed to second-hand smoke and 2% to lead.^(3,4) Various other environmental exposures and workplace risks increase the risk of cardiovascular diseases, including arsenic in drinking-water, high noise levels, stressful working conditions and shift work.^{(6–9)²}

Figure 1. Fraction of NCD deaths attributable to the environment globally, 2012



CANCERS

Many substances are classified as human carcinogens, and they affect **numerous cancer sites**.⁽¹⁰⁾ It is estimated that between 2% and 8% of all cancers are caused by occupational exposures alone.⁽¹¹⁾ Smoking is the most important risk factor for developing **lung cancer**, causing 68% of the burden,⁽⁴⁾ however, more than 20 environmental and occupational agents are proven lung carcinogens in humans.⁽¹⁰⁾ About 25%² of lung cancer deaths are attributable to ambient air pollution, and 17% to household smoke from burning unclean fuels.⁽⁴⁾ Regarding lung cancer deaths, 26% of deaths are attributed to exposure to occupational carcinogens, and 2% to second-hand tobacco smoke.⁽³⁾ Around 4% of lung cancer deaths are attributed to exposure to radon, a natural gas which can be found in homes and workplaces.⁽³⁾

CHRONIC OBSTRUCTIVE PULMONARY DISEASE

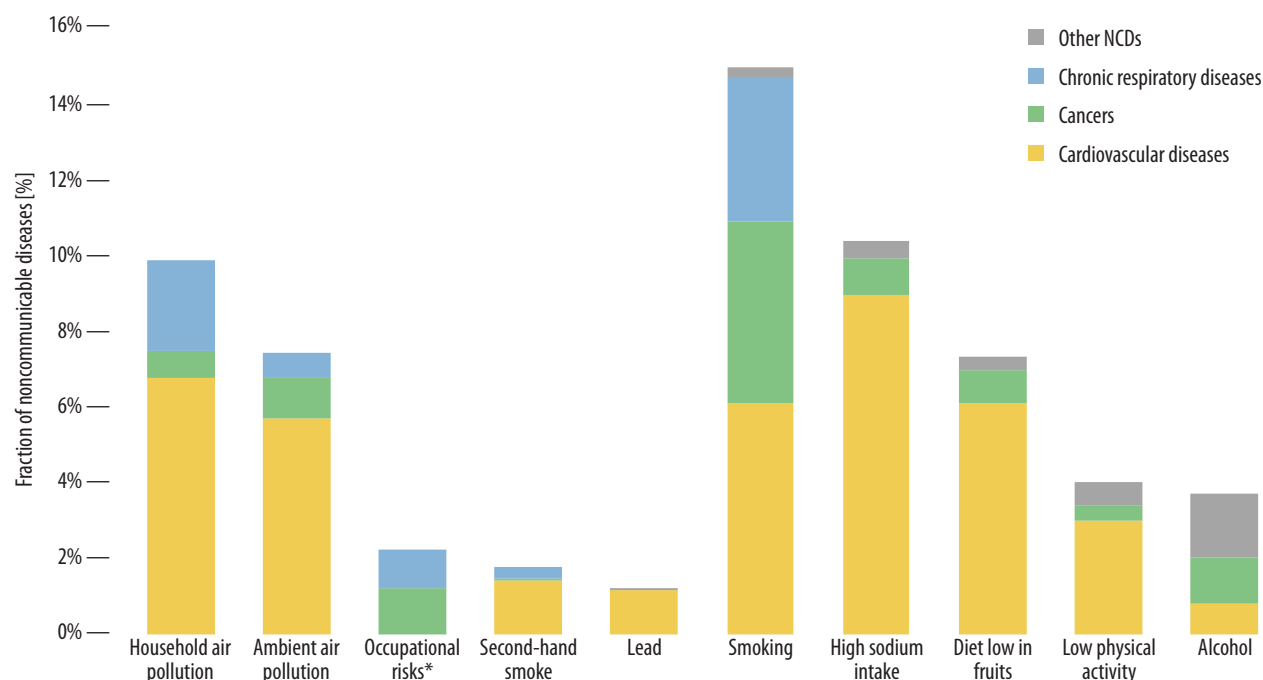
Globally, 41% of chronic obstructive pulmonary disease (**COPD**) is attributable to smoking. Air pollution is also an important cause, with 30% of COPD being attributable to household air pollution, 9% to ambient air pollution and 12% to workplace air pollution.^(3,4) Being exposed to a smoky home due to cooking or heating with unclean fuels and inefficient technologies is a particular risk for COPD. Many occupations are of high risk for COPD, such as coal and hard-rock mining, construction work and the manufacture of concrete, plastics, textiles, rubber, leather and food products. Antenatal or early life exposure to second-hand tobacco smoke and air pollution can induce reduced lung function and a predisposition for pulmonary disease.^{(2)³}

¹ Kerosene used for lighting, and polluting fuels used for heating are additional sources of indoor air pollution which have not yet been included in these estimates.

² Attributable fractions are not directly additive and their sum can exceed 100%, as NCDs are multifactorial and cases could be prevented by removing several exposures.

³ The percentages given for cardiovascular diseases, cancers and COPD relate to disability-adjusted life years (DALYs) – a measure of the burden of disease – unless “deaths” is specified.

Figure 2. Fraction of NCD 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: Air pollution: (4) for 2012; other risks: (3) for 2015.

ASTHMA

Second-hand tobacco smoke and ambient and household air pollution lead to the development of, and increased morbidity from, **asthma**. Exposure to dampness, mould, house dust mites and other allergens in homes are a cause of asthma exacerbation.⁽¹²⁾ Work-related asthma is a frequent occupational disease and can be caused by many agents, including cleaning agents, enzymes, flour, wood dust, latex and metals, which may even require job change if other measures are unsuccessful.

OTHER RELATED RISKS

The urban/built environment, in terms of transport infrastructure facilitating walking and cycling, and favourable land-use patterns, as well as working conditions, may further impact on levels of **physical activity** and **sedentary life style**. These in turn are associated with overweight, obesity, cancers and other NCDs.

Table 1. Deaths from main NCDs attributable to environmental risks by region

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: ^aFrom cooking with polluting fuels; ^bOutdoor air pollution; ^cRow totals may not add up due to rounding. Country data for NCDs attributable to the environment are available at: <http://apps.who.int/gho/data/node.main.162?lang=en>

Sources: Air pollution: (4) for 2012; other risks: (3) for 2015.

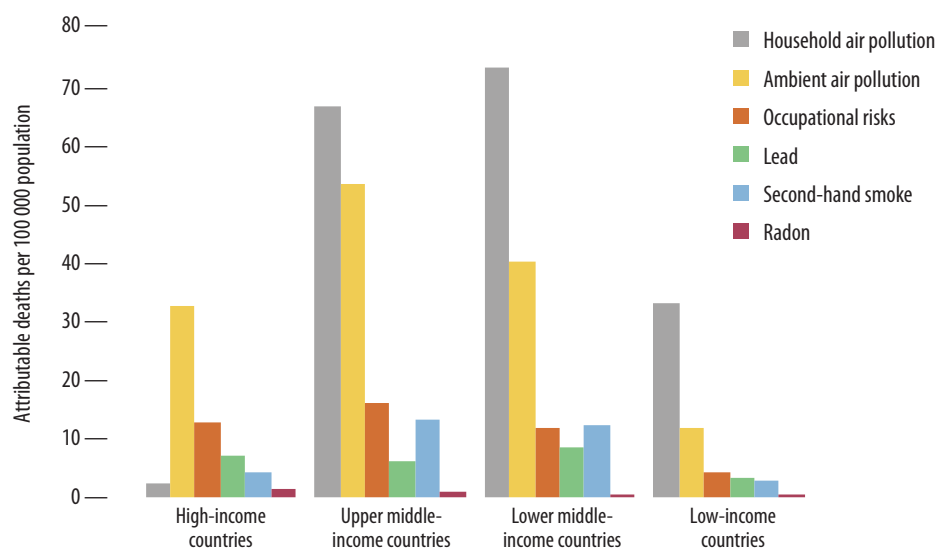
Table 2. Fraction of main NCD deaths attributable to environmental risks by region

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: ^aFrom cooking with polluting fuels; ^bOutdoor air pollution.

Sources: Air pollution: (4) for 2012; other risks: (3) for 2015.

Figure 3. NCD deaths attributable to environmental risks by income level



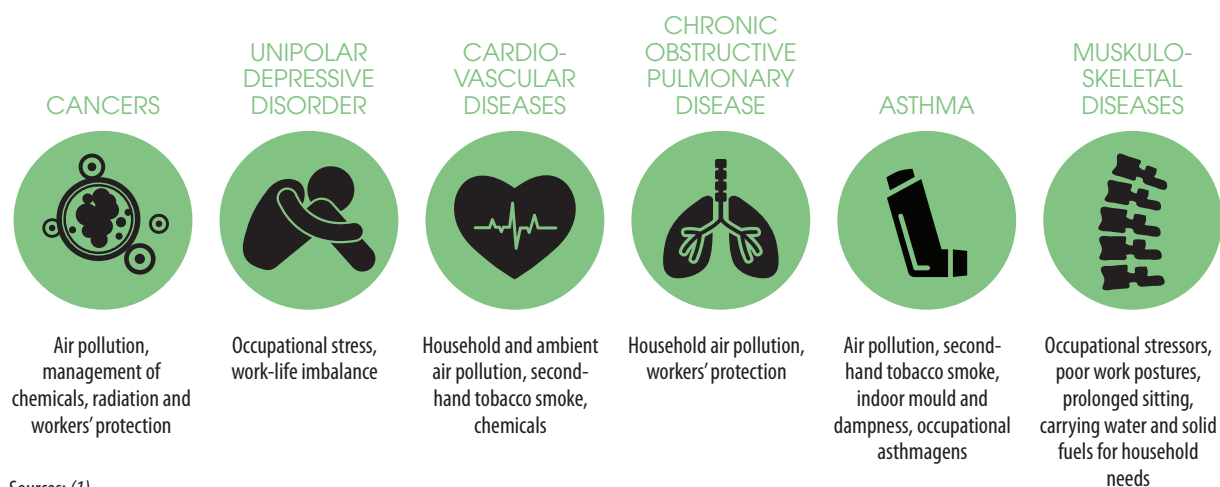
Sources: Air pollution: (4) for 2012; other risks: (3) for 2015.

Disease reduction strategies

Examples of disease reduction strategies

- During the 2008 **Beijing Olympics**, air pollution was decreased – through measures such as traffic control, shutting down highly polluting factories and retrofitting small coal-fired boilers to natural gas – and this was associated with a **decrease in cardiovascular mortality**.⁽¹³⁾
- **Compact cities** – which have a higher population density, greater public transport use, combined with walking and cycling – show significantly reduced disease rates, in particular from **cardiovascular diseases**.⁽¹⁴⁾
- The **ban on coal sales in Dublin** in 1990 triggered a **decline of 15.5% in respiratory** and **10.3% in cardiovascular deaths**, and 5.7% of total non-injury deaths.⁽¹⁵⁾
- **Lung cancer** incidence in farmers in Xuanwei, China, **decreased by more than 40%** when they switched from using smoky coal in unvented fire pits to **stoves with chimneys** in their homes.⁽¹⁶⁾
- Countries in Eastern/Central **Europe** and the United Kingdom showed a **decrease in lung cancer** (odds ratio of **24%**) **after switching from solid to nonsolid fuels** in stoves.⁽¹⁷⁾
- Several workplace interventions for smoking cessation have been found to be effective. ⁽¹⁸⁾
- A review of 42 **workplace health promotion** programmes found a mean of **25% lower medical and absenteeism expenditures**.⁽¹⁹⁾
- Regulations to prevent **radon exposure in new homes** in the United Kingdom were found to be **cost-effective**.⁽²⁰⁾
- Remediating houses damaged by **dampness and mould** significantly decreased **asthma-related symptoms** in adults (e.g. wheezing, by 36%).⁽²¹⁾

Figure 4. Main areas of environmental action to prevent disease



Sources: (1).



Disease prevention strategies by sector

Agriculture

Occupational and consumer exposure to chemicals:

- Regulations, treaties.
- Sound management of pesticides, personal protective equipment.

Industry/commerce

Air pollution:

- Industrial emission control.
- Improved energy options.
- Indoor tobacco smoke-free regulations.

Occupational exposures to air pollutants, UV exposure, noise:

- Regulations.
- Education on protective behaviour.
- Engineering approaches to reduce exposure – ventilation, dust suppression techniques, enclosure of pollution sources etc.
- Removal from sources of pollutant or other relevant exposures.
- Workers' personal protection.

Exposure to industrial chemicals, consumer products and wastes:

- Regulations, treaties.
- Sound management of chemicals – safe storage and labelling, use of alternatives.
- Safe management of hazardous wastes, remediation of polluted sites.

Transport

Air pollution, decreased physical activity:

- Improved urban planning, improved and increased use of public transport.
- Reduction in traffic congestion.
- Replacement of older diesel vehicles, etc.

Housing/community

Household air pollution:

- Use of clean fuels.
- Strategies to reduce exposure to smoke from solid fuels – implementation of WHO indoor air quality guidelines. (22)

Access to safe drinking-water.

Low physical activity, obesity:

- Better urban planning.
- Access to sports facilities.
- School and workplace based programmes.

Exposure to allergens:

- Interventions to reduce house dust and moulds/dampness.

Exposure to radon:

- Regulations, e.g. remediation measures.

Exposure to UV:

- Community-based sun safety education.

Methods to quantify health impacts

The population attributable fraction (PAF) is the proportional reduction in death or disease that would occur if exposure to a risk were removed or maximally reduced to an alternative level. To quantify population health impacts from exposure to environmental risks a systematic literature review compiled estimates of exposure and risk estimates between the respective environmental risk and disease. The preferred source was global estimates of population impacts for selected environmental risks (comparative risk assessment) followed by estimates based on more limited epidemiological data or finally expert opinion (see (1) for details on methods). The health impacts from risk factors presented here are those that could be prevented by removing the risks. The health impacts may not be directly additive as NCDs are multifactorial and exposure-response relations may not be linear.

Diseases and the Sustainable Development Goals

Tackling NCDs through the reduction of exposure to hazardous environmental and occupational risks is essential to achieving the SDGs, notably, SDG 3 on health and, in parallel, to address SDG 7 on energy, SDG 8 on decent work and economic growth, SDG 11 on sustainable cities and SDG 12 on consumption and production and, thereby, chemicals and wastes.

Reducing the high toll of NCD deaths is an SDG target:



By 2030, reduce by one third premature mortality from noncommunicable diseases through prevention and treatment and promote mental health and well-being (Target 3.4).

Reducing exposure to key environmental risks is essential to achieving the SDGs:



By 2030, ensure universal access to affordable, reliable and modern energy services (Target 7.1).



Protect labour rights and promote safe and secure working environments for all workers, including migrant workers, in particular, women migrants, and those in precarious employment (Target 8.8).



By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities (Target 9.4).



By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management (Target 11.6).



By 2020, achieve the environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international frameworks, and significantly reduce their release to air, water and soil in order to minimize their adverse impacts on human health and the environment (Target 12.4).

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CONTACT

DEPARTMENT OF PUBLIC HEALTH, ENVIRONMENTAL
AND SOCIAL DETERMINANTS OF HEALTH
WORLD HEALTH ORGANIZATION
AVENUE APPIA 20
1211 GENEVA 27
SWITZERLAND
<http://www.who.int/phe>

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