Increasing Levels of Carbon Dioxide and Short-Lived Climate Pollutants
Rising Temperature
Rising Sea Levels
Increasing Extreme Weather Events

Demographic, Socioeconomic, Environmental, and Other Factors That Influence the Magnitude and Pattern of Risks

Geography
- Ecosystem change
- Baseline air and water quality
- Agricultural and livestock practices and policies

Warming systems
- Socioeconomic status
- Health and nutritional status
- Access to effective health care

Extreme Weather Events > Heat Stress > Air Quality > Water Quality and Quantity > Food Supply and Safety > Vector Distribution and Ecology > Social Factors

EXPOSURE PATHWAYS

EXAMPLES OF HEALTH OUTCOMES

- Injuries
- Fatalities
- Mental health effects

- Heat-related illness and death
- Exacerbations of asthma and other respiratory diseases
- Respiratory allergies
- Cardiovascular disease

- Campylobacter infection
- Cholera
- Crypthecodinium cohnii
- Harmful algal blooms
- Laptops pinosus

- Undiarrheal enteric infections
- Salmonella food poisoning and other foodborne diseases
- Mycotoxin infections

- Chikungunya
- Dengue
- Eschscholzia (various forms)
- Hand, foot, and mouth disease
- Lyssavirus infection
- Malaria
- R.I.F. (refers to)
- West Nile virus infection
- Zika virus infection

Haines & Ebi 2019
This year's historic heat wave in the Pacific Northwest broke previous records by more than 10 degrees.

Source: ERA5 reanalysis (Copernicus/ECMWF) by Geert Jan van Oldenborgh.
• Characteristics of health systems under SSPs 1, 2, and 3
  - SSP 1: Proactive; adaptively managed; frequent partnerships; interdisciplinary
  - SSP 2: Incomplete planning; new information incorporated as convenient; occasional partnerships
  - SSP 3: Reactive; failure to adapt; siloed information channels & national governance; limited partnerships
Higher concentrations of CO2 alter the nutritional quality of wheat and rice

- CO₂ promotes plant growth
- Less protein and essential micronutrients
  - Protein (~ -10%)
  - Micronutrients (~ -5%)
  - B-vitamins (on average ~ -30%)
- More carbohydrates

Modeled combination of positive and negative influences in 2050:
- Decreased growth in global availability of:
  - Protein by 19.5%
  - Iron by 14.4%
  - Zinc by 14.6%

Beach et al. 2019
Health and climate: co-benefits

Example interventions
These interventions have benefits both for health and for reducing climate change (also known as mitigation):

- Produce more renewable energy
- Improve insulation in homes
- Encourage use of lower emission vehicles
- Promote active transport
- Reduce solid fuels used for cooking
- Less food from animal sources
- Encourage locally produced fruit and veg

Reduced climate change
- Fewer fossil fuels used
- Reduced heat in urban areas
- Improved outdoor air quality
- Insulation
- Lower CO₂ levels
- More renewable energy

Indirect benefits
Reducing climate change also leads to further benefits downstream:
- Fewer deaths and injuries from extreme weather events
- Less skin cancer from UV radiation
- Reduced spread of vector-borne diseases to new areas

Health benefits
- Better mental health
- Fewer deaths from extreme heat
- Less cardiovascular disease
- Less respiratory disease
- Lower rates of cancer
- Lower rates of obesity

Designed by: Will Stahl-Timmins
Content: Nick Watts
Thanks to: Soledad Cuervas, Duncan Jarvis, John Warling

© 2016 BMJ Publishing Group Ltd.
Electricity Generation
Numbers of deaths avoided per 100,000 attributed to PM2.5 concentration in 2040, relative to current pathway

Hamilton et al. 2021
Economic benefits of avoided cases of child health outcomes attributed to U.S. Regional Greenhouse Gas Initiative by county, 2009 to 2014

Step 1: Estimate changes in SO₂ and NOₓ emissions attributable to RGGI implementation (2009-2014)

Tools/Methods: Electricity dispatch modeling and EPA emissions data for ESUs

Step 2: Estimate changes in air quality resulting from changes in emissions due to RGGI

Tools/Methods: EPA Co-Benefits Risk Assessment (COBRA) screening model

Step 3: Assess public health impacts associated with changes in air quality due to RGGI

Tools/Methods: EPA Benefits Mapping and Analysis Program (BenMAP)


- $0 - $15,000
- $15,000 - $35,000
- $35,000 - $75,000
- $75,000 - $100,000
- $100,000 - $1,000,000
- $1,000,000 - $2,165,483

Perera et al. 2020
Health co-benefits of clean energy in Wisconsin

- Wisconsin relies on externally-sourced fossil fuels for energy production
- Conversion to in-state clean energy sources:
  - Creates jobs (162,000 net)
  - Increases state GDP (5%)
  - Reduces GHG emissions (valued at $4.6b)
  - Results in substantial health co-benefits (valued at $21.1b) by reducing air pollution
Promoting bicycling as active transport in Stockholm

Fall in chronic disease cases attributable to increased physical activity among additional bicycle commuters estimated to save €562 million

Figure 2  Estimated yearly expenditure averted (in millions) in the healthcare sector due to increased physical activity, change in air pollution concentrations and risk of traffic injuries.

Kriit et al. 2019
Lancet Countdown 2021: National Adaptation Plans for Health

In 2021, 47 (52%) of 91 countries reported having national health and climate change strategies or plans in place. <25% reported high or very high levels of implementation.
Support to health from multilateral climate funds

Countries with health adaptation strategies/plans

- With health strategy/plan: 50.0%
- Without health strategy/plan: 50.0%

Funding available to support implementation

- Fully available: 91.0%
- Not fully available: 9.0%

WHO Climate and Health Survey Report: (2019)