The Environment and Health Inequalities: Problems and Solutions

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Calisia World Conference on Family Health
Warsaw, Poland
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Background
Occasional Survey

<table>
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<tr>
<th>CHD:</th>
<th>Administrators (960)</th>
<th>Professional and executive (12177)</th>
<th>Clerical (2768)</th>
<th>Other (1625)</th>
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<td>40–49 yr</td>
<td>0.0 (0)</td>
<td>1.4 (78)</td>
<td>2.3 (18)</td>
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<td>50–59 yr</td>
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<td>6.2 (84)</td>
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<td>60–64 yr</td>
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<td>7.2 (79)</td>
<td>9.4 (58)</td>
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<td>Age-adjusted SE</td>
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<td>3.6 (399)</td>
<td>4.9 (160)</td>
<td>6.6 (128)</td>
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<td>6.8 (233)</td>
<td>9.1 (198)</td>
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<td>3.7 (211)</td>
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<tr>
<td>50–59 yr</td>
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<td>9.3 (493)</td>
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<td>60–64 yr</td>
<td>5.6 (4)</td>
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<td>Age-adjusted SE</td>
<td>4.7 (41)</td>
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<td>0.7</td>
<td>0.3</td>
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Figure 2. Survival to the Age of 65 in Harlem, Bangladesh, and among U.S. Whites in 1980.
The United States: Deaths of Despair
Percent change in age-standardized mortality rate from drug use disorders between 1980 and 2014, both sexes
Morton Levin’s Attributable Risk Formula and the Concept of Disease Burden

- Estimate the Relative Risk (RR)
- Estimate the prevalence (P) of each risk factor.
- Calculate the population attributable risk (PAR)

\[ PAR = \frac{P(RR - 1)}{1 + P(RR - 1)} \]
Air Pollution: The world as it is

GBD (2017)*:

Deaths = 2,937,087.20

DALYS = 83,047,567.34

Figure 3. Global and regional distributions of population as a function of annual (2013) average ambient PM$_{2.5}$ concentration for the world’s 10 most populous countries. Plotted data reflect local smoothing of bin-width normalized distributions computed over 400 logarithmically spaced bins; equal-sized plotted areas would reflect equal populations. Dashed vertical lines indicate World Health Organization Interim Targets (IT) and the Air Quality Guideline (AOG).

*http://ghdx.healthdata.org/gbd-results-tool
BC4  This slide used to have a blue background- was there a reason for this?
Bennion, Chloe; 30.10.2017
Air Pollution: The world as it is not
The “counterfactual”

GBD:
Deaths = 0
DALYS = 0

Annual average PM$_{2.5}$ (µg m$^3$)
GBD Risk Factor Collaborators 2016; http://vizhub.healthdata.org/gbd-compare
Why do we have health inequalities?
Economic and Health Inequalities: Non-fiction and Fiction

Unequal distribution
From 1988 to 2008, income gains were greatest for people around the 50th percentile of the global distribution (point A) and among the richest 1 percent (point C). Gains were lowest among people around the 80th percentile globally (point B), most of whom are in the lower middle class of developed economies.

(real ppp income change, percent)

Source: Branko Milanovic.
Note: ppp = purchasing power parity.
Health Across the Life Course

Upstream

Down-Stream

Axis of Nested Hierarchies for Tobacco Control

α₁ AT deficiency, susceptibility to addiction
Models for Health Disparities

Pathways Model

Social and economic circumstances
Ancestry
Environment
Genetic variant

Health

Interaction Model

Ana V. Diez Roux. *Annu. Rev. Public Health* 2012;33:41-58
Trends in health inequalities in 27 European countries

Johan P. Mackenbach, José Rubio Valverde, Barbara Arntikko, Matthias Bopp, Henrik Bronnum-Hansen, Patrick Deboosere, Ramune Kalediene, Katalin Kovács, Mall Leinsalu, Pekka Martikainen, Gwenn Menvielle, Enrique Regidor, Jitka Rychtaříková, Maica Rodriguez-Sanz, Paolo Vineis, Chris White, Bogdan Wojtyniak, Yannan Hu, and Wilma J. Nusselder

Fig. 2. Trends in age-specific mortality among lowly educated men and women between ca. 1980 and ca. 2008 and after ca. 2008, by region and sex. Graphs show average percent annual change in mortality as estimated in interrupted time-series analyses (the trend for 1980–2008 is based on \( \beta_1 \); the trend after 2008 is based on \( \beta_1 \) and \( \beta_2 \); see Materials and Methods for details). Asterisks indicate statistically significant (\( P < 0.05 \)) differences between the two periods. For distinctions between Western and Eastern Europe, see SI Appendix, Table S1.

assessed health slowed in countries severely hit by the financial crisis, this affected lowly and highly educated equally. Crisis-related economic conditions were not associated with widening health inequalities. Our results show that the unfavorable trends observed in the United States are not found in Europe. There has also been no discernible short-term impact of the crisis on health inequalities at the population level. Both findings suggest that European countries have been successful in avoiding an aggravation of health inequalities.
Tobacco and Health Disparities
How Does Tobacco Cause Health Disparities?

• Targeted marketing and access
• Ties to cultural norms
• Links to education level
• Access to health care and cessation services
• Overlooked in prevention programs
• The costs of tobacco products
• The costs of tobacco-caused diseases
"Camel. He grew up to be kind."

Poland
Smoking in Poland: 1980-2014 (GBD)
Contribution of smoking to socioeconomic inequalities in mortality: a study of 14 European countries, 1990–2004

G Gregoraci,¹,² F J van Lenthe,¹ B Artnik,³ M Bopp,⁴ P Deboosere,⁵ K Kovács,⁶ C W N Looman,¹ P Martikainen,⁷ G Menvielle,⁸ F Peters,¹ B Wojtyniak,⁹ R de Gelder,¹ J P Mackenbach,¹ for the DEMETRIQ consortium

ABSTRACT

Background Smoking contributes to socioeconomic inequalities in mortality, but the extent to which this contribution has changed over time and driven widening or narrowing inequalities in total mortality remains unknown. We studied socioeconomic inequalities in smoking-attributable mortality and their contribution to inequalities in total mortality in 1990–1994 and 2000–2004 in 14 European countries.


Results In 2000–2004, smoking-attributable mortality was higher in lower socioeconomic groups in all countries among men, and in all countries except Spain, Italy and Slovenia, among women, and the contribution of smoking to socioeconomic inequalities in mortality varied between 19% and 55% among men, and between −1% and 56% among women. Since 1990–1994, absolute inequalities in smoking-attributable mortality and the contribution of smoking to inequalities in total mortality have decreased in most countries among men, but increased among women.

Conclusions In many European countries, smoking has become less important as a determinant of socioeconomic inequalities in mortality among men, but not among women. Inequalities in smoking remain one of the most important entry points for reducing inequalities in mortality.

Figure 3  Changes in absolute educational inequalities in smoking-attributable and total mortality in 14 European countries between 1990–1994 and 2000–2004, for (A) men and (B) women. SAMRs, smoking-attributable mortality rates; TMR, total mortality rates.
Adult per-capita cigarette consumption and major smoking and health events, US, 1900-2012
Framework Convention on Tobacco Control

- Required 100 signatures and 40 ratifications
- First 40 ratifications included France, Japan, India, NZ . . .
- February 28, 2005: treaty enters “force” (becomes binding on countries that have ratified the treaty)
- Now ratified by 189 nations, but not US and Indonesia
Technological Innovation=Disruption

Be Prepared
The Environment and Health Disparities
How Does the Environment Cause Health Disparities?

• Pollution exposure is not equal within communities, across countries and among nations
• Exposure inversely links to socioeconomic level
• Regulations may not protect everyone equally
• Those more exposed often have lower quality housing and health care
• Pollution reduces potential (lead)
• Costs of pollution caused poor health
Pollution is linked to an estimated nine million deaths each year worldwide—equivalent to one in six (16%) of all deaths, according to this major new report. Most of these deaths are due to non-communicable diseases caused by pollution such as heart disease, stroke, lung cancer, and chronic obstructive pulmonary disease (COPD).
Number of deaths per 100,000 people that are attributable to all forms of pollution, 2015

Global estimated deaths (millions) by pollution risk factor, 2005–15

Deaths Attributable to Environmental and Occupational Exposures, Poland vs Global, 2017

https://vizhub.healthdata.org/gbd‐compare/
Deaths from Environmental and Occupational Exposures, Poland vs Central Europe, 2017

- Ambient particulate matter
- Lead
- Occupational asbestos
- Household air pollution
- Ozone
- Occupational particulates
- Occupational silica
- Occupational injury
- Occupational arsenic
- Occupational nickel
- Occupational diesel
- Unsafe water
- Handwashing
- Occupational sulfuric acid
- Occupational PM2.5
- Occupational asthmagens
- Unsafe sanitation
- Occupational benzene
- Occupational chromium
- Occupational cadmium

Deaths per 100,000

Poland, Both sexes, All ages, 2017

Central Europe, Both sexes, All ages, 2017

https://vizhub.healthdata.org/gbd-compare/
Inequity in consumption of goods and services adds to racial–ethnic disparities in air pollution exposure

Christopher W. Tessum\textsuperscript{a}, Joshua S. Apte\textsuperscript{b}, Andrew L. Goodkind\textsuperscript{c}, Nicholas Z. Muller\textsuperscript{d}, Kimberley A. Mullins\textsuperscript{e}, David A. Paolella\textsuperscript{a}, Stephen Polasky\textsuperscript{f,g}, Nathaniel P. Springer\textsuperscript{b}, Sumil K. Thakrar\textsuperscript{i}, Julian D. Marshall\textsuperscript{a}, and Jason D. Hill\textsuperscript{li}

Fine particulate matter (PM\textsubscript{2.5}) air pollution exposure is the largest environmental health risk factor in the United States. Here, we link PM\textsubscript{2.5} exposure to the human activities responsible for PM\textsubscript{2.5} pollution. We use these results to explore “pollution inequity”: the difference between the environmental health damage caused by a racial–ethnic group and the damage that group experiences. We show that, in the United States, PM\textsubscript{2.5} exposure is disproportionately caused by consumption of goods and services mainly by the non-Hispanic white majority, but disproportionately inhaled by black and Hispanic minorities. On average, non-Hispanic whites experience a “pollution advantage“: They experience \( \sim 17\% \) less air pollution exposure than is caused by their consumption. Blacks and Hispanics on average bear a “pollution burden” of 56\% and 63\% excess exposure, respectively, relative to the exposure caused by their consumption. The total disparity is caused as much by how much people consume as by how much pollution they breathe. Differences in the types of goods and services consumed by each group are less important. PM\textsubscript{2.5} exposures declined \( \sim 50\% \) during 2002–2015 for all three racial–ethnic groups, but pollution inequity has remained high.
Fig. 2. Average PM$_{2.5}$ exposure experienced and caused by racial-ethnic groups. Total exposure to PM$_{2.5}$ caused by population-adjusted group consumption ("caused," or $C_g$) and group exposure to PM$_{2.5}$ caused by total personal consumption ("exposed," or $E_g$), stratified by racial-ethnic group. Pollution inequity is the percent difference between a group's "exposed" and "caused" bars. Each group of bars shows the (A) emitters and (B) end uses responsible for the exposure, with gray connecting lines showing relationships among emitters and end uses. Connecting lines representing $<0.04$ μg·m$^{-3}$ are not shown.
Air pollution is the “new tobacco”, the head of the World Health Organization has warned, saying the simple act of breathing is killing 7 million people a year and harming billions more.
4.2 million deaths (UI 3.7-4.8) attributable to ambient PM2.5

- 7.6% of global deaths
- 5th ranking risk factor

2.9 million deaths (UI 2.2-3.6) attributable to Household Air Pollution

- 5.1% of global deaths
- 10th ranking risk factor

Air pollution contributed to 6.6 million deaths in 2015 (UI 5.7-7.3)

- 11.6% of global mortality
- 4th leading global risk factor after diet, high BP, and tobacco
Premature deaths due to exposure to PM$_{2.5}$ (all-cause (natural) mortality) in Europe over the period 1990-2016 for various data sets of PM$_{2.5}$ concentration
A view of Zywic, where many households use coal or wood for heat. Some 19 million Poles rely on coal in winter.
Maciek Nabrdalik for The New York Times
Climate change is the biggest global health threat of the 21st century.

Executive summary

Climate change is the biggest global health threat of the 21st century. Effects of climate change on health will affect most populations in the next decades and put the lives and well-being of billions of people at increased risk. During this century, earth's average surface temperature rises are likely to exceed the safe threshold of 1°C above preindustrial average temperatures. Rises will be greater at higher latitudes, with medium-risk scenarios predicting 1.5°C rises by 2099 and 4–5°C rises in northern Canada, Greenland, and Siberia. In this report, we have outlined the major threats—both direct and indirect—to global health from climate change through changing patterns of disease, water and food insecurity, vulnerable shelter and human settlements, extreme climatic events, and population growth and migration. Although vector-borne diseases will expand their reach and spread tolls, especially among elderly people, will increase because of heatwaves, the indirect effects of climate change on water, food security, and extreme climatic events are likely to have the biggest effect on global health.

A new advocacy and public health movement is needed urgently to bring together governments, international agencies, non-governmental organizations (NGOs), communities, and academics from all disciplines to adapt to the effects of climate change on health. Any adaptation should sit alongside the need for primary mitigations, reduction in greenhouse gas emissions, and the need to increase carbon sequestration through reforestation and improved agricultural practices. The recognition by governments and electorates that climate change has enormous health implications should underlie the advocacy and political change needed to tackle both mitigation and adaptations.

Management of the health effects of climate change will require inputs from all sectors of government and civil society, collaboration between many academic disciplines, and new ways of international cooperation that have heretofore eluded us. Involvement of local communities in monitoring, discovering, advocating, and assisting with the process of adaptation will be crucial. An integrated and multidisciplinary approach to reduce the adverse health effects of climate change requires at least three levels of action. First, policies must be adopted to reduce carbon emissions and to increase carbon biosequestration, and thereby slow down global warming and eventually stabilize temperatures. Second, action should be taken on the events linking climate change to disease. Third, appropriate public health systems should be put into place to deal with adverse outcomes.

While we must resolve the key issues of reliance on fossil fuels, we should acknowledge their contribution to huge improvements in global health and development over the past 100 years. In the industrialized world and other parts of the developing world, fossil fuel energy has contributed to a doubled longevity, dramatically
Climate change, inequity & health

Emissions of greenhouse gases:

Estimated mortality from climate change:

Air Pollution and Disease

Upstream

Global
- Long-range transport
- Global governance

National
- Laws
- Enforcement
- Tax/Price

Regional
- Laws/Regulation
- Environment
- Regulations
- Source mix
- Enforcement
- Local sources
- Culture
- Environment

Local

Neighborhood
- Indoor sources
- Location
- Characteristics

Family
- House

Individual
- Lifestyle
- Susceptibility
- Time-activity

Downstream
thank you in polish

Dziękuję Ci