Hot Topic

Clinical Climate Impact Research – The Lungs as the Portal Organs, Heat and Air Polution

- From the Epidemiology to the Clinical Practice of Physicians and Patients- Closing the gap -

Workshop on Human Health, global enviromental change and transformative action: The case of health co-benefits

IASS Potsdam 12.11.2018

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Disclosures:

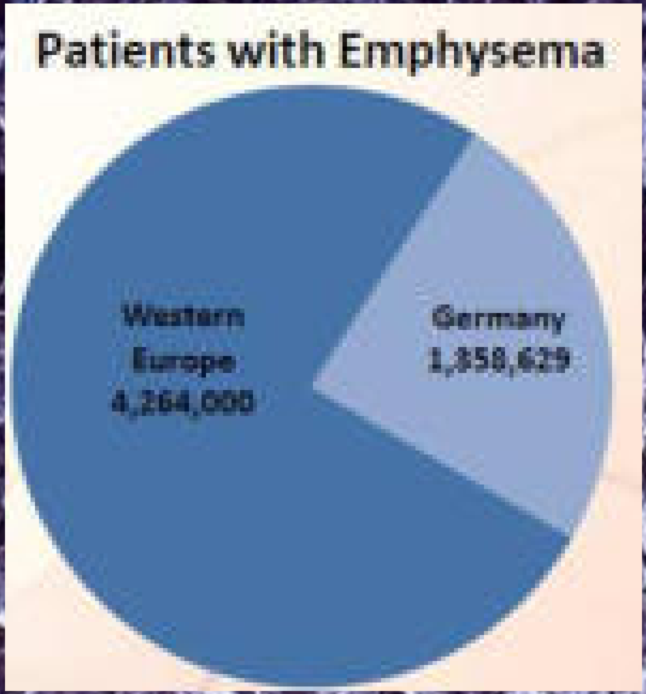
Presentations, Adboards, Education Honoraries, Suiveys,
Expert Opinion from Astra-Zeneca, GSK, MSD, BMS, Berlin-Chemie, Uptake-Medicals, BMG, DFG,BMBF

No conflicts of any interests with that

Prevalence of COPD until 2030
Germany: 82 Mio. inhabitants in 2018

COPD

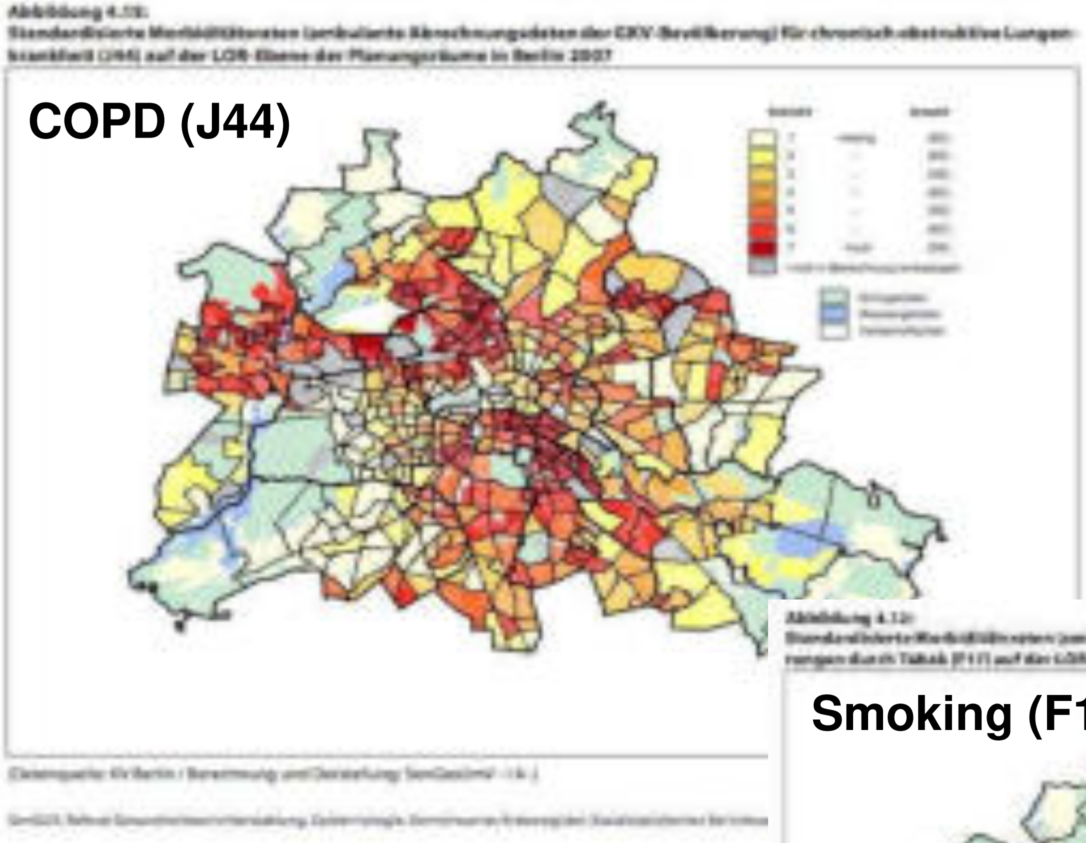
Prevalence	**5.1%**
in 2030	**8.6%**

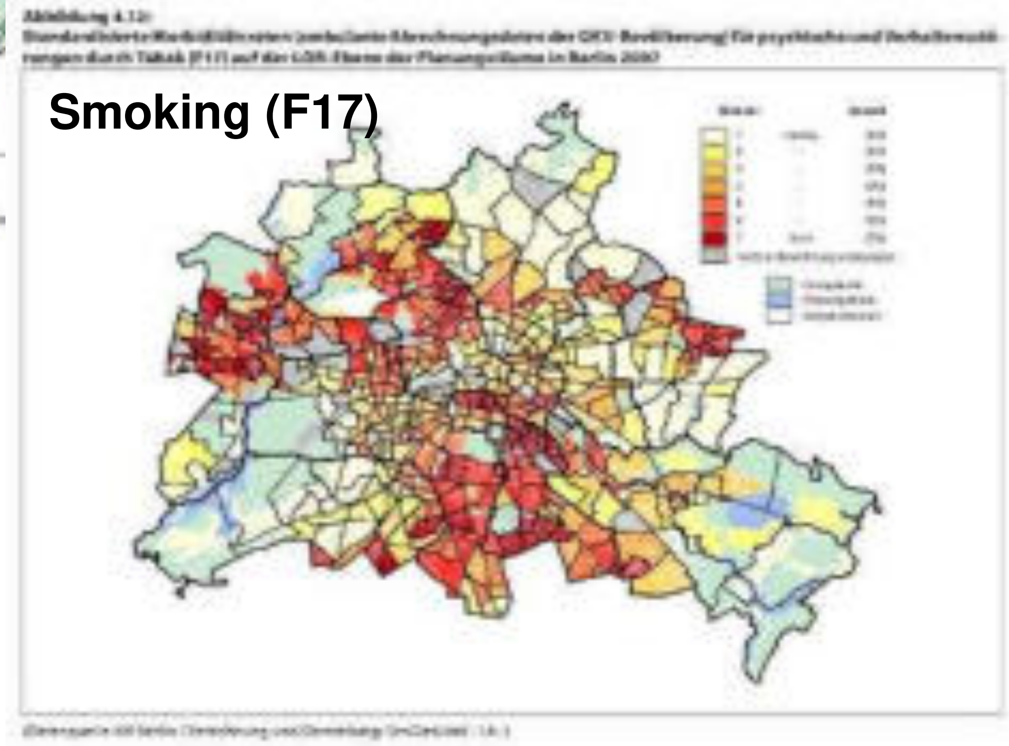


COPD III/IV

0.8 % prevalence Germany

Berlin – Germany
Social White Book



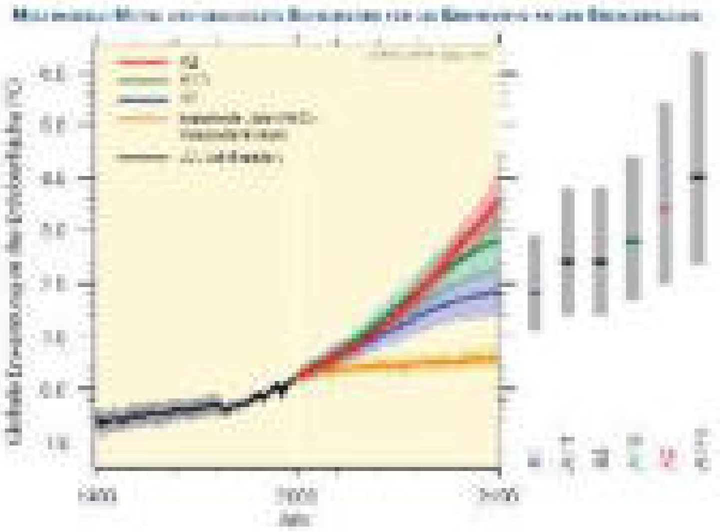


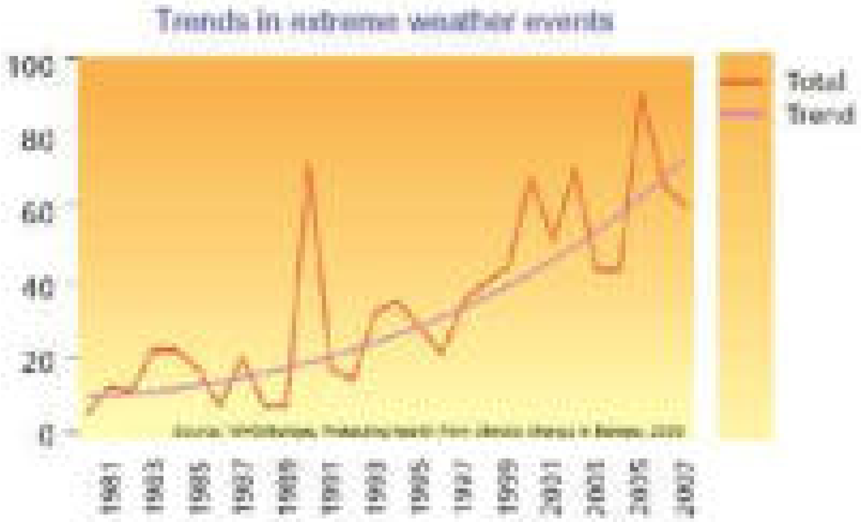
Who is the patient ? right or left ?

Vivantes

Climate Change until 2100 in Germany

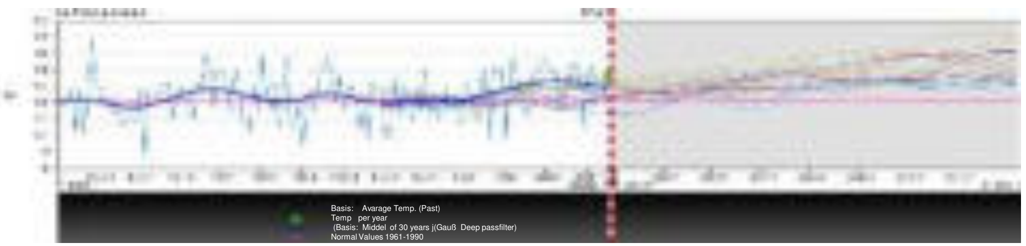
Survival - vulnerable Patients Groups in Changing enviroments





+2-3°C

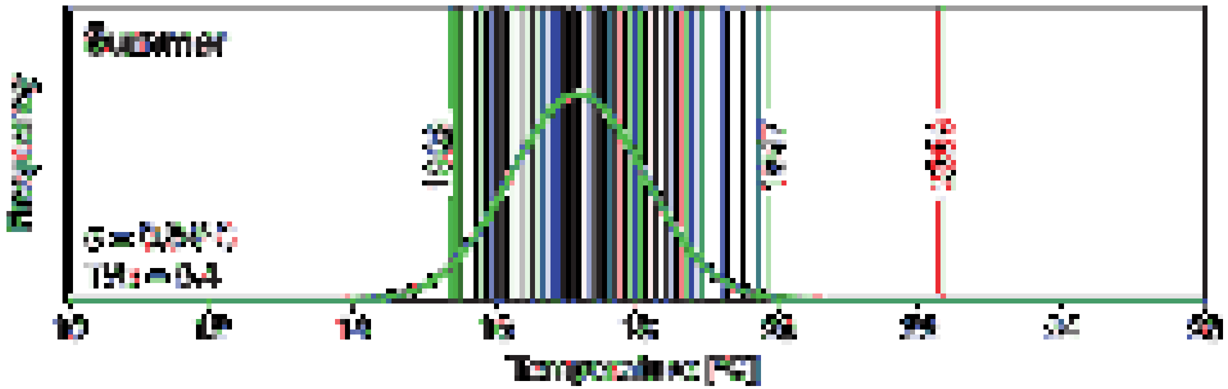
DWD



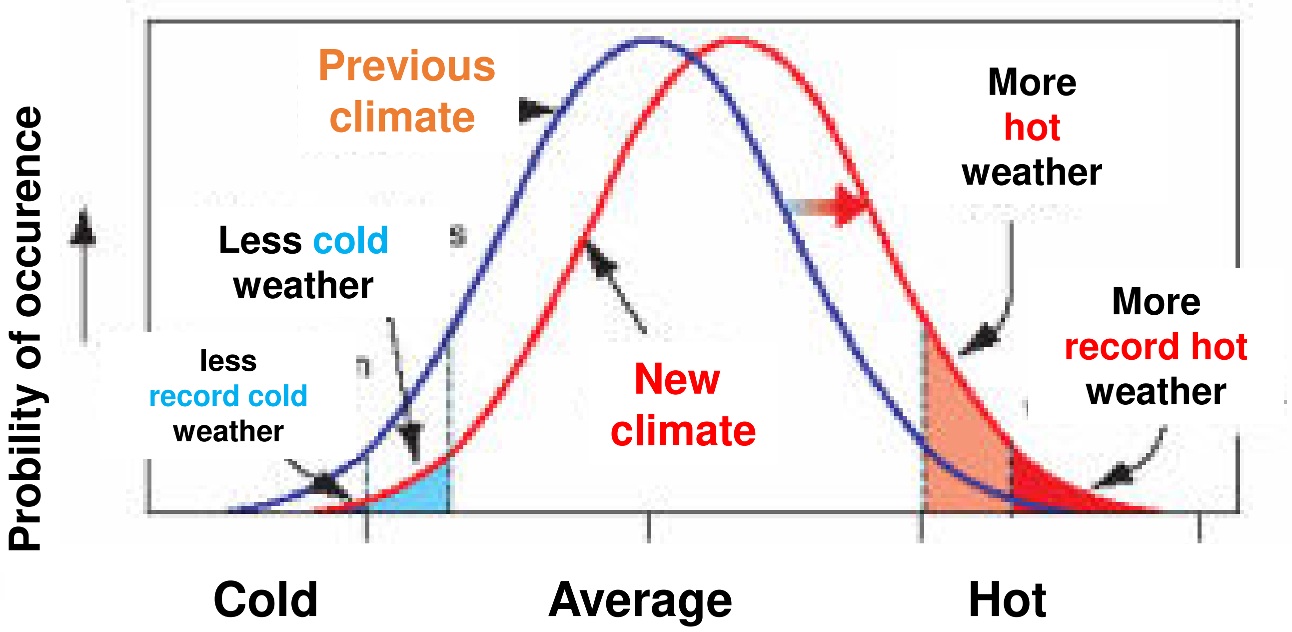
Normal temp. 1961-1990 (May)

May 2016

Climate Change - Increase of Variance - more Heat

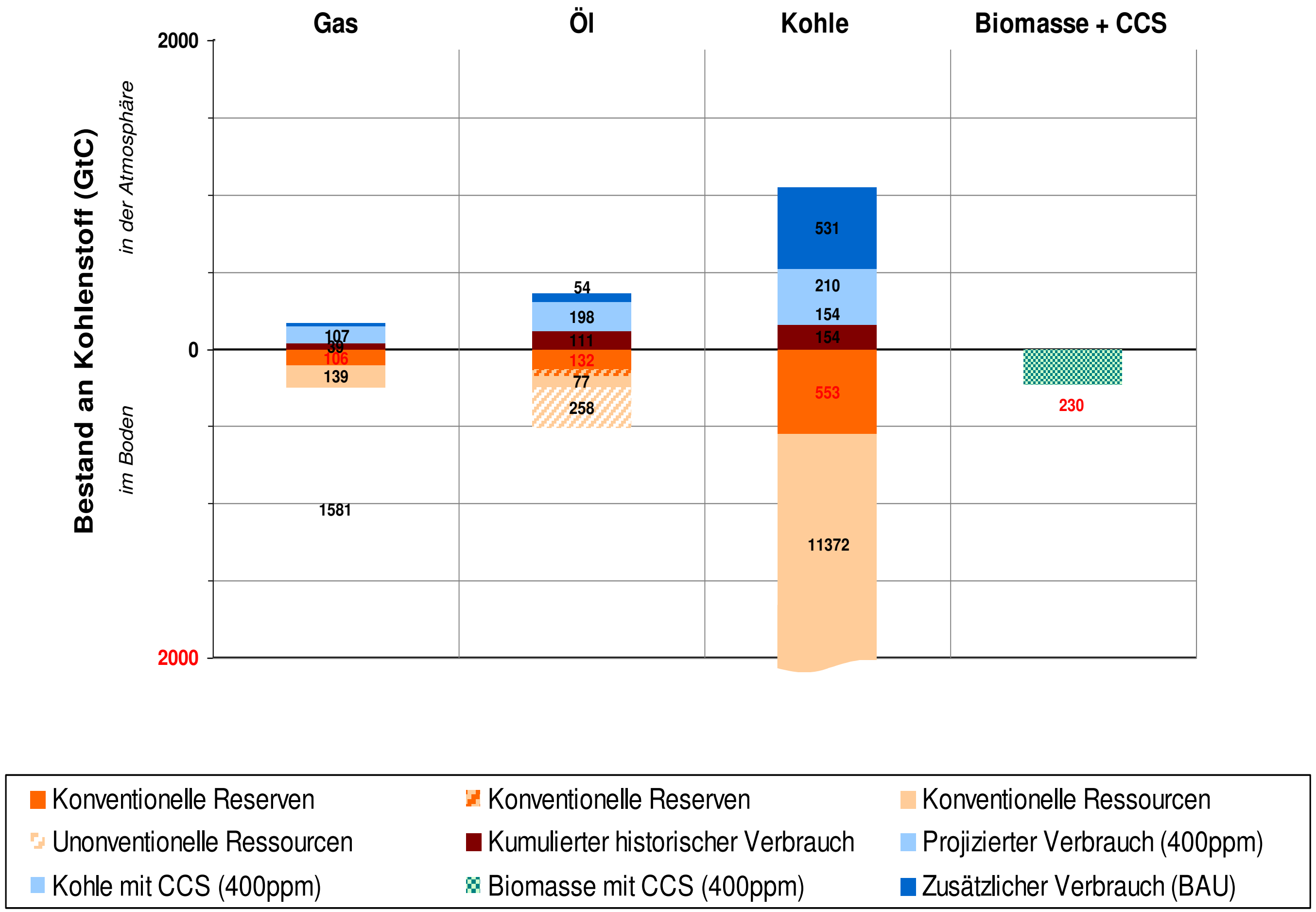


- More record hot days + nights
- More heat waves
- Fewer cold days and nights
- More rain
- More draught
- More storm surges

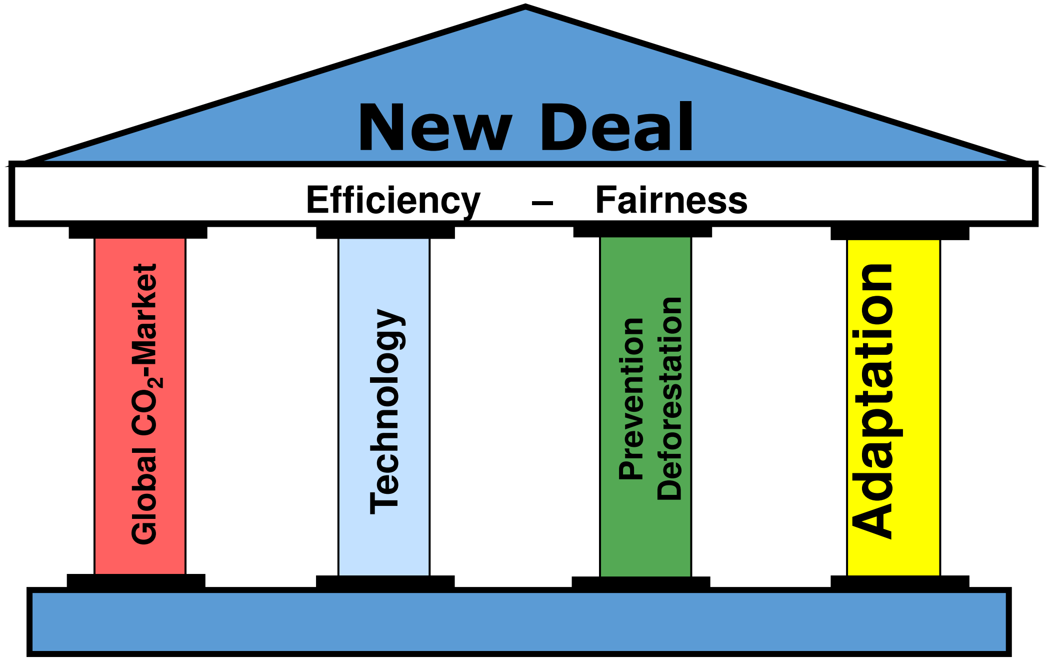


Limited Deposits – Unlimited Ressources

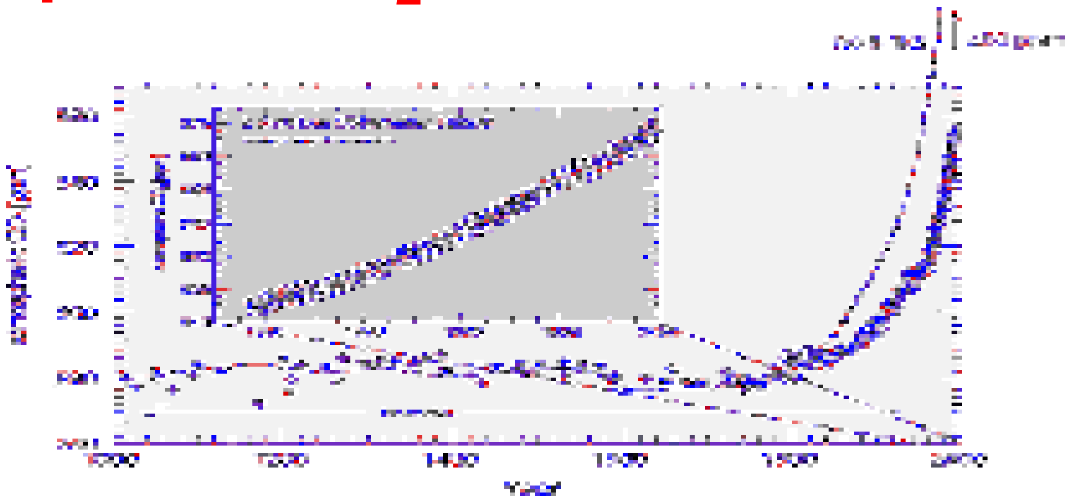
CO_2 - „Shame of the time“

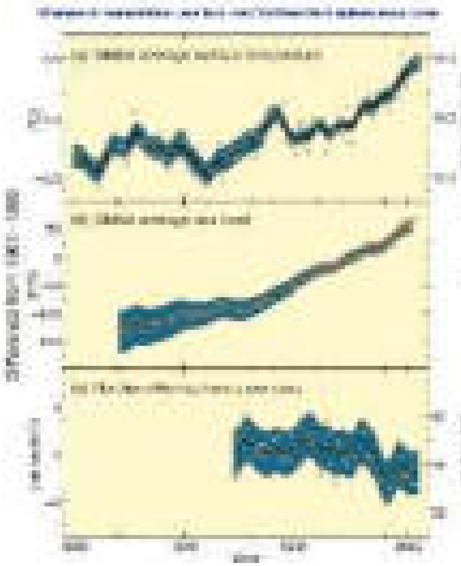


„New Deal“ for the Climate



Impacts of Atmospheric CO_2 Increase

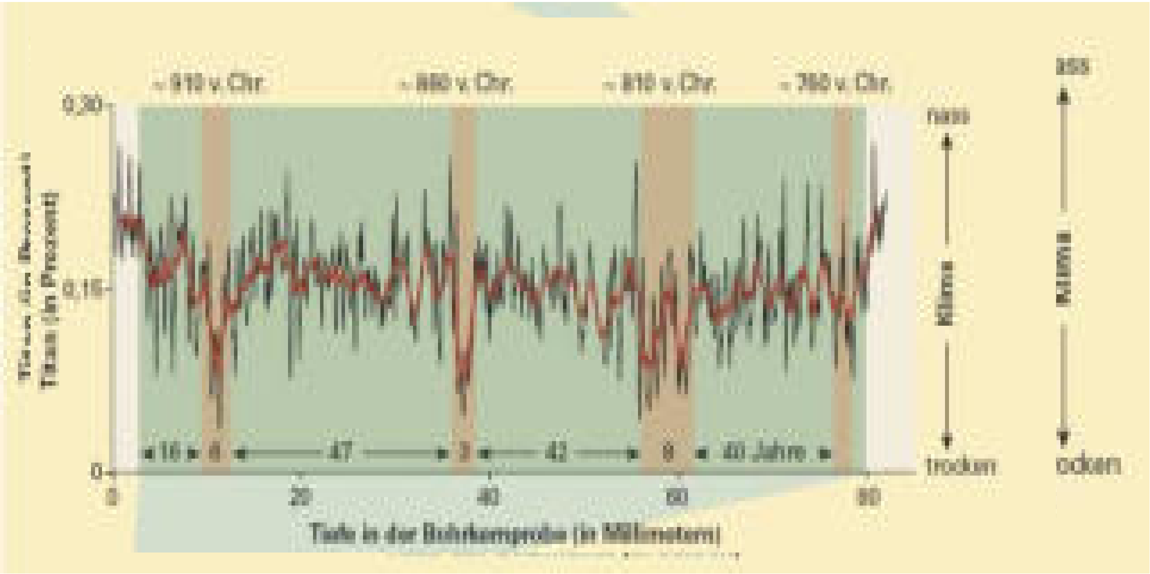




- Globe has warmed by 0.74 °C since the beginning of the 20th century.
- Europe has warmed more than the global average.
- Glaciers, snow cover, permafrost and sea ice sheets have declined, while sea level has risen.
- Projected temperature increase for Europe is 2.3-6 °C by the end of the 21st century.

Source: IPCC, Fourth assessment report, Summary for policy makers, 2007

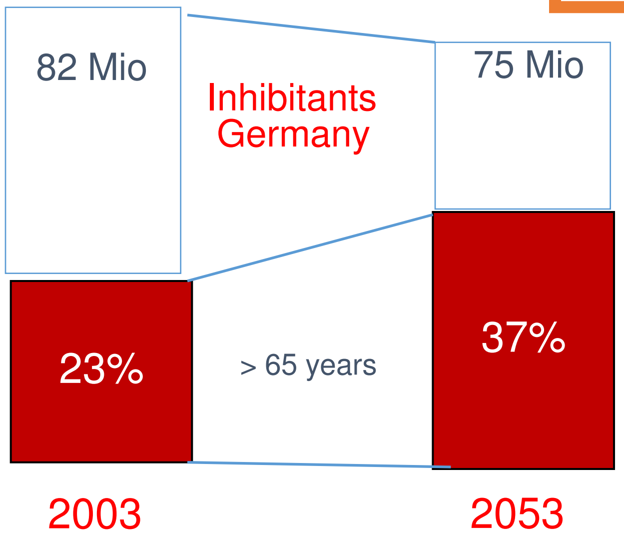
150 Years – End of the Maya-Society



Relation between archäologic Data and Climate Information from Soil probes of the Cariaco-Pelvis in Yucatan region

Water-Deficiency
Earn Deficites

Inhibitants Increase
Deforestation
Extention of land use



Hunger

Crisis- Missmanagement
Legitimation of the Elites ↓

↓

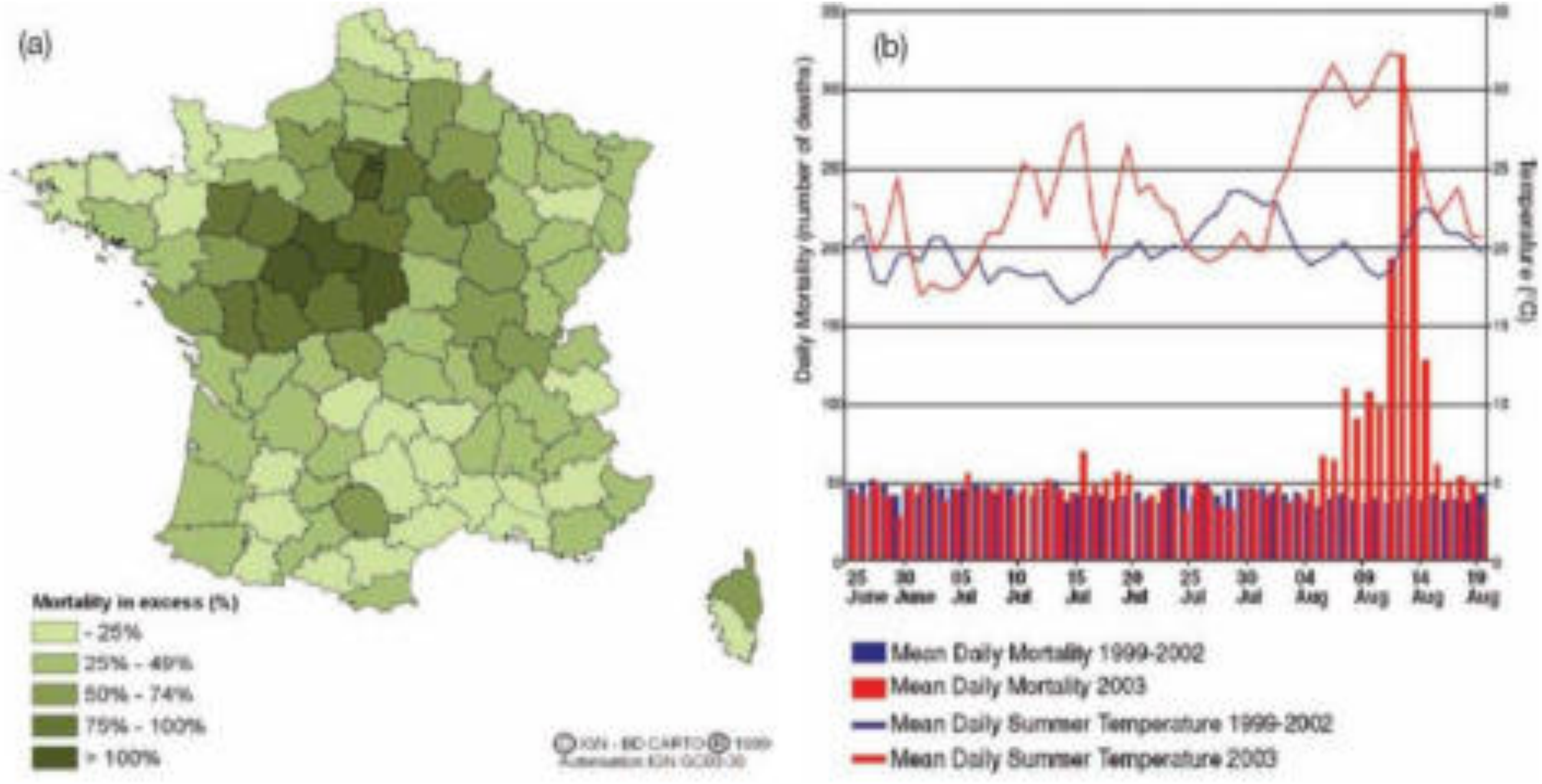
Damage of the Society
(Inhibitants decrease about 10%)

SPIEGEL ONLINE

9. September 2003:

About **20.000 Heat Deaths** in France

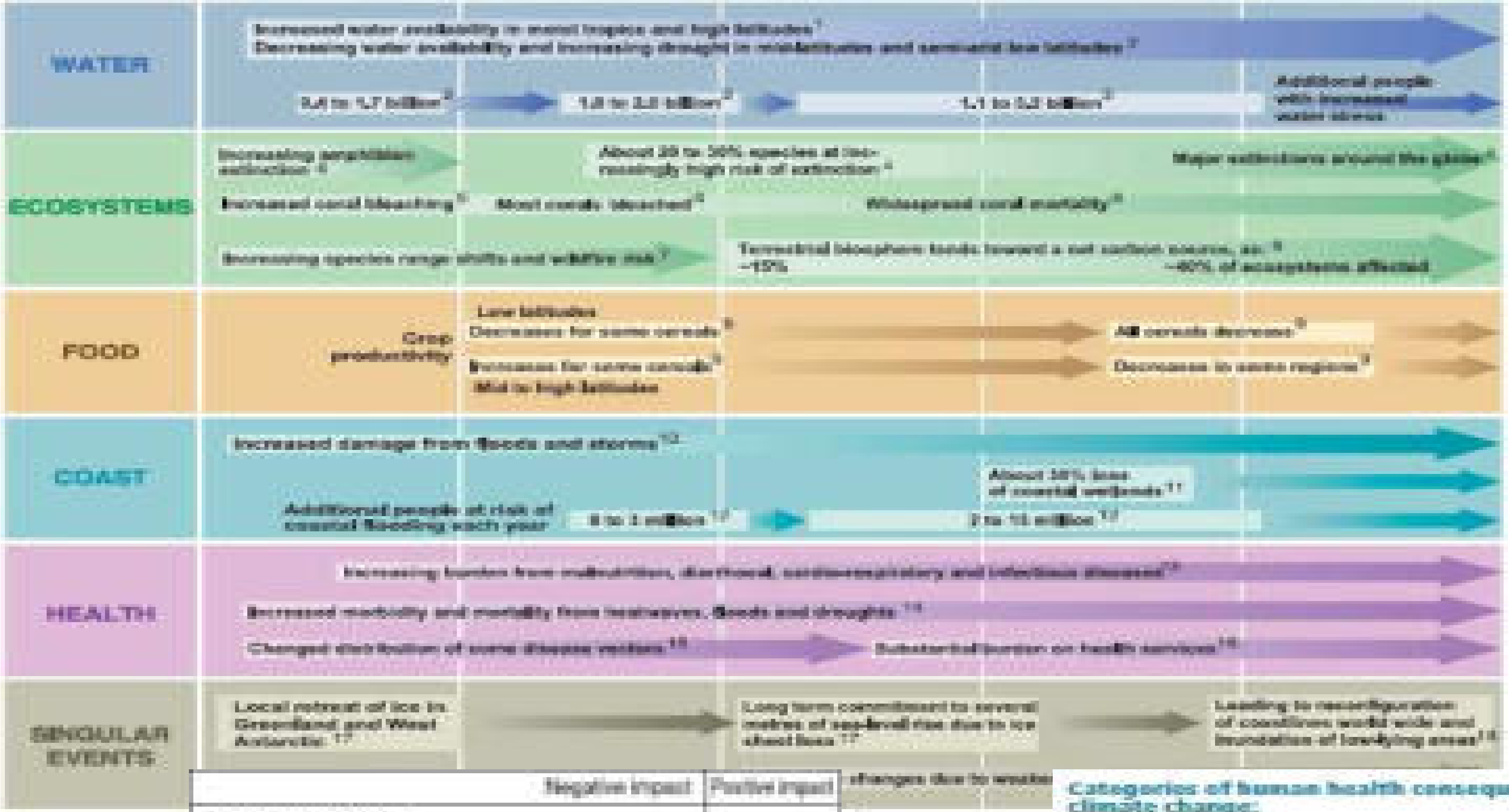
Heat wave and Mortality (Frankreich August 2003)

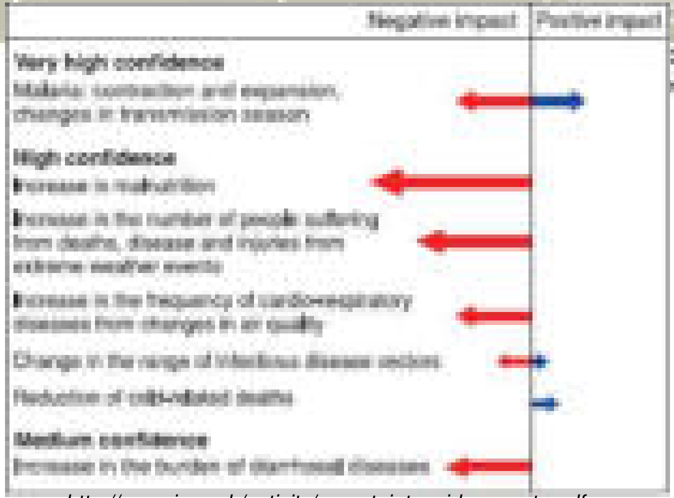


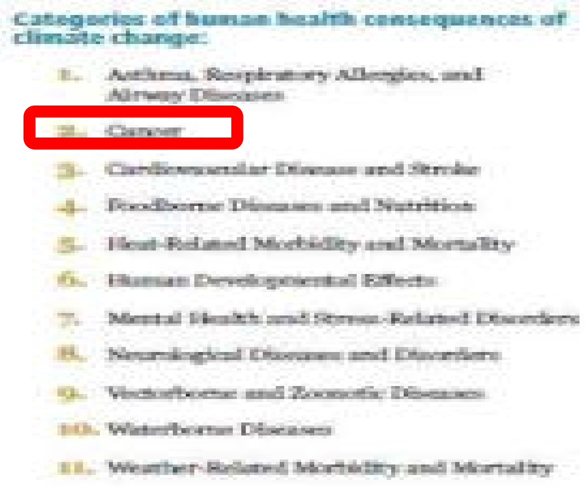
Europe: 22.000 - 45.000 Heat Deaths 2003

Rey et al. Int Arch Occup Environ Health 2007

Impact of Climate Change / Health impact IPCC 2007







NIEHS 2010

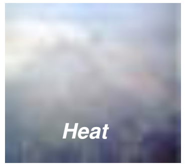
http://www.ipcc.ch/activity/uncertaintyguidancenote.pdf

Lungs/Gut - Portal Organs of Climate Change, incl. Cancerogenesis

- Lung Cancer

„Urban Lung Cancer Screening" ?

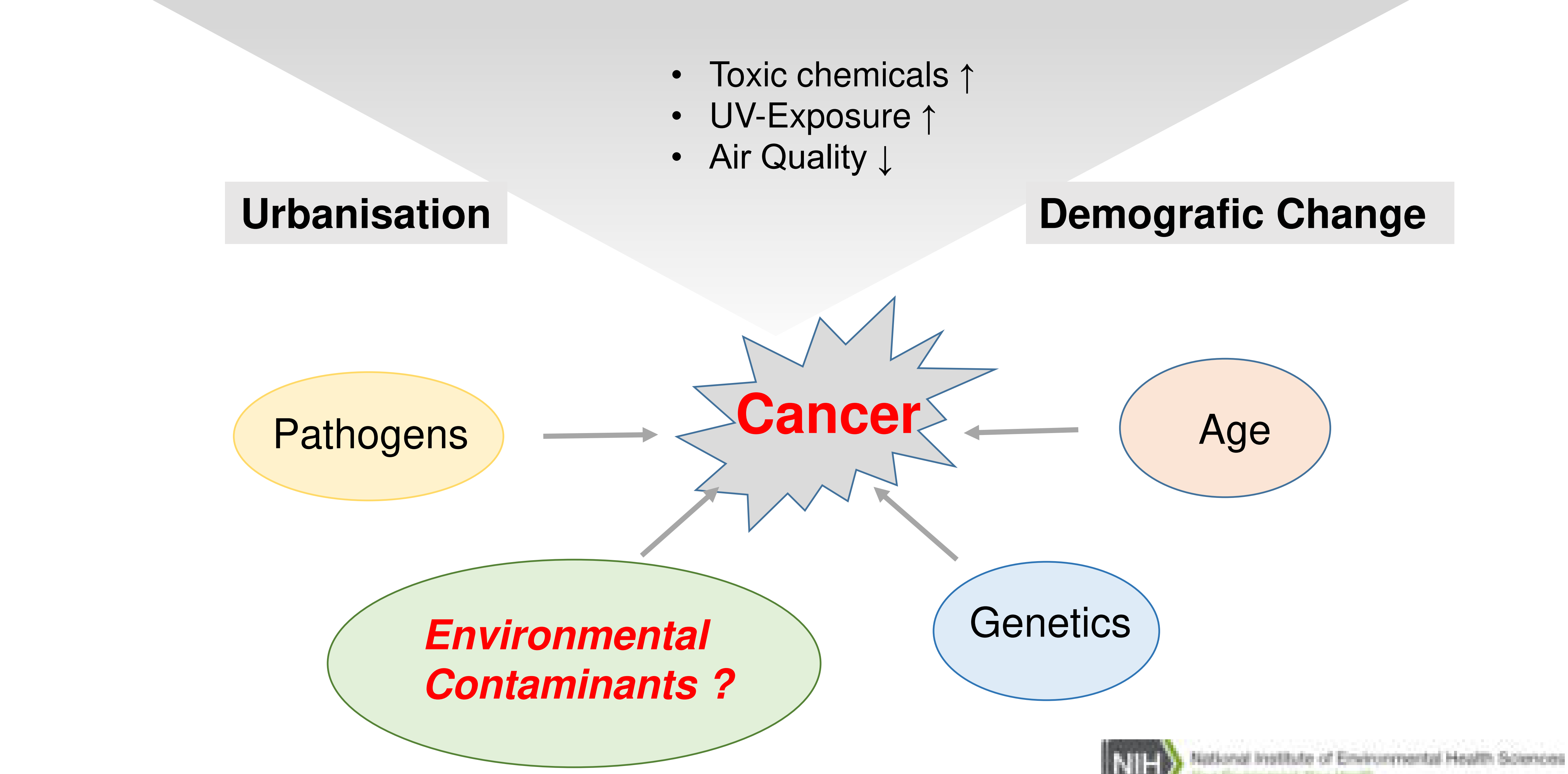
- Obstructive Lung Disease (COPD/Asthma)



- **Allergic Diseases**

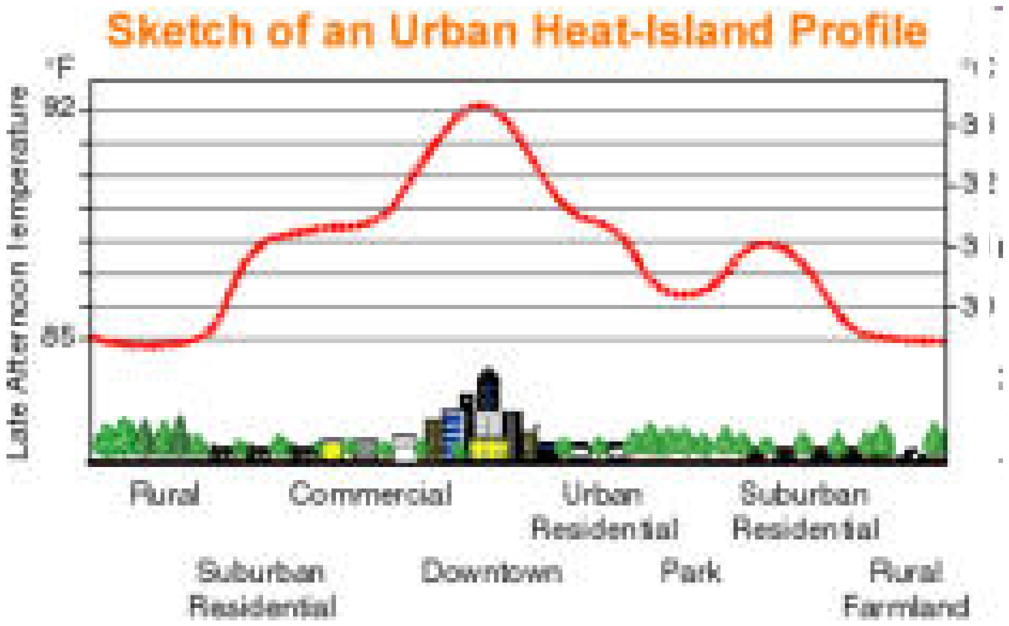
- **Infectious Diseases**

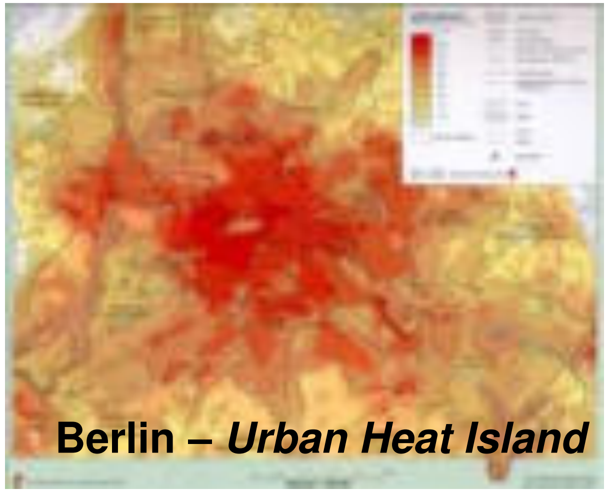
Climate Change – Future Mega Trends – Cancer

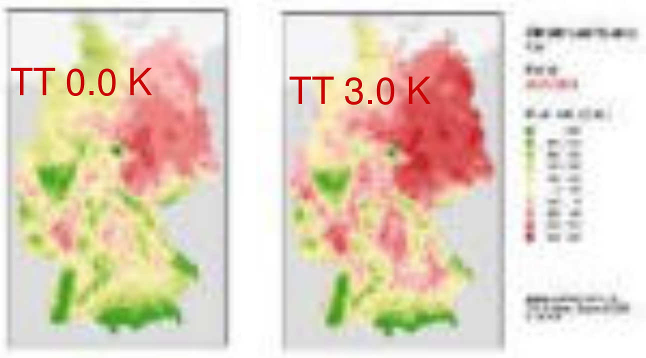


Climate and Human Health

Urban Heat Island Phenomenon and Less Rain Fall

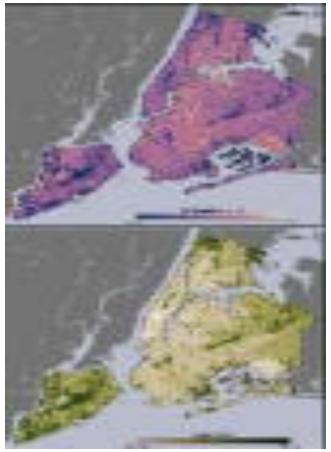


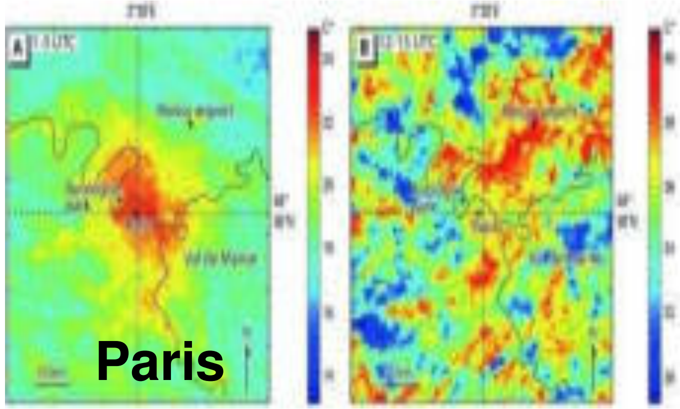




Rain Fall

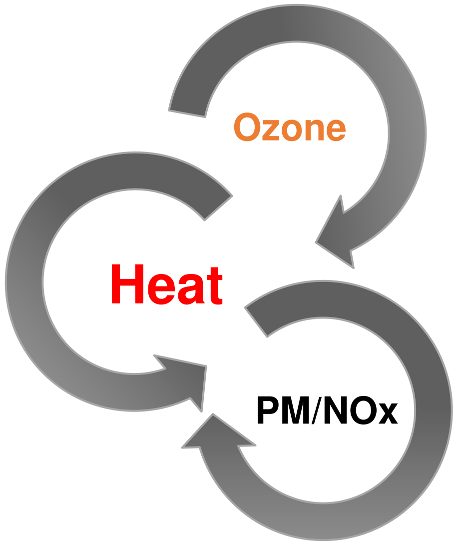
Dataset Germany, DWD, PIK
Median, Update: 03.2008
© PIK 2008





Infrared satellite data measured by NASA's Landsat 7 Enhanced Thematic Mapper Plus on August 14, 2002, one of the hottest days in New York City's summer.
Difference urban to surrounding area: 5-11 °C

Pathophysiology of Heat Stress in the Lungs



↑ Temperature
- >Worsening of air quality (NO_2)

↑ PM , ↑ Ozon
↑ Allergens

Heath Risks Lack of Concentration ↑
Morbidity ↑ Mortality ↑

- Hyperventilation
- Lung fluid loss
- Lung perfusion ↓
- ↑ Airway resistance by stimulating **c-fiber nerves**
- Lower broncho-constructive threshold
- ↑ Inflammation of bronchial musosa
- Imbalance of defence mechanisms

Categories of Climate-Change Risks to Health

Risk Category	Causal Pathway
Primary	Direct biologic consequences of heat waves, extreme weather events, and temperature-enhanced levels of urban air pollutants
Secondary	Risks mediated by changes in biophysically and ecologically based processes and systems, particularly food yields, water flows, infectious-disease vectors, and (for zoonotic diseases) intermediate-host ecology
Tertiary	More diffuse effects (e.g., mental health problems in failing farm communities, displaced groups, disadvantaged indigenous and minority ethnic groups) Consequences of tension and conflict owing to climate change–related declines in basic resources (water, food, timber, living space)

Cancer

Anthony J. McMichael, N Engl J Med 2013

UCaHS - Urban Climate and Heat Stress

in mid-latitude cities in view of climate change

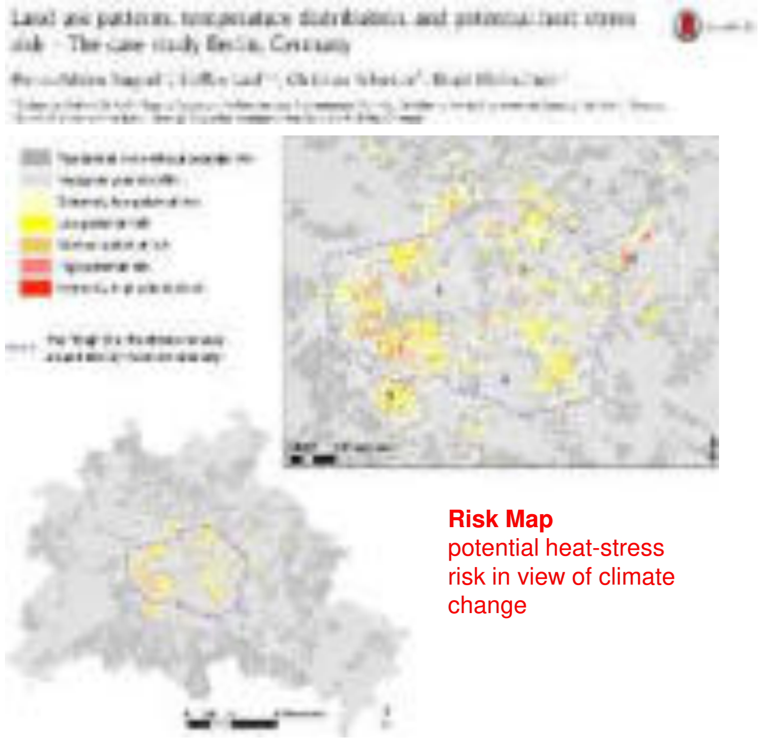
Why Berlin ?

- **not significantly influenced by oceans, mountain ranges or other geographical features**
- **Heat stress is a common phenomenon, since air conditioning of buildings is not applied.**

Goals

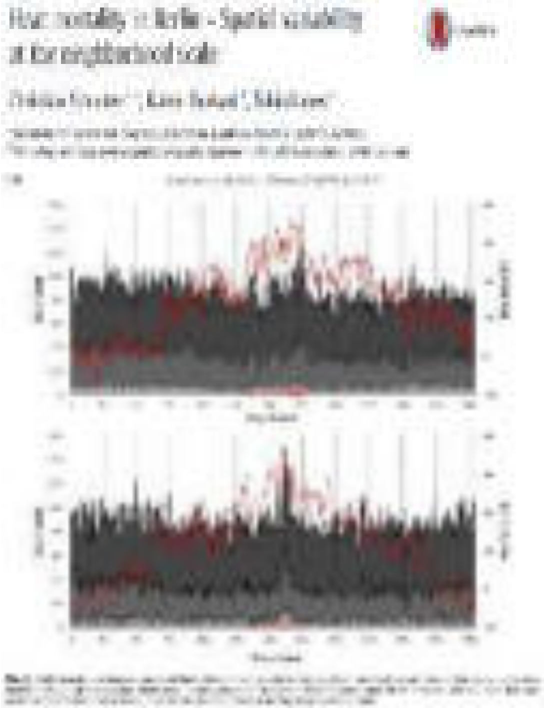
- **Quantification of heat-stress hazards and risks (identification of vulnerable groups)**
- **Efficiency of technical and non-technical actions (adaptation strategies for patients care)**
- **Options for implementation**

Berlin – Heat stress distribution and mortality (2006/2010)



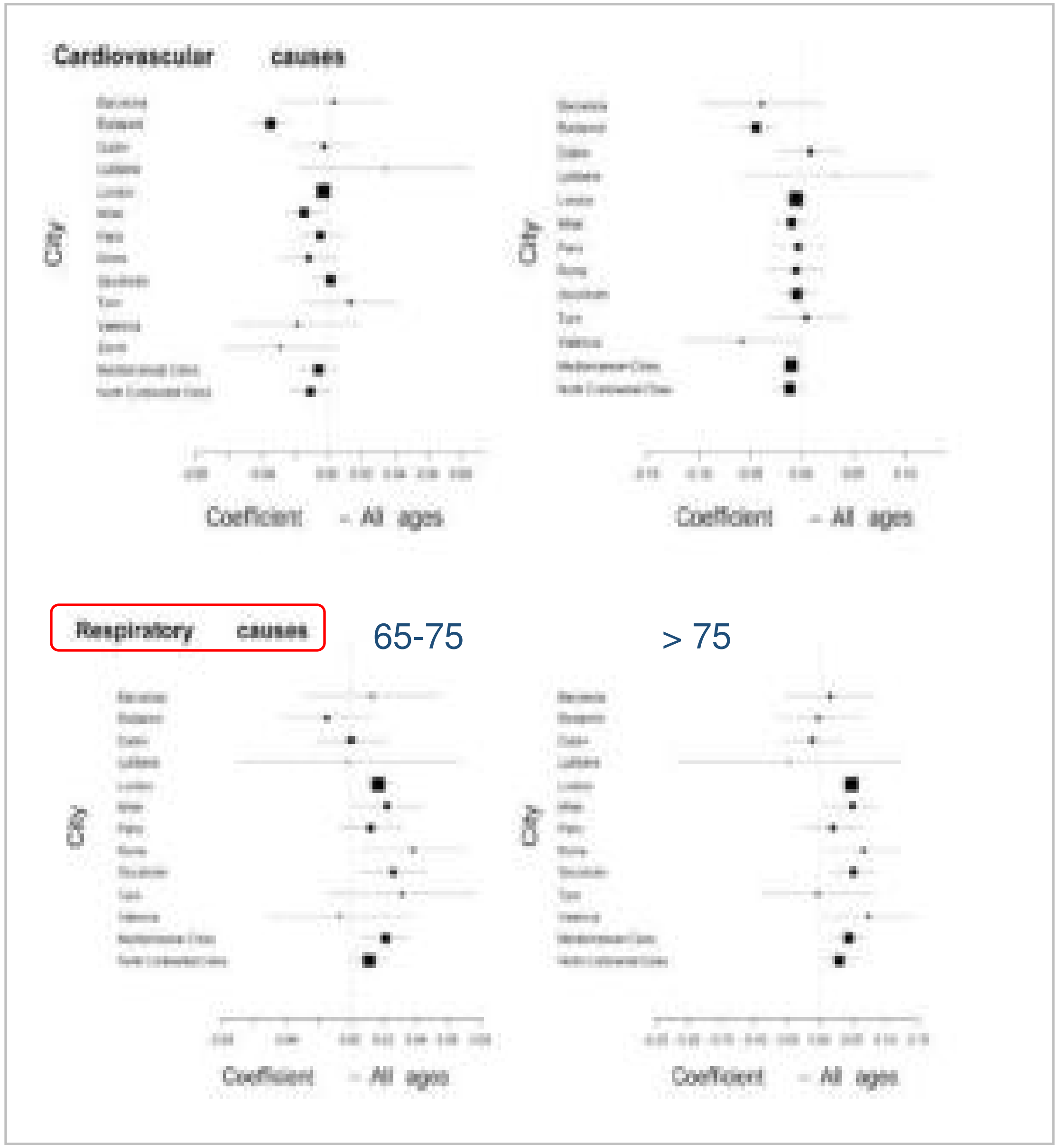
Risk Map
potential heat-stress
risk in view of climate
change

Computers, Environment and Urban Systems 48 (2014) 86–98



Urban Climate 10 (2014) 134–147

Heat stress and Emergency Visits in European Cities



Michelozzi et. al. AJRCCM 2009

Increased mortality rate at a temperature rise of 1 °C in 15 European Cities

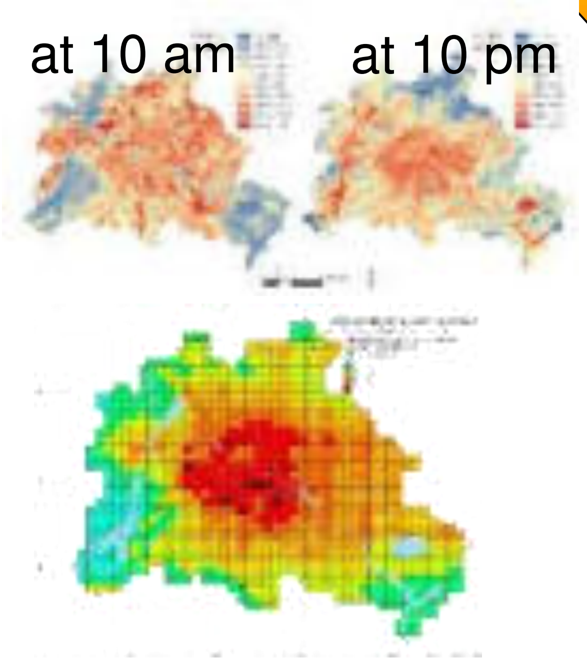
TABLE 3. Overall Meta-Analytic Percent Changes (95% Credibility Intervals) in Mortality for All Natural, Cardiovascular, and Respiratory Causes, in All Ages and by Age Group, Associated With a 1°C Increase in Maximum Apparent Temperature Above the City-Specific Threshold

	Mediterranean Cities		North-Continental Cities	
Age; yrs	% Change	(95% CrI)	% Change	(95% CrI)
Natural mortality				
All	3.12	(0.60 to 5.73)	1.84	(0.06 to 3.64)
15–64	0.92	(−1.29 to 3.13)	1.31	(−0.94 to 3.72)
65–74	2.13	(−0.42 to 4.74)	1.65	(−0.51 to 3.87)
75+	4.22	(1.33 to 7.20)	2.07	(0.24 to 3.89)
Cardiovascular mortality				
All	3.70	(0.36 to 7.04)	2.44	(−0.09 to 5.32)
15–64	0.57	(−2.47 to 3.83)	1.04	(−2.20 to 4.92)
65–74	1.92	(−1.49 to 5.35)	1.50	(−1.12 to 4.62)
75+	4.66	(1.13 to 8.18)	2.55	(−0.24 to 5.51)
Respiratory mortality				
All	6.71	(2.43 to 11.26)	6.10	(2.46 to 11.08)
15–64	1.54	(−3.68 to 7.22)	3.02	(−1.55 to 7.42)
65–74	3.37	(−1.46 to 8.22)	3.90	(−0.16 to 8.92)
75+	8.10	(3.24 to 13.37)	6.62	(3.04 to 11.42)

Baccini et al. Epidemiology. 19(5):711-719, September 2008.

Topics of Clinical Climate Impact Research

Heat related disease exacerbation ?
Heat as a disease-promoting factor?



PM10 pollution (annual mean) in the Berlin, Atlas Senatsverwaltung

COPD Patient (GOLD II-IV)

↓

Heat Stress / Air pollution

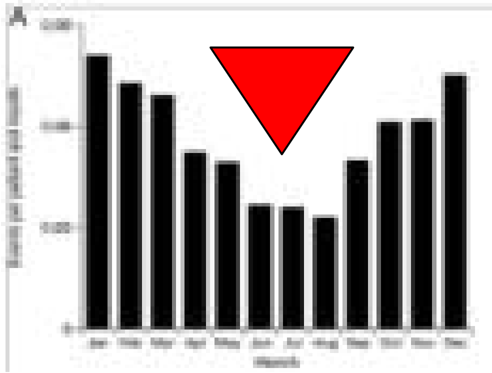
↓ ← Vulnerability

Heat related Exacerbation

Morbidity

↓ ← Vulnerability

Mortality



Rabe, CHEST 2013; 143(3):711–719

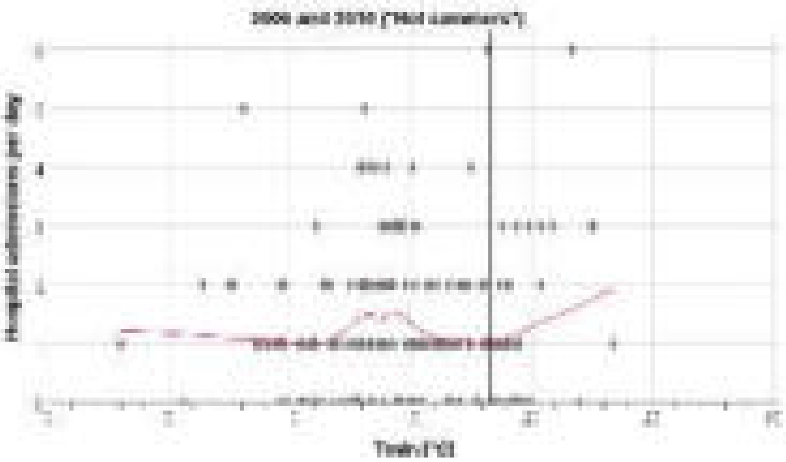
Gavin C Donaldson, Jadwiga A Wedzicha

- Who is vulnerable to heat stress?
- Is there a COPD-phenotype ?
- Does air conditioning support reconvalescence from AECOPD ?

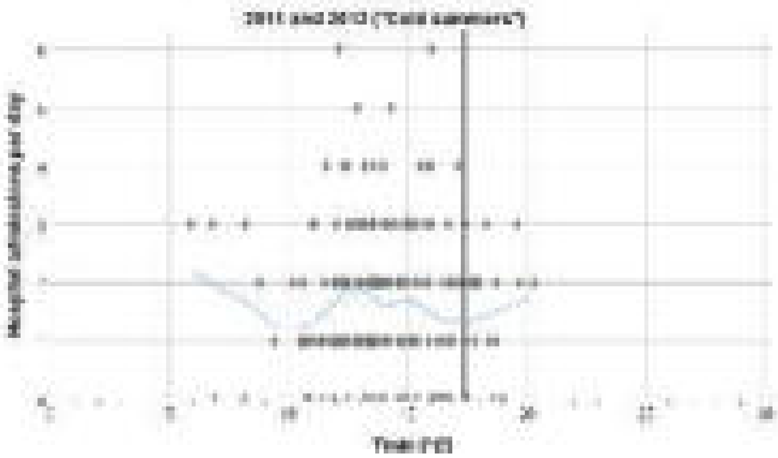
Hospital admissions due to heat-related COPD exacerbation during several summer periods

- Analysis of
  n = 563 patients admitted to the urban hospital via emergency unit due to AECOPD (Vivantes Klinikum Berlin- Neukölln)
- Investigated period   June 1 – August 31
  Years: **2006**, **2010**, **2011**, **2012**
- Climate data from the German Weather Service (DWD)
  $Temp_{max/min/Ø}$

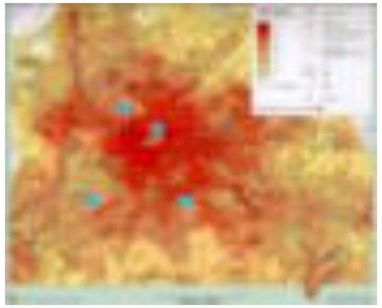
Rising hospital admissions per day starting at a minimum temperature **18.3** °C during **hot summers**



Rising in hospital admissions per day - starting at a minimum temperature **17.4** °C during **cold summers**

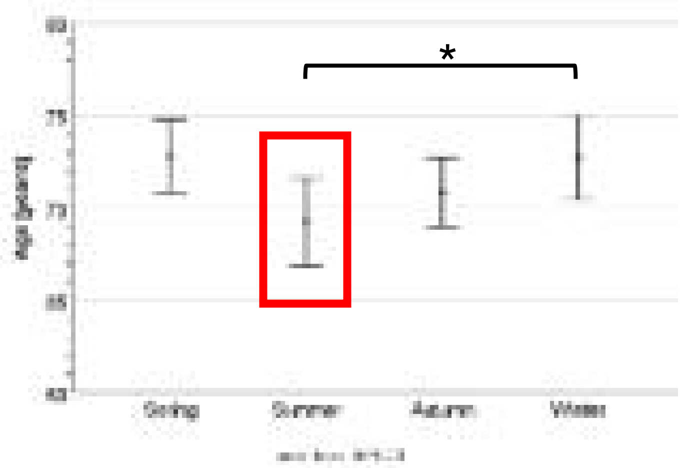


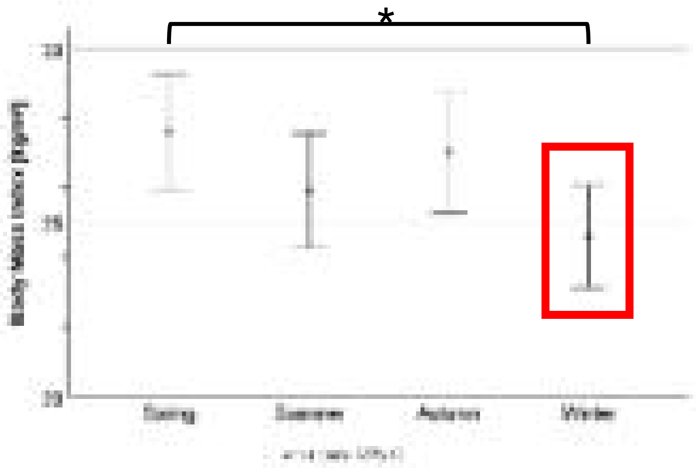
Hospital admissions due to COPD exacerbations during spring, summer, autumn and winter



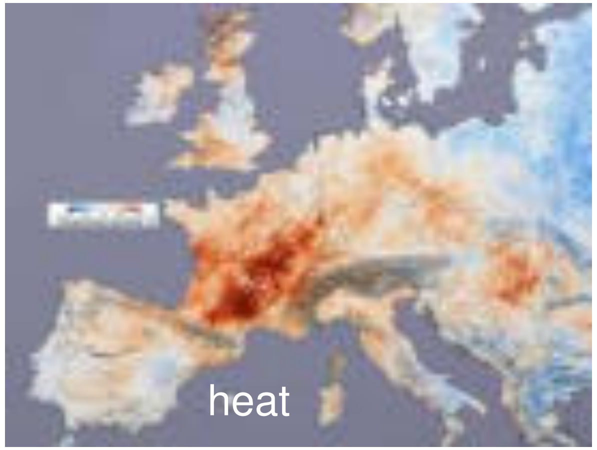
- Retrospective analysis of
  n = 335 patients admitted to hospital due to COPD exacerbation (COPD Guidelines, 2013)
- Investigation period: **May 15 – August 31, 2012**
- Clinical data from **4 large urban hospitals/emergency units**
  - Charité University Hospital and Berlin Vivantes Hospital Neukölln, Berlin Vivantes Hospital Friedrichshain)

Summertime, COPD-exacerbators are **younger** than patients during winter **(p=0.04)**

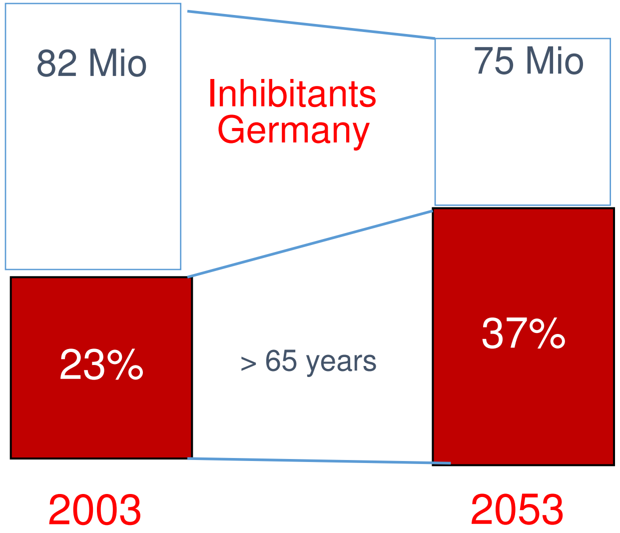




Phenotype of heat-related exacerbator? Comorbidity ?



Climate Change



Energy Change

Climate Change Futures!

Vulnerability

Age, Organ aging

Risk/Hazard

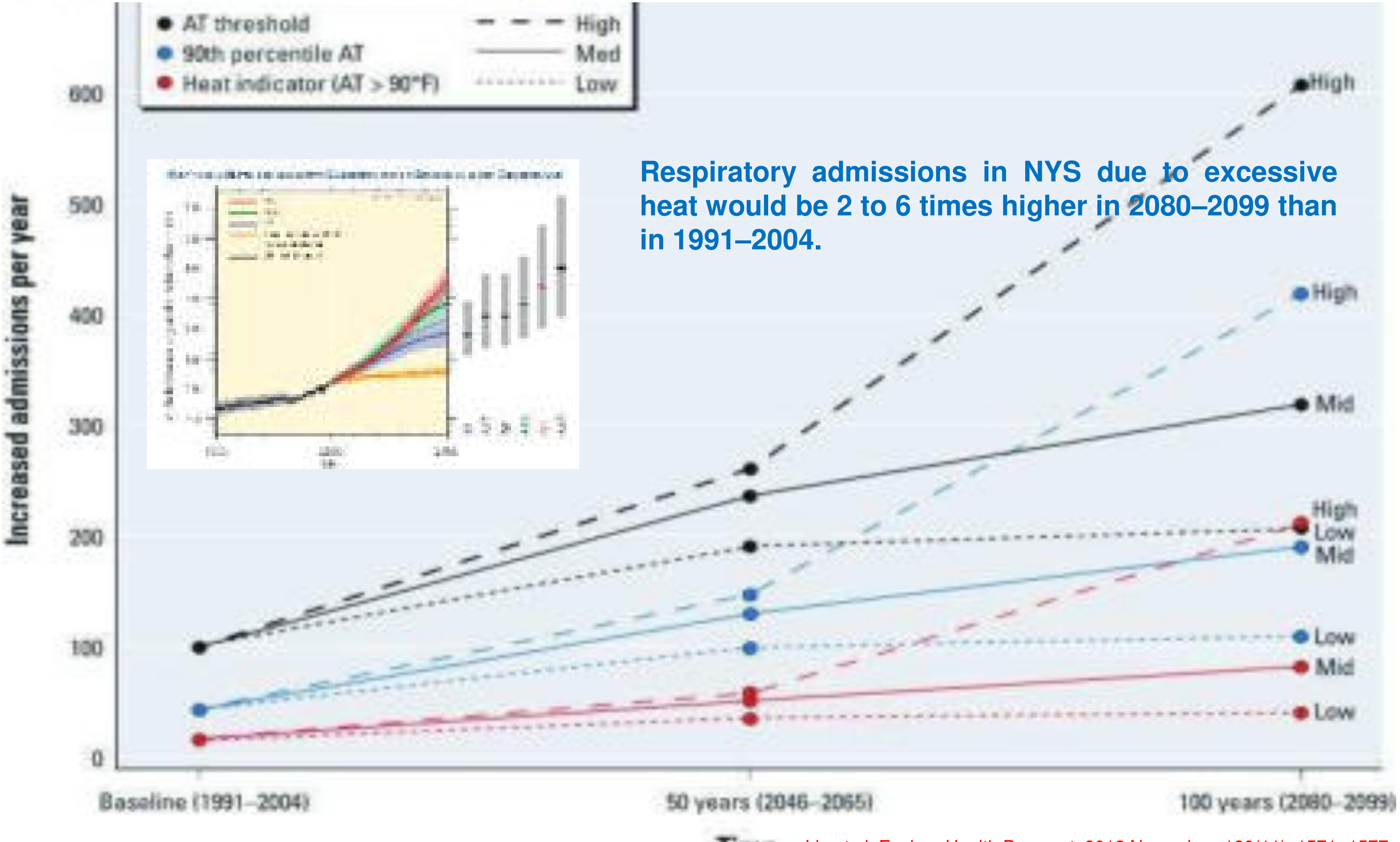
poverty risk

Life work period ↑
Extention > 65J

Excessive Heat and Respiratory Hospitalizations in New York State: Estimating Current and Future Public Health Burden Related to Climate Change

Shao Lin,[1,2] Wan-Hsiang Hsu,[1,2] Alissa R. Van Zutphen,[1,2] Shubhayu Saha,[3] George Luber,[3] and Syni-An Hwang[1,2]

[1]Center for Environmental Health, New York State Department of Health, Albany, New York, USA; [2]Department of Epidemiology and Biostatistics, University at Albany School of Public Health, Rensselaer, New York, USA; [3]National Center for Environmental Health, Centers for Disease Control and Prevention, Atlanta, Georgia, USA

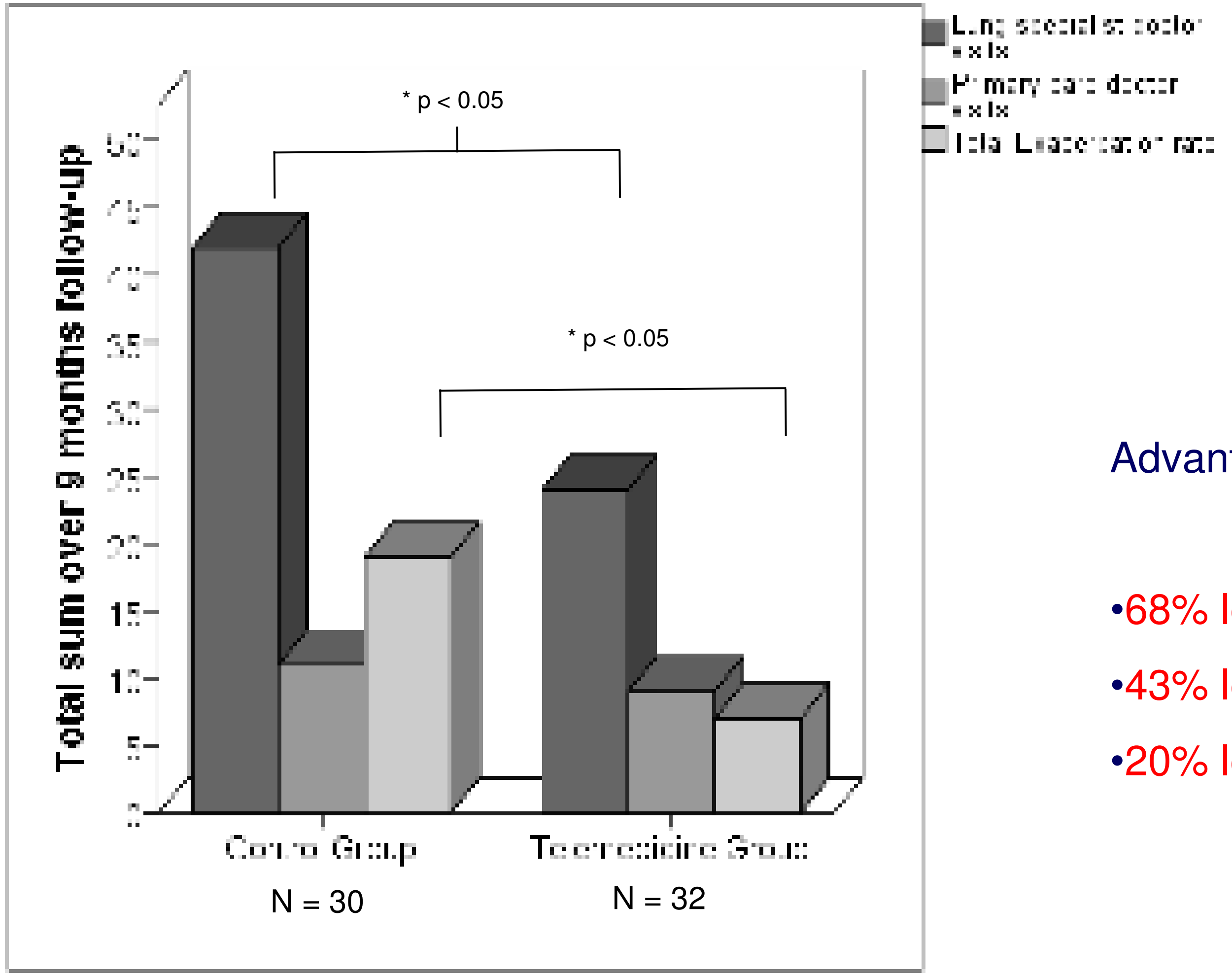


Respiratory admissions in NYS due to excessive heat would be 2 to 6 times higher in 2080–2099 than in 1991–2004.

Lin et al. Environ Health Perspect. 2012 November; 120(11): 1571–1577

Adaptation Concept I Telmonitoring supports in advanced COPD - BMBF KLIMZUG)

Clinical Telemonitoring leads to less exacerbations and consultations



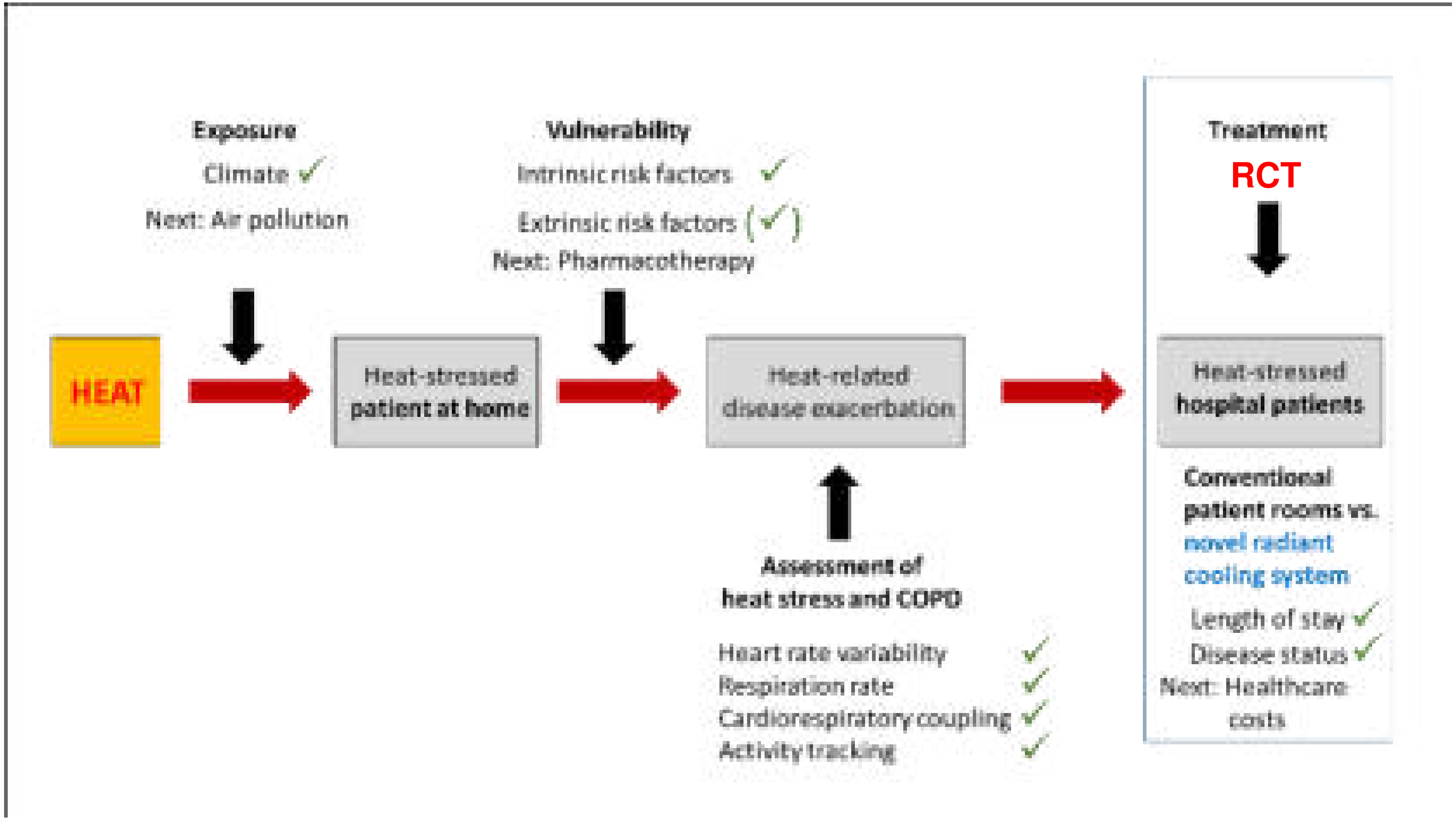
Advantages in the Telemedicine Group

- 68% less exacerbations
- 43% less Pulmo-Consultations
- 20% less GP Consultations

Environmental Health, 2013 Nov 21;12(1):99

Adaptation Research Approach II

Vulnerability leads to Hospitalisation of COPD Patients



Novel climatization model in the hospital for heat-stress related lung disease exacerbation treatment

Adaptation Research Approach II

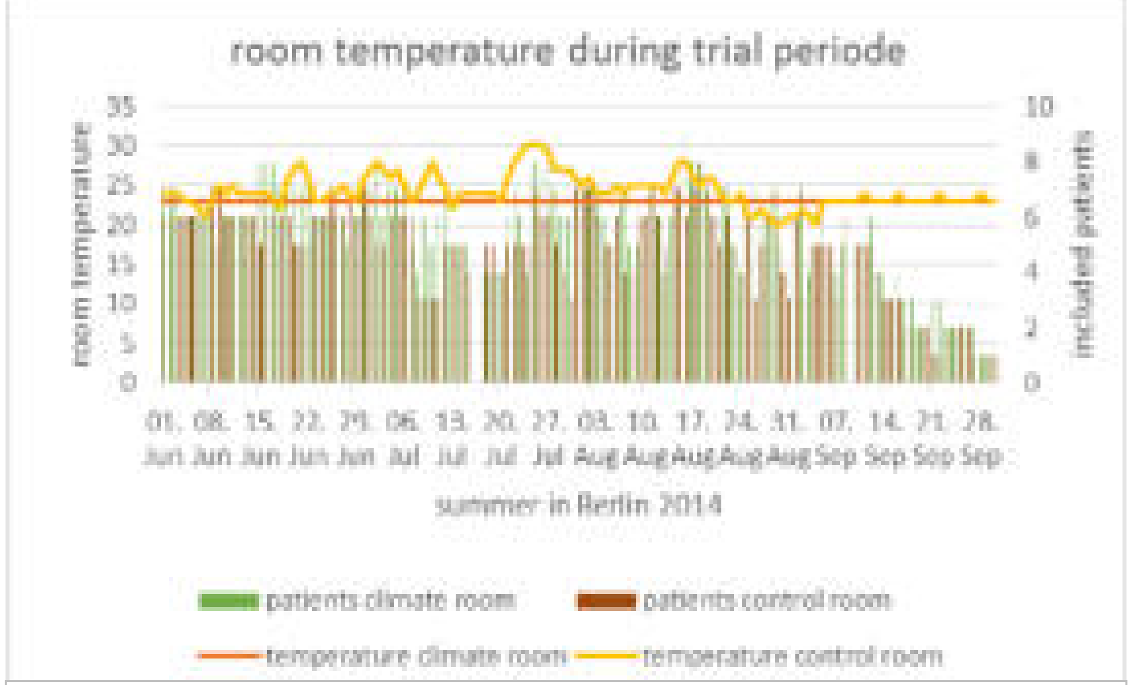
Prospective Randomized Controlled Trial (RCT)

(**DRKS 00004931**, http//apps.who.int/trialsearch/)

Cooling System:

Convection free radiant cooling system using capillary tube mats

(by Clina Cooling, UK Inc., setpoint T 23°C).

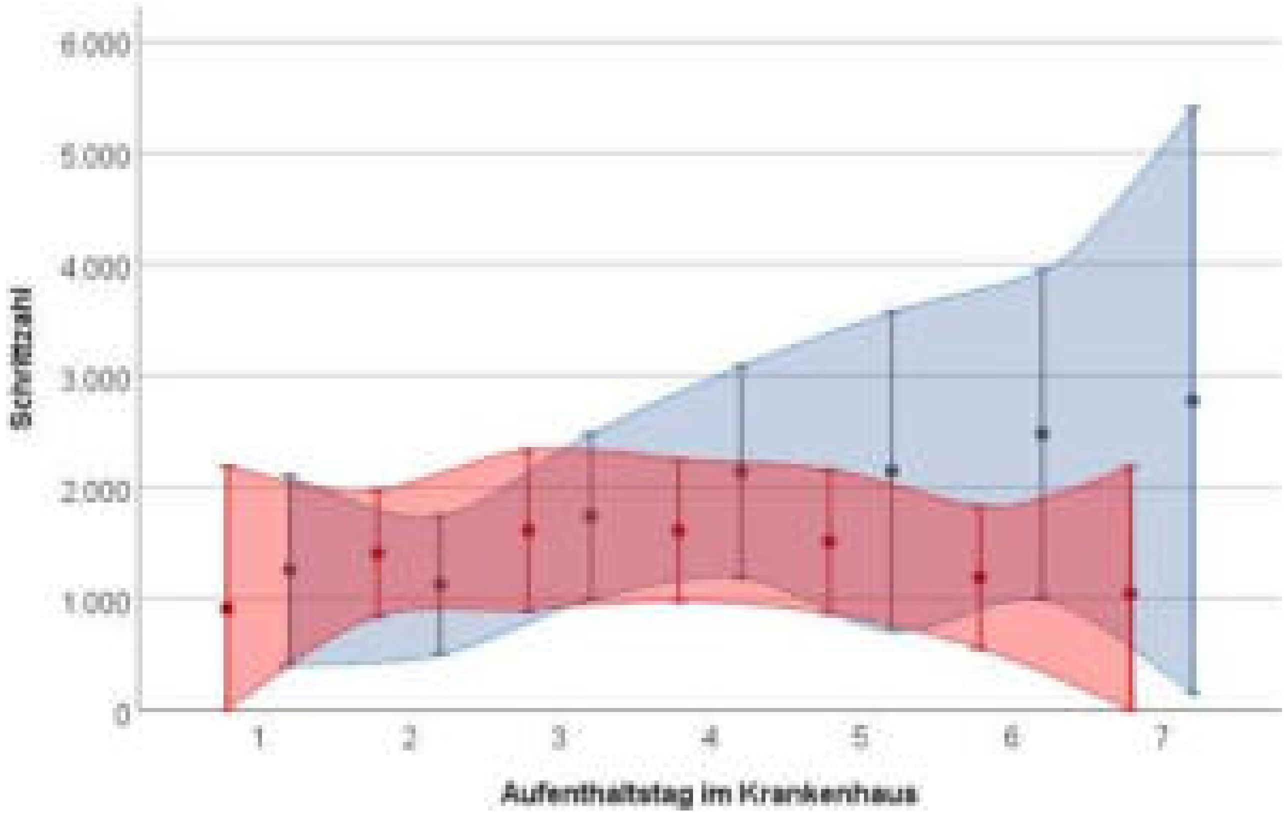


Climatized room 23°C Conventional room until 30.5°C,

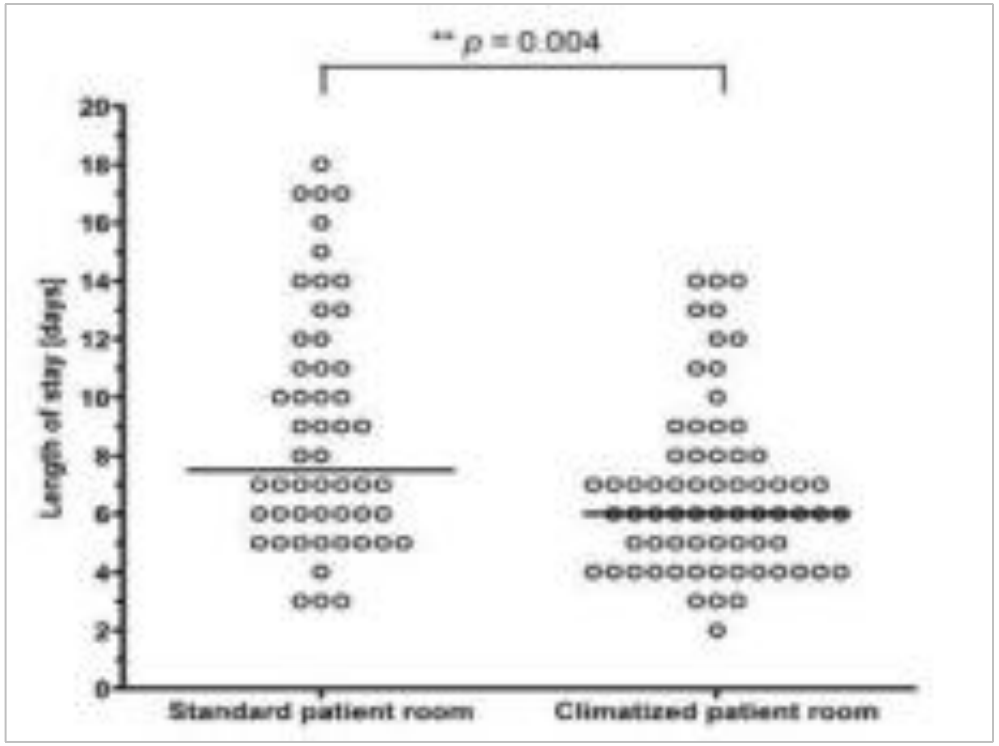
Parameter	Patient room w/o climatization	Patient room with climatization	Total
Patients, n (%)	52 (43%)	68 (57%)	120
Age, median (range)	68 years (43 – 84)	66 years (32 – 90)	
Gender, n			
Female	32	15	47
Male	20	53	73
CAT at admission, median (range)	27 (8 – 39)	26 (8 – 40)	

CAT: COPD Assessment Test

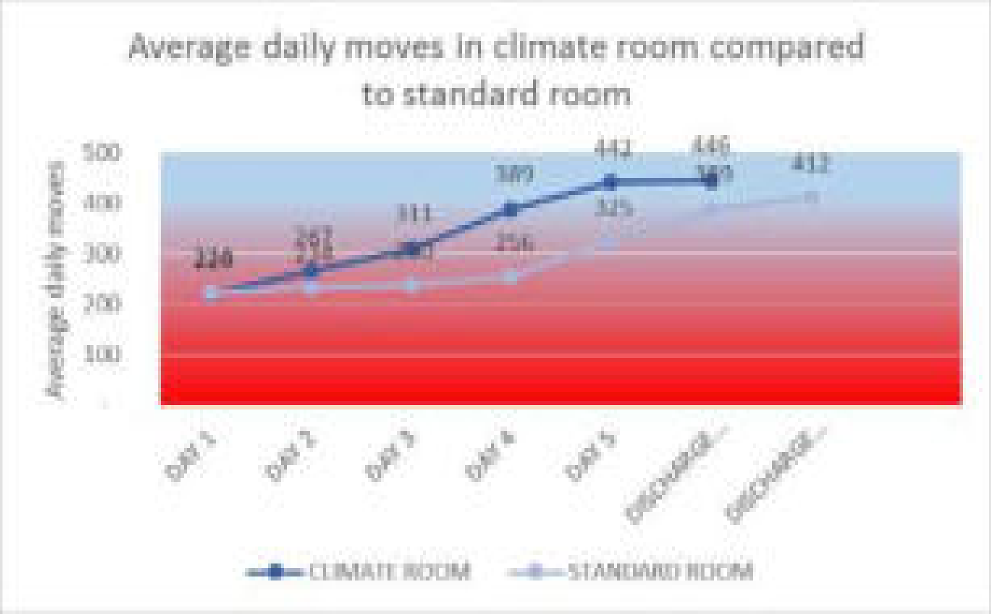
Increase of activity in climatized hospital room - early mobiliozation

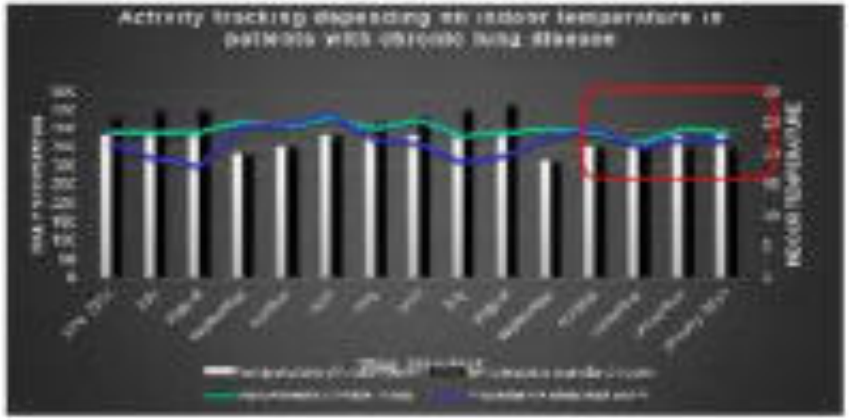


Climate controlled patients rooms improves the activity and support the early mobilization in urban heat-stress related COPD exacerbation (RCT, n= 120)



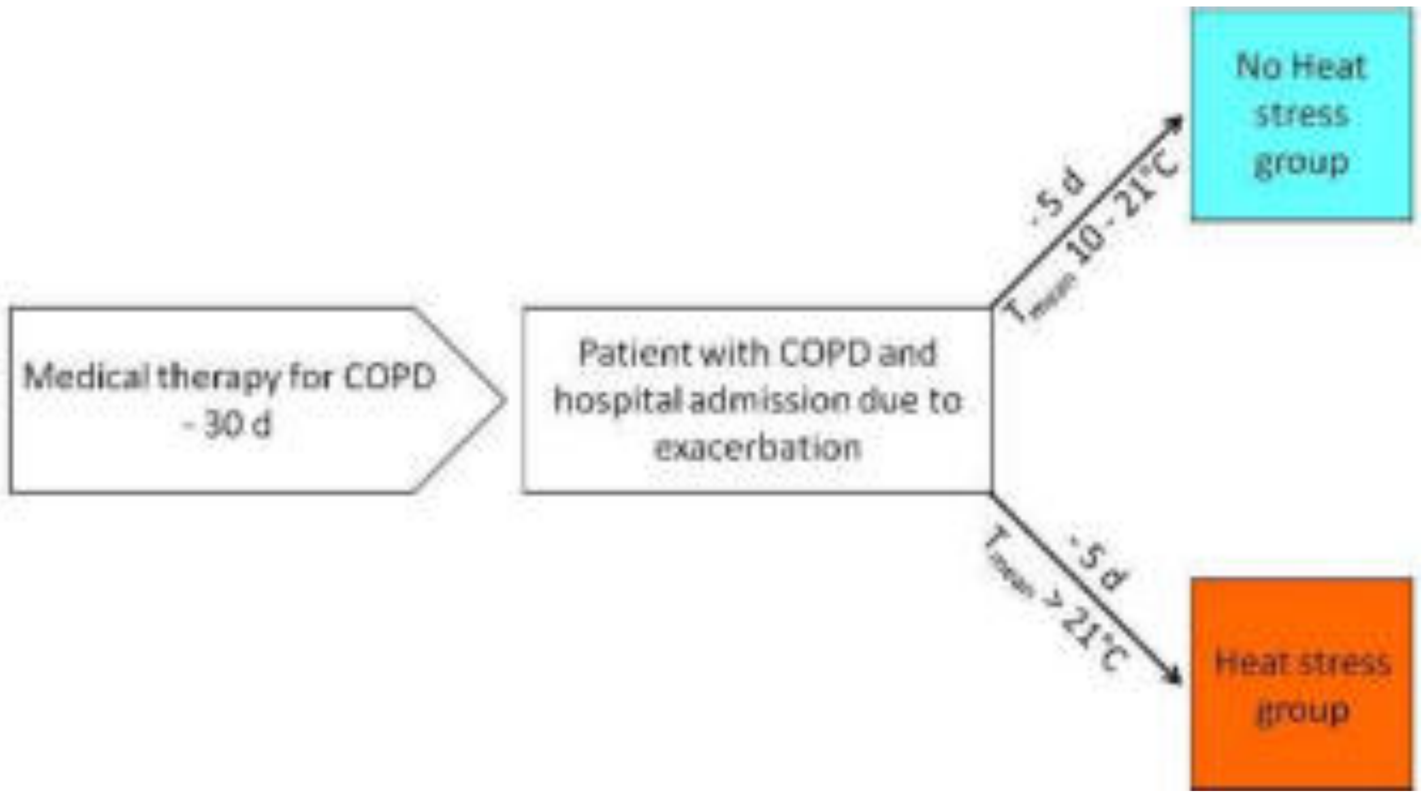
Parameter	Patient room w/o climatization	Patient room with climatization	P value
CAT at discharge, median (range)	23 (12 – 36)	23 (6 – 36)	0.456
Length of stay, median (range)	7.5 days (3 – 18)	6 days (2 – 14)	0.004**





Schubert, Witt et al ATS 2016

„Climate-adapted" inhalation therapy in COPD - *Adaptation Strategy III* to prevent urban heat stress related exacerbation - a prospective study in the metropolitan area Berlin



Studiendesign: prospektive, nicht randomisierte, nicht-interventionelle Studie

Ongoing Cooperation: Berlin Vivantes Hospitals Neukölln, Friedrichshain, DRK-Hospital Mitte

Drug Management in stabile COPD

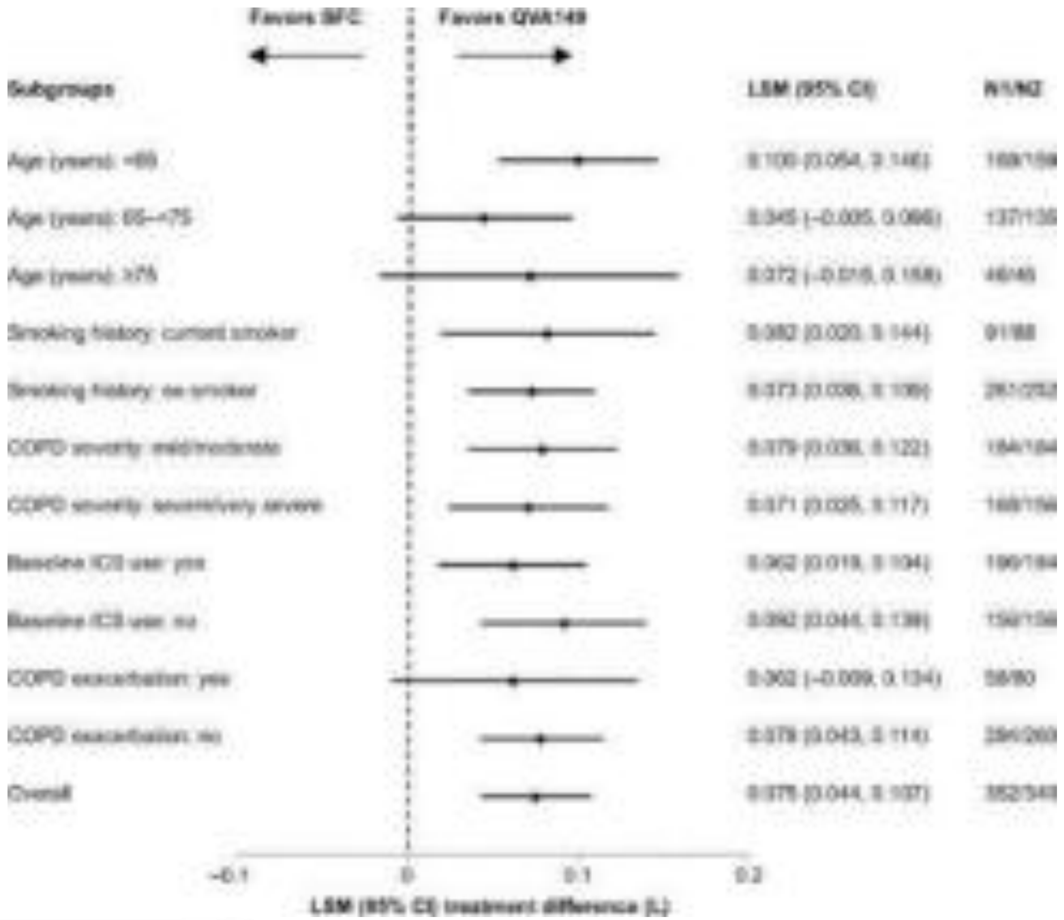
Erste Wahl, Zweite Wahl

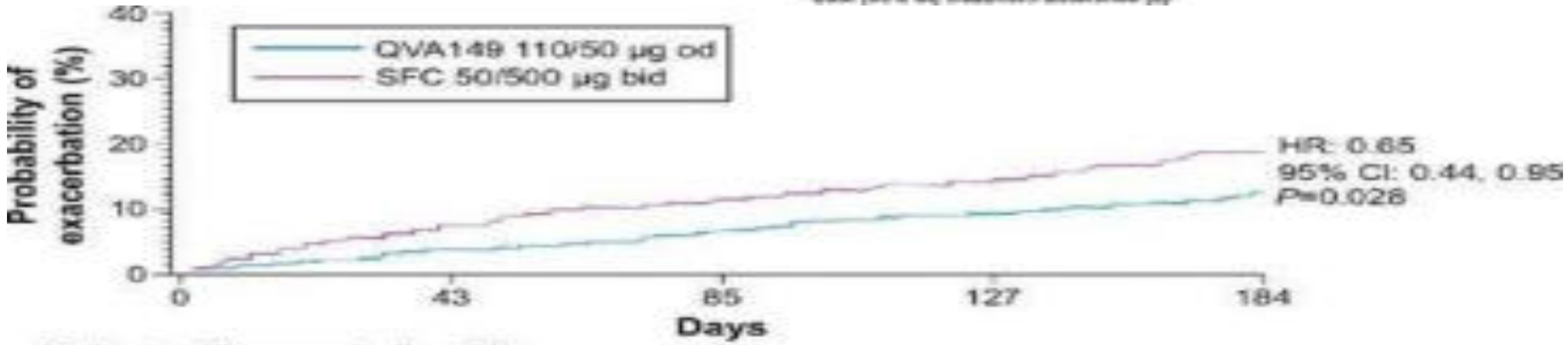
4 <30% **3** 30-50%	**C** ICS + LABA o. LAMA LABA + LAMA	ICS + LABA o. LAMA ICS + LAMA o. ICS + LABA + LAMA o. ICS + LABA + PDE4-Hemmer o. LAMA + LABA o. LAMA + PDE4-Hemmer **D**	≥2
2 50 -80% **1** >80%	**A** SAMA o. SAMA LAMA o. LABA o. SABA + SAMA	LABA o. LAMA LAMA + LABA **B**	1 0
	mMRC 0-1 oder CAT < 10	mMRC > 2 oder CAT ≥ 10	

Global strategy for the diagnosis, management, and prevention of COPD, Revised 2011, http://www.goldcopd.org

FLAME Study

[Int J Chron Obstruct Pulmon Dis]





Patients with exacerbation (%)

QVA149: 0 (0.0%)	12 (3.3%)	20 (5.5%)	31 (8.6%)	43 (12.1%)
SFC: 0 (0.0%)	24 (6.6%)	38 (10.5%)	48 (13.4%)	67 (18.9%)

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Once-Daily Single-Inhaler Triple versus Dual Therapy in Patients with COPD

David A. Lipson, M.D., Frank Barnhart, D.V.M., Noushin Brealey, M.D., Jean Brooks, M.Sc., Gerard J. Criner, M.D., Nicola C. Day, Ph.D., Mark T. Dransfield, M.D., David M.G. Halpin, M.D., MeiLan K. Han, M.D., C. Elaine Jones, Ph.D., Sally Kilbride, M.Sc., Peter Lange, M.D., David A. Lomas, M.D., Ph.D., Fernando J. Martinez, M.D., Dave Singh, M.D., Maggie Tabberer, M.Sc., Robert A. Wise, M.D., and Steven J. Pascoe, M.B., B.S., for the IMPACT Investigators

DOI: 10.1056/NEJMoa1713901

?

Which phonotyp profits realy ?
Overlap Group ?
Bronchitis-Typ ?
Repid Decliner ?

EUROPEAN COMMISSION
Executive Agency for Small and Medium-sized Enterprises

Adaptation Approach IV

Concept, expected impacts, linkages to other research and innovation and the overall methodologies

Cooperation/Network: Vivantes-Hospitals/EvB Hospital Potsdam

TR 6

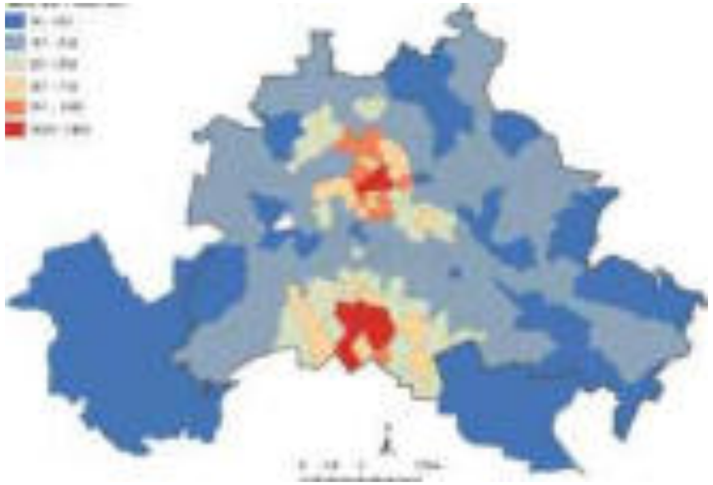
Demonstrator 3.1 Oasis+Health
The objective is to help the health insurance sector to understand much more precisely the relation between the air quality, climate extremes and health conditions in a given population.

→

The health insurance sector will gain accurate information on air quality and climate impacts on health. This will foster new innovations which will allow a better adaptation to new climatic conditions.

⇄

German Association of Private Insurers (PKV). Health insurers active in the OASIS program.

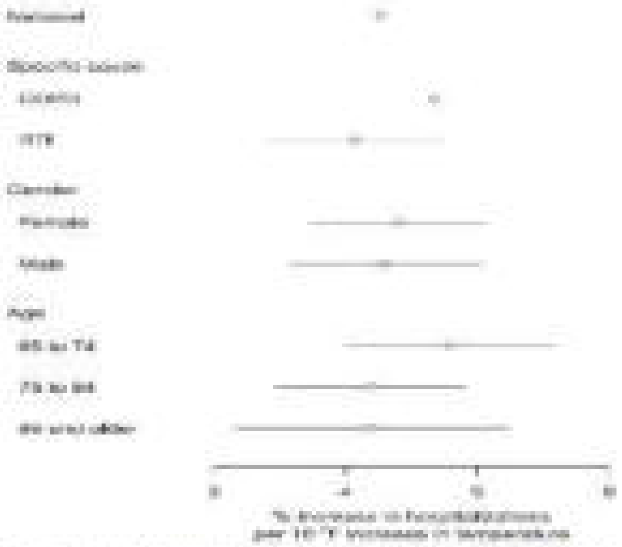


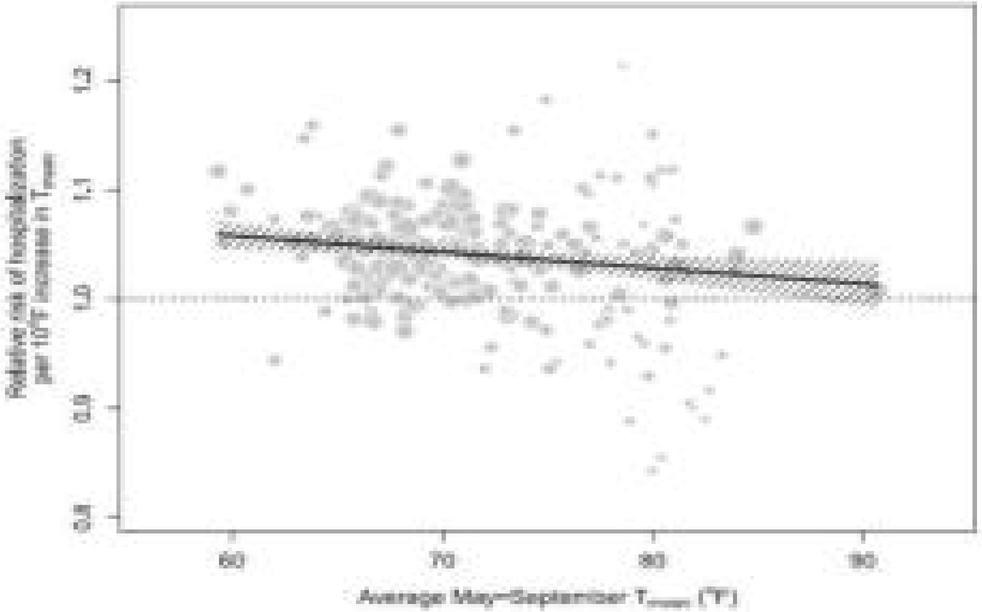
- A demonstrator will be implemented for the **City of Berlin**.
- Fine resolution **air quality and climate models (temperature)** will be used to set up the event set, representing chronic as well as extreme conditions.
- The **health damage function** will be defined on the basis of the **exposure of the population**, especially the most sensitive ones, considering as well data on **affected people**, just after the extremes and after exposure thresholds are exceeded

Heat-related Emergency Hospitalizations for Respiratory Diseases in the Medicare Population

G. Brooke Anderson[1], Francesca Dominici[2], Yun Wang[2], Meredith C. McCormack[3,4], Michelle L. Bell[5], and Roger D. Peng[1]

Overall, each 10°F increase in daily temperature was associated with a 4.3% increase in same-day emergency hospitalizations for respiratory diseases





Urban Heat Stress
Global Warming

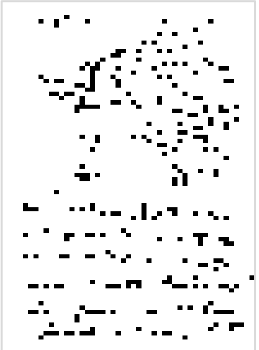
Vulnerability to Lung health risks ↑
(Exacerbation, Allergy, Infection and Cancer)
(Temp. ↑ of Water - Surface)
Trigger-Mechanisms ↑
Microbiome-Change

Mitigation

Adaptation

Evolution

- Identification of vulnerable groups
- Reduce Riks, Prevent Risks,
- Adaptation (climate- adaptive treatments, Innovative indoor climatisation



Towards More Comprehensive Projections of Urban Heat-Related Mortality: Estimates for New York City under Multiple Population, Adaptation, and Climate Scenarios

Elisaveta P. Petkova,[1] Jan K. Vink,[2] Radley M. Horton,[3] Antonio Gasparrini,[4,5] Daniel A. Bader,[3] Joe D. Francis,[2] and Patrick L. Kinney[6]

CONCLUSIONS: These findings provide a more complete picture of the range of potential future heat-related mortality risks across the 21st century in New York City, and they highlight the importance of both demographic change and adaptation responses in modifying future risks.

Adaptation and Resilience Increase in 100 Years ?
COPD and Asthma patients too ?

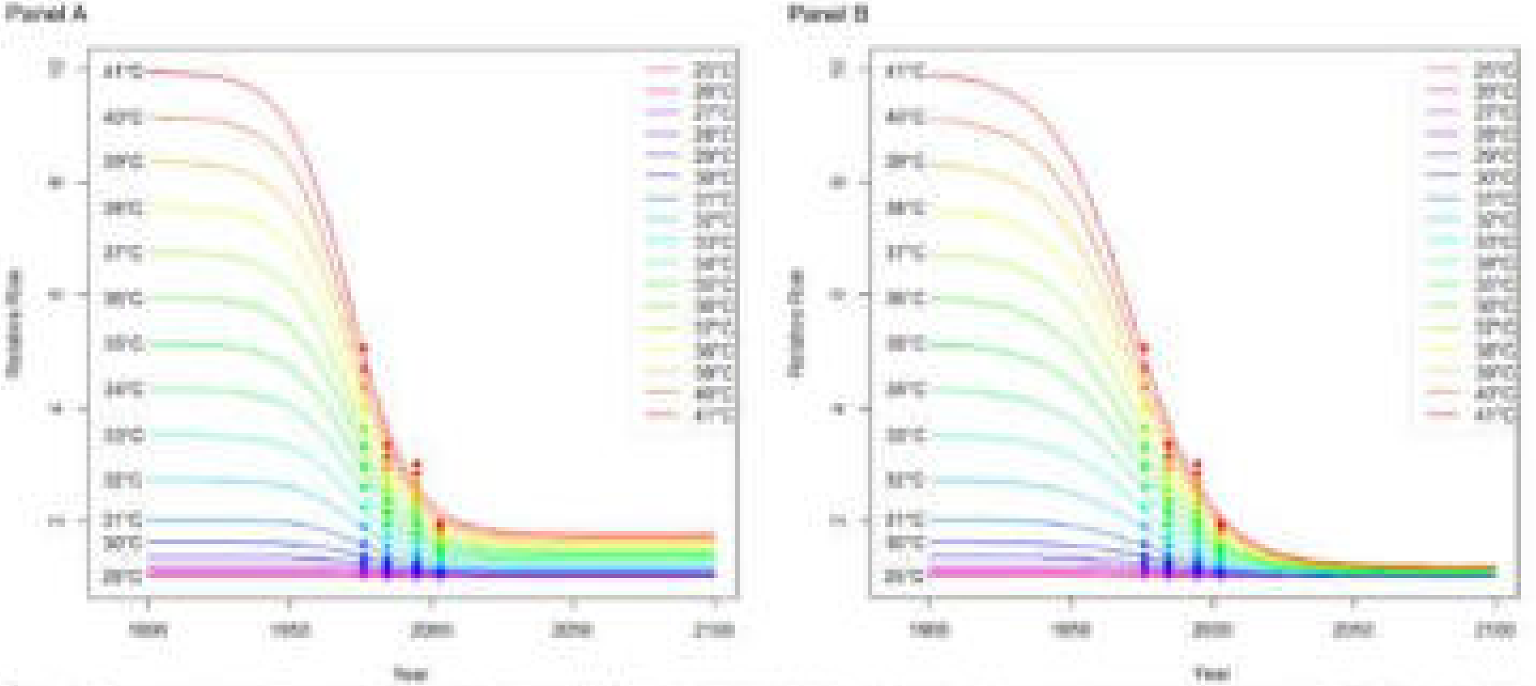
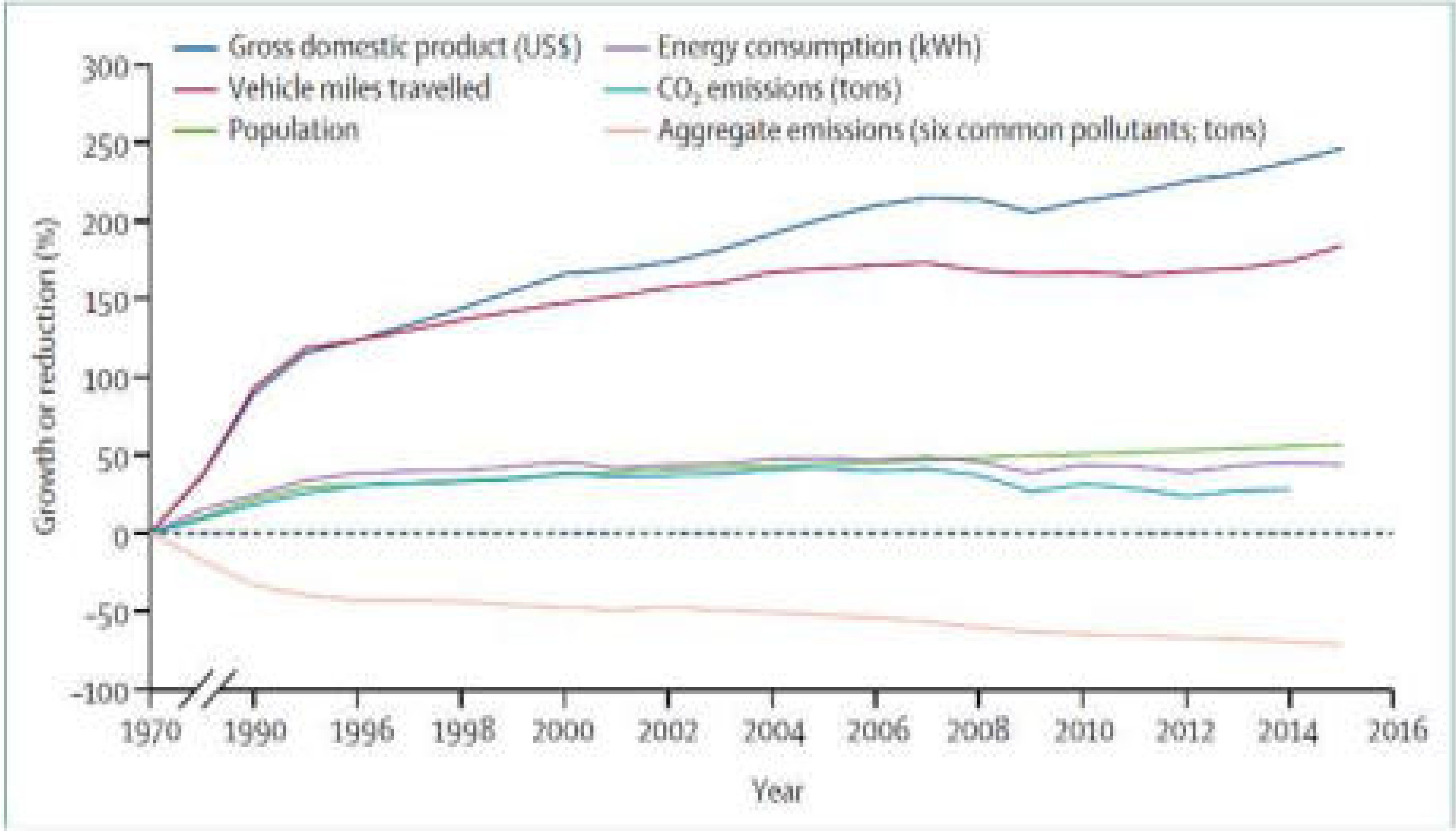


Figure 1. Temperature-specific mortality curves for New York City, 1900–2100. (A) Adaptation model assumes that temperature-specific relative risks will decrease by an additional 20% ("low adaptation") between 2010 and 2100 compared with the 2000s. (B) Adaptation model assumes that temperature-specific relative risks will decrease by an additional 60% ("high adaptation") between 2010 and 2100 compared with the 2000s. Points represent the relative risks (RRs) calculated using the distributed lag non-linear model (DLNM) for each temperature for the 1970s (1973–1979), 1980s (1980–1989), 1990s (1990–1999), and 2000s (2000–2006). RRs were calculated for June–September using a model with a quadratic spline with 4 degrees of freedom and 22°C as a reference temperature.

Relations between Pollution - Population – GDP in the U.S. 1970–2015



www.thelancet.com **Published online October 19, 2017**

Pollution : 9 Mio. Premature Deaths in 2015
(16% of all deaths worldwide)

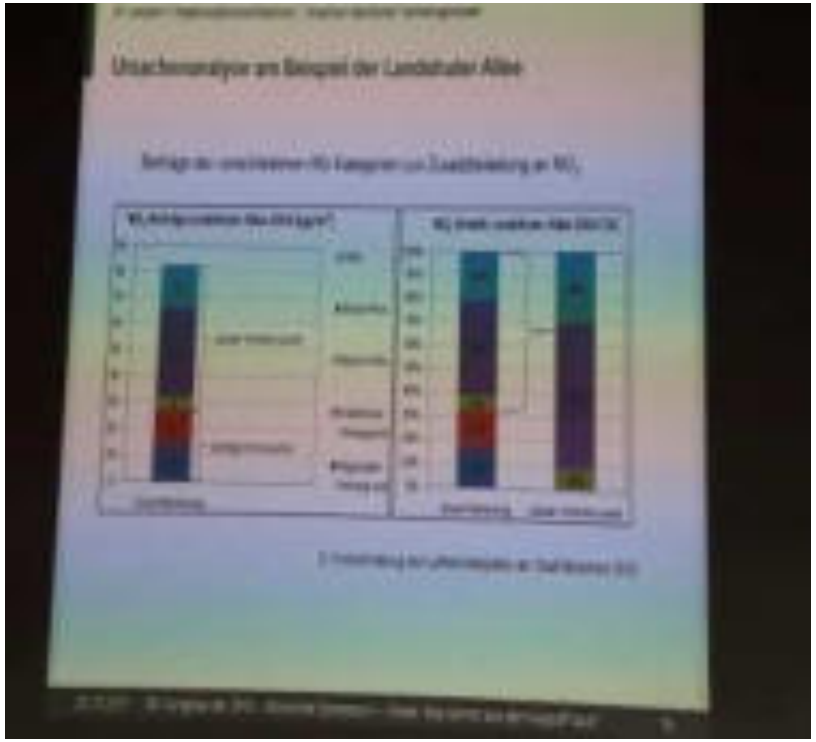
- > 3 times more deaths than from AIDS, tuberculosis, and malaria combined
- 15 times more than from all wars and other forms of violence.

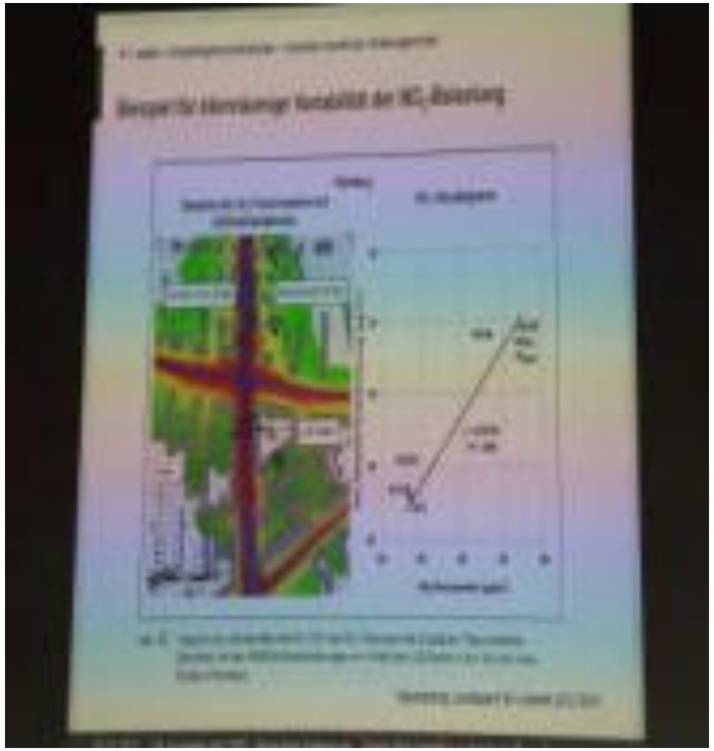
Pollution kills the poor and the vulnerable disproportionately.

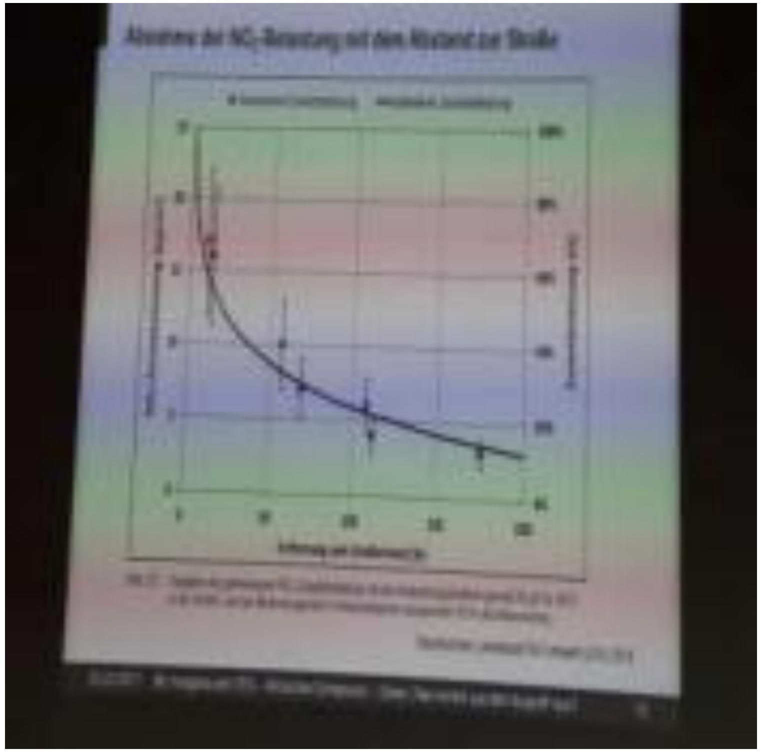
- **92%** of pollution-related deaths occur in **low-income and middle-income countries**
- **Children:** high risk during windows of vulnerability in utero and in early infancy



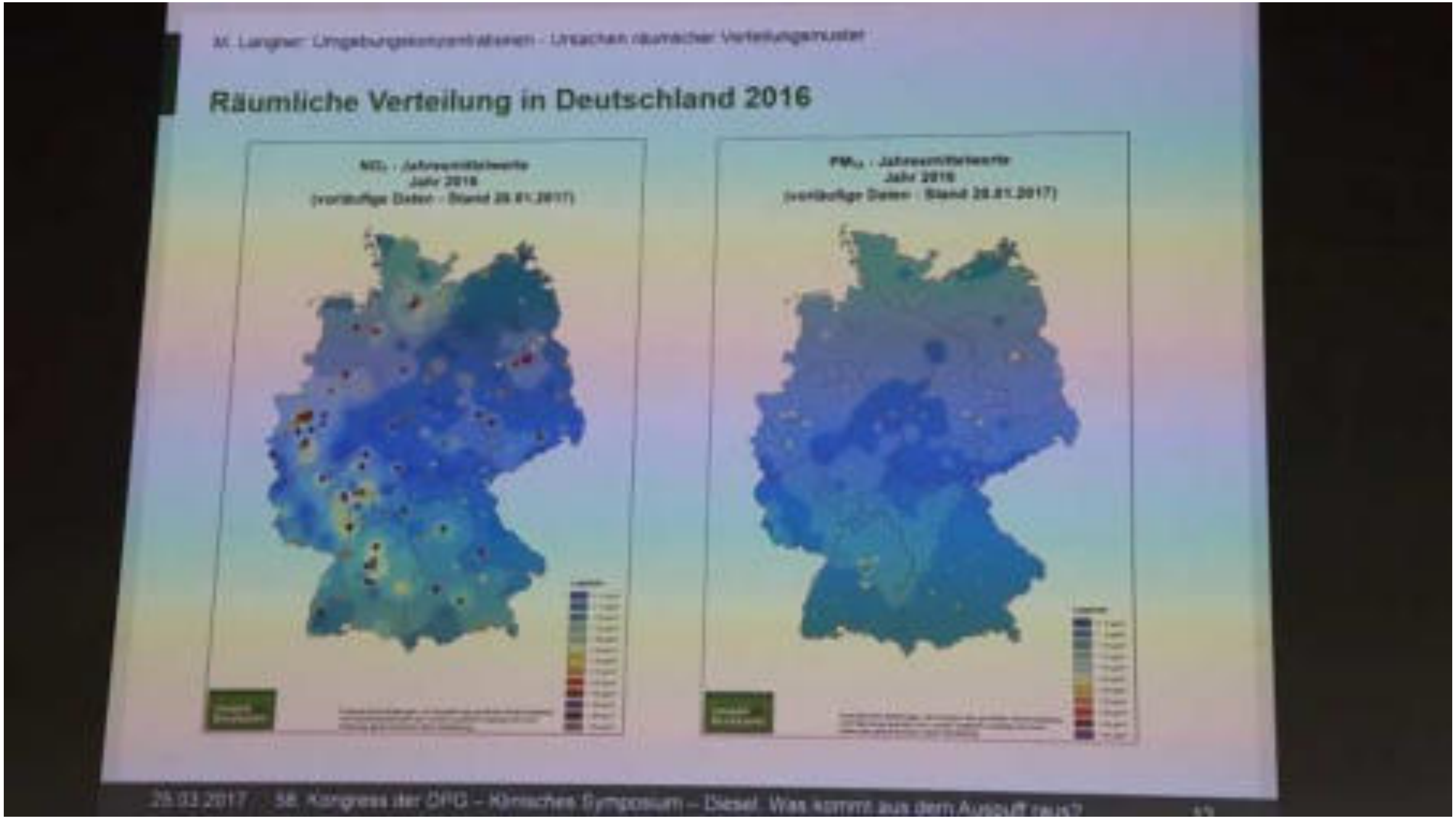

Stickoxid – Belastungen durch Diesel-PKW an Hauptstraßen







nach M. Langner, BUA

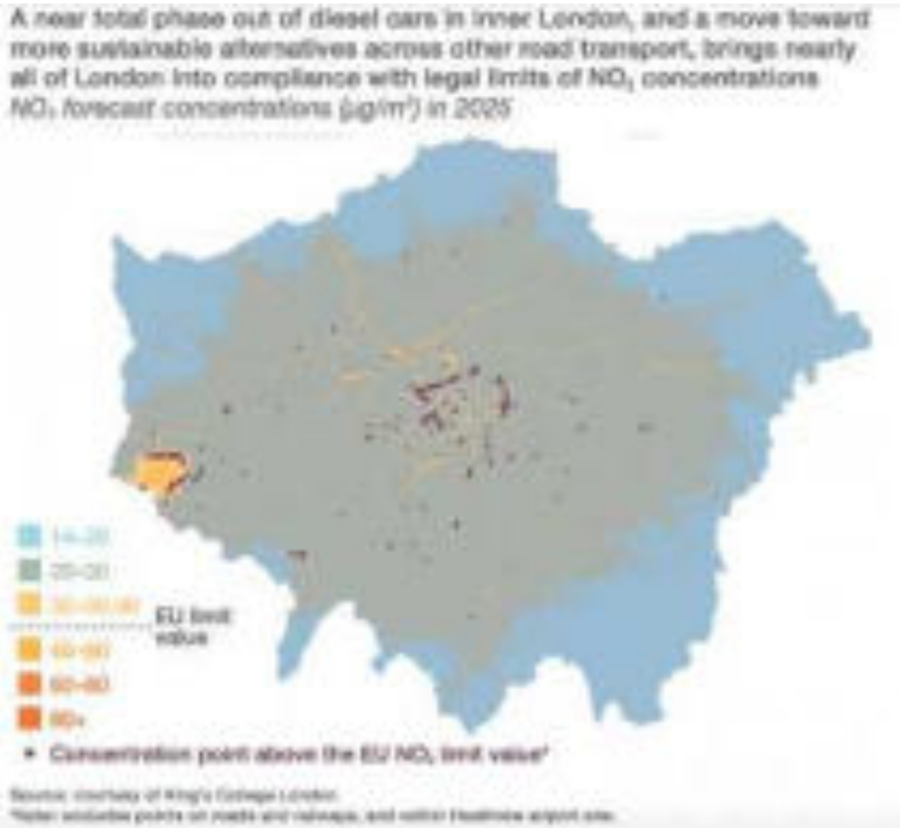

Räumliche Verteilung in Deutschland 2016
NO_2 - Jahresmittelwerte
Jahr 2016
(vorläufige Daten - Stand 20.01.2017)
PM_{10} - Jahresmittelwerte
Jahr 2016
(vorläufige Daten - Stand 20.01.2017)
25.03.2017 58. Kongress der DPG – Klinisches Symposium – Diesel: Was kommt aus dem Auspuff raus?

Air Pollution and Hospital Admissions in London

Table 15 Effects on hospital admissions and deaths brought forward for the year 2008, 2010 and 2012 for anthropogenic $PM_{2.5}$ and NO_2

Pollutant	Year	Central Relative Risk (RR) with lower and upper 95% confidence interval per 10 µg m⁻³	Numbers of hospital admissions or deaths brought forward
Anthropogenic $PM_{2.5}$	2008	Respiratory Hospital Admissions	1658 (-157 – 3516)
	2010	(RR 1.019 (0.9982 – 1.0402))	1992 (-188 – 4232)
	2012		1924 (-182 – 4085)
Anthropogenic $PM_{2.5}$	2008	Cardiovascular Hospital Admissions	654 (122 – 1194)
	2010	(RR 1.0091 (1.0017 - 1.0166))	740 (138 – 1352)
	2012		715 (133 – 1306)
NO_2	2008	Deaths Brought Forward*	499 (295 – 704)
	2010	(RR 1.0027 (1.0016 - 1.0038))	461 (272 – 650)
	2012		439 (260 – 618)
NO_2	2008	Respiratory Hospital Admissions	399 (-212 – 1014)
	2010	(RR 1.0015 (0.9992 - 1.0038))	419 (-223 – 1064)
	2012		398 (-212 – 1012)

*Not to be added to life years gained from long-term exposure to NO_2 and mortality



Lung Cancer Incidence and Long-Term Exposure to Air Pollution from Traffic

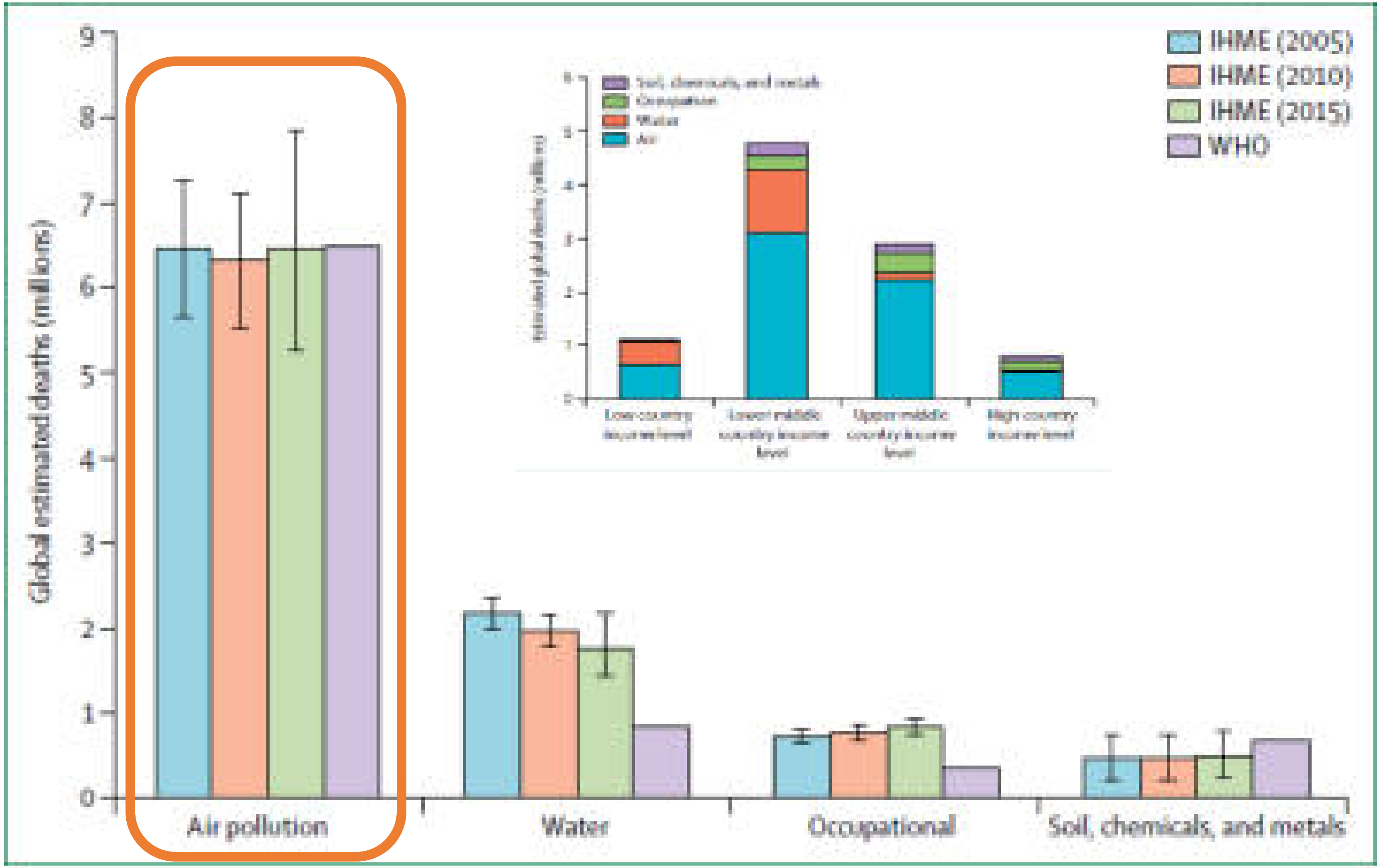
IRRs (incidence rate ratio) for lung cancer associated with the concentration of NOx and proximity to traffic at the residence (52.970 cohort members, 592 lung cancer cases)

Air pollution indicator	IRR (95% CI)	
	Crude	Adjusted[a]
NO_x concentration (µg/m^3)[b,c]		
< 17.2	1.00	1.00
17.2 – 21.8	1.25 (0.97–1.62)	1.09 (0.84–1.40)
21.8 – 29.7	0.92 (0.73–1.17)	0.93 (0.73–1.18)
> 29.7	1.58 (1.27–1.97)	1.30 (1.05–1.61)
Linear trend per 100 µg/m^3	1.53 (1.13–2.07)	1.09 (0.79–1.51)
Linear trend per 100 µg/m^3 at enrollment[d]	1.47 (1.09–2.00)	1.06 (0.77–1.46)
Major road[e] within 50 m		
No	1.00	1.00
Yes	1.47 (1.15–1.88)	1.21 (0.95–1.55)
Traffic load within 200 m (10^3 vehicle km/day)[c]		
< 0.88	1.00	1.00
0.88–2.61	1.09 (0.85–1.40)	0.98 (0.76–1.27)
2.61–6.73	1.30 (1.02–1.66)	1.05 (0.83–1.34)
> 6.73	1.60 (1.27–2.02)	1.17 (0.92–1.47)
Linear trend per 10^4 vehicle km/day	1.21 (1.06–1.38)	1.03 (0.90–1.19)

O. *Raaschou-Nielsen* et al. Environ Health Perspect 2011

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

Using data from the GBD study 42 and WHO.99 IHME = Institute for Health Metrics and Evaluation

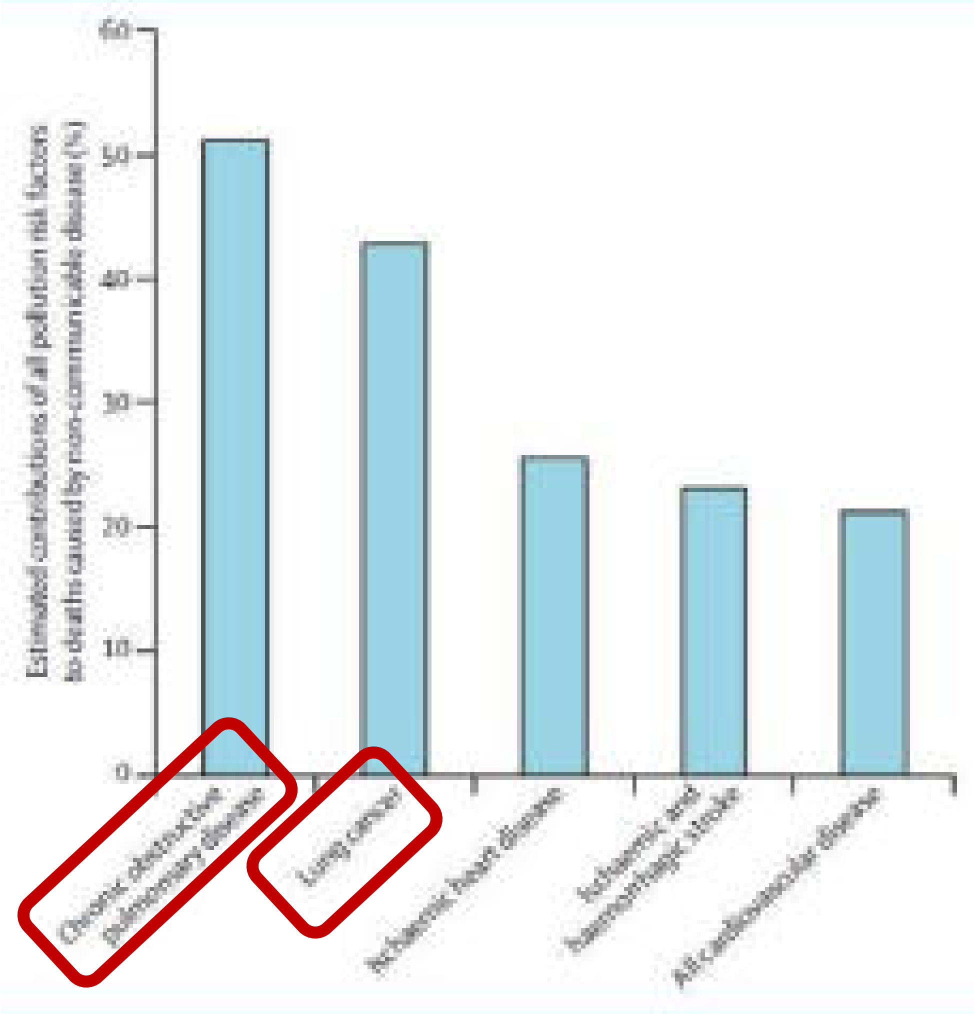


GBD Study, 2016.42

thelancet.com

Estimated contributions of all Pollution Risk Factors to Deaths caused by non-communicable diseases, 71% - 2015

GBD Study, 2016.42



Percentage of disability-adjusted life-years attributable to air pollution

(household air pollution plus ambient air pollution)

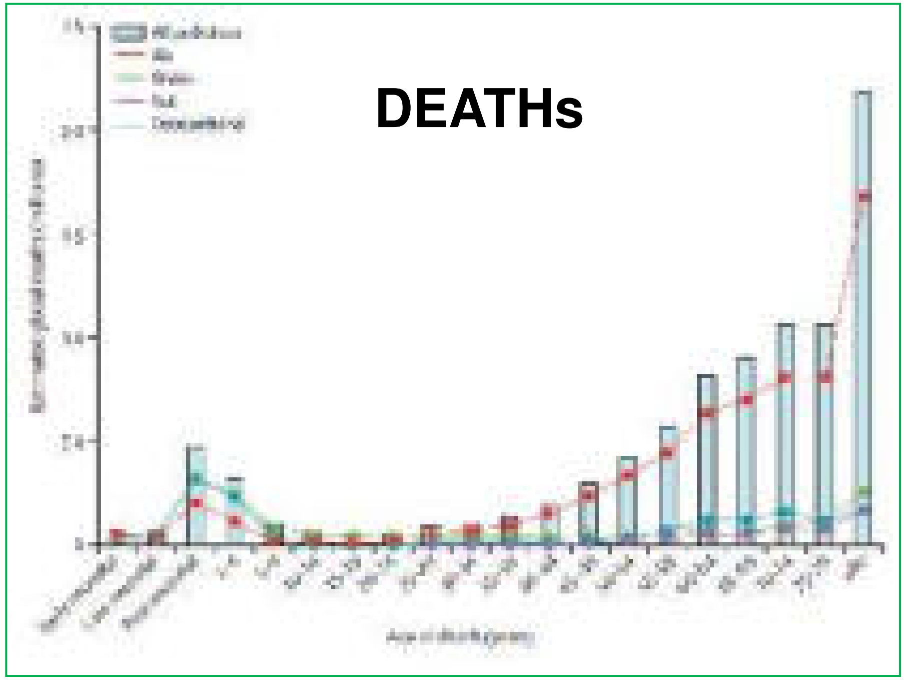
by disease and country income group

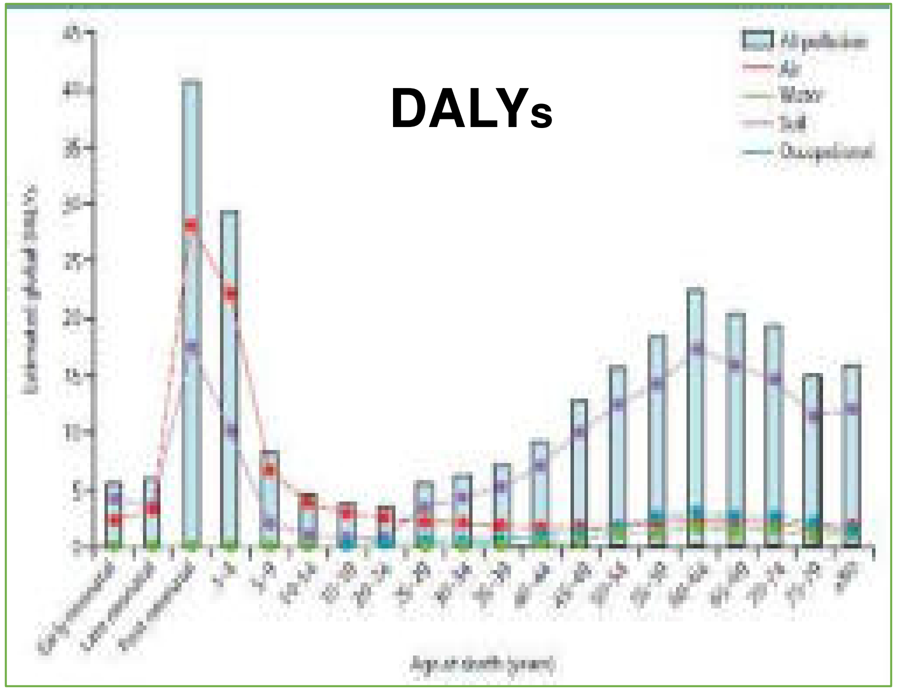
	Lower respiratory infections	Tracheal, bronchial, and lung cancer	Ischaemic heart disease	Ischaemic stroke	Haemorrhagic stroke	Chronic obstructive pulmonary disease	Cataracts
High income	12%	8%	13%	9%	11%	16%	1%
Upper-middle income	34%	30%	24%	20%	24%	41%	14%
Lower-middle income	57%	38%	35%	28%	31%	52%	25%
Low income	64%	48%	43%	36%	22%	51%	35%
Global	53%	24%	28%	37%	27%	44%	19%

Calculations based on data from the GBD 2015 Mortality and Causes of Death Collaborators (2016)[a] and the GBD 2015 Risk Factors Collaborators (2016).[a]

Estimated global **DEATHs** and **DALYs** by pollution risk factor and age at death, 2015

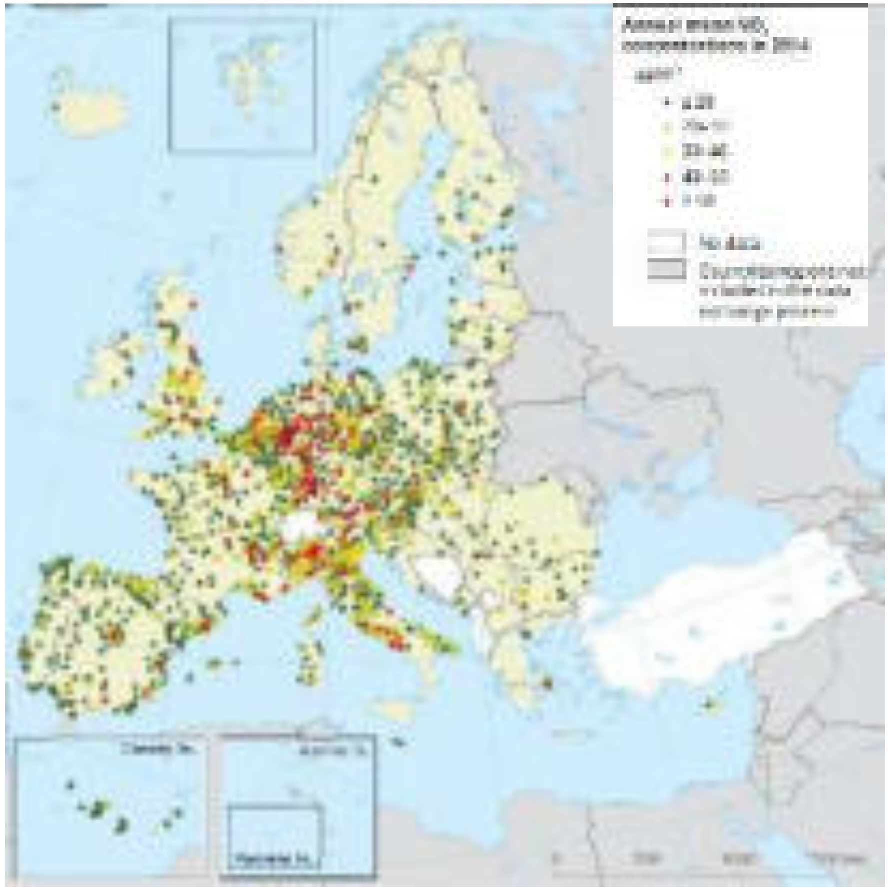
GBD Study, 2016.42 (DALYs=disability-adjusted life-years).



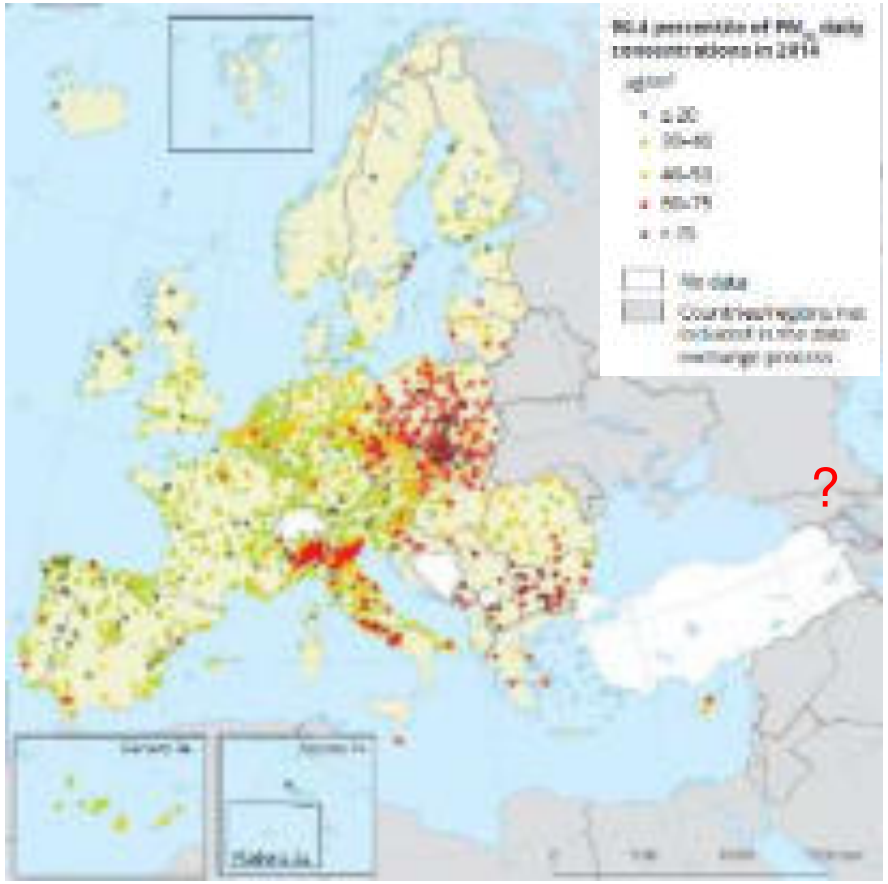


Air Quality Report WHO Europe 2016

Nitrogen Oxides



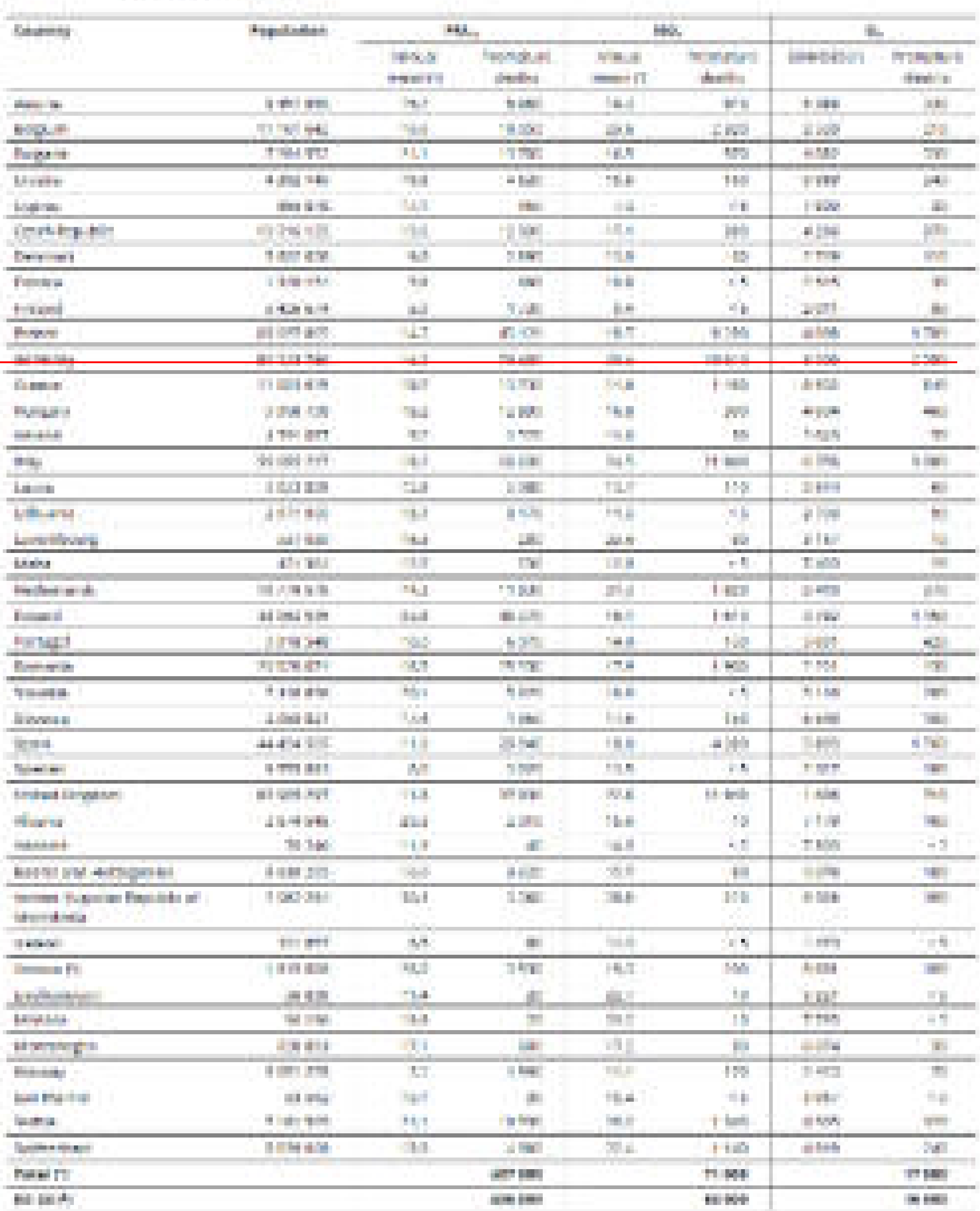
Particulate Matter



Air quality in Europe — 2016 report

Premature Deaths in Europe, Due to Air Pollution

Table 10.1 Premature deaths attributable to $PM_{2.5}$, NO_2 and O_3 exposure in 41 European countries and the EU-28 in 2013



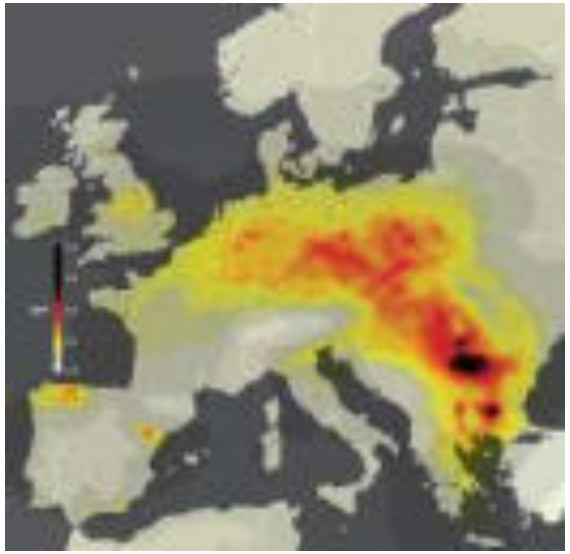
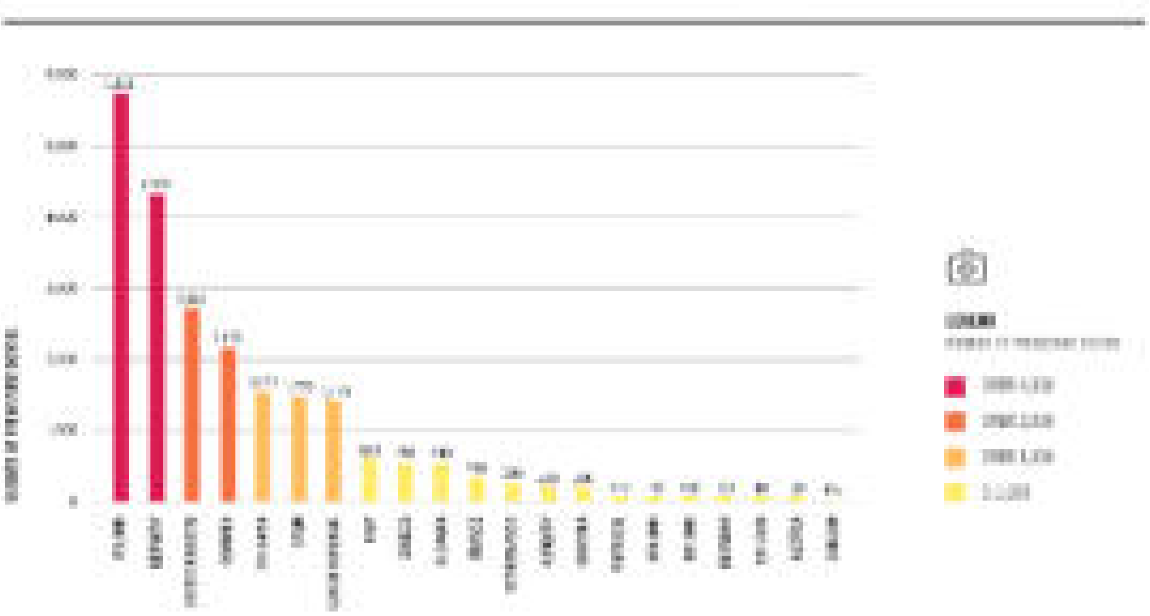
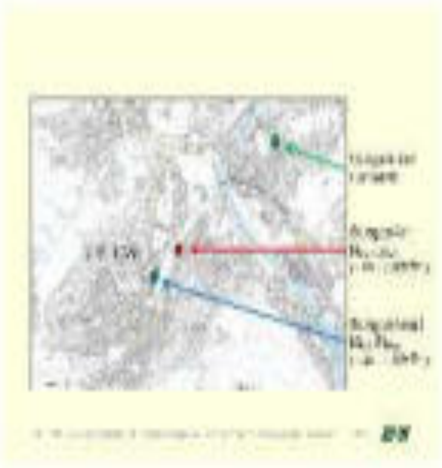


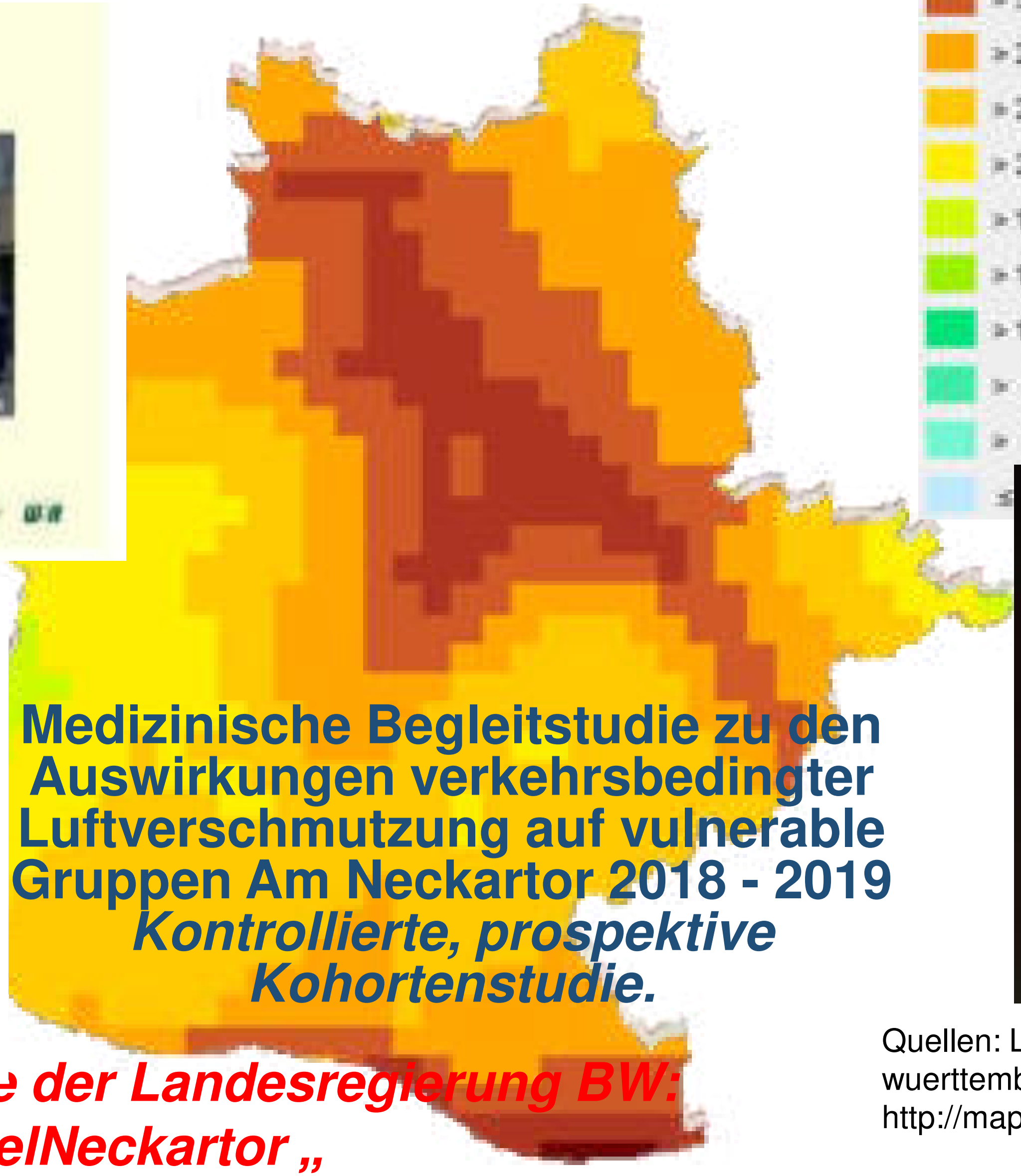
FIGURE 1.

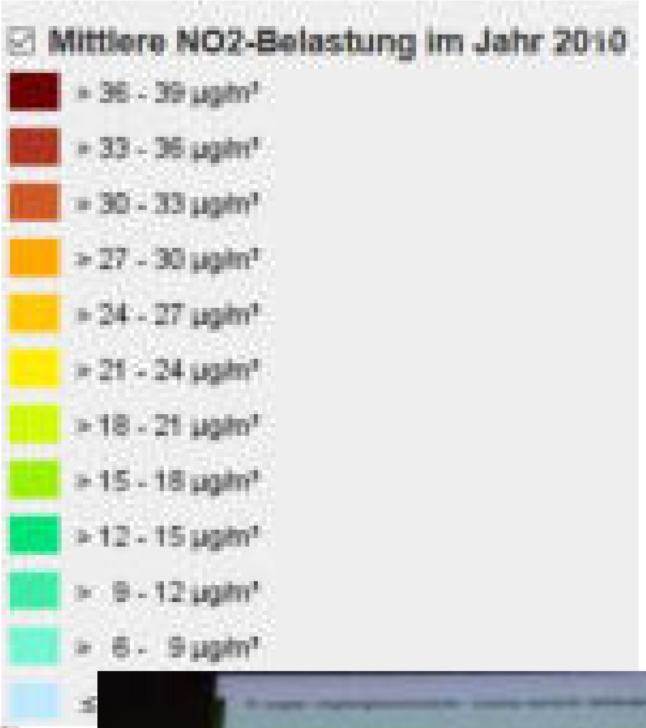
PREMATURE DEATHS FROM COAL-FIRED POWER PLANTS

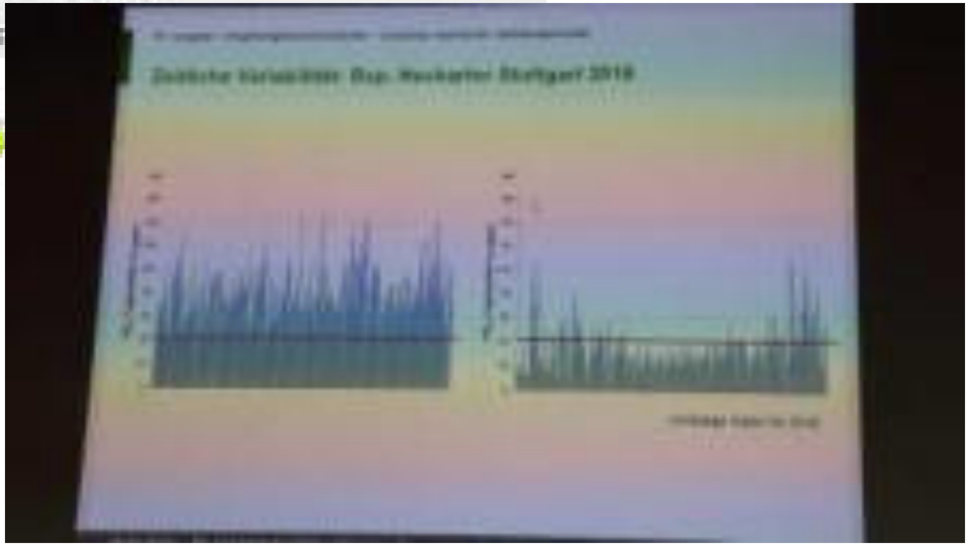


Air Pollution in Stuttgart (NO_2)









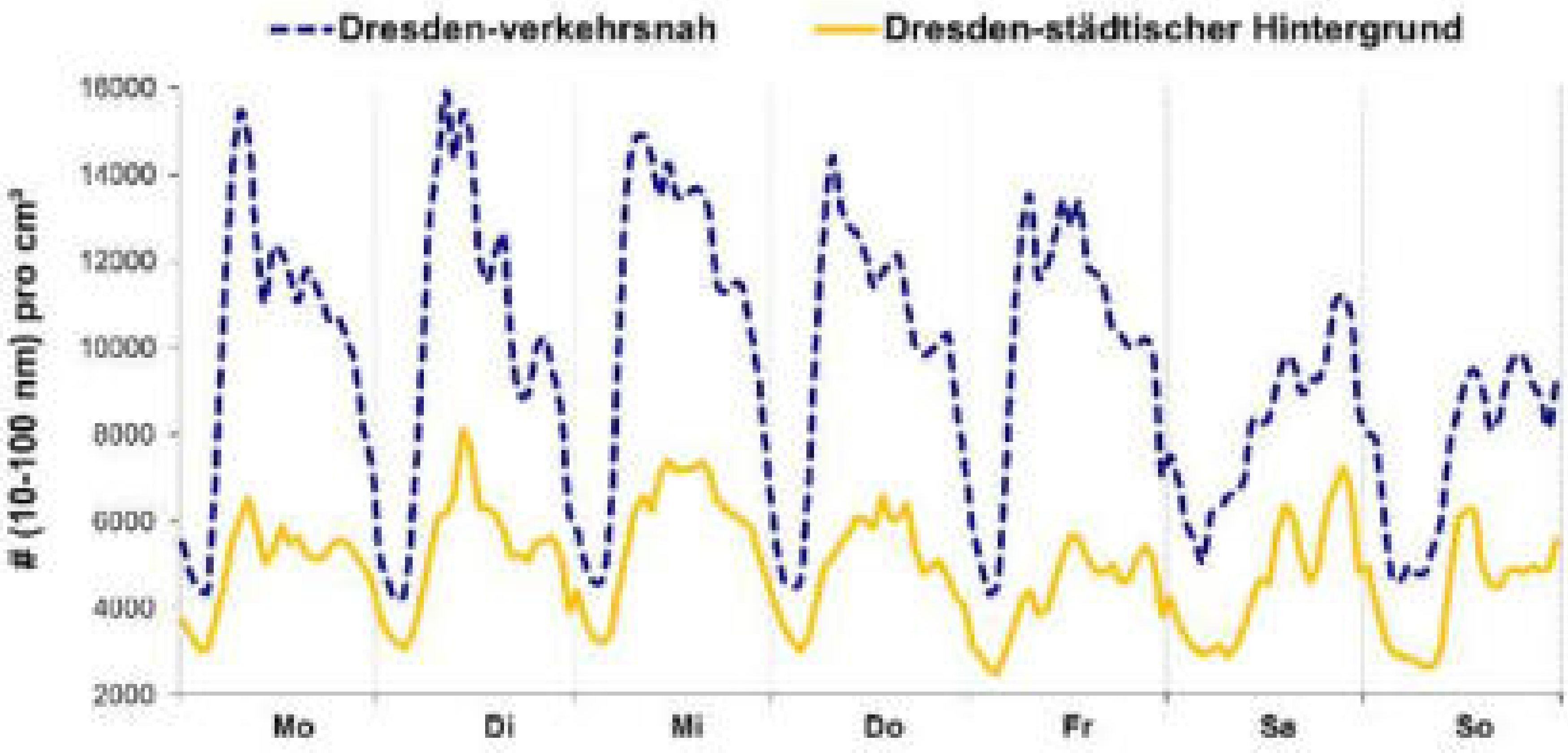
Medizinische Begleitstudie zu den Auswirkungen verkehrsbedingter Luftverschmutzung auf vulnerable Gruppen Am Neckartor 2018 - 2019

Kontrollierte, prospektive Kohortenstudie.

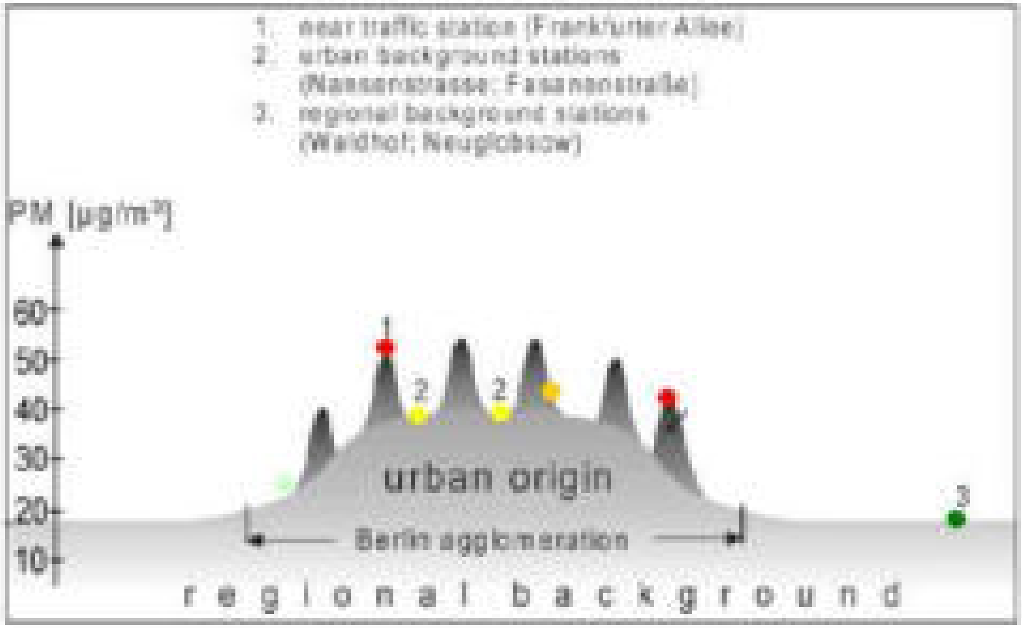
Studie der Landesregierung BW: „DieselNeckartor „

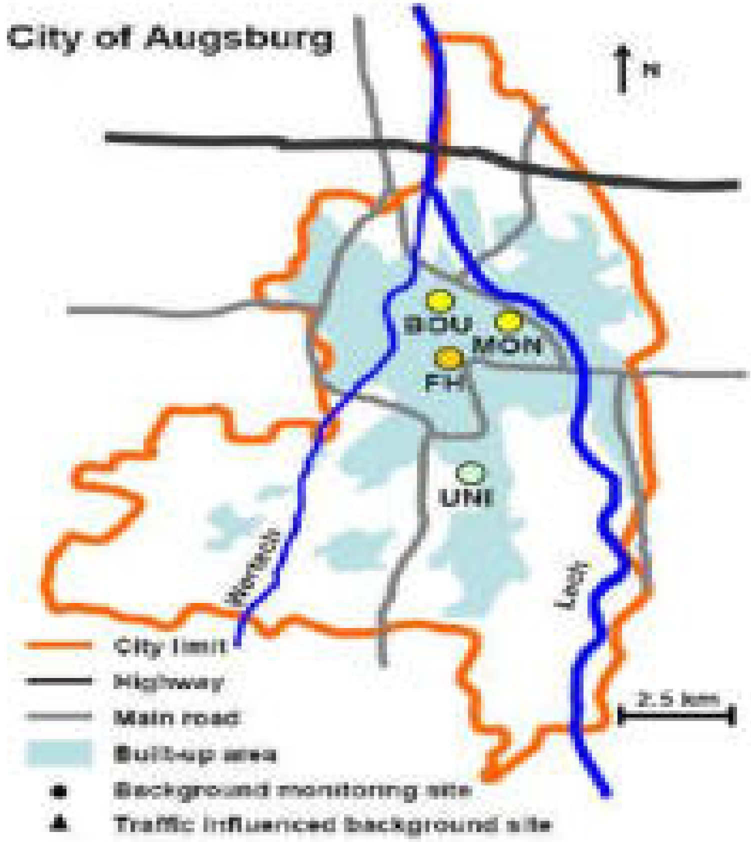
Quellen: LUBW, http://udo.lubw.baden-wuerttemberg.de/public/pages/map/default/index.xhtml
http://maps.google.com

UFIREG: Ausgewählte Ergebnisse



Räumliche und zeitliche Variation von UFP an ortsfesten Messstationen in Augsburg





FH: traffic influenced urban bs
MON, BOU: urban bs
UNI: suburban bs

Cyrys et al., 2008

Hause hould- Instruments of the Future ?

- **Particulate Matter**
  - Particles between 0,3 – 2,5 µm
- **Temperature**
- Humidity
- **CO_2**

Climate Change and Indoor- Pollution

Zeitliche und räumliche Verbreitung von Laserdrucker-Emissionen

Zeitlich: Die Intensität der Emission ist abhängig vom jeweiligen Druckermodell und kann vom Einschalten des Gerätes bis zur Beendigung des Druckprozesses deutlich variieren. Räumlich: Auch die Verbreitung der Teilchen im Raum ist von Drucker zu Drucker verschieden und hängt zudem von raumspezifischen Einflussfaktoren wie der Belüftungsrate ab.

Lung Health- Public Health: Prevention Early detection Protection

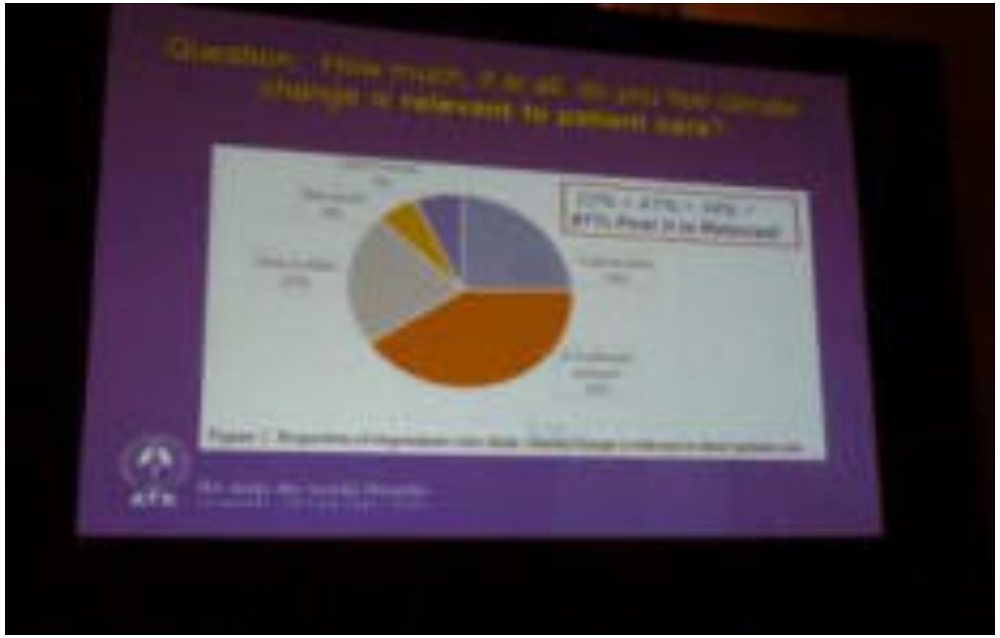
X-Ray Truck, 1957

Mortality
1900: 300 Tbc - Deaths /100.000
1950: 40 Tbc - Deaths/100.000
2008: 50 Lung cancer - Deaths/100.000

Clinical Climate Impact Research !

Impressions about the U.S. Alliance for Climate and Health

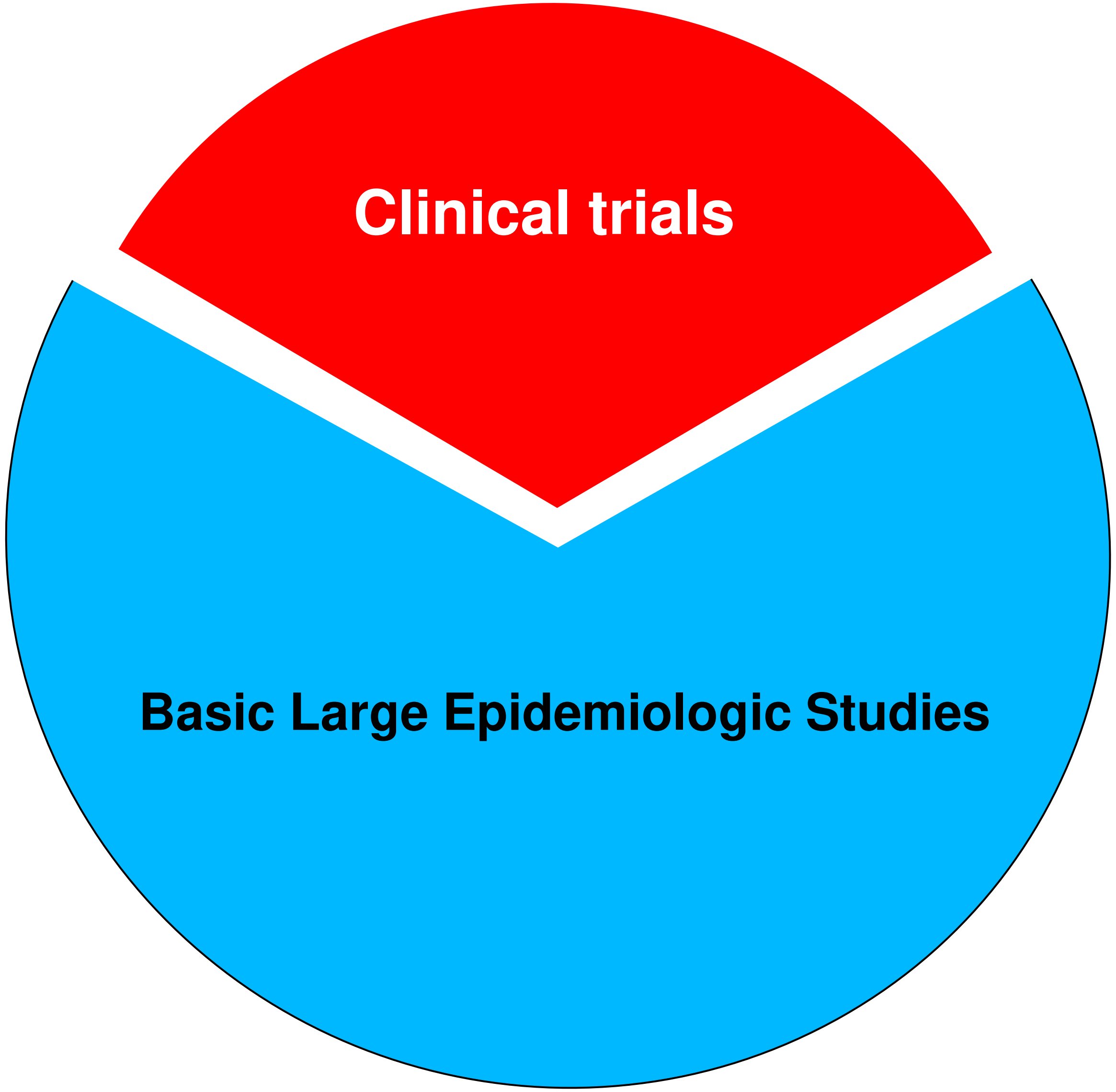
Physicians understood the importance of the Climate Change for the health of their Patients



Patients understood the importance of Climate Change for themselves

„Clinical Climate Impact Research“

„Clinical Air Pollution Impact Research“



Nest steps

Indentifying vulnerable patients groups

Evaluation of clinical adaptation strategies

- Patients
    - Concept: heat resilience increase
    - Concept: „climate adapted“ treatments
    - More use of New Media (Telemonitoring)

- Hospital
    - Climatization of patients rooms,
    - Hospital of the future (architecture)
    - Focus on urban hospitals (heat stress and air pollution)

Workshop „Climate Sciences & Health: A Dialogue“

Leopoldina Nationale Akademie der Wissenschaften

Key questions

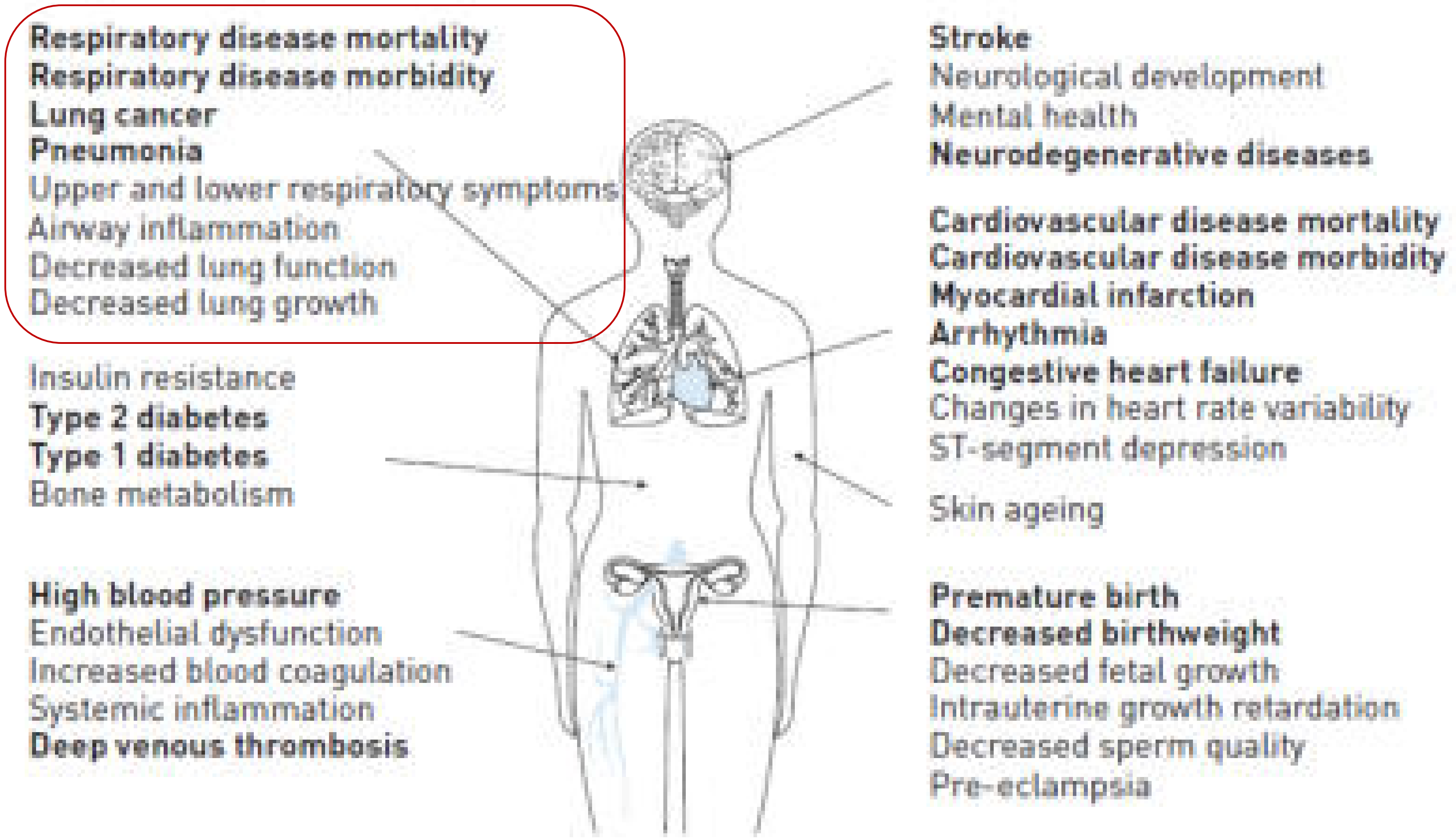
- What do we know within the respective fields of research in the climate sciences or health/medicine?
- What do we know at the nexus of climate sciences and health?
- What specific health services will be needed to protect public well-being under climate change conditions at reasonable costs?
- What concrete and quantitative health co-benefits accrue from climate action and, conversely, what climate co-benefits can be derived from health policies?
- What data campaigns and methodological advances are required for robust answers to the above listed questions?
- What is the state of national and international scientific collaborations between health sciences and climate sciences?
- What kind of collaborations would have to be initialised to maximise a “cooperation dividend”?

PART 1:

13:45 | Contributions to a dialogue between climate sciences and health I (15 min each + disc.)

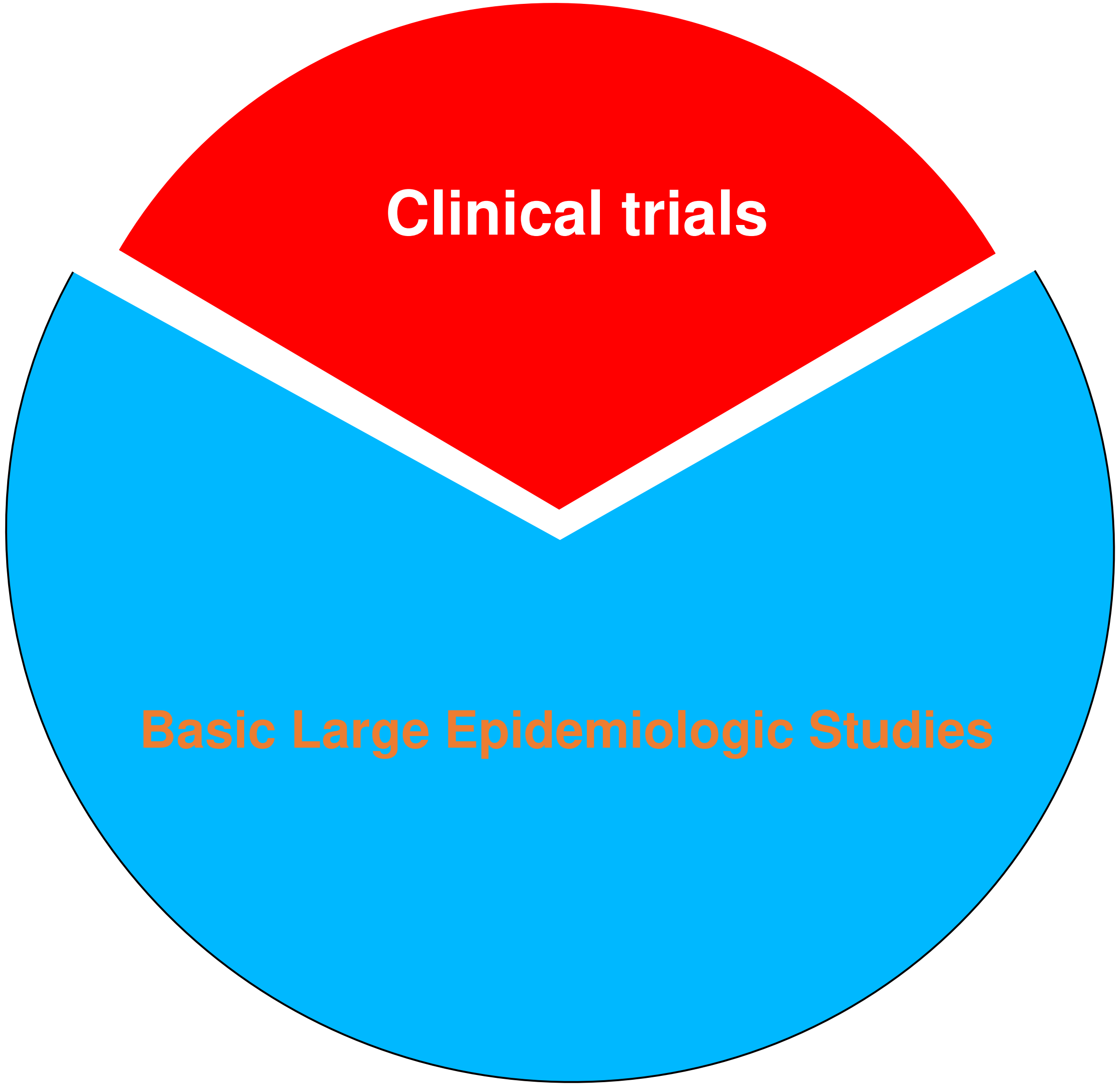
Air pollution	Jos Lelieveld, Mainz
Clinical Climate Impact Research- Portal organ lung	Christian Witt, Berlin
Planetary waves and the increase of heat extremes	Stefan Rahmstorf, PIK
Urbanisation and human well-being	Frauke Kraas, Köln

Overview of diseases, conditions and biomarkers affected by outdoor air pollution.



ERS/ATS STATEMENT | G.D. THURSTON ET AL. Eur Respir J 2017; 49: 1600419.

„Clinical Air Polution Impact Research“



Survival - in Changing Enviroments

Michelangelo, Sixtinische Kapelle

Migration

Raffael , Vatikan

Adaptation

Mitigation (driving ban) and/or Adaptation

- **new technologies** to decrease greenhouse gas emissions
- Hydrogen – Fuel Cell
- Electronic vehicles
- Solar cells

Unintended negative health consequences?

CHARITÉ

Clinical Climate Research Unit

Contributers:

Dr. A. Schubert
Dr. Uta Liebers
Dr. Melissa Jehn
Dr. A. Gebhardt
Dr. Nina Omid
Dr. M. Grabenhorst
Prof. Dr. Christian Witt

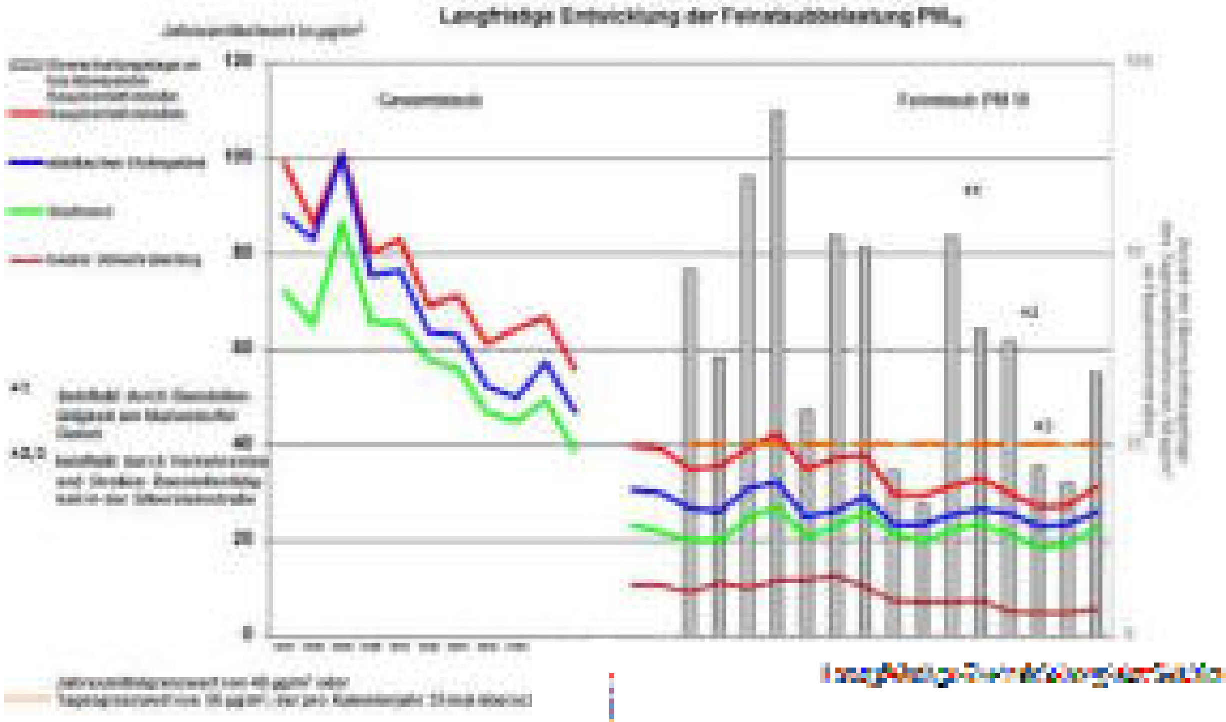
Marija Drozdek
Jana Heinsohn
M. Hanisch
Claudia Schack
Nora Döhner
Ph. Humbsch

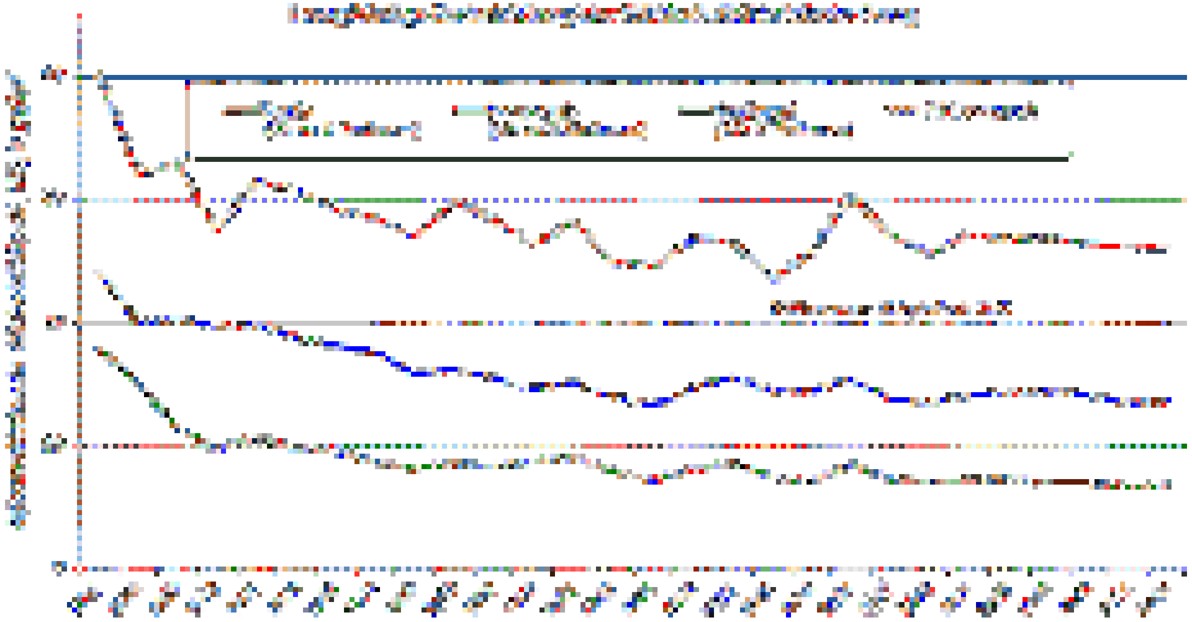
INKA BB

UCaHS

„COOLER KOLLAPS“

Luftqualität Berlin





Quelle: Senatsverwaltung für Umwelt, Verkehr und Klimaschutz

Conclusion—the way forward

Ambient air (outdoor) pollution

Short-term interventions	• Identify sources of key pollutants • Target control of stationary sources • Dust management systems, monitoring systems; • Mandate **improved fuel quality and engine standards**; • Design and implement **effective enforcement systems**
Medium-term interventions	• Establish requirements for **cleaner vehicles**, including testing stations (controls on diesel vehicles, catalytic converters, converting to gas); • Provide incentives for use of electric and hybrid vehicles; • **Upgrade public transport fleets**
Long-term intervention	• Expand or upgrade public transit; • Facilitate active commuting by constructing walkways and cycle paths; • create mechanisms to **discourage vehicle use**
Policy and institutiones	• Undertake source apportionment to identify the most important sources of pollution; • Establish and prioritise control targets and timetables; • Establish a high-level intersectoral Steering Committee; • Involve the public and civil society organisations

Überlegungen zum Klinischen Umgang
mit der Problematik Air pollution und human Health

1. Erkennung vulnerabler Gruppen und suszeptibler Patienten
   (Patienten mit chronischen kardiorespiratorischen Krankheiten, incl. Therapie)

2. Beratung und Aufklärung der Problematik/Risiken - Expositionsanamnese
   (Traffic related diseases durch Wohnort/Kita, Berufliche Belastung)
   Karenz- und Vermeidungsstrategien bisher. (Zukunft „Dieselspray“ ?)

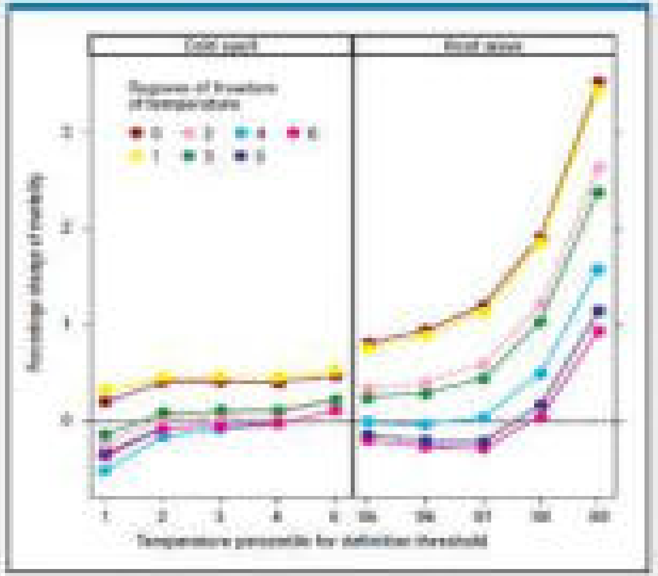
2. Bisher kein abgestimmtes klinisches Vorgehen (RL,LL)
   nur Statements der Fachgesellschaften (Joint ATS/ERS) 2017

4. Keine arbeitsmedizinische/gutachterliche Evidenz

5. Klinische Air Pollution Forschung ist zu stärken !

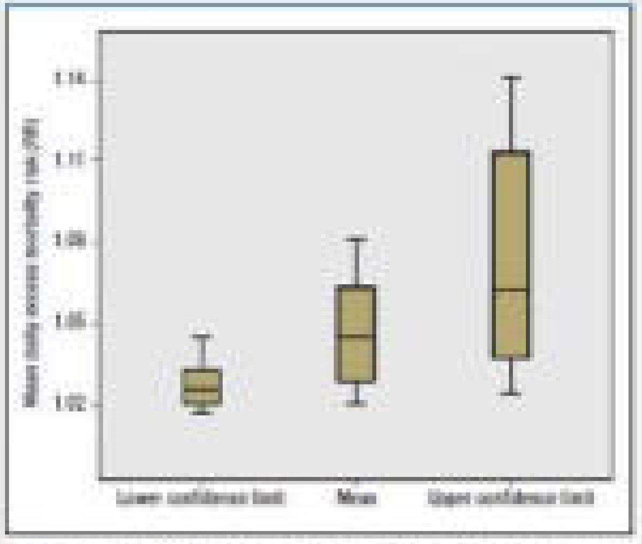
Temperature influences Mortality and Morbidity in COPD

Mortality increase per 1°C in cold spells and heat waves

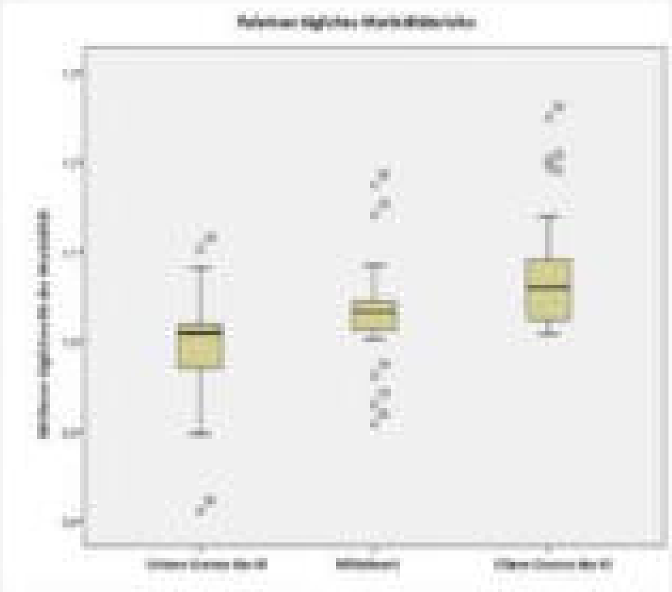


adapted Semenza JC, Rubin CH, Falter KH, et al.

Mean Daily Excess Mortality during heat waves up to 14 %



Mean Daily Excess Morbidity increase during heat waves up to 9%

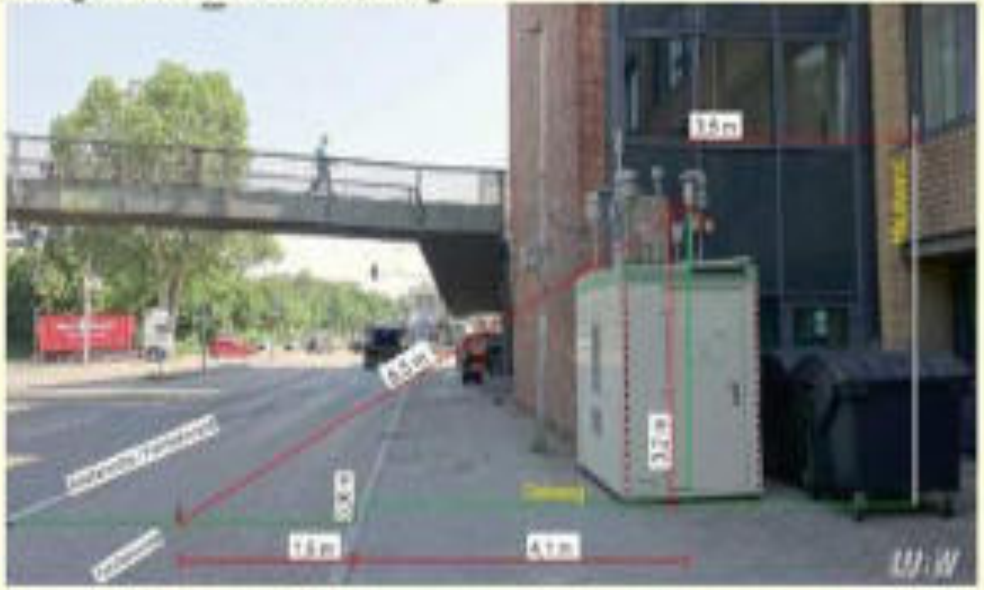


Meta-Analysis of Mortality and Morbidity for Repiratory Diseases due to Heat Waves (1995-2014 >100 Mio. Patients)

Deutsches Ärzteblatt (2015) 112: 878-883

Umsetzung in Stuttgart (Teil 3)

Stuttgart Am Neckartor, NO_2:



(entsprechend für alle Komponenten an allen Stationen)