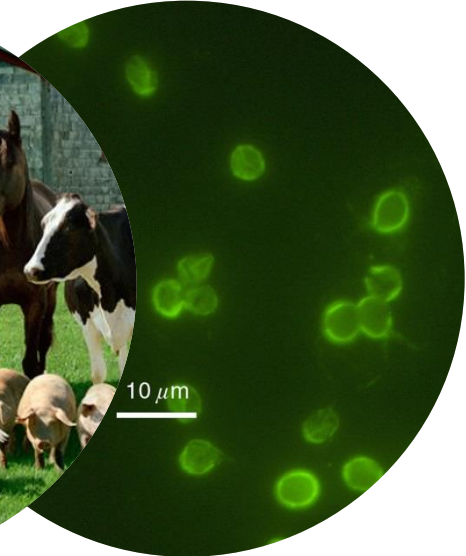# Water Quality Impacts on Human Health

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Mirjam Bak, Gertjan Geerling, Andrew Gemmell, Alessio Ippolito, Issoufou Ouedraogo, Joel Podgorski, Eirini Politi, Jaime Rivera, Philipp Saile, Christian Schmidt, Stefan Simis, Kerstin Stelzer, Maryna Strokal, Michelle van Vliet, Mengru Wang, Jikke van Wijnen

14 September 2022

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Baseline World Water Quality Assessment

WWQA
World Water Quality Alliance

https://communities.unep.org/display/WWQA/UNEA-5+Resources?preview=/45973616/49315847/World%20Water%20Quality%20Assessment%20and%20Alliance_Key%20Findings-Status%20Update-Outlook.pdf

WORLD WATER QUALITY
ASSESSMENT

First Global Display of a Water Quality Baseline

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Content

- Contaminants relevant for health

- Exposure routes

- Data sources

- Some first results
    - State
    - Impacts
    - Response options

- Conclusions

Content

- **Contaminants relevant for health**
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Contaminants relevant for health

Contaminant	Direct impacts	Indirect impacts
Pathogens (viruses, bacteria, protozoans, helminths)	Gastroenteritis, hepatitis, pneumonia, cancer	Stunting, learning deficits, food safety threatened
AMR	Reduced ability to treat infections	Former diseases become problem
Toxic algae/cyanobacteria	Gastroenteritis, respiratory problems	Stunting, bioaccumulation risk
Organic micropollutants	Disruption of the endocrine, reproductive and immune systems, behavioural problems, cancer, diabetes and thyroid problems	Use of anti-microbials can cause AMR, bioaccumulation risk
Arsenic	Skin, vascular and nervous system disorders and cancer	Food quality and safety threatened

Note: List is by no means exhaustive!

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Contaminants relevant for health

Contaminant	Direct impacts	Indirect impacts
Fluoride	Dental and skeletal diseases	
Nitrite/nitrate	Blue baby syndrome	Favourable environment for vectors
Heavy metals	Cancer, other toxic effects, diarrhoea and vomiting	Food quality and safety threatened
Salts/salinity	Hypertension, increased risk of (pre)eclampsia infant mortality	Food quality and safety threatened
Plastics (incl. microplastics)	Particle toxicity leading to oxidative stress, cell damage, inflammation, and impairment of energy allocation functions, toxicity of substances leaching out of plastic	Habitat for pathogens and vectors that can spread infectious diseases

Note: List is by no means exhaustive!

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Common exposure pathways

Drinking

Bathing

Domestic water use

Eating irrigated vegetables, rice (or rice products), or aquatic plants

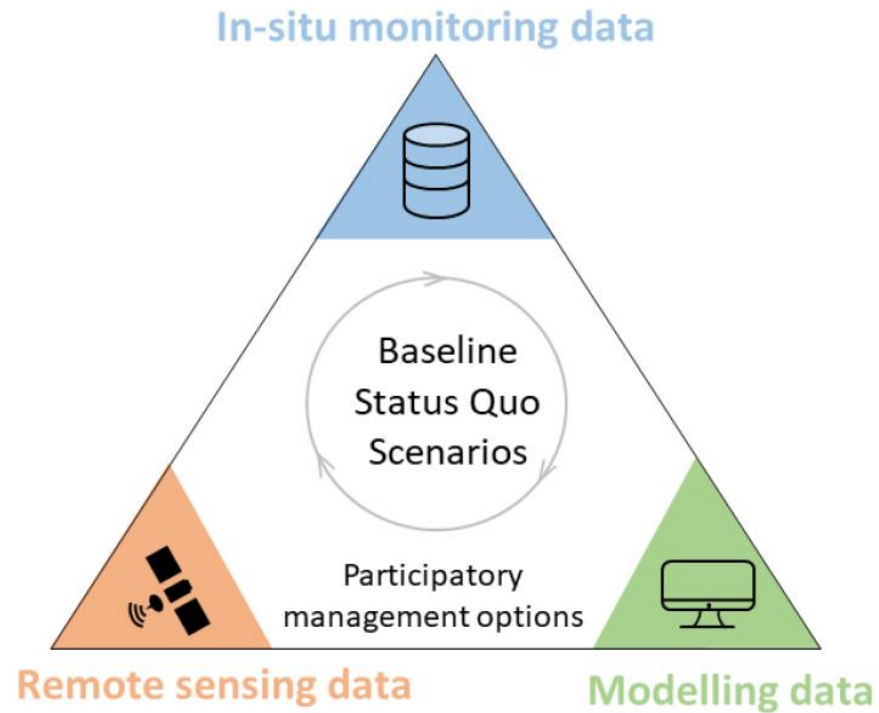Eating contaminated fish and shell fish

Skin contact

Exposure depends on location, livelihood, culture, wealth, gender etcetera.

Content

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- **Data sources**

- Some first results

  - State

  - Impacts

  - Response options

- Conclusions

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Data sources

In-situ monitoring data

Baseline
Status Quo
Scenarios

Participatory
management options

Remote sensing data
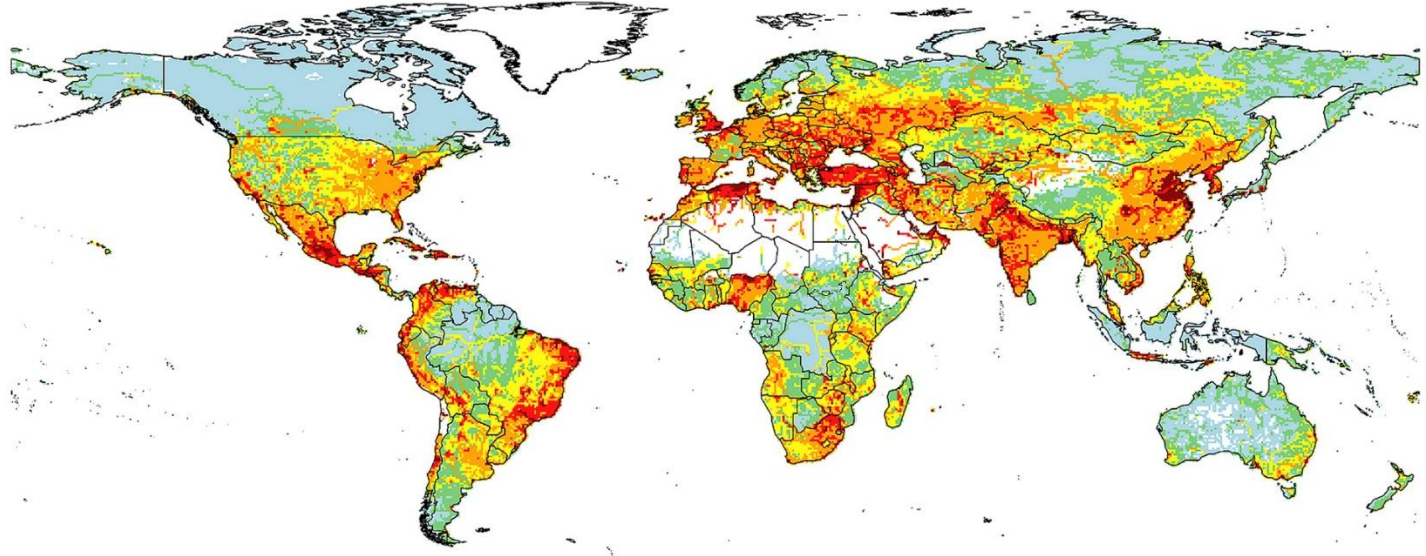
Modelling data

Only considered large-scale results
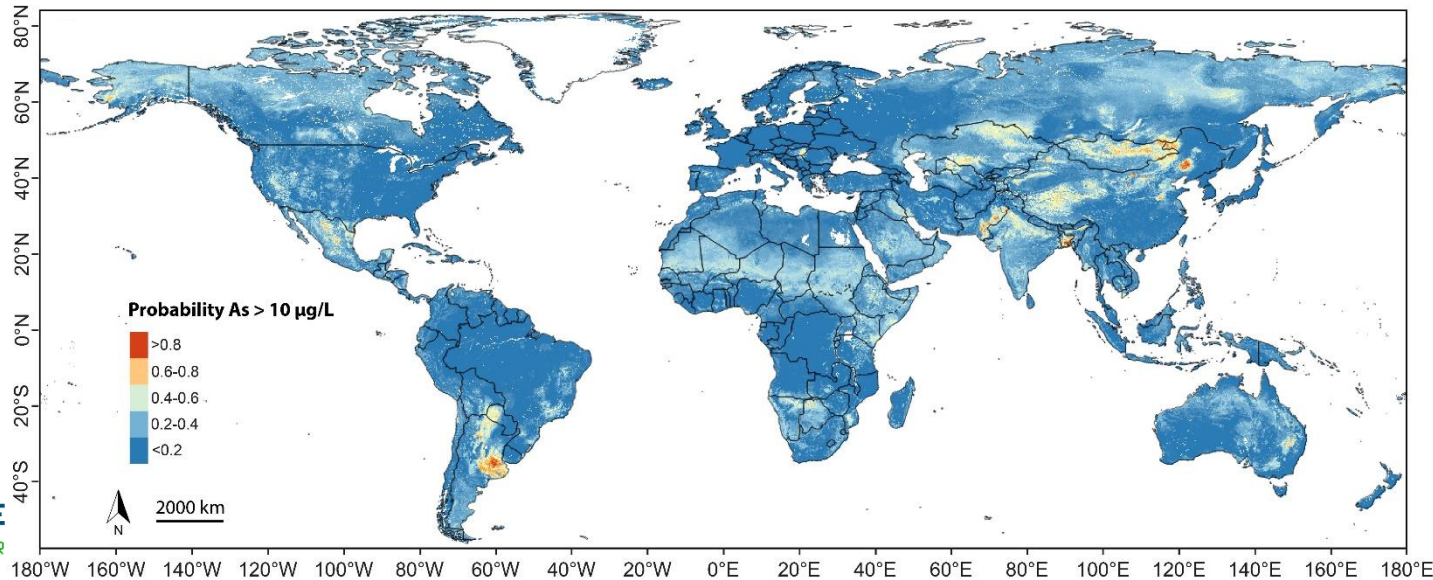
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- Data sources

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  - State

  - Impacts

  - Response options

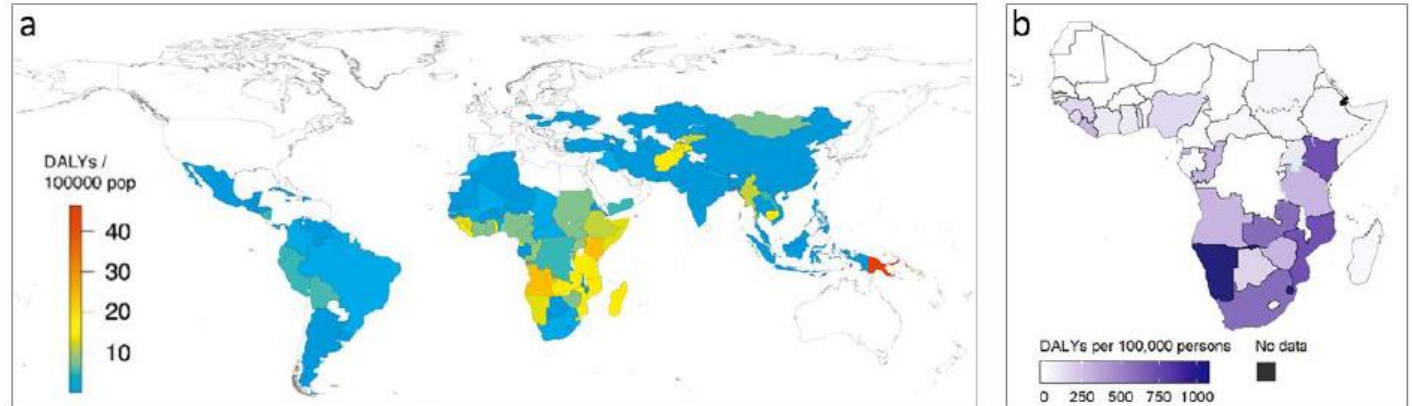- Conclusions

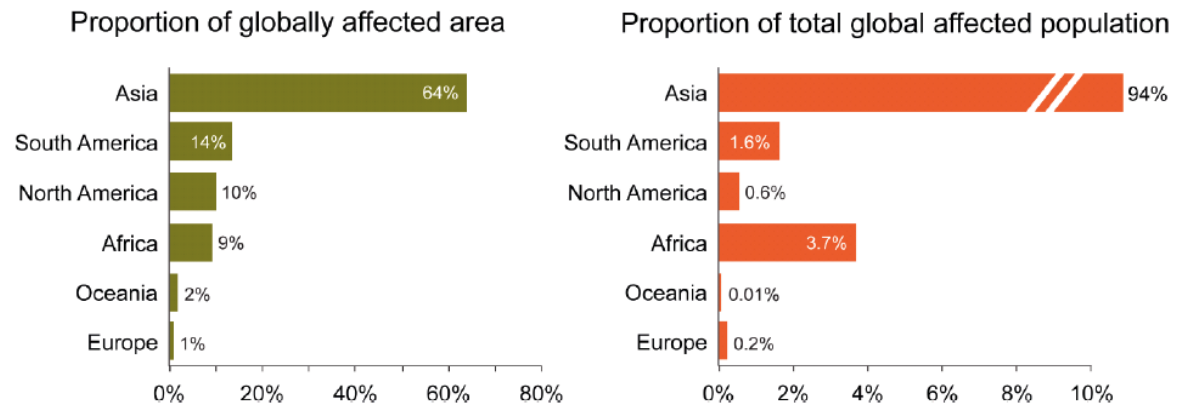# Some first results - State

Cryptosporidium

Arsenic

Probability As > 10 µg/L
- >0.8
- 0.6-0.8
- 0.4-0.6
- 0.2-0.4
- <0.2

2000 km

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Some first results - Impacts

Cryptosporidium

Figure 3.12 *Disease burden (expressed in DALYs per 100 000 population per year) for cryptosporidiosis contracted from a) drinking raw surface water (2 l/day all year - Countries that appear white on the map have no population depending on raw surface water for their drinking water according to data from the Joint Monitoring Programme (JMP) of WHO and UNICEF, Hofstra et al. 2019) and b) drinking raw surface water and tap water made from surface water (Limaheluw et al. 2019) for approximately the year 2010. Figure a does not take potential higher DALYs for the immunocompromised population that has HIV-AIDS into account, while Figure b does.*

Arsenic

Figure 3.13 *Proportions of land area and population potentially affected by arsenic concentrations in groundwater exceeding 10 mg/l by continent (Podgorski and Berg 2020).*

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15

Some first results – Response options

- **Reduce exposure**
  - Reducing emissions
  - Treatment before use
  - Using a different water source
- **Treatment of the health problem**
  - Vaccines
  - Treatment
- **Effectiveness not studied much yet – epidemiology studies and scenario analysis required**

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- **Conclusions**
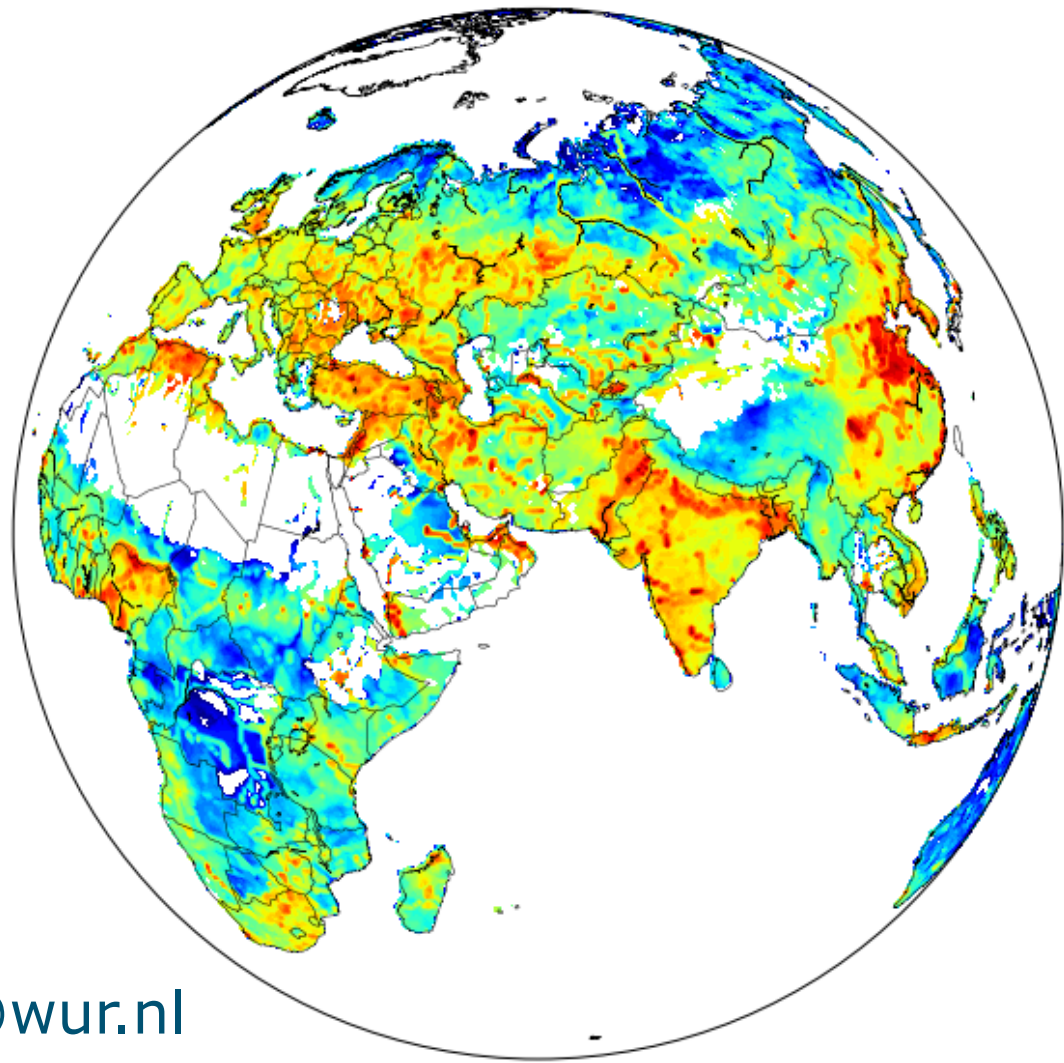
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Conclusions

- Human health is directly and indirectly affected by many different contaminants in water

- Data to quantitatively link water quality to human health is lacking

- Concentration hotspots:
  - for most contaminants: densely populated areas, in particular where wastewater treatment is limited
  - for groundwater arsenic and surface water salinity: India, China and Mongolia

- Contamination sources: mostly human activity
  - domestic water use
  - agriculture (use of manure, irrigation)
  - manufacturing

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Conclusions

- Human health impacts hotspots:

  - for *Cryptosporidium*: areas where surface water is still regularly used for drinking directly

  - for arsenic: Asia

  - for other contaminants, no impact studies available

- Response options: reduction of exposure by

  - reducing contamination sources

  - treatment of the health problem

Thank you

Contact: nynke.hofstra@wur.nl
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