ITC, DEPARTMENT OF EARTH OBSERVATION

UNIVERSITY OF TWENTE.

DO HEALTH RISK PERCEPTIONS MOTIVATE WATER - AND HEALTH-RELATED BEHAVIOUR?

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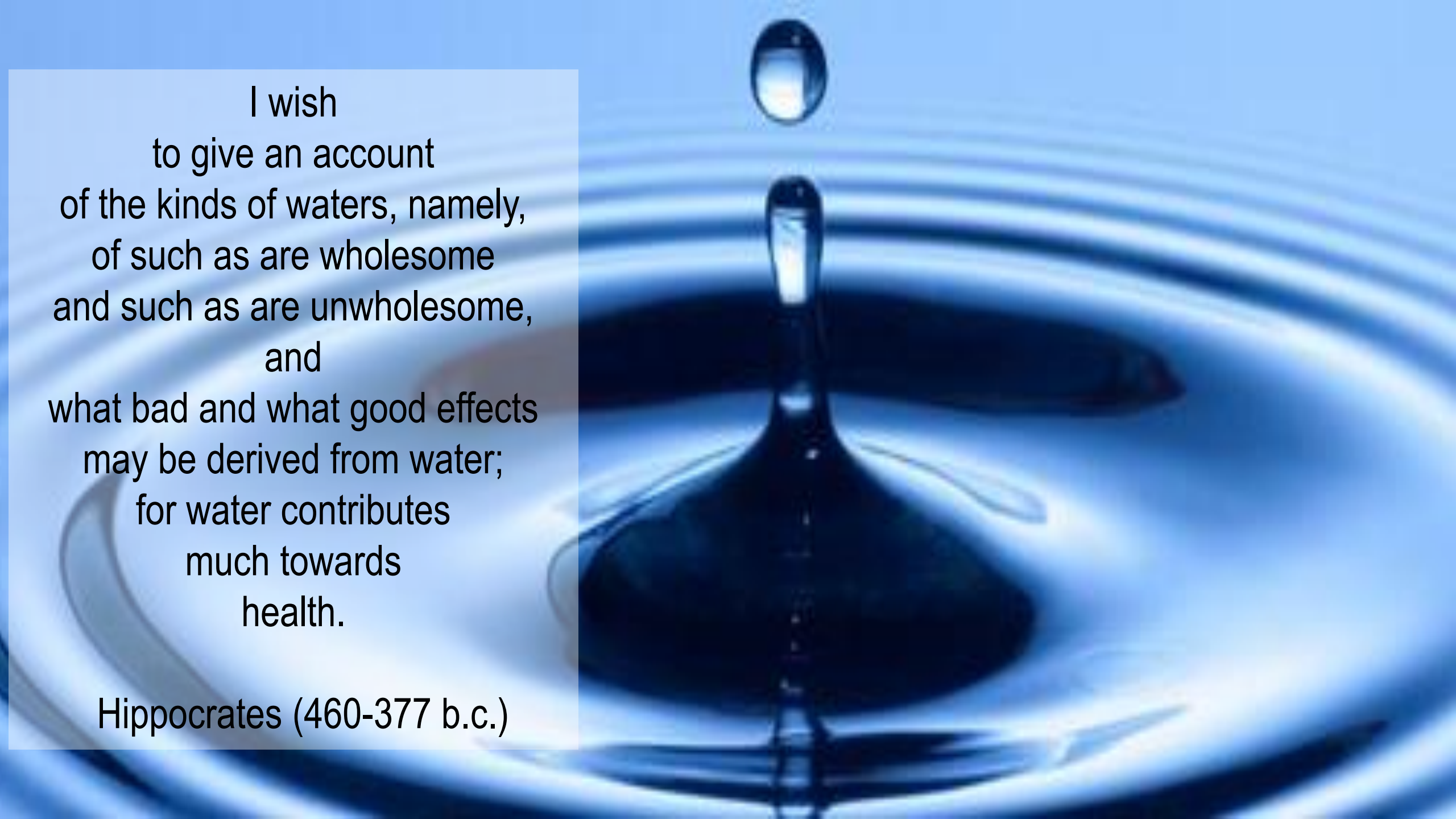
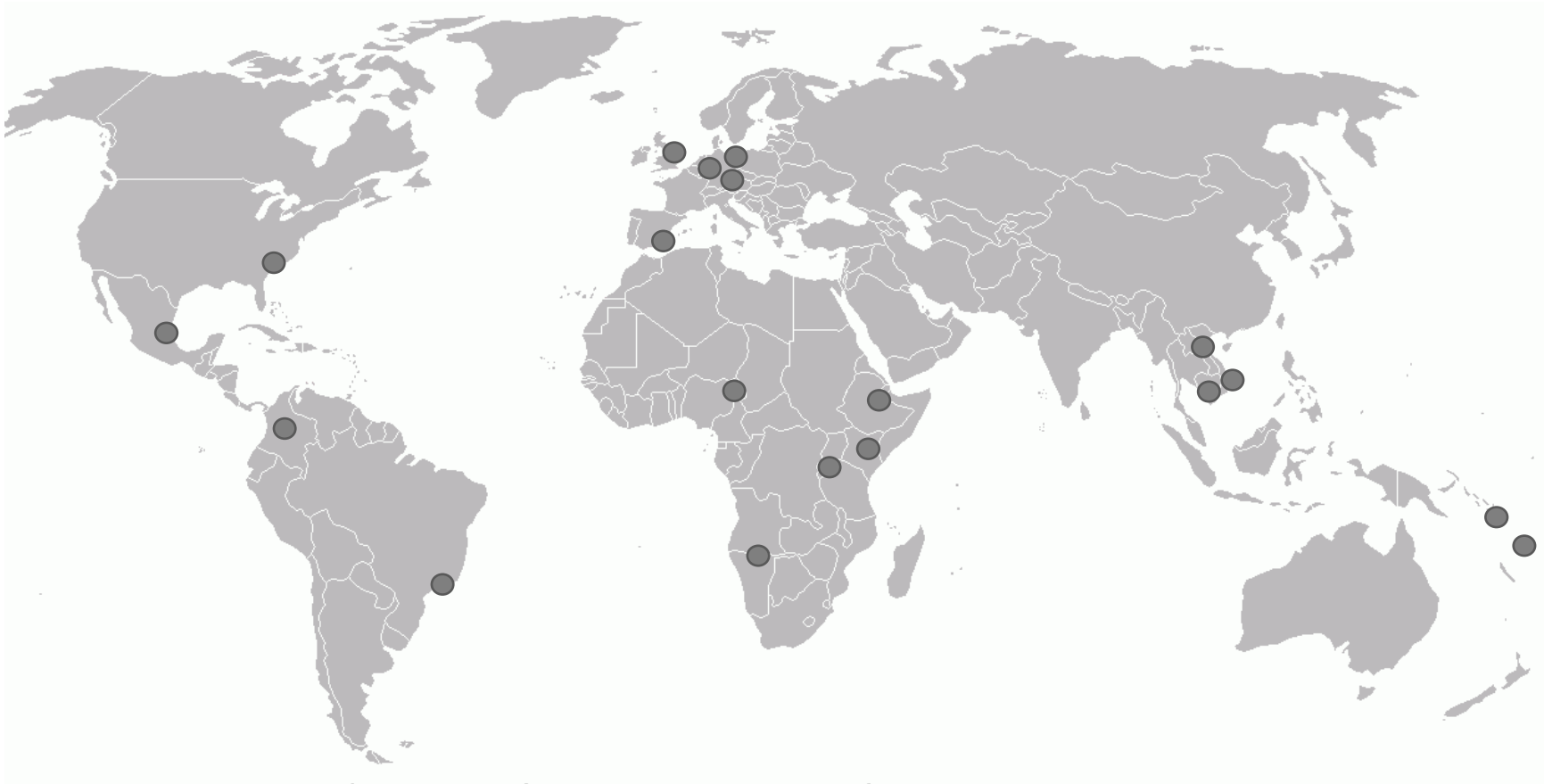
21 JANUARY 2023



I wish
to give an account
of the kinds of waters, namely,
of such as are wholesome
and such as are unwholesome,
and
what bad and what good effects
may be derived from water;
for water contributes
much towards
health.

Hippocrates (460-377 b.c.)

WHO AM I



2020- TT Assistant Professor GeoHealth - ITC

2020 Postdoc – University Edinburgh I Business, Social Sciences
2018-2020 Postdoc – University North Carolina I Global Health
2017 Consultant Water & Health – World Bank, WHO, UNICEF
2017 Postdoc – Environment Agency Berlin I Water, Environment, Health
2017 PhD – University Clinics Bonn I Medical Geography
2012 Diplom – University Bonn I Geography

WATER AND HEALTH RESEARCH

INFRASTRUCTURE, DISEASE MONITORING, EXPOSURE, PERCEPTIONS, BEHAVIOUR
IDENTIFYING SOLUTIONS, INFORMING HEALTH-RELATED DECISION-MAKING

Brazil

Cambodia

Kenya

Fiji, Solomon Islands

Colombia, Ecuador, Mexico

Brazil, Peru

Diplom (2007-2012)
Geography (Bonn)

PhD (2013-2017)
Public Health (Bonn)

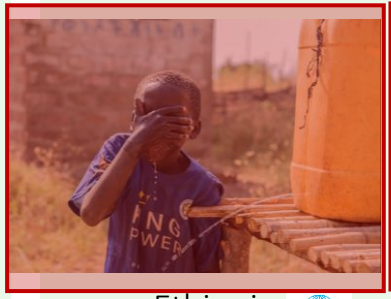
Postdoc (2018-2020)
Global Health (USA, UK)

Tenure Track (since 2020)
GeoHealth (Netherlands)

Vietnam

Namibia

Nigeria



Ethiopia

Europe

Germany, Netherlands

SYSTEMATIC REVIEW ON RISK PERCEPTIONS AND BEHAVIOUR IN THE CONTEXT OF WATER AND HEALTH

Anthonj, C., Setty, K., Ferrero, G., Al-Mounawara A. Yaya, Poague, K.I.H., Marsh, A.J., Augustijn, E.-W., 2022. Do health risk perceptions motivate water - and health-related behaviour? A systematic literature review. Science of the Total Environment 819, 152902. https://doi.org/10.1016/j.scitotenv.2021.152902

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Carmen Anthonj
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Risk perceptions, water and health

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Contents lists available at ScienceDirect

Science of the Total Environment

journal homepage: www.elsevier.com/locate/scitotenv

Review

Do health risk perceptions motivate water - and health-related behaviour? A systematic literature review

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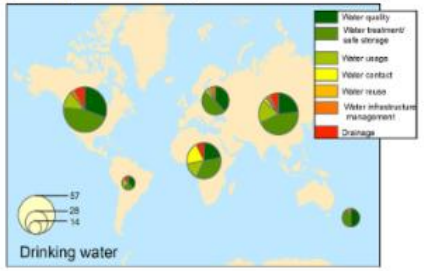
HIGHLIGHTS

- First systematic review of risk perceptions and behaviours in the context of water and health from different continents, countries, settings and contexts around the globe
- Topics dominating literature relate to drinking water, sanitation, hygiene (WASH), waste, health risks, diseases and mental health, and preventative measures
- Evidence of perceptions determining behaviour, e.g. drinking water sources and water safety
- Contextualization with disease prevention, health seeking, variations over space, geography, socioeconomy, time, and cultural context
- Relevance for WASH governance in terms of policy, awareness raising, education and behaviour change, particularly in the face of the ongoing unprecedented pandemic

GRAPHICAL ABSTRACT

Water- and health-related risk perception and behaviour literature reports information from countries around the globe, conducted in various settings and contexts, among different target populations, from various disciplinary angles, using different methods, theories and approaches. Evidence of perceptions determining behaviour is provided particularly related to drinking water sources and water safety.



- Which water- and health-related topics are covered in the risk perception and behaviour literature?
- In which context are respective studies conducted?
- How are health risk perceptions defined and measured across different settings and contexts?
- What is the evidence on water- and health-related risk perception influencing behaviour?

Search strategy

Perception dimension
+ risk dimension
+ behavioural dimension
+ health and disease dimension
+ water
+ programming and/or policy dimension

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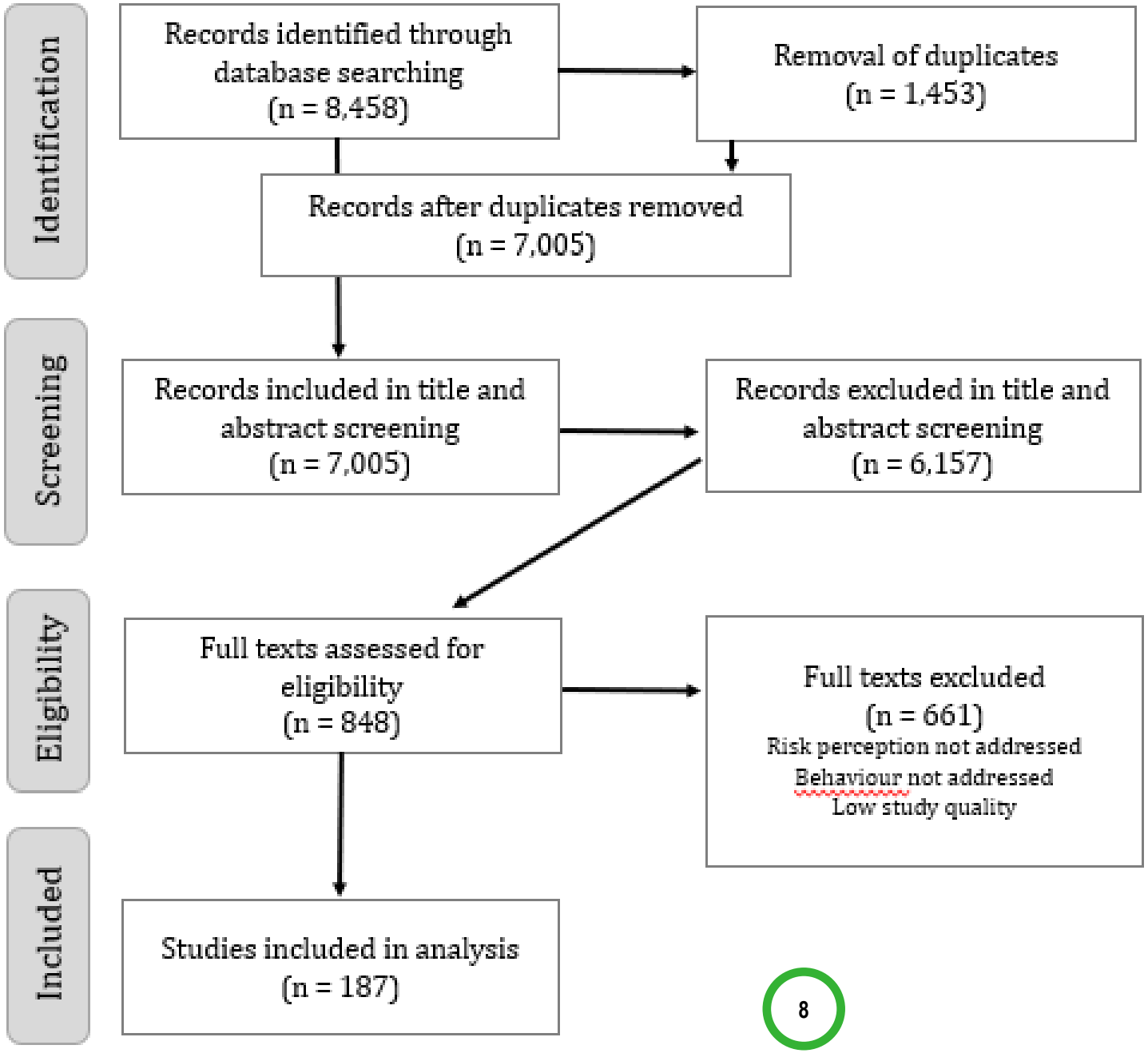
SYSTEMATIC LITERATURE REVIEW (2000-2021)



RESULTING META TABLE

Description of included studies on risk perceptions and behaviours in the context of water and health, based on n = 187 publications (2000 – 2021).

Study	Focus	Study country	Setting detail/context	Methods	Study population
Abu and C 2018.	Urban Poor	Ghana	Urban, flooding	Survey questionnaire	Households
Ackumey 2012.	uli ulcer in	Ghana	Urban, informal settlement	Semi-structured interviews	Individuals, not specified
Aibana et	e Diseas in Rural Haiti	H			
Akpabio, 2	al mirr a	N			es, community us community, tative
Akter and	n m	B			
Alemu et a	on	E			ealth providers, tatives
Alicea-Pla 2019	s	N			
Allwood e	ho	J			
Aluko et a	s in a	N			pecified
Andrade et al., 2019	Evaluating the effectiveness of a community-based hygiene promotion programm in	B			ools
Angelo et	d with	Tanzania	facility Rural	Semi-structured interviews, focus group discussions, intervention/evaluation	Individuals, not specified, children
Anthonj et 2019.	sease exposure among Kenyan wetland communities	Kenya	Rural, wetland, flooding, drought	Survey questionnaire, semi-structured interviews, focus group discussions	Farmers, pastoralists, community leaders, health providers, political representatives
Anthonj et al., 2018.	Health Risk Perceptions Are Associated with Domestic Use of Basic Water and Sanitation Services-Evidence from Rural Ethiopia	Ethiopia	Rural	Survey questionnaire, case control study, spot check, intervention/evaluation	Households
Anthonj et al.,	Water, sanitation and hygiene in wetlands. A case study from the Ewaso Narok	Kenya	Rural, wetland	Survey questionnaire, spot check, semi-structured	Farmers, pastoralists

Study characteristics: description, area, population, methods

Perceived risk factors

Health / disease outcomes

Associations between perceptions and behaviours

Results / discussions

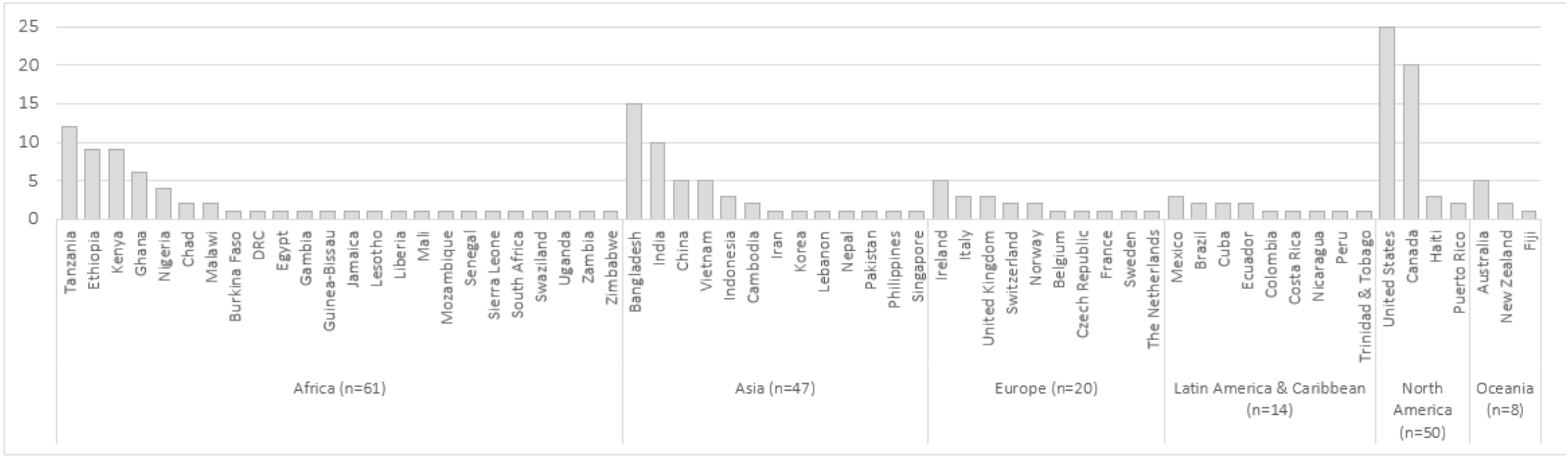
descriptive

theoretical/ methodological

analytical

SYSTEMATIC REVIEW RESULTS: DESCRIPTIVE

SPACE AND TIME



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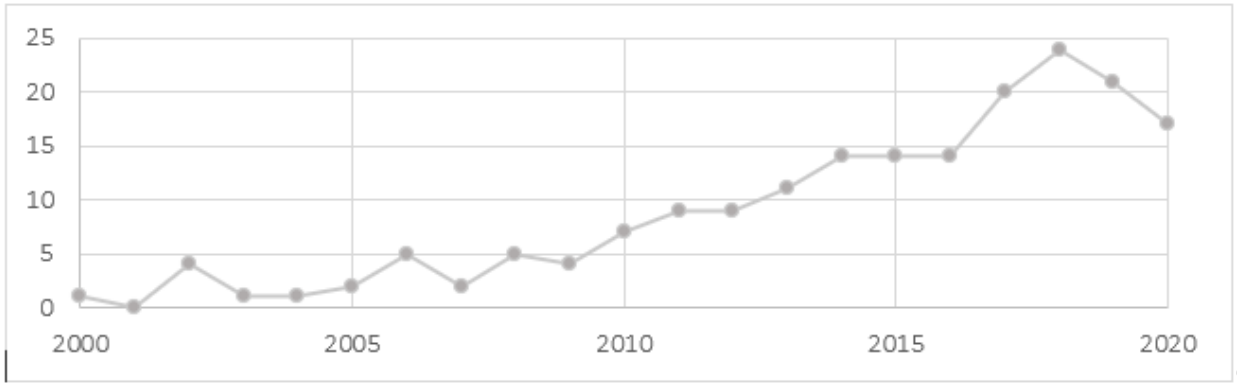

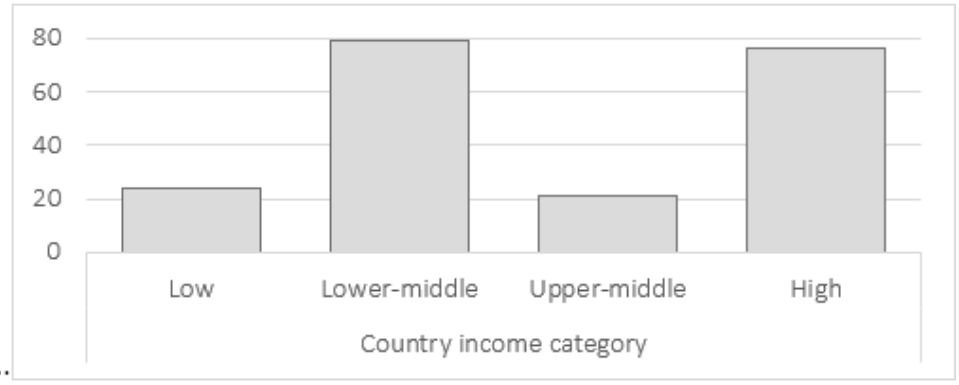

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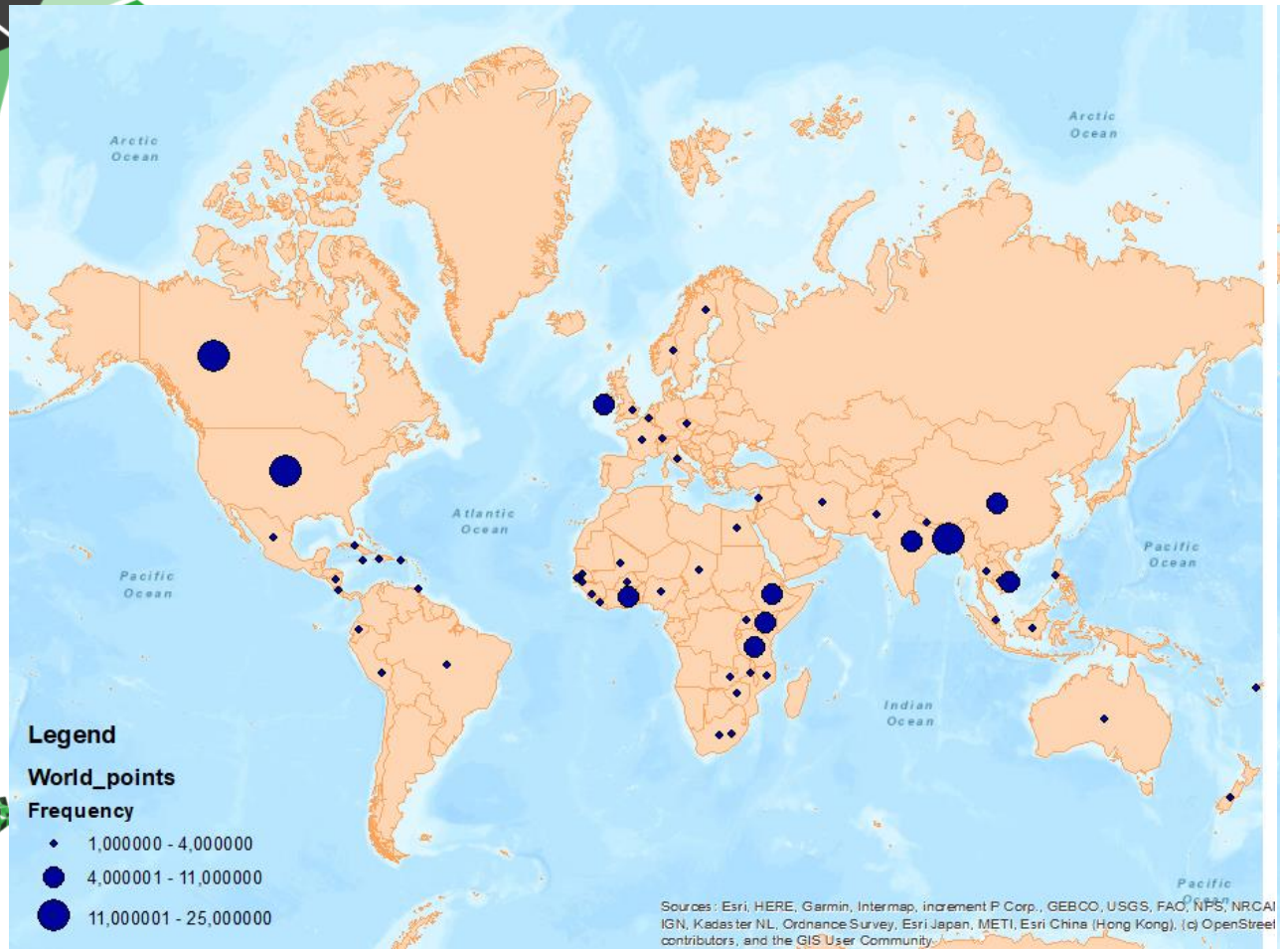
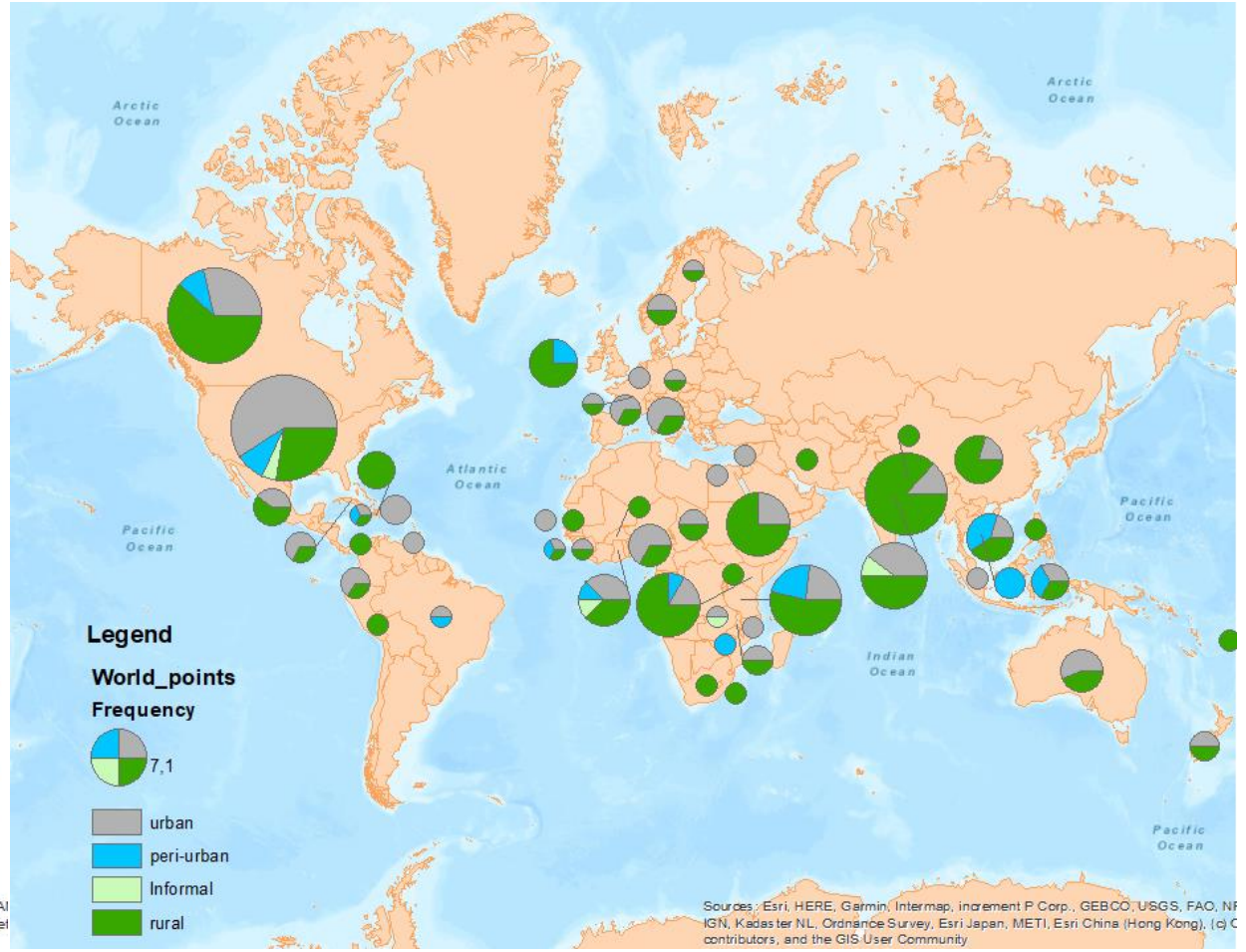
GEOGRAPHY





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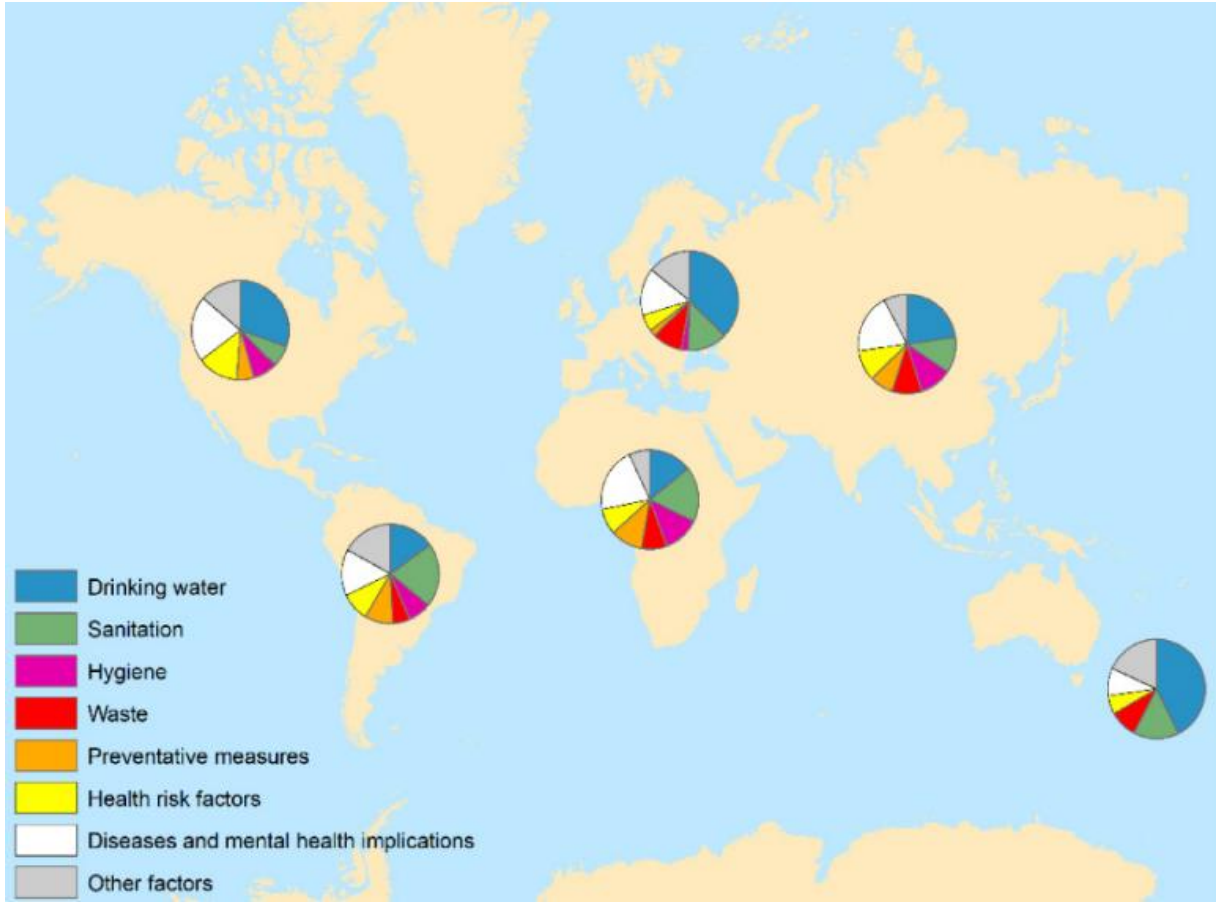
CHARACTERISTICS AND CONTEXTS

- Rural (56%), urban (35%), peri-urban (10%), informal (2%)
- Mainly household or individual level; few studies in schools, health facilities, etc.
- Little indication of specific ecological context; few studies in islands, coasts, wetlands, etc.
- Little indication on environmental condition; few studies on flooding, drought, landslides, etc.
- Mainly research on general population; some studies on children, women, community leaders, healthcare providers, indigenous community, political representatives.
- Sciences: health; natural & environmental; social & political; development; planning; statistics; MEL; human rights; public administration, education

TOPICS AND GEOGRAPHICAL VARIATION

- Drinking water source (73%)
  consumption, choice
- Water safety (71%)
  quality, treatment, safe storage
- Hygiene (40%)
  handwashing, hand drying, menstrual hygiene
- Sanitation (32%)
- Waste management (24%)
- Wastewater management (13%)
- Risks: Water contamination (E. coli, arsenic, lead, micropollutants) (19%); mosquitoes (10%); proximity to water (6%); irrigated agriculture (5%)



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SYSTEMATIC REVIEW RESULTS: THEORETICAL / METHODOLOGICAL

METHODOLOGICAL APPROACHES

Quantitative vs. qualitative vs. mixed methods

- Quantitative approaches commonly applied:
  - Mostly semi-quantitative on-site questionnaire (67%), online (6%), postal (4%), phone (4%)
  - Few case-control (9%) or longitudinal studies (4%), spot checks and inspections (14%), water testing (12%)
- Qualitative approaches frequently employed
  - Semi-structured interviews (34%), focus group discussions (24%)
  - Few participatory studies with choice experiments, exercises, role plays, photovoice or transect walks
  - Intervention studies or evaluation research (24%), including community education or risk communication components related to WASH, health and distribution of WASH-related items.
  - Few studies conducted spatial assessments

RISK PERCEPTION CONCEPTS

Risk perceptions –worry, fear, dread – or perceived seriousness of a disease – e.g. as “serious”, “real”, or “deadly” - are, to a large extent, **based on prior knowledge and beliefs**. Perceptions are **associated with individual, social and cultural factors**, referring to intuitive evaluations of (health) hazards someone is or might be exposed to. **Health-related actions and inactions are often triggered and influenced by our individual risk perceptions**. A higher perceived risk increases the likelihood of positive attitudes towards protective measures. Risk perception is an important determinant of risk exposure, and to the kind of protective behaviour to be put in place. **Risk perceptions have been described as predictors of behaviour**, consisting of two components: perceived severity of consequences and perceived vulnerability to disease. A **mismatch between actual hazard and perceived risk can lead to inappropriate behaviours and compliance to recommended measures**.

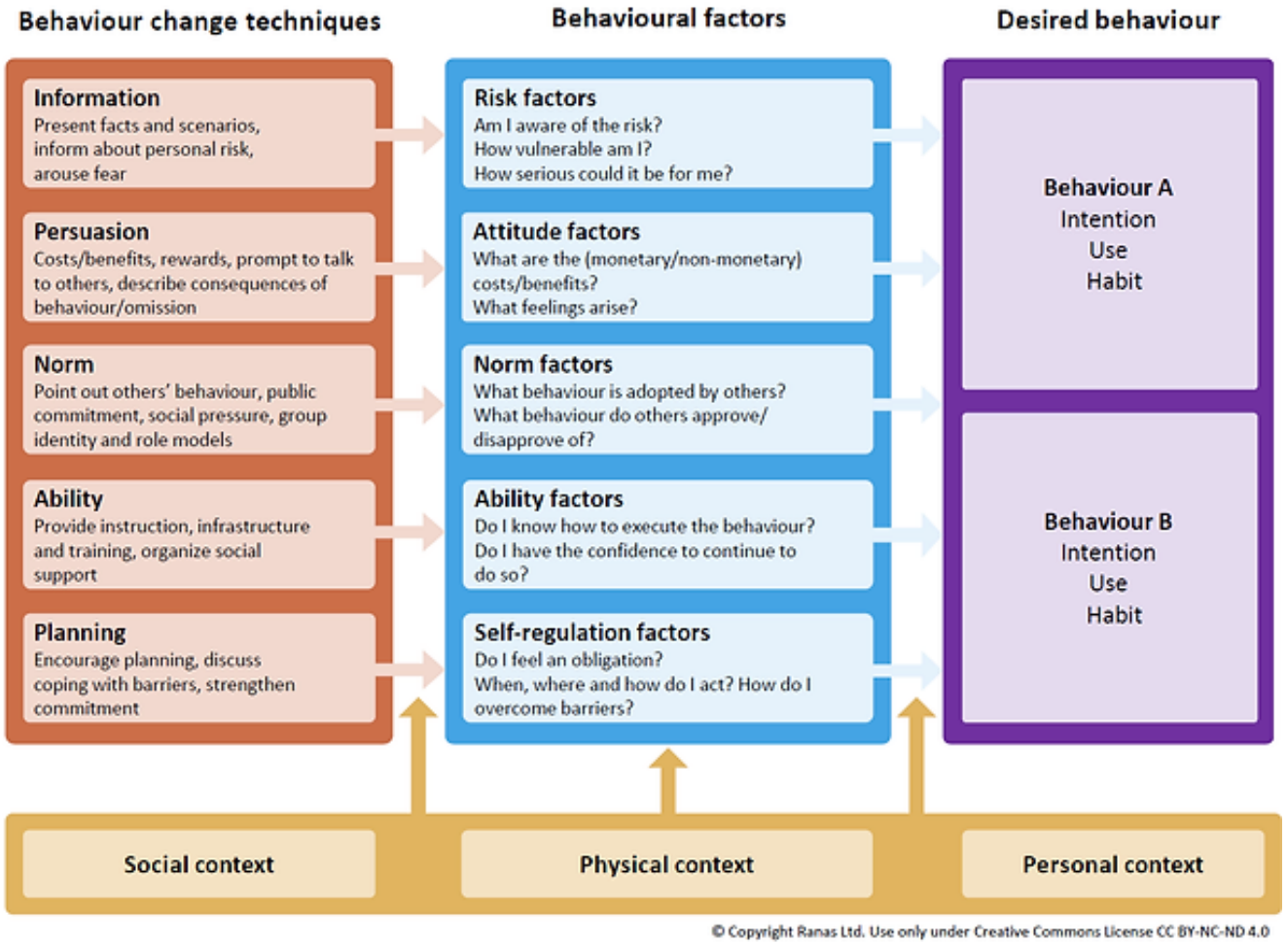
Behaviour change is complex to achieve. Even when individuals are aware of practices to prevent health implications of preventive behaviour, the **implementation of preventive practice may not take place**. Reasons include disease prevention often not being the primary motivator for health behaviours (instead driven by desires for “order and control”).

The **information source of risk communication** is a decisive factor for behaviour change. While media may impact general risk perceptions, they do not necessarily impact the personal risk perceptions that would initiate behaviour responses. Interpersonal information dissemination networks,are often perceived as more credible, efficient and effective.

THEORIES AND ASSESSMENT OF PERCEPTION

The Risks, Attitudes, Norms, Abilities and Self-regulation (RANAS) approach combines causal determinants of health behaviour based on the health belief model (HBM), the theory of planned behaviour, the protection motivation theory, the social cognitive theory, and the health action process approach.

Quantitative survey tools, to determine behavioural factors that increase safe water consumption; arsenic testing; household water treatment.



SYSTEMATIC REVIEW RESULTS: ANALYTICAL

Focus on drinking water

DRINKING WATER SAFETY AND HEALTH RISK

- Risk perceptions determining **use of basic drinking water** and sanitation services. Perceiving water quality as good, or worrying about unsafe water causing diarrhoea increased use of basic water services – Ethiopia (Anthonj et al., 2018)
- Water quality information affecting beliefs about health risks posed by source water, with perceived water safety declining where water indicated contamination - consequent purchase and **use of water treatment** – Cambodia (Brown et al., 2017).
- Behaviour change campaign resulting in higher **self-reported drinking water chlorination**, individual health risk perception and knowledge on diarrhoea, perceived efforts and benefits of water treatment. Increased perceived vulnerability to diarrheal diseases and improved understanding of association between water and disease – Chad (Lilje & Mosler, 2018)
- Perceiving in-house water after storage, handling, and treatment as safe where microbial contamination is not readily observable or germ theory not recognized, determining beliefs on water quality and **willingness to pay** – Cambodia (Orgill et al., 2013).

DRINKING WATER SAFETY AND HEALTH RISK

- Perceiving health risks predicting **drinking water source choice** (tap water), pointing to perceived safety and taste being key barriers to drinking fluoridated water from the tap - United States (Family et al., 2019).
- Regular consumption of well water with an arsenic concentration above the acceptable government standard, with **willingness to reduce exposure** being positively related to awareness of the health risks – Bangladesh (Parvez et al., 2006).
- Hazard level and proximity to an environmental hazard had the largest influences on **intentions to test the water and mitigate exposure** – United States (Severtson, 2013).
- Association between awareness and **switching to a safe source** equal to associations between awareness and using surface water (with or without treatments) or using an existing well after treatment or increasing the depth – Bangladesh (Parvez et al., 2006).
- Individuals (88%) would buy and drink bottled water following a '**do not drink' notice**, but 44% would still drink the polluted tap water – UK (Rundblad, 2008).

OTHER RESULTS

- Disease prevention
  - Despite awareness that Zika virus is transmitted through mosquito bite, only half of surveyed teachers identified vector control as preventive strategy or cleaned their water containers to prevent breeding - Philippines (Gregorio et al., 2019)
- Space, geography, time, socioeconomic differences
  - Information provision on waterborne health risks changed in beliefs about drinking water safety among households with lower than median wealth and education, households living in less developed area, and corresponded with purchase and use of water purification tablets - Cambodia, (Brown et al., 2017).
  - Minority children more likely to drink mostly bottled water compared to the majority population, as they perceived bottled water as safer, cleaner, better tasting, or more convenient - US (Gorelick et al., 2011)
- Health beliefs, cultural context
  - Misconceptions about tap water fluoridation and differences in beliefs about tap water safety were found to be prevalent across different income levels in urban areas – US (Family et al., 2019).

SYSTEMATIC REVIEW RESULTS: DISCUSSION

EXTENSIVE EVIDENCE

- Perception and resulting behaviour / intention to perform behaviour
- Variations across households, gender, income, location, weather, exposure, cultural context
- Risk perceptions changing over time? Lack of detail, lack of longitudinal studies (4%)
  - Decreased knowledge or adherence to risk-informed practices over time (Brown et al., 2017)
  - Improved adherence by follow-up reinforcement measures (Scobie et al., 2012).
  - Immediate cost to practising behaviours perceived as greater than long-term benefits (Ellis et al., 2020).
  - Cognitive biases often lead individuals to discount future benefits and favour immediate rewards.
- Unexpected events, sensitive life stages (e.g. pregnancy) heightening attention to risks
  - Reduced usage of well water contaminated by arsenic for drinking and cooking among pregnant women perceiving risk (He et al. 2018).
  - Success of information intervention on safe water storage and hand hygiene at attaining behavioural improvements (Davis et al., 2011).

WASH GOVERNANCE

POLICY, AWARENESS, EDUCATION, BEHAVIOUR CHANGE

- **Policy**: Suggested use of risk perception studies to identify communities at risk and their challenges, to inform national policies, and tailor targeted contextualized interventions
- **Awareness**: Campaigns to increase knowledge and facilitate participation in prevention practices. Multimedia, face-to-face, mass media, community and home visits effective. Target varied audiences, be timely, relevant, understandable, and based on personal & social norms.
- **Education**: Educational programmes should be target group specific, and embedded in local socio-cultural (e.g. involvement of traditional leaders) and literacy contexts. Active teaching and learning most effective, regular/continuous, long-term programmes be more sustainable.
- **Behaviour change**: Interventions successfully shaping risk perceptions lead to subsequent improvements in health behaviours. Lack of capacity to recognize and understand problem, lack of possibilities and means to implement and sustain behavioural changes, lead to a failure to enact change. Need for periodic campaigns to reinforce knowledge, attitudes, practices. Programmes could be planned and implemented in a series of cycles to (a) monitor achievement of outcomes and (b) modify or adapt as needed.

LIMITATIONS

- Identification and inclusion of all relevant literature due to complex search strategy
- Exclusion of gray literature and non-English documents
- Self-reported results or syndromic surveillance
- Cross-comparison of different geographical and organizational scales, disciplinary perspectives, methodological approaches and definitions
- Context-specific, therefore, our analyses and visualizations serve as a general impression only

CONCLUSIONS AND RECOMMENDATIONS

- First systematic review of risk perceptions and behaviours in the context of water and health from different continents, countries, settings, target populations and contexts around the globe
- Topics dominating literature relate to drinking water, sanitation, hygiene (WASH), waste, health risks, diseases and mental health, and preventative measures. Focus on drinking water safety
- Relevance of local risk perceptions and indigenous knowledge for WASH governance, particularly in the face of the ongoing unprecedented pandemic, to identify population at risk and determinants of behaviour for development or improvement of targeted contextualized interventions and policies
- Future research to focus more on
  - Changes over time, and more in-depth analyses on geographic and other variation
  - Comparison of results across disciplinary angles using different methods, theories and approaches
- Huge dataset that would allow for more analyses in future

PAST AND FUTURE STUDIES

RISK PERCEPTION STUDIES

Health risk perceptions informing wetland management in Kenya

Risk perceptions of water-related infectious diseases in different exposure groups

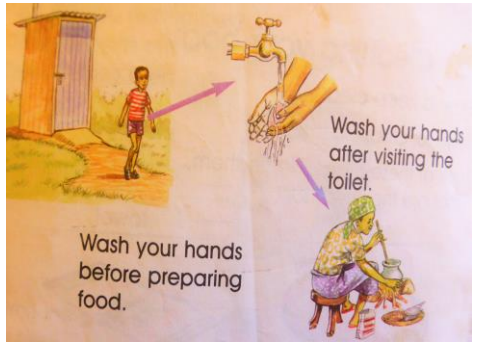
Improved health-based wetland management

Improving Monitoring and Water Point Functionality in Ethiopia

Patterns, trends, factors associated with functional water points

Improvement in terms of practitioner response

School book knowledge for WASH and health education interventions



Map over time level of detail pupils study WASH & disease prevention

Potential integration of school book knowledge into WASH education interventions

Modeling COVID-19 risk perception and coping appraisal in Netherlands

Simulation of COVID-19 outbreak

Identification of priority setting (time, type) of measures by the Dutch government

Targeted measures per age groups and economy

Climate-resilient WASH for those left behind in cities in Germany

Water & health insecurity perceptions

Co-designing data collection methods / analytical techniques, jointly identifying interventions

Mixing methods, inter-disciplinary, transdisciplinary

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THANK YOU!

https://www.itc.nl/global-impact/geo-health/projects/water-security-wash-and-global-health/

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Water, sanitation, hygiene (WASH) and health in schools
"Schools, depending on their access to and quality of water, sanitation, and hygiene (WASH) and the implementation of healthy behaviours, can be critical for the control and spread of many infectious diseases, including COVID-19".

Drinking water infrastructure: Rainwater harvesting
While rainwater harvesting can result in numerous benefits for consumers and the water sector overall, it's not always clear how to effectively promote and increase the prevalence of this practice. (Photo by Joshua Tsu on Unsplash)

COVID-19 and water, sanitation and hygiene in schools. Implications, challenges, solutions.
The role that children play in the transmission pathways of COVID-19 remains unclear. What we know is ...

Water Security, Global Health and Decision-making
How geography can assist policy-makers and practitioners, how it can lead to practical recommendations and interventions, and how it can inform policymakers to tackle and solve health challenges.

Coronavirus in wastewater in space and time
How can spatial data help policymakers on wastewater issues in the Netherlands? An interview with Oladapo Hassan.

Water and sanitation in healthcare facilities
Within this research project, we take a comprehensive look at comparable datasets on WASH in HCFs from 11 countries.

Risk perceptions and behaviours
Health-related knowledge, awareness, and health risk perceptions - how an individual perceives a health threat - are important determinants of health behaviours and components of behaviour change theories.