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Standards for Official Statistics on Climate-Health Interactions (SOSCHI)

Waterborne disease and water-related illnesses: introduction

Alpha Phase document

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We welcome users' views and expertise on the alpha version of the statistical framework to further develop our work. Please email us at climate.health@ons.gov.uk.

Contents

Introduction to the SOSCHI project

The impacts on the health of rising temperatures, wildfires, extreme weather events, and other direct and indirect effects of climate change are a major global concern. The most significant hazards and their impacts differ between countries and regions, as do the possibilities and priorities for climate change adaptation. National and local governments and other stakeholders need to have regular, reliable, and comparable data to monitor climate impacts and inform adaptation strategies, based on a transparent and globally generalizable statistical framework. The SOSCHI project, led by the UK Office for National Statistics and funded by Wellcome, is developing a framework of indicators based on state-of-the-art statistical methods to measure climate-related health risks. To support global reporting and monitoring, we are also developing a knowledge-sharing platform, open-source tools, and R code. Our findings will also help highlight data gaps and help set the agenda for future improvement of data sources and methods.

Project partners

African Institute for Mathematical Sciences Research and Innovation Centre, Kigali, Rwanda
Cochrane Planetary Health Thematic Group, University of Alberta, Edmonton, Canada
Office for National Statistics, Newport, United Kingdom
Regional Institute for Population Studies, University of Ghana, Accra, Ghana
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concerning the availability of data can be made to the project team at climate.health@ons.gov.uk.

Important notes

This document has been published as part of the alpha version of the SOSCHI statistical framework. Therefore, this should be read as a draft document, which does not necessarily represent the final state of the framework. We welcome users' views and expertise to further develop our work.

Please email us at climate.health@ons.gov.uk.

Abbreviations

A	AIMSRIC	African Institute for Mathematical Sciences Research and Innovation Centre
	AR6	Sixth-Assessment Report from IPCC
D	DHS	Demographic and Health Survey
F	FDES	Framework for the Development of Environment Statistics
I	ICD-10-CM	International Classification of Diseases, Tenth Revision, Clinical Modification
	IPCC	Intergovernmental Panel on Climate Change
O	ONS	Office for National Statistics (UK)
S	SDGs	Sustainable Development Goals
	SOSCHI	Standards for Official Statistics on Climate-Health Interactions
	SPEI	Standardized Precipitation Evapotranspiration Index
	SPI	Standardized Precipitation Index
	SSA	Sub-Saharan Africa
U	UK	United Kingdom of Great Britain and Northern Ireland
	UKHSA	United Kingdom Health Security Agency
	UNDP	United Nations Development Programme
	UNDRR-ISC	United Nations Office for Disaster Risk Reduction and International Science Council
	UNICEF	United Nations Children's Fund
W	WASH	Water Sanitation and Hygiene
	WHO	World Health Organization

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As part of upcoming beta phase developments, we are seeking expert feedback to support the development of this topic. if you would like to contribute to this work, please, contact climate.health@ons.gov.uk

2. Waterborne diseases, water-related illnesses, and climate change

2.1. Definition and Scope

According to the United Nations Office for Disaster Risk Reduction and International Science Council (UNDRR-ISC) hazard definition, waterborne and water-related diseases are transmitted through water systems, primarily by indigestion of contaminated water. These diseases can be categorized into four groups[1,2]: waterborne diseases, water-washed diseases, water-based diseases, and water-related vector-borne diseases. The first group, waterborne diseases, includes infections from contaminated drinking water, such as gastrointestinal diseases, diarrheal diseases, and typhoid fever. The second group comprises diseases that result from a lack of clean water for washing and poor hygiene and sanitation, such as scabies, trachoma, bacillary dysentery, conjunctivitis, and skin ulcers[1]. Water-based diseases, the third group, include infections transmitted by aquatic invertebrates, such as schistosomiasis. The fourth group consists of water-related vector-borne diseases, diseases transmitted by insects that depend on water for reproduction. This group includes malaria, West Nile fever, and dengue fever[1].

Diarrheal disease, one of the most prevalent waterborne diseases, is a significant public health problem linked to water quality, water scarcity, and inadequate sanitation and hygiene[3–7]. It is one of the leading causes of death among vulnerable populations, especially children under five and the elderly[8]. There are nearly 1.7 billion cases of childhood diarrheal disease every year in the world, and an estimated 443,832 children die each year globally[9,10]. According to the joint report of the World Health Organization (WHO) and the United Nations Children's Fund (UNICEF) in 2021, 48 underdeveloped countries, particularly those in Sub-Saharan Africa (SSA), still face challenges in accessing safe water and quality sanitation facilities. Approximately 108 to 113 million individuals in these countries rely on unimproved water sources and facilities[11].

Existing research highlighted the increasing impacts of climatic change on waterborne diseases, specifically on diarrheal outbreak[12–14]. For instance, the Sixth Assessment Report (AR6) from the Intergovernmental Panel on Climate Change (IPCC) reports that mortality rates due to extreme water-related conditions and events have increased 15-fold in vulnerable countries over the last decade[13]. Moreover, the risk associated with climate-related waterborne diseases is projected to rise under all climate-warming scenarios[15]. This indicates that the incidence of diarrhea is highly affected by global climatic changes, such as changes in temperature, rainfall, and extreme weather events (floods and droughts).

Extreme heat affects diarrhea in various ways, and its impact may depend on specific local conditions[6]. One way extreme temperatures influence diarrhea is by affecting the replication and survival of pathogens through increased contamination of drinking water sources. High temperatures create favorable conditions for the rapid growth of bacteria, viruses, and parasites that cause diarrhea, enhancing their survival in the environment. For instance, evidence from Bangladesh, Burkina Faso, and Nepal indicates that higher temperatures significantly increase levels of Escherichia coli in contaminated water sources[6,12,16]. However, high temperatures may also reduce pathogen levels which, in turn, may decrease Escherichia coli levels in contaminated water sources, as observed in Tanzania[6,12]. The study conducted in Bangladesh, Nepal, and Tanzania used relative thresholds of 90th, 95th, and 99th percentiles for extremely high-temperatures and 10th, 5^{th,} and 1st percentiles for extremely low temperatures[12].

Moreover, extreme heat often exacerbates droughts and water scarcity, limiting the availability of clean water for drinking, sanitation, and hygiene. This could affect household behavior in terms of water source management. Therefore, inadequate water for personal hygiene such as handwashing, and poor sanitation systems, may increase the risk of diarrheal diseases[12]. For instance, it was highlighted that diarrhea has become even more prevalent with higher ambient temperatures during warmer seasons, showing a high association between water scarcity and diarrhea due to shifting in extreme temperatures[14,17,18].

Another way extreme heat may increase the incidence of diarrheal diseases is through its effects on human physiological functions. High temperatures increase the risk of dehydration, making individuals more susceptible to gastrointestinal infections[19]. Dehydration weakens the body's immune defenses, hindering its ability to fight off infections, including those that cause diarrhea[16,20]. When diarrhea occurs during extreme heat, the risk of dehydration and electrolyte imbalance is exacerbated, particularly in children, the elderly, and immunocompromised individuals. This leads to more severe cases of diarrheal illness and an increase in morbidity[21].

Low temperature also has a considerable impact on diarrheal diseases. According to existing research, low temperatures significantly increase the risk of infectious diarrhea[22,23]. Indeed, low temperatures play a decisive role in the survival conditions of bacteria or viruses causing diarrhea. Viruses such as norovirus, rotavirus, and bacteria such as Salmonella and Shigella can survive longer in cold and moist environments, increasing the likelihood of contact and infection[24,25]. Low temperatures that fall below the 25th percentile have been identified in the preliminary study as a reference threshold, indicating that such temperatures are a risk factor for diarrhea diseases[22,23]. For example, Chen et al.[23] observed that the overall cumulative relationship between the relative risk (RR) of acute diarrhea and temperature was strongest at 11°C, which is below the reference threshold of the 25th percentile.

The connection between rainfall and diarrhea is complex even if rainfall is known to offer breeding sites for pathogens' survival[26]. During dry periods, the absence of rain creates conditions that facilitate the accumulation of pathogens in surface water, leading to increased concentrations. Conversely, rainfall acts as a dilution factor during wet periods, reducing the concentration of pathogens in surface water[17,27]. Therefore, the risk of diarrheal disease may increase due to intense rainfall following a dry spell. This is because heavy rain flushes accumulated pathogens into surface water, leading to higher concentrations. Conversely, heavy rain following a wet period helps protect against diarrheal disease by further diluting the concentrations of pathogens in surface water. This phenomenon is known as the "concentration-dilution hypothesis"[27].

The concentration-dilution hypothesis has also been demonstrated for flood events. Studies have shown that flooding may lead to increasing diarrhea cases. This is due to the direct flushing of faecal matter into the environment and the overwhelming of sanitation systems and infrastructure[3,5,27–29]. However, prolonged flooding also results in the dilution of pathogens, reducing the risk of diarrhea.

In Sub-Saharan Africa (SSA), for example, increased heavy rainfall is associated with a rise in childhood diarrheal disease in regions with significant water, sanitation, and hygiene deficits. This is particularly evident in Ethiopia, Senegal, Mozambique, and

Rwanda[3,5,7,27–30]. In Mozambique, for instance, it is estimated that each additional day with rainfall of at least 1 mm during a week increases the occurrence of diarrheal disease by 1.04% four weeks later[7]. A study conducted in Rwanda found that children in households without improved toilets reported more diarrhea during severe flooding[29].

The Sixth Assessment Report (AR6) of the Intergovernmental Panel on Climate Change (IPCC) emphasizes the need to strengthen the climate resilience of health systems and address health determinants such as water, sanitation, and hygiene to mitigate the adverse health effects of climate change[13,15]. To reduce the impact of climate change on waterborne diseases, including diarrheal diseases, it is essential to develop a comprehensive climate preparedness response. This response should involve understanding the links between climate change and waterborne diseases, enhancing community resilience, improving healthcare capacity, implementing early warning systems, promoting research and innovation, and fostering international cooperation. Therefore, establishing a standardized and unified statistical approach is crucial for assessing the interaction between climate change and waterborne illnesses, such as diarrheal diseases.

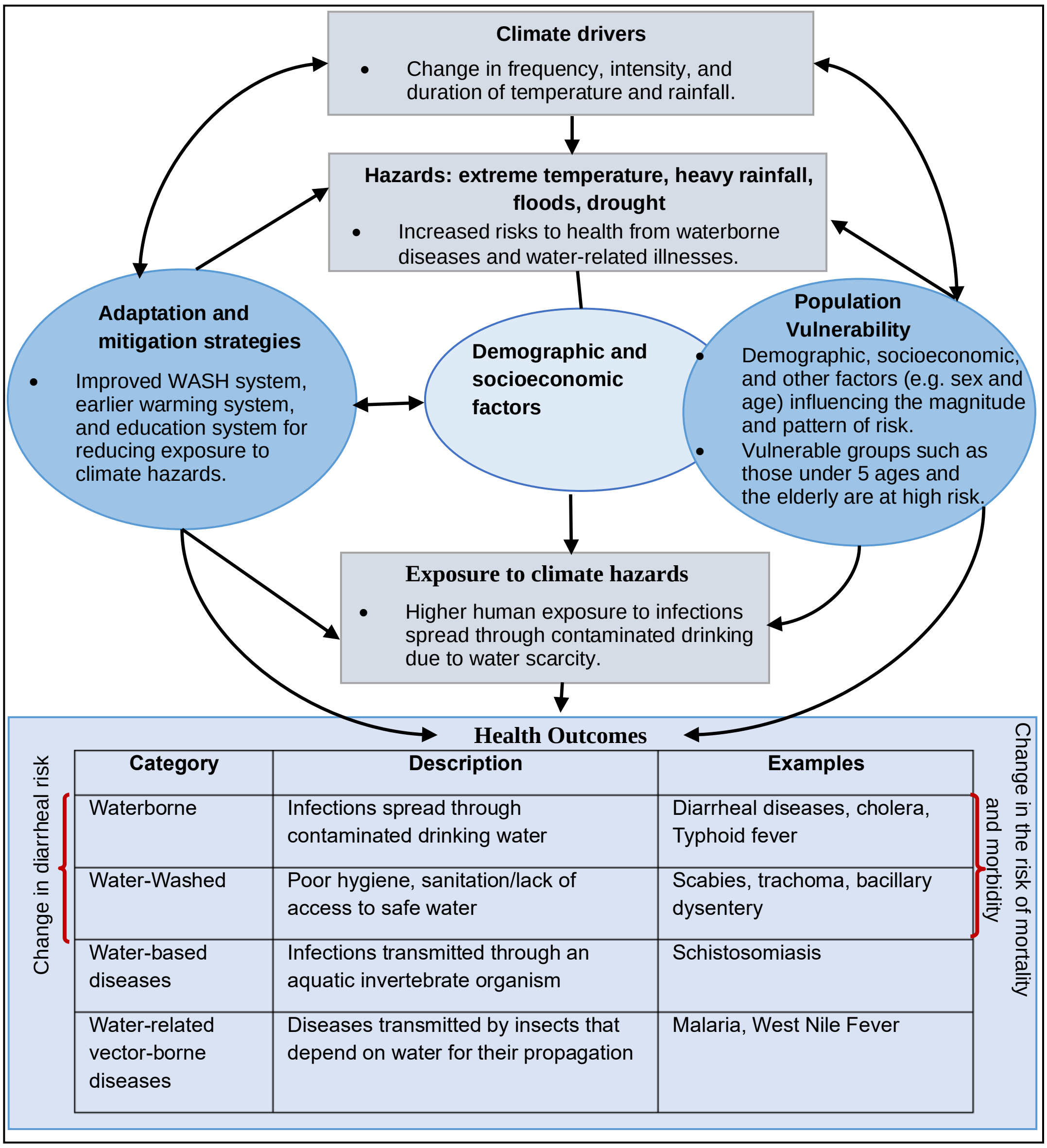
2.2. Impact Pathway

A complex pathway exists between climatic change factors, waterborne diseases, and water-related illnesses such as infectious gastroenteritis, diarrhea, and fever. Figure 1 depicts this correlation linking climate change and waterborne diseases. Following existing studies, increasing frequency, intensity, and duration of climate hazards significantly affects water, sanitation, and hygiene (WASH) behaviors, leading to various consequences. One such consequence is water scarcity caused by extreme heat and droughts, which further contributes to an increased concentration of pathogenic microorganisms in drinking water. This heightened concentration of microorganisms raises the risk of diarrheal disease outbreaks[31].

In addition, heavy rainfall could result in flooding and runoff, creating conditions that contaminate drinking water with faecal matter (faeces). Consequently, this contamination could significantly increase waterborne diseases and water-related illnesses. Vulnerability to such diseases is particularly pronounced among demographic and socioeconomic groups with lower economic status, females, and children. Adopting measures like education, early warning systems, and improved WASH could diminish the threats encountered by vulnerable populations[6,32].

The major illnesses resulting from the interaction of climate hazards and water sources include diarrheal diseases, cholera, shigella, typhoid, hepatitis A and E, and poliomyelitis. This framework focuses on diarrheal diseases, which are directly linked to the drinking water system and constitute the major health problem among children under five.

Figure 1 - Pathways between climate change and waterborne



Category	Description	Examples
Waterborne	Infections spread through contaminated drinking water	Diarrheal diseases, cholera, Typhoid fever
Water-Washed	Poor hygiene, sanitation/lack of access to safe water	Scabies, trachoma, bacillary dysentery
Water-based diseases	Infections transmitted through an aquatic invertebrate organism	Schistosomiasis
Water-related vector-borne diseases	Diseases transmitted by insects that depend on water for their propagation	Malaria, West Nile Fever

3. Health Impacts

This topic investigates the short-term impact of climate hazards, such as extreme temperature and rainfall exposure, on diarrheal diseases. However, the mid-term and long-term effects could be considered where daily health outcome data is unavailable.

From all-cause mortality of waterborne diseases, diarrhea diseases gain more attention due to their increasing and negative effects on the mortality of children under five worldwide, specifically in Sub-Saharan African countries. Although the number of deaths due to diarrhea decreased worldwide between 1990 and 2019, there is still a very high burden of diarrhea-related mortality in Sub-Saharan Africa[33,34]. For example, in 2020, the World Health Organization reported that the global under-5 mortality rate

(U5MR) was 37 (35-40) deaths per 1000 live births, compared to 74 (68–86) deaths per 1000 live births in Sub-Saharan Africa, 14 times higher than those in Europe and North America[8].

4. Framework Indicators

The incidence cases of climate-related waterborne diseases and conditions are well defined in the UN Global Set framework[35]. Following this framework indicator, water-related diseases refer to any significant or widespread adverse effects on human health caused directly or indirectly by changes in the quantity or quality of any water. These effects can include death, disability, illness, or disorders. Similarly, the Framework for the Development of Environment Statistics (FDES) provides a structured approach to gathering and organizing environmental data, which is crucial for understanding the interaction between waterborne diseases and climate factors.

In addition to these frameworks, SDGs 3.3 and 3.9 aim to combat and eradicate waterborne diseases by 2030. For instance, the SDG indicator 3.9.2 uses the mortality rate attributed to unsafe water, unsafe sanitation, and lack of hygiene as indicators for water-related diseases. This framework's indicators include health outcomes such as diarrhea diseases (ICD-10-CM codes A00, A01, A03, A04, A06-A09), acute respiratory infections (ICD-10-CM codes H65-H66, J00-J22, P23, and U04), intestinal nematode infections (ICD-10-CM codes B76-B77, and B79), and protein-energy malnutrition (ICD-10-CM codes E40-E46).

Following these existing frameworks, this topic provides indicators that could be used to examine the relationship between climate factors and waterborne diseases. It focuses on how extreme temperatures and precipitation affect diarrhea deaths and hospital admissions. The topic identifies indicators and metrics grouped into three categories. The first category includes headline outcome indicators, which are part of the topic's alpha framework development. The second category comprises supplementary outcome indicators that may be included in the beta framework delivery. The third category identifies other relevant metrics.

4.1. Headline Outcome Indicators

Our framework indicators focus on estimating diarrheal morbidity resulting from exposure to climate hazards, such as extreme temperatures and heavy rainfall. Morbidity refers to diarrheal hospital admissions cases. Therefore, the following two headline outcome indicators are considered:

- **E1:** Diarrheal hospital admission cases attributable to extreme precipitation[i]
- **E2:** Diarrheal hospital admission cases attributable to extreme temperatures

Due to data limitations in some countries, the indicators are provided to produce monthly estimates. However, if daily and weekly observations are available, daily or weekly estimations could be considered. The proposed priority indicators and cover diarrhea hospital admission cases associated with extreme precipitation or rainfall and extreme temperature exposures, respectively.

For these indicators, extreme precipitation and extreme temperature are defined based on dry months/days, wet months/days, extremely wet months/days, cold months/days, and hot months/days definitions. There are no standard criteria for classifying a day or month as dry, wet, or experiencing heavy rainfall (extremely wet). The classification could be based on either a relative or absolute threshold definition. For this indicator, relative rather than absolute threshold is considered. Thus, a day is classified as dry, wet, or extremely wet, depending on whether the total precipitation for the day is below, within, or above a designated reference threshold.

Following reference thresholds, months with low cumulative precipitation below the reference threshold are defined as dry months, while those with moderate cumulative precipitation are considered wet months. On the other hand, months with extremely high cumulative precipitation above reference thresholds are categorized as extremely wet months. Existing studies used the 5th and 95th thresholds as references for dry and extremely wet days/months respectively[27,36,37]. For extreme temperatures, the indicators use extremely low temperatures when the temperature is below the reference thresholds (1st, 5th, and 10th) and extremely high temperatures for hot months/days when the temperature is above the defined threshold (90th, 95th, and 99th)[12].

4.2. Supplementary Outcome Indicators

In addition to these headline indicators, three additional outcome indicators could also be considered for their relevance in assessing the interaction between diarrhea cases and other climate exposures. These supplementary outcome indicators include:

- **E3:** Diarrheal death attributable to extreme precipitation
- **E4:** Diarrheal death attributable to extreme temperatures
- **E5:** Diarrheal hospital admission attributable to drought severity
- **E6:** Diarrheal mortality attributable to drought severity

Indicators E3 and E4 cover deaths from diarrhea attributable to extreme precipitation and extreme temperature exposures, respectively[36,37]. The methodology proposed for

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[i] Temporary indicator numbers have been assigned for reference during the development of the SOSCHI framework and will change in the final version.

the prioritized indicators described above (E1 and E2) could also be applied to these indicators of diarrhea death related to extreme temperature and rainfall.

Indicators E5 and E6 examine the specific effects of drought severity on hospital admissions and deaths due to diarrhea[31,32]. Drought severity measures flood and drought exposures and is calculated using the Standardized Precipitation Evapotranspiration Index (SPEI) or Standardized Precipitation Index (SPI). SPEI calculates the climatic water balance by comparing the available water content of soil and vegetation with the atmospheric evaporative demand[38]. It provides a more reliable measure of drought severity in a warming world than only considering precipitation. SPEI uses the monthly or weekly difference between Precipitation and Potential Evapotranspiration (PET). Drought exposure is captured for SPEI ≤ 0.5, while non-drought exposure corresponds to SPEI > 0.5. Another categorization of Drought could also be used following previous studies[31,32,39]: −0.8< SPEI ≤−0.5 as mild drought, −1.3< SPEI ≤−0.8 as moderate drought, −1.6< SPEI ≤−1.3 as severe drought, and SPEI ≤−1.6 as extreme/exceptional drought. Flood exposure is defined as SPEI ≥ 0.5 and non-flood exposure is SPEI < 0.5 [32].

4.3. Other relevant measures

Table 1 below lists other recommended indicators of the pathway between climate drivers, waterborne diseases, and water-related illnesses. Indicator E7 considers other climate hazards that could be included in the attribution calculation following the proposed framework. It includes climate hazards such as the number of dry and wet days in a month. In addition, indicator E8 is proposed to include other climate hazards such as runoff water, and relative humidity. This indicator aims to estimate the possible impact of runoff water on diarrheal cases, as runoff water plays a crucial role in flushing faeces into drinking water[40].

The health impact of water-related diseases and conditions from climate hazards could differ among the population due to their sociodemographic conditions, so indicator E9 captures vulnerability and exposure measures. One notable aspect of this indicator is its ability to assess the impact of unimproved water, sanitation, and poor hygiene on all-cause water-related health outcomes, particularly flood exposure. A similar indicator, which addresses health and extreme weather-related events, is included in the Lancet framework[2]. Moreover, the flood exposure method defined above could also be considered for this indicator.

Indicators E10 and E11 are proposed to provide an estimate of adaptation strategies for reducing the impact of climate hazards on health outcomes. Indicator 7 covers the adaptation strategies of providing basic drinking water, sanitation services, and hand-washing facilities. This action plan could reduce the population's exposure and vulnerability to WASH-attributable burden diseases. Similar indicators exist in the Sustainable Development Goal framework (SDG indicator 3.9.2). Indicator 8 also provides insight into other adaptation measures. For instance, the climate warming system and the number of households with timely access to climate and health surveillance systems and information could help prevent the population's exposure to water-related diseases and conditions from climate hazards.

Table 1 - Other relevant measures

ID	Topic sub-area	Indicator	Measuring	Related Indicators
E7	Water-related diseases and conditions	Number of dry days and wet days in a month	Hazard	UNDRR-ISC Hazard Definition and Classification Review
E8	Water-related diseases and conditions	Runoff water	Hazard	UNDRR-ISC Hazard Definition and Classification Review
E9	Water-related diseases and conditions	Number of a vulnerable population exposed to unsafe water, unimproved sanitation, and poor hygiene	Exposure & Vulnerability	UN global set of climate change statistics and indicators: Water-related diseases and conditions SDG indicator 3.9.2 UKHSA Climate change and public health indicators scoping review: Water quality and quantity and their health impacts Lancet Countdown 2022: Health and extreme weather events
E10	Water-related diseases and conditions	Community covered with basic drinking water services, basic sanitation services, and basic hand-washing facilities	Adaptation	Lancet Countdown 2022: Climate Information for Health SDG indicator 3.9.2
E11	Water-related diseases and conditions	Number of population covered by environmental and health surveillance systems and information	Adaptation	UN global set of climate change statistics and indicators: Buildings adapted to climate change Lancet Countdown 2022: Climate Information for Health

5. Proposed beta phase developments

The alpha framework prioritized indicators of diarrhea hospital admission cases attributable to extreme temperature and rainfall (E1 and E2). The method and codes for estimating these prioritized indicators are in development and will be part of the beta phase documentation. In addition to these indicators, methods and codes for diarrhea deaths related to extreme temperature and rainfall indicators (E3 and E4), and indicators of diarrhea hospital admission cases and deaths attributable to drought severity (E5 and E6), may be incorporated in the beta phase. As part of the beta phase, additional work will be undertaken to detail the limitations and future developments of current data and methods within this topic.

6. Comparison to existing frameworks

The proposed indicators here could be compared to the following existing framework:

- **SDGs Target 3.3, and Indicator 3.9.2**

One of the main objectives of SDG Target 3.3 is to combat and eradicate waterborne diseases by 2030. As it is well known, climate-related changes such as temperature rises, heavy rainfall, flooding, and droughts directly impact the transmission of waterborne diseases. Therefore, to achieve the SDGs target 3.3, there is a need to quantify how much climate factors affect waterborne diseases. The SDGs indicator 3.9.2 provides a valuable indicator for measuring this impact. It targets the mortality rate attributed to inadequate water, poor sanitation, and lack of hygiene (exposure to inadequate WASH services for All). It measures the number of deaths caused by inadequate WASH systems that could be prevented through improvements in the WASH system. However, this indicator does not account for the short-term impact of exposure to extreme weather events such as temperature rises, heavy rainfall, flooding, and droughts on health outcomes. Therefore, the primary distinction between our proposed indicator and the SDGs indicator is that our indicator offers greater insight into climate exposure and waterborne disease interaction, enabling mediation analysis.

- **Paris Agreement: Article 7; 13.8**

The Paris Agreement provides a solid framework for developing the proposed indicators. Article 7 emphasizes the need to establish a global goal for adaptation, focusing on enhancing adaptive capacity, strengthening resilience, and reducing vulnerability to climate change, including health risks. Waterborne diseases play a crucial role in climate change adaptation, as shifts in climate patterns such as rising temperatures, increased rainfall, and extreme weather events directly affect the spread and severity of these diseases. Article 13.8 outlines a mechanism for countries to report on their adaptation measures, including those related to public health. This article supports the proposed waterborne-related climate exposure indicators, designed to track and report progress in managing waterborne diseases linked to exposure to climate hazards.

- **Sendai Framework: Target A, B**

The Sendai Framework for Disaster Risk Reduction 2015–2030 is a global, voluntary agreement designed to reduce disaster risks and strengthen resilience against natural and human-induced hazards. Its primary emphasis is minimizing disaster losses in terms of lives, livelihoods, and health. Regarding waterborne diseases, the framework's focus on disaster risk management and resilience-building directly contributes to efforts to mitigate the health impacts of climate-related events, particularly those that result in water contamination and outbreaks of waterborne diseases.

Target A of the Sendai Framework aims to "substantially reduce global disaster mortality by 2030, focusing on reducing the average per 100,000 global mortality rates between 2020 and 2030 compared to 2005-2015". The link between waterborne diseases and weather-related events such as floods and droughts is clear. These events contaminate water sources, facilitating the spread of illnesses like cholera, typhoid, and diarrhea. Such diseases significantly increase mortality rates, particularly among vulnerable populations that lack access to clean water and adequate healthcare. Its Target B aims to "substantially reduce the number of affected people globally by 2030," comparing the reduction in the number of affected people per 100,000 during the 2020–2030 period with the 2005–2015 baseline.

- **Framework for the Development of Environment Statistics (FDES)**

The FDES provides relevant indicators that link climate factors such as extreme temperature and rainfall variability with the occurrence of waterborne diseases. Under its component 5 "Human Settlements and Environmental Health" and subcomponent 5.2 "Environmental Health", the indicator FDES 5.2.2. targets water-related diseases, and conditions, linked to environmental hazards. It assesses how water-related hazards, such as flooding, drought, and heavy rainfall, are significant drivers of waterborne disease outbreaks, such as diarrhea. This provides a fundamental framework for monitoring and predicting the occurrence of diarrheal diseases following extreme weather events, such as extreme temperatures and extreme precipitation.

- **UN Global Set: Indicator 44. Incidence of cases of climate-related diseases**

The indicator "Incidence of cases of climate-related diseases" is included in the United Nations Global Set of Climate Change Statistics and Indicators, focusing on monitoring climate-related diseases. This indicator tracks the health impacts of climate change, particularly those associated with airborne diseases, water-related diseases, and vector-borne diseases. It also examines water-related diseases connected to climate factors, including extreme temperatures, heavy precipitation, floods, and droughts. By offering data on the incidence and prevalence of waterborne diseases related to climate change, this indicator enables countries to identify and track trends in the relationship between climate and health over time.

- **Lancet Countdown Indicators 1.2. Health and extreme weather-related events**

The Lancet Countdown monitors the link between climate change and public health using different indicators. One important indicator, “1.2. Health and extreme weather-related events”, offers valuable insights into the impact of climate change on waterborne diseases. Extreme weather events and shifting climate patterns create conditions conducive to the spread of diseases through contaminated water. This indicator is crucial in assessing the public health burden resulting from such events, including diarrheal diseases, strongly linked to extreme temperature and rainfall patterns.

7. Further reading

- UN global set of climate change statistics and indicators: Water-related diseases and conditions
- Lancet Countdown 2022: Health and extreme weather events
- Targets and Indicators of the Sendai Framework for Disaster Risk Reduction
- Global Burden of Disease (GBD)
- Measuring the climate resilience of health systems WHO
- UNDRR-ISC Hazard Definition and Classification Review

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