



Climate Change and Waterborne Diarrhoea in Northern India: Impact and Adaptation Strategies

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Although some studies showed the vulnerability of human health to climate change (e.g. 22.000 to 45.000 excess mortality cases during the heat waves in Europe, or the association of malaria outbreaks with El Niño) a clear quantification of the increased risks attributable to climate change is often lacking. Even more complicated are the assessments of the adaptation measures for this sector. Adaptation measures are in most cases very site specific. We discuss the impact of climate change on diarrhoea as a representative of waterborne disease affecting human health in the Ganges basin of Northern India.

India is by far the leading country when it comes to child mortality under five years caused by diarrhoea and accounted for 386.600 deaths in 2007. Estimates on the increased risk of diarrhoea as a result of increased temperature in the 2030ies range between 8-11%. Uncertainties around these estimates mainly relate to the few studies that have characterized the exposure-response relationship and inter-model discrepancy of climate models. The influence of other climate parameters than temperature on diarrhoea in the future has not been assessed.

As empirical studies and surveillance data for India are lacking we developed a conceptual framework for climate exposure-response relationships based on a literature review and applied it to future climate projections for the Ganges basin. Four climate variables are analysed: temperature, increased/extreme precipitation, decreased precipitation/droughts and relative humidity.

In an analysis of reports on diarrhoea outbreaks we show the spatial and temporal distribution over the subcontinent. Most cases of diarrhoea occur during the hot summer (23%) and the wet and humid monsoon (57%) months. These reports often suggest sewage and pipe leakage as the leading cause of the local outbreaks.

We demonstrate the applicability of the conceptual framework for the two districts in West Bengal, North and South 24 Parganas. All climate factors correlated positively with diarrhoea incidences. However, for relative humidity a positive correlation was not in line with the framework.

Combining the impact of all four parameters gives an indication of the overall impact of climate change on diarrhoea in northern India. For the projected changes between current and future (2040ies), the expected impact ranges from no change to an increase of 21% in incidences, with 12% increase on average for the whole of northern India. The mid and mid-eastern region are expected to experience a high increase in incidences above average, influenced by the combined impacts of higher temperatures and decreases in humidity and precipitation.

Actions to improve the health situation are often driven by daily realities and pressures of the current development context. However, improvements which are robust on the long term should incorporate future projections of population, economic growth, physical urban expansion, health sector development? and climate change. This can pose a challenge at first, but can also generate new incentives and innovations to tackle pressing problems. We discuss three types of measures: reactive actions, preventive actions and policy options and make recommendations on their applicability.