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Associations between extreme weather events, water quality and waterborne illnesses in Norway and impacts of climate change

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Climate change will lead to higher temperatures, increased precipitation and runoff and more frequent extreme weather events in Norway. Aging drinking water treatment and distribution systems and sewage systems will be particularly vulnerable to flooding, leading to potential deterioration in the quality of drinking water. Many infectious microorganisms are sensitive to climatic conditions. These factors together will increase the risk and burden of waterborne illnesses. In Norway, little is known about how climate change will affect the safety of drinking water and, thus, waterborne illness and potential needs for adaptation.

Here, we study the association between extreme weather events, water quality and waterborne illnesses by combining meteorological, hydrological and epidemiological data. Impacts of increasing future extreme weather events on water quality are investigated using different climate scenarios. Raw and treated water quality data were collected from selected water works and consultations for gastroenteritis were obtained from the Norwegian Syndromic Surveillance System. We transformed daily values of rainfall and runoff into “extreme” vs “not-extreme” using the 95th percentiles as cut off. Data for the period 2006 to 2015 were included in the analysis and were stratified by season, age groups, supply coverage and water work size.

We found a positive correlation between extreme weather events and a deterioration of raw water quality parameters (colour, turbidity and indicator bacteria), especially in one week before the water sampling. The correlation seems to be strongest in autumn and winter, possibly due to lack of thermocline in the water source, resulting in influence of contaminants from the surface water at the water intake depth. However, no positive correlations were found between extreme weather events and the quality of treated drinking water. This indicates that the waterworks included in the study have capacity to manage extreme weather events in the current situation, and are able to prevent illness due to contamination in the water supply due to these events as they occur today. However, with more extreme weather events in the future this may change.