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Disease risk predicted by new climate change adaptation tool

A tool to calculate the risk of food and waterborne diseases under current or future climate change conditions has been presented in a recent study. Free to use, the online tool can help guide climate change adaptation, such as improvements to water management, by estimating the likelihood of contracting four diseases under a range of environmental conditions.

It is known that climate affects health, for example, excess rainfall can cause sewage overflow, leading to outbreaks of waterborne disease, and higher temperatures can influence disease incidence by either encouraging or restricting pathogen reproduction, depending on the species. Concerns have therefore been raised about the impacts of climate change on public health.

In response to a World Health Organization call for new decision-support tools to assess climate change's potential health impacts[1], the authors of this EU-funded study[2] developed a software package to assess the risk from climate change (CC-QMRA: Climate Change Quantitative Microbial Risk Assessment)[3]. It estimates the risk of infection by norovirus, *Cryptosporidium*, and *Campylobacter* and non-cholera *Vibrio* species, which can all cause gastroenteritis. Four specific sources of exposure to the pathogens are considered: drinking water, bathing water, oysters and chicken fillets. Users can model each pathogen's 'journey' with the tool, considering the complex influences on its spread from source to infection to reach an overall risk rating. This allows estimates of infection risk under current and future climates to be compared.

The tool's developers stress that the results' quality depends on the quality of the input data, which must be detailed and local. Experiences with other QMRA tools shows that working closely with environmental inspectors and water companies, for example, leads to good results. The tool can be illustrated by the case of *Campylobacter* infection from contaminated recreational water. Surface waters can become contaminated by this bacterium via human and animal faecal waste, which poses a risk to swimmers. The factors which influence this risk are wide-ranging and competing.

Under heavy rainfall *Campylobacter* contamination levels increase through sewage overflow and agricultural runoff. However, rainfall also lowers the risk in other ways by diluting concentrations and making rivers run faster. Higher flow rates mean that the bacterium has less time to be exposed to higher temperatures, which would kill the pathogen. To derive an overall risk rating for *Campylobacter* infection from recreational water, the user can thus input data on a range of relevant factors. These include local temperature, wastewater treatment methods, agricultural land use (e.g. grassland or cropland), and river flow rate. The tool also accounts for public behaviour, for example, it estimates how much water is typically swallowed by swimmers.

The tool shows that the effects of flow rate are greater than the effects of dilution on *Campylobacter* infection risk. The net effect of heavy rainfall is thus a higher risk of infection, because the pathogen has little time to die-off in the fast flowing waters. To assess food poisoning risk, users can input data on water temperature, which influences *Vibrio* survival in oysters. Data on air temperature and the prevalence of *Campylobacter* in poultry flocks is entered to estimate risks of eating chicken fillets. For all diseases, the tool considers the risk in relation to the 'dose', for example, the volume of drinking water typically consumed per person per day. The researchers say that the tool provides information which can help inform climate change adaptation. For instance, if it indicates that the risk of infection from recreational waters will increase under the future local climate, then improved wastewater treatment could be recommended, along with measures for preventing overflow.

Environment

1. http://apps.who.int/gb/ebwha/pdf_files/WHA61-REC1/A61_REC1-en.pdf

2. This study was funded by the European Centre of Disease Prevention and Control (ECDC), an agency of the EU. See http://www.ecdc.europa.eu/en/Pages/home.aspx

3. http://climate-adapt.eea.europa.eu/ecdc-tool