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TITLE: Gastrointestinal Illness among Triathletes Swimming in Non-Polluted versus Polluted Seawater Affected by Heavy Rainfall, Denmark, 2010-2011

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ABSTRACT:

Recent years have seen an increase in the frequency of extreme rainfall and subsequent flooding across the world. Climate change models predict that such flooding will become more common, triggering sewer overflows, potentially with increased risks to human health. In August 2010, a triathlon sports competition was held in Copenhagen, Denmark, shortly after an extreme rainfall. The authors took advantage of this event to investigate disease risks in two comparable cohorts of physically fit, long distance swimmers competing in the sea next to a large urban area. An established model of bacterial concentration in the water was used to examine the level of pollution in a spatio-temporal manner. Symptoms and exposures among athletes were examined with a questionnaire using a retrospective cohort design and the questionnaire investigation was repeated after a triathlon competition held in non-polluted seawater in 2011. Diagnostic information was collected from microbiological laboratories. The results showed that the 3.8 kilometer open water swimming competition coincided with the peak of post-flooding bacterial contamination in 2010, with average concentrations of 1.5×10^4 E. coli per 100 ml water. The attack rate of disease among 838 swimmers in 2010 was 42% compared to 8% among 931 swimmers in the 2011 competition (relative risk (RR) 5.0; 95% CI: 4.0-6.39). In 2010, illness was associated with having unintentionally swallowed contaminated water (RR 2.5; 95% CI: 1.8-3.4); and the risk increased with the number of mouthfuls of water swallowed. Confirmed aetiologies of infection included Campylobacter, Giardia lamblia and diarrhoeagenic E. coli. The study demonstrated a considerable risk of illness from water intake when swimming in contaminated seawater in 2010, and a small but measureable risk from non-polluted water in 2011. This suggests a significant risk of disease in people ingesting small amounts of flood water following extreme rainfall in urban areas.

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