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## **Incidence of gastrointestinal illness following wet weather recreational exposures: Harmonization of quantitative microbial risk assessment with an epidemiologic investigation of surfers**

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### **ABSTRACT**

We modeled the risk of gastrointestinal (GI) illness associated with recreational exposures to marine water following storm events in San Diego County, California. We estimated GI illness risks via quantitative microbial risk assessment (QMRA) techniques by consolidating site specific pathogen monitoring data of stormwater, site specific dilution estimates, literature-based water ingestion data, and literature based pathogen dose-response and morbidity information. Our water quality results indicated that human sources of contamination contribute viral and bacterial pathogens to streams draining an urban watershed during wet weather that then enter the ocean and affect nearshore water quality. We evaluated a series of approaches to account for uncertainty in the norovirus dose-response model selection and compared our model results to those from a concurrently conducted epidemiological study that provided empirical estimates for illness risk following ocean exposure. The preferred norovirus dose-response approach yielded median risk estimates for water recreation-associated illness (15 GI illnesses per 1000 recreation events) that closely matched the reported epidemiological results (12 excess GI illnesses per 1000 wet weather recreation events). The results are consistent with norovirus, or other pathogens associated with norovirus, as an important cause of gastrointestinal illness among surfers in this setting. This study demonstrates the applicability of QMRA for recreational water risk estimation, even under wet weather conditions and describes a process that might be useful in developing site-specific water quality criteria in this and other locations.

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