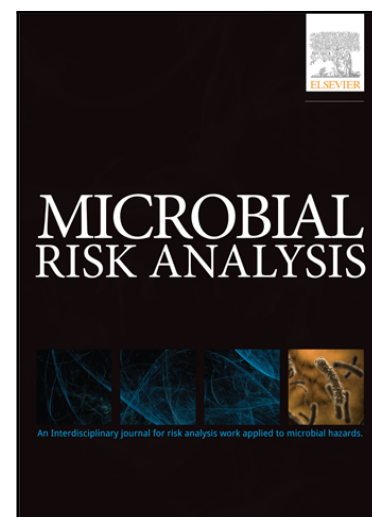


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Using quantitative microbial risk assessment and life cycle assessment to assess management options in urban water and sanitation infrastructures: opportunities and unresolved issues

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Abstract

Quantitative microbial risk assessment (QMRA) and life cycle assessment (LCA) are two distinct environmental management techniques that can provide complementary perspectives when assessing management options for urban water and sanitation infrastructure. While QMRA per definition concerns microbial risks, accounting for pathogens in LCA has received little attention. A few case studies, however, have explored the concurrent use of QMRA and LCA. These studies were motivated by the perceived need to address trade-offs between local health burdens associated with pathogens and global health burdens associated with other stressors at different spatial and temporal scales. Along with the LCA, the QMRA results were sought to provide the basis for addressing such trade-offs, rather than for deciding whether pathogen-related adverse effects experienced by specific individuals or populations are acceptable, or which scenario leads to the highest overall health burden for a given community, as is traditionally the case in QMRA. This paper highlights opportunities and unresolved issues related to the concurrent use of QMRA and LCA, such as assumptions in translating chemical and pathogen health impacts to a common metric or other model structure and parameterisation aspects. Our aim is to facilitate more consistent design and transparent communication of future case studies of this type, and to highlight opportunities for QMRA experts to contribute to LCA method development so as to include pathogen health impacts. While most examples provided in this paper focus on water reuse, the findings apply more broadly and can also be extrapolated to other pathogen exposures in the context of urban water and sanitation systems as well as other contexts.

Keywords: LCA, QMRA, human health risks, pathogen risk, pathogen impact, trade-off

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