In order to address these situations, sampling microorganisms in sand should be considered a public health policy priority, and therefore included in regulatory programs aimed at protecting recreational users from infectious disease.

**Lessons**
Overall, environmental and epidemiological studies to investigate the link between fungi exposure in sand and human health are recommended. Also, sand analysis and sampling procedures need to be reviewed in order to ensure representativeness of the site. Efforts should focus on evaluating viruses believed to be the main cause of GI illness in beach environments.

**Key messages:**
- Sampling microorganisms in sand should be considered a public health policy priority, and therefore included in regulatory programs aimed at protecting recreational users from infectious disease.
- Awareness of decision-makers and regulators at different levels of decision is of utmost importance.

**Microbiology of sands and its impact on human health**

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**Issue**
Recent studies suggest that sand constitutes a reservoir of potential pathogenic microorganisms at beach sites, sandboxes and recreational areas world-wide, leading to public health threats, health costs and economic losses. Recreational water quality monitoring mainly focuses on bacterial indicators that cause gastrointestinal (GI) illness.

**Description of the problem**
The most recent European bathing water directive indicates that areas surrounding recreational water constitute a possible contamination source. However, the directive lacks the 2003 WHO recommendation of sand monitoring, especially in regions where beach users stay mainly on the sand due to low water temperatures.

Recent epidemiological studies and data collected during a 5 year beach sand monitoring program of the Portuguese coast support this recommendation.

**Changes**
Given the diversity of microbes found in sand, further studies are needed to identify the most significant aetiologic agents of disease and to relate these to human health risk. Although other microbes have been documented, monitoring sandboxes is currently limited to measurements of Toxocara eggs. An emerging group of fungi of particular relevance includes black, endemic and azole resistant fungi. In non-coastal settings, Cryptococcus gattii, has also been gaining significance as the cause of a serious meningitis outbreak in Vancouver, Canada.