Madeira 2010 – Aftermath of flashfloods and mudslides on bathing water quality indicators and on sand microbial levels

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Abstract

Recent and past studies indicate that infectious disease outbreaks often take place after extreme weather events, as microbes, vectors and reservoir animal hosts are able to exploit the disrupted environmental conditions (1). Beaches, due to their proximity to oceans and cities, are often setting of such events affecting microbial communities, both in sand and bathing water (1 and 2).

On 20th of February 2010, a series of storms, caused by an active cold front combined with Atlantic low-pressure and temperature differences of the sea surface across the Atlantic Ocean with unusually warm waters from West Africa, affected several countries, such as Portugal, Spain, Morocco and the Canary Islands, causing flooding, rain and strong winds. Madeira, an island with different types of beaches within a small coastline was severely affected. Between 6 a.m. and 11 a.m., 108 mm of rain were recorded at Funchal weather station and 165 mm at Pico do Arieiro (1818m of altitude).

The entire February’s month average rainfall in Funchal is 88.0 mm. The South of the island was severely affected by flashfloods, originating mudslides that tore down everything along the way. The degree of devastation was highly substantial and costly, both in lives and economically. The areas affected the most were Funchal, Ribieira Brava, Câmara de Lobes and Santa Cruz.

The impact of this event in microbiological communities caused a notorious peak of Enterococcus spp., E. coli and sporulating fungi, both in sand and water until September of the same year. Bathing water and sand quality monitoring months later revealed thus that both water and sand profiles were profoundly altered for months to follow.

Contaminated sand is a known source of coastal water pollution, due to tides in the swash zone and run-offs. Our analysis shows the disruptive effect of the storm on beach sand quality, as published in 2016 (2), combined with a comparison of the subsequent expected effect on bathing waters for the island of Madeira for 2010 and 2011.

Bacteria: A story of ups and downs

Annual trends showed high values in 2010, and a gradual decrease throughout the years, with a small occurrence for bacteria in the following years (2).

Fungi: A story of persistence

After experiencing high values in 2010, yeasts and dermatophytes tend to decrease whilst potentially pathogenic fungi seem to be persistent during the course of time (2).

Concluding Remarks

Bacteria suffer a higher fluctuation, but fungi populations such as yeasts and dermatophytes are also affected (2).

Artificial sand beaches also seem to take more time to recover from these extreme weather events, specially when focusing on fungal microorganisms (2). The complexities of topography, atmospheric and ocean circulation systems means that the nature and impact of abrupt climate changes cannot, yet, be accurately predicted by climate scientists (3). Surveillance and rapid public health response can restrict infectious diseases from spreading fast, knowledge of microbiological profiles of exposed, and therefore susceptible, environments can also help predict the emergence of potential pathogens (1,2).

References


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