



MERA provides results in the context of water contamination.

The results have the potential to influence water policies in Costa Rica.

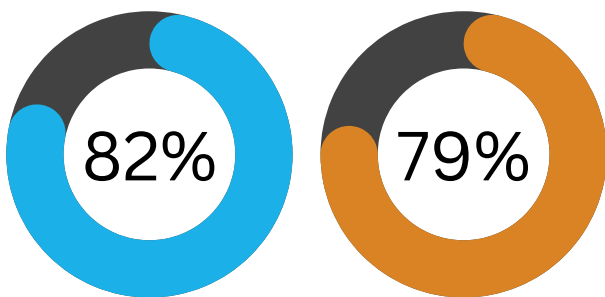




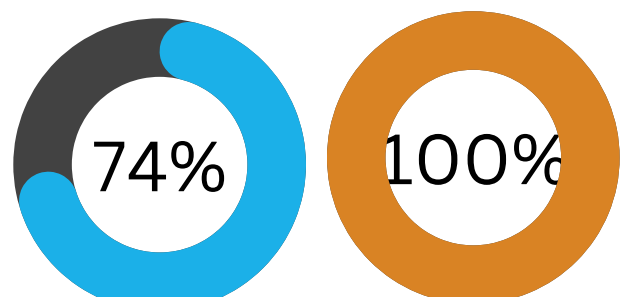
IN FOCUS

THE FINDINGS

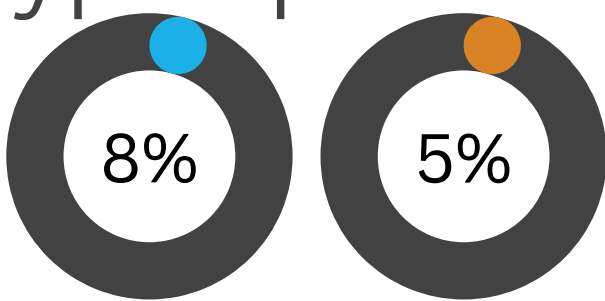
Giardia



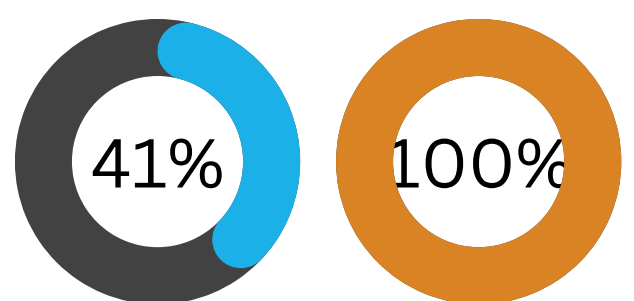
Salmonella



Cryptosporidium



Norovirus



 Wet Season  Dry Season



Water Quality

- The rivers are a constant source of contamination, regardless of season.
- The rivers most affected correspond to the most developed sub-watersheds.
- The most important predictive environmental variable is antecedent rainfall.

Quantitative Microbial Risk

- There is a risk to human health for swimmers regardless of the season.
- Human enteric viruses (NoVGI and AdV) contribute most to the risk of gastrointestinal disease.
- All sub-watersheds require pathogen reduction to ensure safe swimming conditions.



Epidemiological Study

- 5,000 Surveys
- 2,808 hours surveying beachgoers
- >1,000 follow up surveys

Ethnographic Study

- 500 observations of human behavior at the beach
- 80 Interviews
- Participant observation



Publications

- K.D. Orner, E.M. Symonds, H. Madrigal-Solís, R.A. Orozco-Montoy, A. Fonseca-Sánchez, M.E. Verbyla, and M.R. Cairns. (2021). Holistically Managing Pathogens and Nutrients in Urbanizing Tropical Towns: Can Sanitation Technologies Create Safer Conditions for Beach Recreation? *Environmental Science & Technology Water*. 1(5): 1184-1197. ([Link to article](#))
- A.E. Laureano-Rosario, E.M. Symonds, A. González-Fernández, O. G. Lizano R., D. Mora Alvarado, P. Rivera Navarro, A. Badilla-Aguilar, D. Rueda-Roa, D.B. Otis, V.J. Harwood, M.R. Cairns, and F.E. Muller-Karger. (2021). The relationship between environmental parameters and microbial water quality at two Costa Rican beaches from 2002 to 2017. *Marine Pollution Bulletin*. 163: 111957. ([Link to article](#))
- A. González-Fernández, E.M. Symonds, J.F. Gallard-Gongora, B. Mull, J.O. Lukasik, P. Rivera Navarro, A. Badilla Aguilar, J. Peraud, M.L. Brown, D. Mora Alvarado, M. Breitbart, M.R. Cairns and V.J. Harwood. (2021). Relationships among Microbial Indicators of Fecal Pollution, Microbial Source Tracking Markers, and Pathogens in Costa Rican Coastal Waters. *Water Research*. 188: 116507. ([Link to article](#))
- Workman, M.R. Cairns, F. de los Reyes, and M.V. Verbyla. (2021). Global WaSH Approaches: Anthropological Contributions and Future Directions for Social Science and Engineering. *Environmental Engineering Science special issue on Global environmental engineering for and with historically marginalized communities*. 38(5): 402-417. ([Link to article](#))