Transdisciplinary Approaches to Sustainable Water Resources and Treatment in Developing Countries

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Waterborne disease is a global public health problem, especially in developing countries like Haiti and Bangladesh. The World Health Organization (WHO) estimates that, globally, 748 million people lack access to a safe drinking water sources and 2.5 billion people lack access to improved sanitation (1). This lack of sanitation infrastructure and clean water lead to widespread diarrheal disease a reduction in economic productivity. Unsafe and unsustainable drinking water systems in developing countries are the result of a complex set of economic, ecologic, geologic, sociocultural, and political factors, which require a transdisciplinary approach for evaluation and successful intervention.

Cultural perceptions of water in many developing countries are based on a combination of religious beliefs, education, and common practice, which can lead to dangerous misconceptions about the safety of water being consumed, and often a lack of acceptance of effective safe-water interventions. Despite this important association between water safety and cultural perceptions, the cultural perspective is often neglected in water resource assessments and intervention planning and implementation. A transdisciplinary approach provides a means to enhance our understanding of the social landscape and ecological contexts of water borne infectious disease, improving prevention and control of emerging infections and pathogens (2, 3, 4).

The nature and impact of water-related infectious diseases on human health are mediated by both ecologic and sociocultural processes (5, 6). Transdisciplinary teams of public health, natural, social, and physical scientists should focus on integrating empirical science, sociocultural, and health data. By focusing on all the facets of the problem, research teams can more effectively combine their respective expertise and arrive at sustainable solutions that are compatible with the cultural context in which they are being implemented. This approach has been used successfully in rural Haiti by Paul Farmer’s organization, Partners in Health, to explore linkages between societal perceptions and disease.

Transdisciplinary perspectives and methods are needed to provide cultural context for empirical water quality and resource data. The understanding of how perceptions of water relate to empirical information can then be used as a road map to empower the local community, institutions, Non-Governmental Organizations (NGOs), and water resource professionals. Implementing this road map will result in socially suitable training, education, and a set of realistic tools to provide safe water supplies in developing countries.

The anthropological concepts of emic and etic viewpoints, originally proposed by Pike, provide a useful framework for understanding the complex relationship between water and culture. These concepts have been refined and expanded in the concept of indigenous ecological knowledge (IEK) (7). Both IEK and
the emic concept represent the intrinsic set of cultural beliefs and traditions that shape the way a given society or community views and interacts with their natural surroundings. This is in contrast to the scientific (etic or external) perspective, which is comprised of empirical information that can inform and influence behavior if successfully communicated to a receptive community. The scientific view of water resources includes water quality data, pathogen abundance and classification, geology, ecology, hydrology, and water treatment information (Fig. 1). In most developed nations, advances in science and engineering knowledge are rapidly incorporated into the society when critical human health impacts are involved. In contrast, the intrinsic cultural context and traditions in many developing nations results in a view of disease and water resources through a different cultural prism, which may be disconnected from, and unresponsive to, empirical scientific data.

For example, in Bangladesh some villagers believe that evil power causes disease and holy words can get rid of the evil power. The villagers go to religious healers to get treated, and are asked to bring with them a glass or a bottle of water. The healer then whispers some holy words and blows on the water. The idea is that if the patient drinks the water, the evil power will leave the body and the patient will be cured. Viewed scientifically, the water may be clean and safe, or it may contain pathogens that can kill. Blowing onto it may introduce germs into the water which makes it less safe or have no effect at all. But from the point of view of the culture of the village, the water with holy words has the power to remove the evil that is causing the disease.

In Haiti, a similar cultural code exists with the Voodoo and Catholic culture which has a profound impact on the consumption and perceptions of water. The dissonance between cultural concepts and empirical scientific data can result in the failure of an intervention strategy if conflicts are not understood and resolved in a culturally appropriate manner. While IEK and empirical scientific perspectives often are in conflict, their respective strengths can be used to produce more effective outcomes. What is needed is more than just physical water quality interventions, such as filters and chemicals, installed in homes and schools. Influential leaders within the local community must be enlisted to serve as catalysts for transforming cultural perceptions regarding water by incorporating and disseminating empirical scientific information. Empowering influential leaders, within the local community, with data and culturally suitable education will allow these leaders to help rather than hinder the efforts to provide sustainable water quality interventions.

In developing countries like Haiti, the need for sanitation, safe water supply programs, and effective water quality interventions have become acute due to the outbreak of cholera after the 2010 earthquake. The geology of Haiti is particularly prone to contamination, and recontamination, with water-borne pathogens. One of the major strategies used to address this problem is the installation of protected sources, such as capped springs or wells, and point of use water quality interventions. There is empirical evidence in Haiti that some water quality interventions may actually increase the likelihood of contamination. For example, a solar powered water filter was installed in rural Haiti to treat contaminated water from a spring. Local community resources were not provided with socially suitable maintenance information and education. The filter became contaminated with bacteria, resulting in the filtered water being more contaminated than the source water. In order to be effective, water interventions must be designed to be socially suitable and sustainable for the target population; and
coupled with public health education involving influential community leaders. Discussion and collaboration with these individuals may also provide important cultural insights into lifestyle issues that can be used to recommend the most appropriate intervention technology.

It is crucial to understand the underlying cultural framework of traditions and beliefs when undertaking water quality interventions because these factors influence decisions about water resource use. Sustainable water quality intervention decisions need to be made based on a collaborative combination of empirical, social, and health sciences that include quantitative resource assessment and public health education consistent with cultural practices. In order to support and facilitate the transdisciplinary approach, more data and transdisciplinary studies are needed, including ethnographic surveys, public health surveys, hydrogeologic assessments, and water quality testing. This approach will empower developing countries to better understand links between safe water and health through collaborations between international researchers, NGOs, governmental agencies, community leaders, and stakeholders.

References

7 A. Davis, and K. Ruddle, Constructing confidence: rational skepticism and systematic enquiry in local ecological knowledge research. Ecological Applications. 20 (3) (2010).
Figure 1. Conceptual model for the transdisciplinary approach.