

**CATEGORY | Best Innovative Environmental
Health Solution**

WINNER | Missouri University of Science & Technology



“Interventions to improve environmental health conditions for the indigenous Ladino population in the Western Highlands of Guatemala”

INTRODUCTION

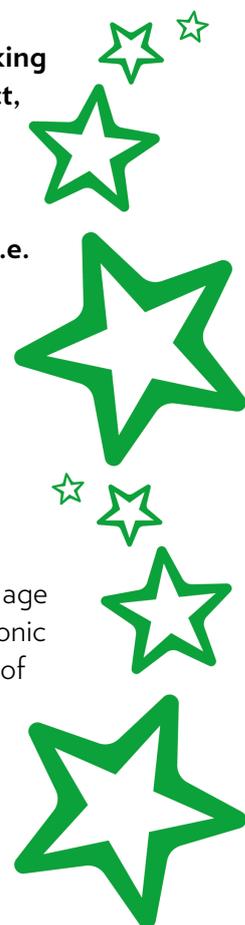
Through a decade of outstanding professional practice, Professor Daniel B. Oerther, FCIEH, cost-effectively improved environmental health conditions among 210,000 non-Spanish speaking indigenous people (i.e. “Ladinos”) living in the highly inaccessible Western Highlands of Guatemala. Dr. Oerther pioneered an innovative environmental health solution – using a suite of data analytics to inform the construction of Structural Equation Models to assess the effectiveness of water and food safety interventions. And during the period, January 2017-April 2018, Professor Oerther, completed a PROJECT delivering culturally sensitive food safety training with the long-term aim to eliminate childhood stunting among the approximately 7 million Ladinos of Guatemala.

Background

The “Ladino” population of Guatemala – including nearly 7 million non-Spanish speaking indigenous citizens – suffered decades of systematic abuses – including armed conflict, forced relocation and expropriation of lands, and discrimination against indigenous languages and religious practices. These political, economic, and social conditions contribute to a hostile environment yielding poor health outcomes including excess diarrheal illness (i.e. measured as morbidity and mortality) and widespread stunting (i.e. low height for age of a child corresponding to short of stature adults).

Rationale

Although acute diarrheal illness is life threatening to susceptible populations – including children less than five years of age (in Guatemala, under five mortality was 29 per 1,000 live births in 2012; 20% due to diarrhea; United Nations Children’s Fund (UNICEF)) – the prevalence of diarrhea occurrence may be reduced effectively through improved access to technology for water, sanitation, and hygiene (WaSH). In contrast, stunting – low height for age (in Guatemala, 47% of children were stunted in 2012; UNICEF) – is a difficult to reverse chronic medical condition that contributes to a lifetime of poverty. Stunted children grow into short of stature adults with diminished cognitive ability and lower earning potential contributing to stunting in the next generation. The Ladino population of Guatemala is the most stunted in the Western Hemisphere and among the most stunted in the world.



Objective

To address the complex interdependent requirements for both sufficient clean water as well as safe healthful food among the Ladino population of Guatemala, Professor Oerther pioneered an innovative environmental health solution.

- First, advanced data analytics are utilized to identify statistically significant correlations within historic household sanitary surveys.
- Second, Structural Equation Models (SEM) are constructed using a combination of the statistically-identified variables, literature review, expert input, and field observation.
- Third, additional data is collected from the performance of household sanitary surveys.
- Fourth, confirmatory SEM analysis using collected data provides guidance in the development of interventions.
- Fifth, a community-based participatory research (CBPR) approach is employed to deliver linguistically- and culturally-sensitive interventions, which are further assessed and used as input to newly constructed SEMs.

Approach

From 2006 through 2016, Professor Oerther established cottage industries to partner with community development groups and also trained school-age children to promote WaSH technology as a multipronged intervention resulting in reductions in diarrheal prevalence among 70,000 Ladino residents of the municipality of Ixcán, Guatemala (2016, “Improved Water Quality for Ixcán, Guatemala,” Environmental Engineer and Scientist, attached).

The effectiveness of these interventions was reported in the peer-reviewed scientific literature (2013, <https://doi.org/10.1021/es303624a>). The approach developed in Guatemala was replicated at an independent site located in the state of Para, Brazil (2015, <https://doi.org/10.2166/ws.2015.041>). To further improve the ENVIRONMENTAL HEALTH SOLUTION, a number of data analytic tools were used to enhance the construction of SEMs (2018, <https://doi.org/10.1089/ees.2017.0338>).

Implementation

Starting in 2016, Professor Oerther assessed three interventions to reduce childhood stunting mediated by environmental enteric dysfunction (EED) – characterized by inflammation, reduced absorptive capacity, and reduced barrier function in the small intestine (2018, <https://doi.org/10.1016/j.ijheh.2018.01.001>). Oerther’s interventions included:

1. Improving knowledge of food safety among farmers and food market operators (i.e., raising awareness of the potential for harm from the ingestion of aflatoxin originating from fungal contamination likely due to indigenous religious practices for processing maize);
2. Improving food and nutrition security among school-age children and mothers through education (i.e., encouraging political awareness to advocate for the “four pillars” of food security, namely:

availability, access, utilization, and stability); and

3. setting up cottage industries to partner with community development groups to promote the dissemination of WaSH technology.

Evaluation

During the period, January 2017-April 2018, Professor Oerther's interventions were performed as part of community health fairs aiming to eliminate childhood stunting among 140,000 Ladino residents of the municipality of Totonicapan, Guatemala, and the successful results were reported in the peer reviewed literature (2018, <https://doi.org/10.1080/09603123.2018.1468424>).

Budget

Funding was provided by the John A. and Susan Mathes Endowment at the Missouri University of Science and Technology and in-kind contributions by local non-government organizations (i.e. Christian missionaries) plus partnerships with government organizations – including the United States Agency for International Development (USAID), Peace Corps, and the United Nations Food and Agriculture Organization (UNFAO) and UNICEF. The National Science Foundation (NSF) and competitive university fellowship provided salary and travel support for Professor Oerther's students. By using inexpensive educational interventions (i.e. food and nutrition security) and promoting cottage industries with partnerships (i.e. WaSH technology), the long-term lost income attributed to stunting is eliminated and the short-term cost of pharmaceutical interventions to treat diarrhea are reduced.

Summary

Professor Oerther's decade-long efforts to improve environmental health among 210,000 Ladinos (70,000 in Ixcán and 140,000 in Totonicapan) living in the Western Highlands of Guatemala – employing best practices while remaining culturally sensitive to religious preferences of the Ladino population – were recognized with the 2015 Steven K. Dentel Award for Global Outreach from the Association of Environmental Engineering and Science Professors, the 2016 Superior Achievement Award from the American Academy of Environmental Engineers and Scientists, and the 2018 Dr. John L. Leal Award for Public Health Leadership from the American Water Works Association.

Professor Oerther's collaborations with nurses – including service-based learning for interprofessional education (IPE) – have resulted in Oerther's election as a lifetime Honorary Fellow of the American Academy of Nursing and as a lifetime Honorary Fellow of the Academy of Nursing Education. Professor Oerther earned his doctorate in environmental health engineering from the University of Illinois in the United States in 2002. He was a tenured professor and head of the Department of Civil and Environmental Engineering at the University of Cincinnati before joining the Missouri University of Science and Technology in 2010 where he is currently a tenured professor and held the Mathes Endowed Chair.

In the United Kingdom, Professor Oerther is a Fellow of the Society of Environmental Engineers (SEE), registered as a Chartered Engineer (CEng) with the Engineering Council, and recognized as a Chartered Environmentalist (CEnv) by the Society for the Environment. Professor Oerther is a Fellow of the Royal Society for Public Health (FRSPH) and a Fellow of the Chartered Institute of Environmental Health (FCIEH).