

Commentary

The Role of the Occupational Hygienist in Development-Oriented Public Health Engineering Projects

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Organizations dedicated to applying engineering solutions to improve health in developing countries may lack sufficient expertise in the public health aspects of these efforts to ensure successful project design and implementation. The occupational hygienist is a valuable complement to the efforts needed for development-oriented public health engineering projects.

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These thoughts result from work I did with a multi-disciplinary university-based chapter of Engineers Without Borders, carrying out an initial community health assessment in two, small neighboring rural communities in a mountainous region of Guatemala, ~30 km west of Guatemala City, by interviewing key informants to profile the community's injury and illness experience. The community is comprised of ~140 households (~1300 residents) of predominantly Kaqchikel Mayan descent and covers 4.5 km² at an elevation of 1890 m. The health assessment identified diarrheal disease, particularly among children, as a primary morbidity concern of the community. The community size and subsequent water demand had exceeded the system's supply design and water was not continuously available at the household tap, necessitating water storage for washing, bathing, and drinking. The community water supply was characterized in terms of flow rates, distribution routes, system operation, and storage practices at the household level, and an exposure assessment strategy was devised to quantify, characterize, and pinpoint the source of microbial contam-

ination in the water supply. We have presented these results to the community and are currently working to derive a sustainable intervention strategy. Concurrent with these direct project-related roles, I worked with occupational hygiene and safety graduate students to develop and manage the team's travel health and safety plan, as well as construction safety on related projects, while in Guatemala.

Non-governmental organizations (NGOs) dedicated to applying engineering solutions to improve health in developing countries may lack sufficient expertise in the public health aspects of these efforts to ensure successful project design and implementation. Occupational hygienists (OHs), trained to work in interdisciplinary teams in order to describe current health and safety status, anticipate and recognize threats, assess exposure to hazards, communicate risk, develop and prioritize strategies for improvement using the hierarchy of control, and implement them while considering resources and sustainability, are a potential asset to engineering teams working to develop lasting public health solutions. The Guatemala project illustrates how this can work in practice.

In the industrial setting, the OH must first take a systematic approach to understand the manufacturing

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processes in order to determine whether health and safety risks may exist. This same approach is needed to understand systems in place in communities, such as water distribution or waste disposal, that may leave members vulnerable to injury or disease. The analogous first step in initiating a new community-based public health endeavor is a community health assessment, used to describe the injury and illness experience of the population, as well as other demographic characteristics of the community. These data are then used to identify community hazards and prioritize them for action. In the case of our water project, the community health assessment identified diarrheal disease as a major community concern. The assessment is repeated on a periodic basis to qualitatively track progress of the effort to reduce morbidity and mortality, which is helpful when formal surveillance programs are lacking or do not exist. The same principles of anticipation and recognition of health hazards that OHs utilize in the industrial setting, through integration of knowledge of epidemiology, toxicology, disease transmission, and pathophysiology, are applicable to the identification of threats to health at the community level.

Once physical, chemical, or biological hazards and routes of exposure have been identified in the community, an exposure assessment strategy may be needed. This aids understanding the magnitude and severity of the problem and is critical to ensure that an intervention strategy is successful at reducing exposure. Like exposure assessment performed in industrial settings, in a community setting both qualitative and quantitative measures may be useful for adequately characterizing exposure. Quantitative results may then be compared with established health protection criteria values to determine if the exposure is acceptable, unacceptable, or if additional information is required. In the drinking water project, a sampling strategy was devised to test for microbial contamination and isolate where water was becoming contaminated between the water source and point of use. The laboratory results were then compared with established values to assess the severity of the problem.

Results of an exposure assessment must then be shared with the affected community. The fundamentals of appropriate and effective risk communication that drive the OH's practice are also essential in community-based projects. Though risk communication in developing countries may be significantly complicated by language barriers, varying perceptions of risk and health, and literacy and formal education, the OH may work with community partners for effective risk communication.

Fortunately, most occupational hygiene training programs emphasize the importance of interdisciplinary teams to solve environmental and occupational health and safety problems. OHs are trained early in their careers in the importance and necessity of working with occupational physicians, occupational health nurses, epidemiologists, biostatisticians, safety professionals, health physicists, and engineers of all disciplines. Modern interdisciplinary teams often include anthropologists, mental health specialists, veterinarians, urban planners, geologists, and other professionals. Besides learning cross-disciplinary communication, the OH is also trained to recognize the value and utility of this combined expertise to approaching problems. The community, with local and more in-depth knowledge of the conditions and needs of the population than a visiting team can hope to gain, is the parallel group of cross-disciplinary experts. OHs thus will understand the importance of involving community partners in deriving solutions. In the deployment of public health engineering projects, these efforts may involve both formal and informal community leaders. In our case, community partners include members of the village government, NGO personnel, and local educators.

The OH hierarchy of controls is a furthermore useful framework for public health engineering intervention strategies at the community level. The development of effective and sustainable control strategies for environmental exposures in cooperation with relevant engineering disciplines—in the drinking water project, principally civil and environmental engineers—will help ensure successful mitigation of hazards. In addition to acute solutions, the OH plays an increasing role in sustainability and product stewardship in industry. As such, the OH may also be well-positioned to contribute to decision making relative to the sustainability of proposed solutions in community projects. Environmentally and economically sustainable solutions must be the expectation in developing countries (as we hope they are everywhere), and interventions that create new environmental problems or that are financially impractical for the community after implementation must be avoided.

Just as many manufacturing environments change dynamically over time, so do community needs, through advancements in formal education, connectedness to neighboring communities (and in many instances the globe, through technology), growing populations, and greater expectations of government from their constituencies. The development of public health interventions must be made in concert with ongoing advancements or setbacks within the

community, and the OH is particularly suited to identifying new and emerging trends that may result in community risk.

For project assessment and implementation trips, as when traveling to Central America for the ongoing water project, the OH is a valuable resource for protecting the health and safety of the traveling engineering team. This may include ensuring appropriate vaccinations before travel and location-specific briefings on possible personal security concerns. Anticipating other naturally occurring hazards such as adverse weather conditions, geologic activity, terrain, and local flora and fauna is necessary to prepare the team for travel. Subsequently, establishing mechanisms of communication and transportation for team extraction from hazardous situations, including medical emergencies, natural disasters, civil unrest, or other anthropogenic sources, are needed. Since the implementation of many public health engineering projects also require construction or repair of infrastructure, construction safety management is essential, including deployment of best work practices and use of personal protective equipment on active work sites.

Finally, the presence of the OH to support development-oriented engineering efforts may also be a first step toward highlighting the importance of oc-

cupational safety and health in rural and industrial areas of developing nations. Though the occupational hygiene and certain business communities are working to ensure the global availability of trained health and safety personnel, occupational hygiene and safety are very much a little known luxury in most of the world. Conversations that arise with community members while participating in public health projects describing our profession in various corners of the world may be a very small but necessary step to call attention to the importance of workplace safety and health.

NGO engineering teams addressing public health problems in developing nations would be well-served to seek out and utilize the expertise of an OH. Through this article, I hope to have highlighted important ways in which OHs can adapt and apply their training outside of industrial applications to positively impact public health engineering efforts. Such disciplinary crossover is the type of contribution needed to provide effective and sustainable solutions for major public health problems in developing nations.

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