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Resetting our priorities in environmental health: An example from the south–north partnership in Lake Chapala, Mexico

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Abstract

Lake Chapala is a major source of water for crop irrigation and subsistence fishing for a population of 300,000 people in central Mexico. Economic activities have created increasing pollution and pressure on the whole watershed resources. Previous reports of mercury concentrations detected in fish caught in Lake Chapala have raised concerns about health risks to local families who rely on fish for both their livelihood and traditional diet. Our own data has indicated that 27% of women of childbearing age have elevated hair mercury levels, and multivariable analysis indicated that frequent consumption of carp (*i.e.*, once a week or more) was associated with significantly higher hair mercury concentrations.

In this paper we describe a range of environmental health research projects. Our main priorities are to build the necessary capacities to identify sources of water pollution, enhance early detection of environmental hazardous exposures, and deliver feasible health protection measures targeting children and pregnant women. Our projects are led by the Children's Environmental Health Specialty Unit nested in the University of Guadalajara, in collaboration with the Department of Environmental Health of Harvard School of Public Health and Department of Pediatrics of the New York School of Medicine. Our partnership focuses on translation of knowledge, building capacity, advocacy and accountability. Communication will be enhanced among women's advocacy coalitions and the Ministries of Environment and Health. We see this initiative as an important pilot program with potential to be strengthened and replicated regionally and internationally.

Keywords

Environmental health; Priorities; Partnership; Barriers; Lake Chapala; Mexico

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1. Introduction

“Knowledge is not enough; we must apply. Willing is not enough; we must do.”

JW Goethe

Lake Chapala is the largest watershed in Mexico. It is a major source of water for crop irrigation and subsistence fishing for a population of 300,000 people. Industrial sewage discharges, over extraction of water and weak environmental regulations have created unprecedented pressure on the whole watershed resources (Hansen and Van, 2001). Mercury, in particular, is released into the environment by burning coal, mining, tanneries, deforestation and “slash and burn” farming practices. Once in the sediment of rivers, lakes and streams, a portion of this mercury is transformed into methyl mercury, which biomagnifies in the aquatic food chain. Methyl mercury is a potent neurotoxicant with long-term cognitive and behavioral effects on children (Axelrad et al., 2007; Clarkson, 2002; Davidson et al., 1998; Grandjean et al., 1999). Previous reports of mercury concentrations detected in fish caught in Lake Chapala have raised concerns about health risks to local families who rely on fish for both their livelihood and traditional diet (Ayla and Ford, 2001; Jay and Ford, 2001).

2. The children environmental health partnership

In 2008, in response to local concerns, three of the authors (E.C., L.T. and F.L.) assessed mercury contamination in carp, whitefish and tilapia from Lake Chapala. This exposure assessment was performed along with a pilot investigation to assess correlations between fish consumption and hair mercury levels in the local population (Trasande et al., 2010). According to our data, 27% of women of childbearing age had elevated hair mercury levels (>1 ppm) when compared with an US reference population (Axelrad et al., 2007). Multivariable analysis indicated that frequent consumption of carp (*i.e.*, once a week or more) was associated with significantly higher hair mercury concentrations. Preliminary data suggested that influx of mercury from the major tributary river (Rio Lerma) may account for significant mercury contamination in Lake Chapala. (Trasande et al., 2010)

Opportunities exist to prevent environmental hazardous exposures, if a more proactive policy is implemented. International organizations have called for building scientific capacity among health care providers to enhance early detection of children’s and prenatal environmental exposures, in conjunction with improving the quality of health services, strengthening the legal framework and regulation (Cifuentes et al., 2010). Children’s Environmental Health Specialty Units (CEHSUs), in particular, may deliver necessary services to concerned communities and, at the same time, also give advice to governments (Ortega et al., 2007; Paulson et al., 2009; WHO, 2010). CEHSUs are usually nested in University-affiliated Hospitals and advise public agencies, community health workers, physicians and nurses about pediatric environmental health issues. CEHSUs also assist in building local community capacities and contributing to the development of children’s environmental health training curriculum (Kilpatrick et al., 2002). Studies have shown that health care providers, if adequately trained and empowered, may provide a wide range of activities that link vulnerable groups to needed services, improve pregnancy and birth outcomes, and reduce gender and rural–urban disparities (Bhutta et al., 2010; CDC, 2010). General practitioners, nurses, psychologists, toxicologists, social scientists and lawyers can build partnerships and help entire community to navigate bureaucratic systems (Table 1). These partnerships may contribute to strengthen the translation of knowledge related to environmental health priorities and promote institutional changes (Perez and Martinez, 2008). Community based projects may build bridges between institutions to gather resources needed to update and reinforce policy protection tools. There are, however, a series of obstacles, institutional gaps, challenges for sustainable funding and logistical barriers that

need to be addressed in order to get the work done. The importance of these challenges and barriers is well described in a manuscript that reviews lessons learned from the National Institutes of Environmental Health and Environmental Protection Agency funded Centers for Children's Environmental Health and Disease Prevention Research (Eskenazi et al., 2005).

In this paper we describe a comprehensive project, which responds to some of the challenges in the Lake Chapala region described above. With support from the National Council for Science (Mexico), the Commission for Environmental Cooperation and US funding agencies, we developed and implemented a comprehensive training program for persons involved in a cohort investigation of potential impacts of environmental neurotoxins in rural communities surrounding Lake Chapala. The authors of this paper are collaboratively building resources that are needed to establish a sustainable research program involving community based projects. These activities are coordinated by the Lake Chapala's CEHSU, nested in the University of Guadalajara, Mexico, in collaboration with local health services, the Department of Environmental Health of the Harvard School of Public Health, and the Department of Pediatrics at the New York University. Some of the major obstacles overcome are briefly described below.

3. Training a cadre of health care providers

The local team at the University of Guadalajara has a strong track record in community outreach work, focused mostly on vector borne diseases. When we started this collaboration, however, they had limited experience in the design and implementation of epidemiological cohort studies of prenatal neurotoxicant exposures that included the evaluation of cognitive and behavioral effects. The local team also required guidance in the development of bio-repository capacity and training in analyses of biospecimens for environmental contaminants of concern. Furthermore, our field team had limited experience in the use of valid instruments to assess early childhood neurodevelopmental outcomes that are commonly used in epidemiological studies. In addition, no local professionals trained in the use of epigenetic methods were available until early 2011, thus creating another barrier for studying gene-environment interactions.

To address the training needs in neurobehavioral testing, Dr. David Bellinger, from the Children's Hospital (Boston) has already trained a group of psychologists in the administration of neurodevelopmental instruments, such as the Bayley Scales of Infant Development-Third Edition (Bayley, 2006) through intensive in-person trainings sessions conducted in Lake Chapala communities, followed by a series of teleconferences, accompanied by review of video recordings of examinations. Similarly, Dr. Kimberly Yoltin (University of Cincinnati) has also trained and certified a group of neonatologists in the administration of the Neurobehavioral Network Scale (Boukydis et al., 2004; Lester, 2002), an instrument, which remains free of cultural and translational vagaries. The use of both instruments requires close supervision, in order to ensure reliability and validity. Subsequent teleconference communication has been supplemented by review of examination results to assess consistency.

We are already analyzing biological specimens for blood mercury concentrations, lead and persistent organic pollutants in cord blood, as well as inorganic arsenic in pregnant women's urine samples. Laboratory technicians located in the University of Guadalajara are being trained, and quality control procedures are being implemented with guidance and support from the National Center for Environmental Health at the Centers for Disease Control (CDC). This new capacity will not only serve the current cohort study, but also be available for research projects in other regions of Mexico and Latin American countries. In April

2011, two local young geneticists started their training in the use of epigenetic methods, to further examine the roles of gene–environment interactions in influencing exposure–biomarker and exposure–outcome relationships.

4. Progress report: barriers overcome

To date, we have recruited more than 300 women in their first or second trimester of pregnancy, with a <5% refusal rate. Our field workers gather household and women's data into the project database, including women's cell phone numbers. We have implemented a simple system of communication, using cell phone calls and text reminders for prenatal visits, which has facilitated appointments and collection of whole blood and urine samples from every woman during each pregnancy trimester. Specimens of whole blood, serum and urine are stored at -80°C for future analysis for environmental contaminants. Implementation activities are closely monitored during weekly conference calls, monthly progress reports and quarterly meetings at the University of Guadalajara. Nearly half of these women have been followed through their third trimester of pregnancy (80% retention rate). Initial seminars on cord blood collection techniques and engagement of obstetricians has witnessed a 70% cord blood collection rate during the last six months, which is consistent with collection rates in children's environmental health cohorts in maternity hospitals in the US. Our first annual symposium reviewing progress in the Lake Chapala project and discussion of new potential research projects were held last summer (2010). The next retreat is scheduled for June 2011 to update progress and to discuss problems, solutions and emerging opportunities.

In addition, we have already started a pilot exchange program involving young health care professionals from Mexico and the US. Pending new funding, our partnership will also establish a competition for community health workers to complete six-month training internships to study ecosystem approaches to human health, the environmental legal framework, and feasible methods for the reduction of water pollution. These internships will take place in the Center for Health Studies at the Universidad de Guadalajara (CUCS). Eligible individuals who are selected will receive scholarships; these fellows will learn skills for developing research proposals, budgeting, reporting and leading projects that are concerned with environmental rights, translation of knowledge to local priorities and advocacy. Active learning methods utilizing case-based and problem-based teaching techniques, in conjunction with lectures format, will be used in order to foster effective and participatory debate in the areas of prenatal and children's environmental exposures. Relevant cases and specific examples will be derived from local experiences and priorities, in order to more fully engage the participants while highlighting key general principles of children's environmental health and international law. Students will also communicate about cases and assignments through the use of "seminar blogs" (Goldman et al., 2008), which will also enable distant and asynchronous learning, whenever computers and internet access are available. Based on the availability of the technology, environmental health education workshops could be offered to a wider group through the development and use of online training modules, coupled with trainee interchange on the seminar blogs. Face to face educational sessions followed by online sessions for additional educational experiences would create a "hybrid" or "blended" learning experience (Mayadas and Picciano, 2007). We expect to start a South–South seminar series next year.

Following initial training, and pending financial support, environmental health "champions" will receive a small "re-entry" grant, which will enable them to build particular interventions, as described in their proposals. In 2–3 years, our partnership will bring environmental health advocates together for coalition building and sharing of experiences (Table 1). These meetings will include both new grant recipients, as well as "champions" or

recipients of “re-entry” grants. Special attention will be paid to policy translation activities in order to convey appropriate messages utilizing risk communication principles to the local authorities and concerned communities. Interested individuals (e.g., researchers and health care providers, advocates, community members and government representatives) will be invited to join a coalition responsible for social accountability and translation of knowledge into environmental health priorities. The mandate of our coalition is to articulate these priorities with interventions, and provide support to a wide spectrum of stakeholders and concerned communities. We will offer an open, neutral space for productive debate and interaction. Critical work commissioned by the partnership will contribute to the development of culturally acceptable and effective tools for resetting the environmental health agenda in Latin America.

5. Environmental health in the classroom

We have identified additional needs and priorities concerning community health and risk communication. It is in this context and with financial support from the Commission on Environmental Cooperation that knowledge-to-policy translation exercises have started. Briefly, we provide weekly one hour presentations in communities along the Lake (Chapala, Tuxcueca, San Luis Soyatlan, El Molino, Jocotepec and San Pedro) about environmental contaminants, their potential impact on pregnant women and their children, and ways to reduce these exposures. Interested individuals provide their contact information to the local clinic. We build upon prenatal visits and community health activities, while engaging new stakeholders (e.g., elementary public schools and parents’ associations). In 2011 we started a series of activities concerning environmental health in the classroom *i.e.*, dry sanitation toilets, hand washing and water disinfection using appropriate technology. We are also planning to introduce a series of nutritional education exercises and health fairs to convey messages concerned with traditional diet, including fish consumption during pregnancy. These activities will be described in future communications.

6. Obstacles and challenges

Bureaucracy has created an endless list of difficulties, most of which have had no actual purpose other than obstruction, and with no other possible explanation than false perceptions of power, authority and control. We have also faced challenges reflecting a common assumption – often mistaken – that solutions come from the North, and problems arise from the South. We are learning the difference between intellectual curiosity –while preventing temptation of time consuming and overwhelmingly detailed questionnaires, – and ethical imperatives *i.e.*, advocacy and health protection measures.

7. Conclusions

Our work is far from finished. This particular intervention represents a blend of research, training and education, and “service” or “practice” led by a South–North collaboration initiative. Dr. Julio Frenk, Dean of the Harvard School of Public Health has proposed that rather than defining our mission as three distinct sets of activities, we provide a single product – knowledge – and a single, integrated process around it – what Frenk calls the “circle of knowledge”. This circle includes the *production* of knowledge through environmental health research, the *re-production* of knowledge through capacity building, and *translation* of knowledge into evidence that can guide practice, community outreach and health protection policy. Following this process, we may scientifically assess both environmental policy and community health practices, as well as their performance in the real world; then we may complete the cycle, with the creation of a new circle of knowledge (Frenk et al., 2010).

Under this approach we assume that most environmental health interventions cannot be delivered by one individual or group working alone; shared interests may build the necessary trust and facilitate consensus making among partners, including the concerned communities. Progress will be evaluated using the following indicators: (1) number of new community health workers and advocates engaged in children environmental health priorities, (2) number of “re-entry” grants and trainees engaged in particular interventions, (3) number and types of linkages with children’s environmental health and other priorities (health and non-health) clearly articulated, (4) qualitative evidence about acceptability of approaches that link sectors or constituents with different backgrounds, and (5) number and types of participants from different disciplines and sectors willing to use linkages to strengthen programs and specific interventions with the potential to advance the environmental health agenda.

Finally, a broad remark regarding the political agenda. It is necessary to point out that weak governance has contributed to decades of environmental injustice and neglect. The local political machinery is engaged in the preparations for national elections (2012), and all the attention is focused, again, on the struggle for power. When we communicated our preliminary results to local politicians, some of them expressed concerns about their harvest of votes; environmental health is not an actual priority in their agenda. Resources are simply diverted to war on illicit drugs and organized crime, instead of paying attention to environmental health issues.

Collaborative partnerships have become an increasingly helpful resource while resetting both environmental health priorities and the political agenda. If expanded to other countries in Latin America, a Task – Force will require the broad engagement of leaders at the local, regional and global levels. We hope to stimulate policy makers to make children’s environmental health one of the top priorities.

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Table 1

Partnership's core values.

The Children Environmental Health Partnership will:	
<ul style="list-style-type: none">•••••••	operate collaboratively, transparently and inclusively
	plan and implement joint community based projects
	foster innovation, joint organization of seminars, workshops and long distance learning activities
	add value without overlapping or competing with existing initiatives
	communicate frequently with a broad community of partners
	exchange information, including documentation, publications and research results
	recognize and celebrate all participants' accomplishments