

Transferable Training Modules: Building Environmental Education Opportunities with and for Mexican Community Health Workers (*Promotores de Salud*)

Denise Moreno Ramírez, MS,

Department of Soil, Water and Environmental Science, Superfund Research Program University of Arizona, 429 Shantz Bldg. #38 Tucson, Arizona 85721

Lourdes Veal,

Sonora Environmental Research Institute, Inc., 3202 E. Grant Rd, Tucson, AZ 85716

James A. Field, PhD,

Department of Chemical and Environmental Engineering, University of Arizona, PO Box 210020 Tucson, Arizona 85721

Paul B. Baker, PhD,

Department of Entomology, University of Arizona, Forbes Building, Rm. 410 Tucson, AZ 85721

A. Jay Gandolfi, PhD, and

College of Pharmacy, University of Arizona, 1703 E. Mabel Street Tucson, AZ 85721

Raina M. Maier, PhD

Department of Soil, Water and Environmental Science, Superfund Research Program University of Arizona, 429 Shantz Bldg. #38 Tucson, Arizona 85721

Abstract

Community health workers (*promotores de salud*) have the ability to empower communities to mitigate negative health outcomes. Current training efforts in environmental topics are lacking. This project addressed this gap by developing four transferable training modules on environmental health. By applying a series of surveys, interviews, and trainings, we evaluated their relevance. Partners provided favorable feedback for three of the four modules. It was also learned that the development method could be improved by engaging technically trained *promotores de salud* in the role of co-creators. This project has implications for environmental justice communities as it can lessen information disparities.

Keywords

Promotor training; environmental health; peer education; environmental justice; Arizona-Sonora border

Conflicts of Interest

There is no conflict of interest for the corresponding author or the coauthors.

INTRODUCTION

In the United States (U.S.), minority and low-income communities are disproportionately exposed to environmental contamination¹. Such contamination can result in illness and health disparities. When other social determinates of health are present (e.g., environmental health literacy level), these issues can be exacerbated. Environmental health disparities in Latino communities have been described in the literature extensively¹⁻⁵. According to the Natural Resources Defense Council, a large proportion of the Latinos in the U.S. live and work in areas that can expose them to air pollution, contaminated water, and pesticide residue⁶. Approximately one-third of these Latinos, reside in the western part of the country where natural sources of arsenic and industrial chemicals contaminate potable water supplies⁶. Latinos also make up the majority of farmworker labor force and therefore it is estimated that they and their families are regularly exposed to pesticides⁶. Even though these disparities have been documented, current government attention and research funding is not enough to impact the environmental health of Latinos¹.

In Arizona's U.S.-Mexico border region, the unique characteristics and history of the area have contributed to environmental justice issues that have yet to be resolved⁷. There are growing health disparities in border cities attributed to exposures to pollution and hazardous waste⁸. Exacerbating the problem is that those who normally investigate environmental issues in the border are not directly impacted, while affected populations are often not interested or equipped to deal with large-scale environmental problems. The latter may be due to the lack of a clear understanding on how these issues affect them or the higher prioritization of other issues that impact their daily lives. Whatever the cause, the outcome is a minimal involvement of local border communities in the different facets associated with environmental pollution. Border environmental justice issues are very complex and therefore communities experiencing environmental contamination may often have a clearer perception of the problems and the potential solutions to these problems⁹.

The engagement of communities can be challenging particularly since many times they do not trust the motives of the research/project due to historical exploitation of their knowledge, misuse of biological or environmental samples, and irrelevant results that do not address local issues. When it comes to environmental pollution, it is of vital importance to engage community members¹⁰. There are various levels in which communities maybe engaged ranging from outreach ("communication flows from one to the other to inform, provides community with information") to shared leadership ("final decision-making is at community level, form strong partnership structures")¹¹. One effective mode of engagement is through local leaders or conduits that are versed in peer education/train-the-trainer approaches. Peer education focuses on building knowledge in a targeted population via designated community members as the teachers. This is contrary to traditional pedagogy models (top-down) where the learner simply receives information and cannot influence the educational agenda with their own experience. As a result, peer education can often create a more empathetic and credible relationship than the traditional top-down model, ultimately enhancing the transfer of knowledge. By applying peer education, the learner can be actively involved and incorporate personal knowledge, which has been demonstrated as essential in adult learning

(andragogy)¹². Individuals gain the ability to critically discuss their current circumstances as related to environmental health¹³⁻¹⁴.

Case studies of minorities dealing with public health issues, as in the U.S.-Mexico border region, highlight the effectiveness of Mexican community health workers (*promotores de salud*). These workers have successfully established intervention programs aimed at decreasing negative consequences of various public health issues¹⁵⁻¹⁹. The *promotor de salud* is a community leader who provides culturally and linguistically appropriate education to support the advancement of diverse issues. They serve as effective conduits of information as well as agents who can reduce and eliminate social barriers²⁰. *Promotor de salud*-focused trainings and projects have shown success in improving health outcomes and behaviors in diabetes, heart disease, women's health, and obesity²¹⁻²⁴. However, equivalent training in environmental health-themed topics such as hazardous contaminants, human health exposure, and risk assessment has not been readily available. Only a few *promotor de salud* environmental health-themed projects that incorporate trainings have been described in the literature²⁵⁻²⁷. Considering the success of *promotores de salud* with traditional public health issues, we hypothesize that making appropriate trainings available to them can address the information disparities present in environmental justice communities.

This project was designed to address the gap of environmental health knowledge/training materials targeting *promotores de salud* in the Arizona-Sonora border region. The project objective was to design and pilot test transferable training modules on environmental health topics relevant to the region and to establish if the training module content was useful to *promotores de salud*. This project was a collaboration between Arizona and Sonora academics (professors, researchers, and graduate students), *promotor de salud* organizations, and individual *promotores de salud*. The participating academic partners represented multiple disciplines with specialties in community-engaged research, environmental science, environmental toxicology, environmental engineering, geology, environmental health, and entomology. The collaborative *promotor de salud* organizations and their respective *promotores de salud* focus on community health (clinic setting), environmental health, and cultural preservation. This manuscript describes the community-engaged project (*promotor* transferable training modules on environmental health) phases implemented between 2010 and 2012 as well as the lessons learned from this experience to help guide future efforts.

PROMOTOR DE SALUD TRANSFERABLE TRAINING MODULES ON ENVIRONMENTAL HEALTH

Interactions with various groups in Arizona and Sonora established a need for a peer-driven model for environmental health trainings. In 2007 the University of Arizona Superfund Research Program (UA SRP - Tucson, Arizona) - Community Engagement Core (CEC), developed a partnership with *promotores de salud* from the Sonora Environmental Research Institute, Inc. (SERI – Tucson, Arizona). SERI *promotores de salud* are unique in the Arizona-Sonora border in that they specialize in environmental health outreach. Environmental health disparities facing the stakeholders of SERI *promotores de salud* range from neighborhoods in close proximity to hazardous waste sites, disproportionate morbidity

associated to environmental exposures, and persistent air and water pollution. The partnership focus was to expand their already-established environmental health training efforts (e.g., new topics, new instructors, new content).

The *promotor de salud* network grew when the Instituto Tecnológico de Sonora (ITSON - Ciudad Obregón, Sonora) requested to collaborate with the CEC to provide environmental health-themed trainings at a specialized workshop organized on October 28, 2008. The *promotores de salud* who participated in the trainings wanted to increase their knowledge on arsenic in addition to the associated health effects (e.g., environmental toxicology concepts). The ITSON researchers requested the trainings as a complement to an epidemiology study being established in the agricultural district of the Valle del Yaqui in Mexico. The main environmental contaminants of concern in the region include industrial application of pesticides and naturally occurring arsenic in drinking water.

Information about these initial training efforts was disseminated at diverse U.S.-Mexico border forums to interested stakeholders such as the Regional Center for Border Health, Inc. (RCBH – Somerton, Arizona). Environmental disparities addressed by RCBH *promotores de salud* primarily focus on asthma as a result of environmental exposures to such contaminants as pesticides and particulate matter. RCBH administrators were seeking such environmental health-themed trainings and suggested information be packaged as transferable training modules based on a peer education/train-the-trainer model to support multiplication of the efforts.

The modules were developed as concise units of education, each of which contains a set of focused learning objectives²⁸. The central characteristic of modules is flexibility. They are designed for easy individualization according to the education level and the instruction method desired²⁹. Since targeted module learners are adults, we applied Malcolm Knowles' adult education theory of andragogy to evaluate our final product as well as explain the project results obtained. This theory proposes that the trainer is not all knowledgeable and as a result the learner should participate by utilizing his or her own experiences¹². He also suggested implication for the practice of andragogy that can include: 1) involvement of the learner in the planning and self-evaluation of their instruction; 2) learner experience provides the basis for the learning activities; 3) emphasis on subjects that have immediate relevance to their job or personal life; and 4) learning is problem-centered rather than content-oriented¹². This theory was selected because it not only parallels aspects of peer education/train-the-trainer, but also because it continues to be influential in adult education design.

METHODS

Study Design

This transferable training module project was founded on a community engagement process. According to the Center for Disease Control and Prevention, it is a method of “working collaboratively with and through groups of people affiliated by geographic proximity, special interest, or similar situations to address issues affecting the well-being of those people”¹¹. We consulted (“communication flow to the community and then back by seeking answers and gets feedback from community”) with our *promotor de salud* partners on the design and

development of the transferable training modules. We built upon existing collaborations with *promotores de salud* as well as their respective *promotor de salud* organizations. The project team worked together to determine the training topics and module design. This project was divided into three phases. The first phase gathers input from *promotores de salud* and organization directors regarding the design and development of the modules. The second phase focuses on obtaining module content input (data) via pilot trainings. The third phase centers on analyzing the data gathered in the previous phase as well as integrating it into a final product. The project and associated survey/interview materials were submitted to the University of Arizona Human Subjects Protection Program for review.

Phase 1: Needs assessment, design, and development of the modules

The first steps in the module design process were to identify relevant environmental issues common to the areas where the *promotor de salud* organizations were located. Using teleconferences and face-to-face meetings, the three partnering *promotor de salud* organizations (SERI, ITSON, and RCBH) identified four themes that were of mutual interest to each organization: pesticides, arsenic, environmental toxicology, and fate and transport of contaminants.

The next step was to gauge existing knowledge on module themes and opinions of the module design from the *promotores de salud*. A needs assessment survey was the primary data collection tool. Separate surveys were developed and tailored for each of the *promotor de salud* organization locations reflecting local nuances. A draft version of each survey was provided to *promotor de salud* organization directors as well as academic partners for input and refinement. Questions in the needs assessment survey consisted of dichotomous (yes/no), ordinal (1 being the best and 10 being the worst), multiple choice, and Guttman scaling (rate the item). Filter questions were also incorporated to provide an opportunity to expand on personal knowledge related to the theme. The survey responses received were compiled in an Excel spreadsheet and quantified. Information gaps were either identified based on an incorrect response to a knowledge-based survey question (cumulative score of 50%) or a frequency response to a behavior-based survey question (cumulative score of 50%). All survey results were reported back to each of the participating *promotor de salud* organizations (SERI, ITSON, and RCBH) as well as the academic partners to guide their development of the module content.

As part of this phase, partnering *promotor de salud* organizations were asked to provide photographs that narrated visually each of the four module themes in their community. They used digital cameras to take pictures and subsequent images were submitted electronically. The purpose of the photographs was to include local images in the module-prepackaged PowerPoint presentation to evoke familiarity (peripheral strategy)³⁰.

The design elements for these transferable training modules were guided by existing *promotor de salud* curricula and adult instructional design models^{31–35}. It was decided to incorporate the following sections into the training modules: 1) module summary; 2) learning objectives; 3) background information; 4) additional resources (e.g., websites); and 5) training tools (video resources, PowerPoint presentation, training assessments and extensions, and concept activities). Collaborating academic experts developed the

PowerPoint presentations. These presentations served as an outline for the background information content.

All content presented in the modules targets an early middle school level³⁶. The inclusion of a module summary and learning objectives is self-explanatory and typical of educational modules or curricula. The background information section was designed to present concise information on the thematic topic to assist the trainer prepare for the training. When possible, simple tips on decreasing environmental health exposures are included.

Under the additional resources section of each module, various online resources or tools are provided that reflect or expand on information provided in the background section. These tools include videos (visual) and concept activities (hands-on) that can be used to supplement or clarify training concepts. The PowerPoint presentation (visual) is contained here and comprised of a series of slides covering talking points paralleling the background information.

The training assessments and extensions included in the additional resource section can be applied to evaluate knowledge transferred to trainees (alternative to pre- and posttests) or as an additional opportunity to further develop a certain training concept. To further support the trainer, supplementary information was included in the overall module package that provides instructions on how to use the modules, how to prepare for a training (checklist), tips on presenting, and suggested icebreakers.

Phase 2: Implementation, evaluation, and analysis of module pilot trainings

The next step was to pilot test the draft module materials with both collaborative and new *promotor de salud* audiences (e.g., had not been involved in the module development process). University of Arizona academics and SERI *promotores de salud* tested the modules via pilot trainings coordinated in the Arizona-Sonora border region. Eight pilot training events took place in Tucson, Somerton, and Nogales, Arizona between 2011 and 2012. These trainings served to test and evaluate the content and functionality of the transferable training modules. New *promotor de salud* participants were recruited via the partnering *promotor de salud* organizations hosting the event. The host organizations also provided the facility for the pilot trainings. Pilot events consisted of either one module theme taught as part of a larger training or the four module themes taught within a two-day training period (two module themes per day). The pilot trainings were between 1 to 1.5 hours in length with small (5–10) to medium-sized (10–20) groups of *promotores de salud*. The events provided the *promotores de salud* with the opportunity to experience the module theme lecture, PowerPoint presentation, and concept activities. For the most part, a Spanish-speaking trainer delivered the pilot training, and if a Spanish proficient trainer was not available, then a simultaneous translator was provided.

A post-training survey was provided to participating *promotores de salud* at each of the pilot trainings to obtain feedback on the usefulness of training materials, lecture structure, information applicability, training experience, and knowledge gained. This survey contained two, four-point Likert scale questions (poor, fair, good, and excellent) as well as four, three-category scale (yes, partly/maybe, and no) and five open-ended questions. Two of the three-

category scale questions in the survey were designed to assess knowledge gained. Previous work with SERI *promotores de salud* suggested that formal pre- and posttests were “intimidating” and therefore this was resolved by providing two questions in the survey probing knowledge gained. The post-training survey was designed to be short and to-the-point to decrease intimidation and increase the response rate.

All post-training survey responses received were entered into an Excel spreadsheet along with number identifiers tied to the paper copy of the survey (responses were anonymous). Four-point Likert scale and three-category scale questions responses were quantified. The open-ended responses provided in the post-training surveys were organized into general thematic groups. Each thematic group was assigned a definition as well as a variable that was used to code and organize in the database. Pilot training observations including meta-communication as well as other observations (e.g., presentation typos) were also incorporated into the evaluation process. An observer was integrated into the audience at each of the trainings and developed observation notes. Observer feedback was then used to either immediately correct an issue or to make modifications during the finalization stage (notes were also organized into general thematic groups). The same observer was used at all the pilot trainings.

Feedback was also gathered from SERI *promotores de salud* via a group interview at the end of the pilot training phase. The idea was to listen to their opinions to develop detailed insight regarding their experience as both audience members and module trainers. This activity was meant to add context to the paper survey responses received through the pilot trainings. The specific objectives of the group interview was to find out: 1) if *promotores de salud* could successfully train other *promotores de salud* using the module materials (peer education) and 2) if module content could be readily implemented and comprehended by *promotores de salud* (both trainers and trainees).

The academic project lead, who has long-standing rapport with SERI *promotores de salud*, led the group interview to facilitate a comfortable and open communication experience (facilitate bidirectional feedback). An icebreaker was conducted at the beginning to engage the group. The group interview comprised of a consent form, five-question demographics survey, participation rules (purpose of the group interviewing, their rights as a group interview participant, and how the information gathered would be used), and eight open-ended interview questions (divided into engagement, exploration, and exit questions). Probing questions were added during the interview process to get more information on specific ideas discussed. Comments were reiterated by the academic project lead as well as written down on an easel pad to ensure they were captured correctly (member check). This member check was also incorporated to provide *promotores de salud* an opportunity to challenge what are perceived as wrong interpretations of their words (qualitative validity). The interview was broken down by question into thematic categories to better interpret the information obtained. Summary statements reflecting interview responses were developed to capture the essence. These summary statements were in turn converted into a qualitative report detailing the interview questions, interview responses, and side conversations. The group interview was not recorded.

Phase 3: Data integration

Academic partners were responsible for finalizing each of the modules. As a first step, themes obtained through the analysis of the *promotor de salud* feedback mechanisms were incorporated (e.g., pilot training surveys, observations at pilot trainings, and group interviews). Next, modules were resent to experts at the University of Arizona for review of science content after comments from *promotor de salud* participants had been incorporated. A final step was to obtain an outside evaluation of the penultimate version of the modules. The reviewer was an adult education specialist who provided an andragogy evaluation of the module content.

RESULTS

Phase 1: Needs assessment, design, and development of the modules

In the first phase of the project, a total of 25 *promotores de salud* from SERI (five respondents), RCBH (six respondents), and ITSON (14 respondents) returned the needs assessment survey for each of the four themes. All survey respondents were female and self-identified as being Mexican, Mexican-American, or indigenous people of Mexico. Each respondent preferentially filled out the Spanish language survey (both English and Spanish surveys were supplied).

Needs assessment survey respondents suggested that the preferred learning methods for the modules themes are: 1) training or workshop (32%); 2) information material (23%); and demonstration/hands-on activities (20%). The knowledge gaps captured by the needs assessment survey varied for each of the module themes. Since surveys were tailored using nuances of the location where the *promotor de salud* organization were situated, it was not possible to directly compare all of the questions. It was possible to determine general trends using questions that did not vary. Table 1 provides a list of the knowledge gap categories derived from the responses of this survey.

These knowledge gaps were incorporated into the module learning objectives (Table 2). As a last component to this phase, we received a total of 148 photographs from our three partnering *promotor de salud* organizations. The photographs were mainly used in the pesticide and environmental toxicology modules and typically captured hazardous chemicals in the home, pesticides and pesticide application (industrial and household), and wildcat dumping sites.

Phase 2: Implementation, evaluation, and analysis of module pilot trainings

A total of 58 *promotores de salud* participated in pilot trainings from El Rio Community Health Center, Campesino Sin Fronteras, Sunset Community Health Center, Mariposa Health Center, Instituto Tecnológico de Nogales, RCBH, and SERI. Some *promotores de salud* attended more than one pilot training, but each attendee was only counted once in the total. A total of 98 post-training surveys were collected at the piloting events. One of the four-point Likert questions revealed that the majority of the participants thought that the training experience was overall excellent (66%) or good (13%), while 17% of the participants did not provide a response. Responses to the other four-point Likert question

suggested that the quality of the PowerPoint presentation was by and large excellent (68%) and good (20%), with 9% of the respondents not providing an answer. To summarize the three-category scale question responses, a majority of the respondents thought the information was applicable to their work (79%), the concept activities were effective in translating information (89%), they could translate the information obtained to community stakeholder (86%), and they would participate in future trainings (85%).

One of the open-ended question of the pilot training survey was focused on what training information was most practical to transfer to their stakeholders or clients. Thirty percent of the *promotor de salud* respondents answered that “all” of the information was useful to their stakeholders or clients. Other respondents thought that the specific information on contaminants (14%), arsenic (12%), exposure (7%), and pesticides (7%) were transferable. Thirteen percent did not respond to this question. The next open-ended question showed that 33% of the *promotores de salud* liked all aspects of the training, highlighting concept activities (25%), training presentation (11%), arsenic information (8%), how information was presented (6%), and ability to understand information (6%) as valuable aspects of the training. When asked what they liked least about the workshop, 80% either did not respond or specifically responded “nothing.” *Promotores de salud* also provided suggestions to improve the module trainings including: 1) provide printed materials that are complementary to the training information or presentation; 2) condense trainings lengths since these topics are overwhelming to novice; 3) highlight the more practical applications of the themes considering the audience; 4) fate and transport themes were too complex and not applicable; and 5) work on simplifying the language used in the presentations/trainings.

Pilot training observations were conducted for all eight pilot trainings. The main types of observations that resulted from this activity included: 1) physical gestures/reaction; 2) errors in presentation; and 3) questions/comments by trainees. Questions/comments by trainees were noted for the most part within the fate and transport module. These questions/comments were related to information about atoms and molecules, reduction-oxidation reactions, and biodegradation. Observational analysis also showed that the two concept activities *Every Day Chemical* and *Can You Smell the Chemicals?* were confusing for the audience. This was determined from reactions observed once the activities were initiated. In contrast, the concept activity that seemed to spur the most creativity, excitement, and engagement was *Arsenic, As Seen On TV*.

Six SERI *promotores de salud* participated in the group interview process. These *promotores de salud* were selected because they were involved throughout the module development and piloting experience (both as trainees and trainers). Demographics information was captured prior to the start of the interview regarding their background and expertise (Table 3).

Responses from the first half of the group interview revolved around how to create a more practical module tool to increase the knowledge base of *promotores de salud*. Generally, it was indicated that the amount of training time required for each module theme (1 to 1.5 hours) was long and that a shorter training time should be considered. Comments also received reinforce the notion that practical examples are necessary. Useful practical examples suggested by SERI *promotores de salud* included: reading pesticide labels;

household chemicals and cleaning mixtures; food and beverage toxicity examples; personal protection measures; and alternative products to pesticides. When it came to the improvement of module content, all *promotores de salud* stated that the fate and transport module was too complex and provided little information that could be readily incorporated into their existing work. Useful suggestions were also provided regarding the arsenic module that included: 1) make concepts more relatable; and 2) restructure concept activity instructions. No other substantive suggestions were made for the environmental toxicology or pesticide modules.

The second half of the group interview highlighted the barriers toward true incorporation of the *promotores de salud* in the co-creation of the transferable training modules. SERI *promotores de salud* stated that it is crucial to mentor and incorporate technically trained *promotores de salud* as co-authors of subsequent modules. They also stressed the importance of incorporating academic partners that have experience working with community members (they are knowledgeable of the nuances involved). A lack of sensitivity when working with community members was perceived as the hindrance to the process of building trust. *Promotores de salud* suggest that academic partners involved should be mentors to build capacity and confidence as the relationship moves forward (e.g., growth in roles and expectations). It was also suggested that academic partners that are new to community-based work should receive training in the cultural and linguistic nuances of the Arizona-Sonora border region to facilitate a fruitful community partnership.

Phase 3: Data integration

The results obtained under this phase focus on the andragogy evaluation completed on the penultimate version of the *promotor de salud* transferable training modules. Overall, it was suggested that the modules contain some of the elements of the andragogy framework and are in line with the andragogy design process. Specifically, it was highlighted that the modules were designed and developed with “sincere focus on the leaning [of the *promotores de salud*].” The suggestions on how to improve the modules are the following: 1) develop a “preparing for learning” module; 2) add an activity for strengthening the psychological climate; 3) provide opportunity for input or negotiation of the schedule; 4) ensure needs of participants can be accommodated; and 4) add supplements on the strategies and methodologies of highly effective adult educators. These suggestion have been integrated into the final module products. Since an outside professional provided the evaluation, we will not include these finding in the discussion.

DISCUSSION

The focus of *promotores de salud* is evolving, as these individuals are more involved in environmental health issues prevalent along the Arizona-Sonora border. As a result, some of the most pressing public health problems that they address are now being looked through an environmental health lens. For example, studies now suggest that arsenic exposure via environmental sources may contribute to the development of diabetes³⁷. Therefore, similar to scientific researchers evolving into multidisciplinary investigators, so should *promotores*

de salud. As a result, these modules fill a needed gap that inserts a new discipline into their public health focused curriculums.

In this manuscript, we describe the design and development of the transferable training modules via the consultation of *promotor de salud* partners. The project concluded in the development of four draft modules that incorporate local needs, promote peer education, and contain prepackaged training tools. Three of the four modules (arsenic, environmental toxicology, and pesticides) have been finalized. The fourth module on the fate and transport of environmental contaminants was deemed not successful. As we reflect on the principles of andragogy and community engagement, we are able to clarify lessons learned. SERI group interview responses highlighted a need to increase their involvement in the development of the modules as well as fortify trust between researchers that are properly trained in community involvement. These comments echo a “shared leadership” level of community engagement and not the “consult” level that what was applied to the project. Principles of andragogy also reiterate the need of adult learners to be more involved in the development of their instruction. By shifting our community engagement level to a shared leadership one, we feel we can better partner with *promotores de salud* (or other environmental justice community partners) to create environmental health modules.

Also, with shared leadership, we can better develop applicable content of abstract concepts such as those found in the fate and transport of environmental contaminants module. According to Balcazar and Caudillo²², trainings should apply technical information to everyday life situations that are common to *promotor de salud* stakeholders. This finding is also consistent with Ramos *et al.*³⁸, who concluded that educational efforts must be sensitivity to local culture in order to promote environmental health literacy. As a result, the fate and transport module contained abstract concepts of contaminant transport (e.g., sorption, volatilization, and biodegradation) that the *promotores de salud* could not relate to or apply to their work. The group interview provided suggestions to refocus this module on household contaminants and what happens to this pollution when it leaves homes (e.g., when it is poured down the drain, dumped into the soil, put in the garbage, or placed in recycle bin). For the above reasons, we suggest that future module development efforts apply academic-*promotor de salud* co-creation methods.

This project has other limitations. First, *promotor de salud* knowledge gained was not directly tested using andragogy-based evaluation tools. Therefore, we cannot assert that the knowledgebase of participating *promotores de salud* was expanded. A second limitation was testing for transferability (wide range of learning levels/styles) due to our small sample size and focused location. However, due to the flexibility inherent in these modules, the trainers should be able to tune the training to the target level²⁹. Future work should be done to evaluate the usefulness and effectiveness of these modules with *promotores de salud* in other areas of the United States or Mexico.

CONCLUSION

The *promotor de salud* transferable training modules described here provide an opportunity for these public health conduits to transcend the typical health topics in their current

outreach efforts. These modules are tools that *promotores de salud* can use to address environmental inequities through education. Not only this, but they provide an opportunity for them to become more involved in environmental justice issues. As collaborations increase to produce such transferable modules, *promotores de salud* can enter shared leadership roles with university researchers. As *promotores de salud* gain experience in these topics, and researchers gain knowledge in community involvement, they can both influence how future work is conducted in environmental justice communities.

Acknowledgments

Acknowledgments Credits

ITSON - CONACULTA *promotoras*, RCBH *promotoras*, SERI *promotoras*, Amanda Aguirre, Ann Marie Wolf, Dr. Diana Meza, Dr. José Luis Martínez Carrillo, Dr. Mercedes Meza, Rocio Estrella, Michelle Lutz, and UA Superfund Research Program Training Core students.

Source of Funding

The project described was funded by the United States Environmental Protection Agency Border 2012 Region 9 Program, Border Environmental Cooperation Commission, and the National Institute of Environmental Health Sciences Superfund Research Program grant P42 ES04940.

References

1. National Institute of Environmental Health Sciences. [Accessed February 9, 2016] Advancing environmental justice. http://www.niehs.nih.gov/research/supported/assets/docs/a_c/advancing_environmental_justice_508.pdf
2. Williams BL, Florez Y. Do Mexican Americans perceive environmental issues different from Caucasians: a study of cross-ethnic variation in perceptions to water in Tucson. *Environmental Health Perspectives*. 2002; 110(Suppl 2):303–310. [PubMed: 11929742]
3. Carter DE, Pena C, Varady R, Suk WA. Environmental health and hazardous waste issues related to the U.S.-Mexico border. *Environmental Health Perspectives*. 1996; 104(6):590–594. [PubMed: 8793340]
4. Brulle RJ, Pellow DH. Environmental justice: human health and environmental inequalities. *Annual Review of Public Health*. 2006; 27:103–124.
5. League of United Latin American Citizens. [Accessed February 10, 2016] Air of injustice: how air pollution affects the health of Hispanic and Latinos. 2004. <https://lulac.org/assets/pdfs/pollutionreport2.pdf>
6. Natural Resources Defense Council. [Accessed February 9, 2016] Hidden dangers: environmental threats in the Latino community. https://www.nrdc.org/health/effects/latino/english/latino_en.pdf
7. Carruthers, DV. Where local meet global: environmental Justice on the US-Mexico border. In: Carruthers, DV., editor. *Environmental Justice in Latin America: Problems, Promise, and Practice*. Cambridge, MA: MIT Press; 2008. p. 137-160.
8. Lara-Valencia F, Harlow SD, Lemos MC, Denman CA. Equity dimensions of hazardous waste generation in rapidly industrializing cities along the United States-Mexico border. *Journal of Environmental Planning and Management*. 2009; 52:195–216.
9. Austin D. Partnerships, not projects! improving the environment through collaborative research and action. *Human Organization*. 2004; 63(4):419–429.
10. Brown, P. *Toxic Exposures*. New York, NY: Columbia University Press; 2007. p. 30-55.
11. National Institute of Health. [Accessed February 10, 2016] Principles of community engagement. http://www.atsdr.cdc.gov/communityengagement/pdf/PCE_Report_508_FINAL.pdf
12. Knowles, MS. *The Modern Practice of Adult Education from Pedagogy to Andragogy*. Englewood Cliffs, NJ: Cambridge; 1980. p. 46-55.
13. Freire, P. *Pedagogy of the Oppressed*. New York, NY: Herder and Herder; 1970. p. 20-50.

14. Campbell C, MacPhail C. Peer education, gender and development of critical consciousness: participatory HIV prevention by South African youth. *Social Science and Medicine*. 55:331–345.
15. Ingram M, Piper R, Kunz S, Navarro C, Sander A, Gastelum S. A case study for the use of participatory evaluation in creating effective and sustainable community-based health promotion. *Fam Community Health*. 2012; 35:130–138. [PubMed: 22367260]
16. Spinner JR, Alvarado M. *Salud Para Su Corazón* – a Latino *promotora*-led cardiovascular health education program. *Fam Community Health*. 2012; 35:111–119. [PubMed: 22367258]
17. McCloskey J. *Promotores* as partners in a community-based diabetes intervention program targeting Hispanics. *Fam Community Health*. 2009; 32:48–57. [PubMed: 19092434]
18. Bonillas ZE, Morrison SD, Norsigian J, Rosero E. Reaching Latinas with Our Bodies, Ourselves and the *Guía de Capacitación para Promotoras de Salud*: health education for social change. *Journal of Midwifery and Women's Health*. 2012; 57:178–183.
19. Wiggins N, Johnson D, Avila M, Farquhar SA, Michael YL, Rios T, Lopez A. Using popular education for community empowerment: perspective of Community Health Workers in the *Poderes Salud/Power for Health* program. *Critical Public Health*. 2009; 19:11–22.
20. Eng E, Young R. Lay Health Advisors as community change agents. *Fam Community Health*. 1992; 15:24–40.
21. Lujan J, Ostwald SK, Ortiz M. *Promotora* diabetes intervention for Mexican Americans. *The Diabetes Educator*. 2007; 33:660–670. [PubMed: 17684167]
22. Balcázar H, Alvarado M, Fulwood R, Pedregon V, Cantu F. A *Promotora de Salud* model for addressing cardiovascular disease risk factors in the US-Mexico border region. *Preventing Chronic Disease*. 2009; 6:1–8.
23. Livaudais JC, Coronado GD, Espinoza N, Islas I, Ibarra G, Thompson B. Educating Hispanic women about breast cancer prevention: evaluation of a home-based *Promotora*-led intervention. *Journal of Women's Health*. 2010; 19:2049–2056.
24. Crespo NC, Elder JP, Ayala GX, Slymen DJ, Campbell NR, Sallis JF, McKenzie TL, Baquero B, Arredondo EM. Prevent and control childhood obesity among Latino children: the *Aventuras para Niños* study. *Annals of Behavioral Medicine*. 2012; 43:84–100. [PubMed: 22215470]
25. Ramos IN, May M, Ramos KS. Environmental health training of Promotoras in Colonias along the Texas-Mexico border. *American Journal of Public Health*. 2001; 91:568–570. [PubMed: 11291367]
26. Barraza-Roppé, B., Moya, M., Takvorian, D. San Diego's answer to environmental racism: the SALTA project. Poverty and Race Research Action Council Newsletter. Jan-Feb. 1998 http://cjtc.ucsc.edu/globallocalpoped/downloadable/EHC/prrac_article.doc
27. Balcazar H, Caudillo RD. Development of a model for training Community Advisors in environmental health (project no. EH PP96111-6). SCERP Final Report CX- 824924-01-0. 1996
28. Robinson WB Jr, Crittenden JW. Learning modules: a concept for extension educators? *Journal of Extension*. 1972; 10:35–44.
29. Barbosa, EF., Maldonado, JC. An integrated content modeling approach for educational modules. In: Kumar, D., Turner, J., editors. *Education for 21st Century-Impact of ICT and Digital Resources*. Boston, MA: Springer; 2006. p. 17-26.
30. Kreuter MW, Lukwago SN, Bucholtz DC, Clark EM, Sanders-Thompson V. Achieving cultural appropriateness in health promotion programs targeted and tailored approaches. *Health Education and Behavior*. 2002; 30:133–146.
31. Clark, D. [Accessed January 20, 2011] Instructional system design: the ADDIE model. www.nwlink.com/~donclark/hrd/sat.html
32. National Center for Healthy Housing. [Accessed March 22, 2011] NCHH healthy homes for Community Health Workers course. <http://www.healthyhomestraining.org/chw/>
33. Agency for Toxic Substances and Disease Registry. [Accessed February 17, 2011] ATSDR toxicology curriculum. <http://www.atsdr.cdc.gov/training/toxmanual/overview.html>
34. Community Health Worker National Education Collaborative. [Accessed January 20, 2011] Key considerations for opening doors: developing Community Health Worker education program. <http://www.chw-nec.org/pdf/guidebook.pdf>

35. World Health Organization. [Accessed January 20, 2011] Instructions for the use of the WHO training package for the health sector. http://www.who.int/ceh/capacity/training_modules/en/
36. Meade CD, McKinney WP, Barnas GP. Educating patients with limited literacy skills: the effectiveness of printed and videotaped materials about colon cancer. *American Journal of Public Health*. 1994; 84:119–121. [PubMed: 8279598]
37. Gribble MO, Howard BV, Umans JG, Shara NM, Francesconi KA, Goessler W, Crainiceanu CM, Silbergeld EK, Guallar E, Navas-Acien A. Arsenic exposure, diabetes prevalence, and diabetes control in the Strong Heart Study. *American Journal of Epidemiology*. 2012; 176(10):865–874.
38. Ramos IN, He Q, Ramos K. Improvements in environmental health literacy along the Texas-Mexico border following community-wide health education. *Environmental Justice*. 2012; 5(1): 32–37.

Table 1

Promotor de salud

Knowledge Gaps Identified Through the Needs Assessment Survey (N = 25)

Knowledge Gap - Themes
Read and interpret pesticide labels
Pesticide information targeting both households and industrial agriculture use
Dangers of mixing household cleaning chemicals
Proper disposal of household hazards
Local examples of contaminated sites
What is a dose-response curve?
What is chronic/acute exposure?
Resources regarding each module theme
What is arsenic and where is it found?
What is the maximum contaminant level (MCL) for arsenic in drinking water?

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript

Table 2

Learning Objectives Developed for Each of the Four Transferable Training Module Themes

Module Theme	Learning Objectives
Arsenic	<ul style="list-style-type: none"> • Gain knowledge about arsenic and its properties. • Determine the chemical forms of arsenic. • Acquire information on the many uses of arsenic. • Define the different human exposure routes. • Learn the basics of arsenic toxicology. • Understand methods to decrease exposure to arsenic.
Environmental Toxicology	<ul style="list-style-type: none"> • Understand toxicology and associated terms. • Learn about everyday toxic substances. • Interpret a dose-response curve. • Acquire information about biological variation. • Define exposure types. • Familiarity with toxicity episode phases. • Basic understanding of risk assessment.
Fate and Transport of Environmental Contaminants	<ul style="list-style-type: none"> • Understanding atoms and molecules. • Familiarity with the concept of concentration. • Identify the possible fates of chemicals. • Learn about exposure routes. • Determine how citizens can decrease chemicals in the environment.
Pesticides	<ul style="list-style-type: none"> • Understand the definition of a pesticide. • Learn about the different types of pesticides. • Acquire information about pesticides associated risks. • Familiarity with pesticide safe handling. • Interpret pesticide labels and images. • Define integrated pest management and other pesticide alternatives.

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript

Table 3Demographics of SERI *Promotores de Salud* Participating in Group Interview (N = 4)

Mean age	45
Years working as a <i>promotor</i> (mean)	5 years
Specialty area as a <i>promotor</i>	Healthy Homes (100%) Household hazardous waste (50%) Air Quality (25%) Asthma (25%) Lead (25%) Pesticides (25%) Pollution prevention in small Businesses (25%) Water Harvesting (25%)
Experience training other <i>promotores de salud</i> and community members	100%
Stakeholder visits per month	More than 15 (100%)