

Building Community Capacity for Agricultural Injury Prevention in a Navajo Community

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ABSTRACT. *This article describes the process of building community capacity to plan, implement, and evaluate culturally appropriate agricultural injury prevention programs on the Navajo Nation. Navajo farmers and ranchers, the community stakeholders in this model program, experience significantly greater farm-related occupational mortality compared to other ethnic groups in the southwestern U.S. In this population, effective agricultural injury prevention projects designed to change livestock and pesticide handling practices are likely to reduce agricultural-related injuries and deaths. Community-based organizations and community members may benefit from training to develop the capacity to undertake systematic planning and evaluation. Using a community-based participatory research approach that addressed the need for such training, a stakeholder group consisting of university faculty and community members implemented a sequential planning process that incorporated scientific principles and activities. Over five years, community stakeholders identified criteria to define capacity improvement and then proceeded to implement activities to enhance their ability to develop, implement, and evaluate agricultural injury prevention projects. Specifically, stakeholders developed, translated, and administered a baseline survey of agricultural practices among Navajo farmers and ranchers, used survey results to design two agricultural safety projects, and implemented and evaluated the interventions. The results of the evaluation of capacity building suggest that the project was successful. This project may serve as an innovative model for increasing community involvement in the development of agricultural injury prevention interventions with underserved populations where mortality and morbidity are high, and strategies for prevention have either not been effective or adequately studied.*

Keywords. *Agricultural injury prevention, Behavior change theory, Community capacity, Planning and evaluation.*

American Indians in the southwestern U.S. experience significantly higher farm-related occupational mortality compared to other ethnic groups (Crandall et al., 1997; Fullerton et al., 1995). However, evidence-based agricultural health promotion strategies have been primarily tested among white men in Midwest-

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ern rural communities (Hwang et al., 2000; Curwin et al., 2002; Keim and Alavanja, 2001; Mandel et al., 2000). Although some agricultural health studies have been conducted among ethnic minority groups, much of this research concentrates on Hispanic seasonal and migrant farm workers in the west and southeast (Arcury et al., 2002; Flannery et al., 2003; McCauley et al., 2004; Quandt et al., 2001a) and African-American farmers in the south (McGwin et al., 2000; Omishakin, 1994). Nevertheless, the application of these strategies holds great potential for agricultural injury prevention in American Indian communities.

The purpose of this article is to reflect on our experience of engaging Navajo farmers and ranchers in a capacity-building initiative to improve their ability to undertake a comprehensive planning and research process to identify, address, and reduce agricultural injury. Knowing that achievement of this goal requires the cultivation of trust over lengthy periods of interaction between community members and academic researchers, who have historically not engaged American Indian communities in a collaborative fashion, the model program described here focuses on strategies to increase local capacity so that stakeholders can collaborate as equal partners in agricultural injury prevention research projects. Community capacity has been defined as the "characteristics of communities that affect their ability to identify, mobilize, and address social and public health problems" (Goodman et al., 1998). In this program, we sought to enhance the capacity of Navajo farmers and ranchers to initiate and sustain new projects to address the problem of agricultural injury within their community. The information presented here utilizes the form of a practice-oriented narrative, which follows sequentially from the project's initiation to the subsequent activities of the stakeholder group at the end of the project.

Background

Community-Based Participatory Research

Community-based approaches are increasingly viewed as essential for tailoring health promotion strategies to local contexts, and many more individuals are playing important roles in shaping the health and well-being of their communities through participation (Arcury et al., 2000; Goodman et al., 1998; Roskam, 2001). Participatory research is conducted through systematic inquiry in collaboration with those affected by the problem under study for the purpose of education and effecting social change (Green et al., 1997). In community-based participatory research, or CBPR, researchers and local stakeholders from the affected population as well as representatives from local agencies work in partnership to identify and define specific issues that require investigation; to design, implement, and evaluate interventions; and finally to disseminate research results within community settings (Israel et al., 1998; Green et al., 2003; Minkler and Wallerstein, 2003) and in academic publications. Over the past decade, CBPR has become integral to the National Institute of Occupational Safety and Health's (NIOSH) national translational research agenda to reduce occupational health disparities (NIOSH, 2008).

CBPR approaches are not utilized to simply conduct research, but to lay the groundwork for future collaborations through the development of research capacity within communities. Capacity building is intended to improve the ability of an individual, organization, or community to carry out stated objectives (Goodman et al.,

1998; LaFond et al., 2002). CBPR combines research methodology and community capacity-building efforts to apply research findings directly to interventions and policies (Green and Mercer, 2001; Green et al., 1997; Macaulay et al., 1999).

Additionally, capacity building engenders a supportive environment to sustain partnerships that address behavioral change through the development of locally responsive strategies, such as those promoting the adoption of safe farming practices (Stringer, 1999; McKleroy et al., 2006). In an academic-community partnership, faculty focus on nurturing community capacity by providing training opportunities for local stakeholders, building on the knowledge and skills necessary to be full collaborators in research studies (Quandt et al., 2001b; Roskam, 2001).

The CBPR project described here utilized adult learning principles and culturally appropriate models of dissemination (McCauley et al., 2001; McKleroy et al., 2006; Bransford et al., 1999) to improve agricultural practices among a population that experiences significant health disparities. This program may serve as an innovative model for other agricultural injury prevention groups seeking to intervene in underserved populations where mortality and morbidity are high and strategies for prevention have either not been effective or adequately studied.

Agricultural Injury Prevention on the Navajo Nation

Approximately 180,000 people reside on the Navajo Nation; thousands of its citizens also live off the reservation (U.S. Census, 2000), making the tribe the second largest in the U.S. The land base of the Navajo Nation totals more than 6 million hectares (15 million acres), comprising the largest American Indian reservation in the U.S. (Encarta, 1997) and stretching into three states (New Mexico, Arizona, and Utah) of the Four Corners region. The Navajo Nation is composed of five Agencies, which represent specific geographical locations. Each Agency includes several chapters, the local tribal government unit and community center; 110 chapters comprise the Navajo Nation.

Data on agricultural injuries in American Indian populations are strikingly limited. While the overall work-related injury death rate for American Indians (6.4 per 100,000 person-years) is lower than for Anglos (non-Hispanic whites) (8.8) and Hispanics (7.3), subgroup analysis of agricultural deaths shows a farm-related injury death rate among American Indians of 51.2 per 100,000 person-years, more than twice the rate for Anglos and Hispanics combined (Fullerton et al., 1995; Crandall et al., 1997).

One important step in assessing the health needs of a community and effectively planning agricultural health and safety programs is to better understand the beliefs, values, and concerns of community members (Wadud et al., 1998). While nearly all extended families living on the reservation are engaged in agriculture (Rodgers, unpublished), the results of our CBPR project suggest that agricultural activity and practices on the Navajo Nation are changing. Historically, most families engaged in traditional farming practices using non-mechanized equipment. Few Navajos owned tractors; most utilized tractor services provided by the chapter. Usually, those services included a tractor operator. Today, an increasing number of farmers devote much of their acreage to cash crops and larger-scale farming, which requires mechanized equipment. More people own tractors, but lack the experience to use them safely, or only have access to older tractors without rollover protection systems.

The available information on Navajo agricultural practices highlights community concerns about risk. In one qualitative study of agricultural injury among Navajo fami-

lies (Crandall, 2000), high-risk agricultural practices, knowledge, attitudes, and behaviors regarding farm-related injury were identified. Focus group participants emphasized the need for safety training to handle equipment as their primary concern. Work with livestock was identified as the second most important injury prevention issue. While sheep herding, a traditional mainstay of Navajo family life (Aberle, 1982; Witherspoon, 1983), was occasionally mentioned as a source of injury, cattle handling emerged as a more significant issue.

The Navajo livestock industry has shifted dramatically from sheep to cattle in the past 50 years, reflecting changes in lifestyle and in the markets for wool and mutton (Etter and Moore, 1996). Etter and Moore (1996) reported that the average Navajo herd consists of nine mature cows and one bull and observed that the highly unsafe method of cinching a cow to a post and dragging her to the ground is frequently employed. The vast majority of producers cannot afford the required investment in equipment to maintain these herds, and very few producers have the facilities to handle cattle safely. In addition to these equipment issues, because handling cattle is not a historically traditional Navajo activity, little local knowledge and experience exists concerning safety practices in dealing with cattle.

The Intervention Planning Project

History

The setting of this CBPR project is the Shiprock Agency, which is located in the northeastern section of the Navajo Nation. The Shiprock Agency consists of 20 chapters and covers almost 3 million acres, with an estimated farming and ranching population of 1200 families. In this Agency, farming (alfalfa, vegetables, and corn) and ranching (sheep and cattle) are the principal types of agriculture. Farms and ranches are primarily irrigated through an intricate ditch system, a source of agricultural-related drowning and other water-related injuries, especially among farm families.

Between October 1998 and 2001, the Southwest Center for Agricultural Injury Prevention and Education at the University of Texas Health Sciences Center (SW Center) funded a pilot study with the Shiprock Agency Cooperative Extension Service (CES)/Arizona 4H Youth Foundation, and the University of New Mexico (UNM). The study examined the feasibility of developing and implementing educational interventions to prevent agricultural injury.

Four pilot interventions were implemented: (1) equestrian safety for youth, (2) tractor safety, (3) livestock handling safety, and (4) pesticide safety. These interventions were knowledge-based and disseminated information through workshops for large numbers of people. Three equestrian safety-training programs were implemented for 30 youth, and 200 farmers participated in seven training sessions on general farm safety and animal handling safety. Fifteen workshops on livestock handling safety were conducted, reaching about 40 people per workshop, or 600 people. In addition, the project initiated an equipment loan program as a resource for squeeze chutes, a calf table, pregnancy table, and a sprayer. This equipment has been enhanced in the last five years and is still available for short-term loan to Navajo farmers and ranchers. The Shiprock CES manages the program on-site and provides complete training in safe equipment use.

Formal Approvals

The Northern Navajo Agency Council, which is composed of representatives from each of the 20 chapters, and the Shiprock Agency Health Board endorsed our CBPR project, passing resolutions to encourage this capacity-building partnership. The Navajo Nation Human Research Review Board (NNHRRB) and the UNM Human Research Review Committee approved the procedures used in this project, including our informed consent document and processes for obtaining informed consent. Both review boards continued to oversee and approve this work annually.

Assessing Capacity Building

The stakeholders compiled a list of competencies that they identified as key indicators of capacity building that could be enhanced through participation in the project. These included:

- Understand and analyze issues related to agricultural safety.
- Articulate different factors that contribute to agricultural injury.
- Link those factors to a plan to reduce or prevent agricultural injury.
- Develop specific strategies to reduce or prevent agricultural injury and understand why the specific strategies will work.
- Set goals and objectives for a safety program.
- Develop evaluation methods to determine if goals and objectives are met.
- Understand the role of research in designing and evaluating a safety program.
- Interpret research data.
- Be better able to pay attention and understand to other stakeholders' perspectives.
- Achieve consensus in a group.

We used these criteria as guiding principles and to assess the impact of capacity building efforts among the stakeholder group members.

Critical Reflection

At the beginning of the fourth year of collaboration, stakeholders engaged in a systematic process of critical reflection regarding our community capacity-building process and its outcomes, utilizing a focus group format. Representative quotes from the focus group discussion are provided to underscore the perspectives of participants on the topic of capacity building. As we describe below, the process of joint reflection led us to better understand the progress made to enhance local capacity building and to identify future needs so that agricultural injury programs could be planned, implemented, and evaluated in this community setting.

In addition to the focus group, stakeholders participated in a written evaluation of capacity building, using the criteria defined above.

Moving Forward

In the years leading up to this model CBPR project, UNM provided safety equipment to the Shiprock CES; both parties were interested in developing safety training programs that could be combined with an equipment loan program to ensure proper use. Subsequently, the university faculty were invited to lead a new CBPR initiative to undertake a systematic and stepwise process necessitating the articulation of defined outcomes and performance measures informed by both qualitative and quantitative data. The steps in the process included: (1) convening a stakeholder group; (2) using

locally collected data and a logic model process to understand the contributing factors to agricultural-related injuries on the Navajo Nation; (3) describing the theoretical foundations of interventions to influence those factors; and (4) developing, implementing, and evaluating culturally appropriate interventions to ameliorate those factors.

To begin the new CBPR initiative, members of the grazing and ranching committees from each of the 20 chapters of the Shiprock Agency were invited to attend an organizing meeting. As one stakeholder described the recruitment process:

"We selected those people that were opinion-leaders and from different areas to be on the board. A lot of them were Grazing Committee members, and we tried to balance it with Farm Board members. We've added people since then... but you know, there'll come a time, and that time's coming, when we'll probably need to involve more people."

Also present at the meeting were individuals from relevant government agencies (Navajo Nation Departments of Agriculture and Environmental Health), local community agencies (Farm Board, Water Board), and Shiprock CES staff. Invested in the process and outcome of this project were faculty from two academic institutions (UNM and New Mexico State University [NMSU]) who participated in all aspects of the project and who provided technical assistance in the science-based methods (UNM) and agricultural safety procedures (NMSU).

The average age of the stakeholder group member was 52 years, and all members spoke English. With the exception of university faculty, all participants also spoke Navajo. Over the course of five years, the group met between four and eight times per year. Smaller subgroups met more frequently to work on specific aspects of the project, such as the survey translation, development of the survey sample, analysis of survey data, and design of specific intervention materials. The SW Center supported the work of the stakeholder group under a subcontract from NIOSH. Individual stakeholders were provided stipends to facilitate their participation and travel expenses. As revealed during the focus group discussion, the stakeholders described their willingness to participate because the issue of agricultural injury was important to them. As one stakeholder later reflected: *"In all these years, the issue of [agricultural injury] has been here, but nobody has ever addressed it in the Navajo, or among the smaller tribes."*

Baseline Assessment of Agricultural Injury

The stakeholder group first reviewed the literature and locally available data sources to prioritize agricultural injury causes in need of further investigation. The group observed that the literature was filled with data concerning other populations, not their own, and recognized the need to collect locally relevant data to supplement the currently existing data. Members quickly developed consensus about the need for a baseline survey focused on the agricultural risk areas cited in the literature.

Beginning with a survey tool implemented successfully in Kentucky (Browning et al., 1998), and after review of other similar survey tools, we consulted with two agricultural injury-prevention experts who assisted the group in selecting questions, making adaptations, and formulating new questions specific to the local context. The group then modified the survey tool so that it was culturally appropriate for farming and ranching practices on the Navajo Nation. In this situation, cultural appropriateness referred to the ideas, beliefs, and practices associated with agricultural work in the Shiprock Agency (see Kumanyika, 2003).

The survey tool included questions on types of agricultural work of primary importance on the Navajo Nation: handling cattle, using tractors and other equipment, and applying pesticides. Another issue of community concern was child safety around waterways, particularly in agricultural ditches, and on farms in general. The survey also inquired into the ways that Navajo people learned to ranch, how agricultural information was disseminated and received, local decision-making about agricultural safety issues, information about agricultural-related injuries in community settings, and respondent participation in safety trainings. Questions were both close-ended and open-ended. The use of both formats allowed participants to choose among a set of responses and then to explain their choices. Photographic images and props (e.g., images of people using farm equipment and items used in pesticide safety) were incorporated to overcome potential communication barriers posed by language differences.

We translated the survey tool into Navajo, a language only recently available in written form, through a consensus-building process. A small group of bilingual stakeholders worked together to agree on appropriate Navajo translations for questions and response scales. Sometimes translations were not appropriate, resulting in substitution of English words, rewording of questions, and modification of scales (e.g., from a five-point to a three-point scale). For each question, the group debated the best way to state the question in Navajo, and then when they had agreed, the resulting translation was captured on a tape recorder. Subsequently, we asked a professional Navajo translator to back translate the tape into English. The two resulting English versions were compared and found to be almost identical.

The team members then participated in a pilot test of the instrument, each with two individuals from their local chapter. Several minor changes were made after the pilot test to clarify specific questions. The finalized Navajo tape and the English written version were then duplicated and prepared for administration.

This iterative process took several months of intensive effort. One stakeholder described the process in this way:

"The questionnaire [we] developed... I thought it was pretty good, because it was more culturally sensitive than [the first version]. When it first started... if you asked some of those questions to some people, they would have thrown you out, cuss you out. We made it more culturally sensitive. It became easier when we translated it to Navajo to get a response."

As reflected in the quotation above, the stakeholders contributed to the development of the survey and were proud that they had accomplished this "research task" together. Through the process, they learned about survey construction and the challenges of developing reliable instruments to collect information about community knowledge, attitudes, and practices, which could be used to help them design interventions.

Data Collection

Ten community members volunteered to serve as surveyors. They lacked training in collecting data, but they were interested in gaining such skills to assist in their work on grazing and farming committees. One individual was particularly interested in garnering these skills, as she was seeking to apply them in her master's thesis research. These community members agreed to conduct the surveys in exchange for \$10 compensation for each completed survey, plus reimbursement for travel expenses.

The stakeholder group derived its sample of 220 individuals from the Bureau of Indian Affairs (BIA) land permittee list, the only comprehensive list of families allotted lands on which to farm and/or graze on the Navajo Nation. Proportional sampling was utilized, based on the number of farms and ranches (estimated at 1200 total) per each of 20 chapters. Within each chapter, permittees were randomly selected until the desired proportion was reached.

The survey tool was initially administered by these ten trained surveyors. Each surveyor was provided with a survey "tool box" that included a tape recorder with the Navajo translation of the survey questions, an interview assignment list of the randomly selected permittee holders, props such as gloves, photos of equipment in use, a laminated copy of the instrument, and response sheets to record answers. Surveyors were instructed to read the questions to the respondent in English, unless the respondent preferred to hear them in Navajo, at which time the surveyor would use the tape-recorded version of the questions and response categories.

Many factors contributed to data collection challenges. Problems with surveyor compensation and reimbursement did not become evident until more than halfway through the data collection period. As a result, several trained surveyors dropped out; five more community members were recruited and trained. Bad weather also made some roads impassable during the winter months when some of the data collection occurred. Surveyors often traveled miles to find no one home; due to the lack of telephones, availability could not be determined in any other way. Even when a potential respondent was home, ethical research practices required that the respondent be offered the opportunity to think about participating and to contact the surveyor at a later date to confirm his/her interest. Due to the part-time nature of agricultural work on the Navajo Nation, many farmers and ranchers went to their farms and ranches only on weekends, restricting data collection opportunities. Since the names of ranchers and farmers were determined from an outdated, albeit "official," list of ranch and farm permittees, many of the people on the list were found to be deceased or infirm. The stakeholder group suggested that we adapt our recruitment strategy to include those permittee's family members who actively took part in agricultural activities and to use opportunities to interview in other settings, such as the grazing or farming committee meetings. In the end, the stakeholders felt that the challenges of conducting the survey were justified by the outcome. One member said:

"The survey was difficult to complete, but the actual process was excellent in the sense that everybody was really happy when the survey was done. But then when we got the analysis back, there were actually numbers... we had a direction to go with the data that was collected. Once we got the data it was... like it was worth it."

Data were entered into Statistical Package for the Social Sciences (SPSS), and analyzed by UNM staff. Stakeholders convened a smaller data analysis work group, and these members traveled to Albuquerque twice during the data analysis period to provide interim guidance to UNM faculty and staff.

Survey Results

Of an original sample target of 220 permittee holders, 195 representatives of permittee families participated (one per family) (89% response rate). Respondents were male (66%) and female (44%), between the ages of 20 and 89 (83% between the ages of 49 and 79), and 55% had attained at least an eighth grade education. Thirty-one percent reported doing only ranching, 23% only farming, and the highest percentage

(43%) engaged in both farming and ranching. Seventy percent reported that their agricultural work was a part-time occupation. However, there was a difference in the proportion of part-time agricultural work between farmers and ranchers; 52% of farmers said it was a part-time occupation versus 70% of ranchers.

Presentation and Utilization of Survey Results

The results of the baseline survey were presented several times. The first presentation was to a large audience of interested community members, including the stakeholder group, the Navajo Nation Departments of Agriculture and Environmental Health, and the Water Board. Subsequent presentations were delivered to the Navajo Nation Vocational Agricultural Program, the Northern Navajo Agency Council, the Navajo Nation Human Research Review Board First Annual Conference, and the Shiprock Area Health Board.

The presentation of survey findings marked a milestone in the stakeholder group process. One stakeholder explained:

"It was good... once you got the data it did form a picture of this is where we need to go. But up to that point, really even us, we didn't know what areas we needed to look at. I sat on the Grazing Committee and I knew the problems related to livestock, and as a farmer I knew my problems, but not the community problems."

A second stakeholder stated:

"It was like... going through melted butter. We got ready to identify the things that needed to happen. Because the opinion-leaders in the community were there to identify those things. And since then, everybody kind of took an interest in it and was ready for the interventions."

It was evident that the stakeholders felt that the systematic collection and presentation of data on Navajo agricultural injuries and safety practices helped spark the interest and participation of other community members. Their work to collect these data, although difficult, was validated by the community reaction. As a result, more community members volunteered to join the stakeholder group.

Given the high proportion of part-time farmers responding to the survey, the results showed that factors such as time constraints, available light, and exhaustion play a role in increasing injury risk among this population. The survey results indicated that knowledge about safety practices was moderate and could be enhanced. The results also suggested that a train-the-trainer model using respected opinion-leaders to teach safety practices is likely to be effective because it follows traditional learning models.

Implementation of the Planning Process

The expanded stakeholder group chose two interventions: (1) livestock handling and (2) pesticide use. The stakeholder group then developed two logic models, one for each intervention area. This process included discussions of risk factors and protective factors; institutional and informal resources on the Navajo Nation and in their own communities; other inputs, which were primarily the grant funds as well as CES funds and personnel resources; activities of the intervention; and process, short-term, and intermediate outcomes. Figure 1 provides an example of the logic model for the livestock handling intervention. Stakeholders found this process to be "intuitive" and insightful. One stakeholder remarked: *"I think it's pretty neat how we all did this... how we all sat down and we all learned how we can do it [create logic models]."*

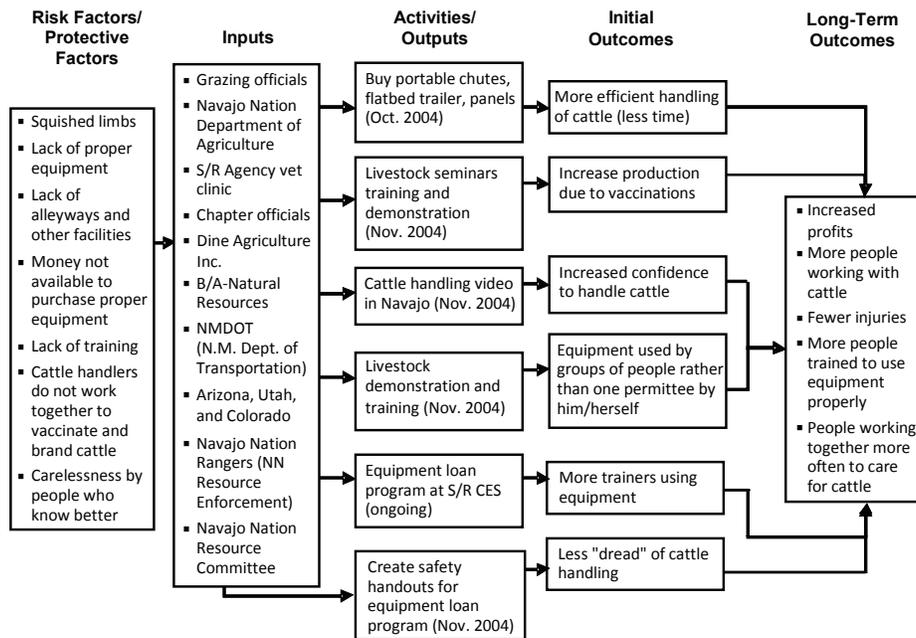


Figure 1. Logic model for livestock handling safety intervention.

The stakeholder group undertook a systematic review of well-validated and widely used behavioral change theories, including the Health Belief Model (Hochbaum, 1958), Theory of Planned Behavior (Fishbein, and Ajzen, 1975), Social Cognitive Theory (Bandura, 1986), Transtheoretical Model of Change (Prochaska, and Di-Clemente, 1983), and Theory of Diffusion of Innovations (Rogers, 1995). We discussed the strengths and weaknesses of each theory, clarifying what constructs were relevant to the baseline data, underlying the importance of explicitly articulating the role of theory in the design and evaluation of the intervention (Helitzer et al., 2006). The group agreed that attention would be paid to how information is best communicated within each intended intervention population in order to foster the adoption of new safety-related behaviors.

The stakeholders eventually chose the Theory of Diffusion of Innovations (Rogers, 1995) because it included constructs central to their culturally based way of communicating and diffusing information. This well-accepted theory, originally developed for dissemination of novel agricultural products and practices, describes how information flows through social networks and how these networks can be mobilized to create change. Opinion-leaders and change agents play dominant roles in this theory, as does the idea that innovations are more likely to be accepted if they can be easily observed and implemented, do not conflict with existing beliefs and practices, and yield a relative advantage over these practices.

After completing the logic model and choosing the theory, stakeholders divided into smaller work groups, depending on their interest and expertise. A rancher headed the livestock-handling safety group, and a farmer headed the pesticides-handling safety group. Each group arrived at an intervention design, produced materials, and planned the intervention. The workgroups presented their evolving plans and sample

materials to the larger body at each subsequent stakeholder meeting. The plans were developed within a six-month period.

For its intervention, the pesticides-handling safety group created handouts on pesticide application safety, translated a pesticide safety video developed by NMSU into Navajo, and developed demonstration plots on farms throughout the Shiprock Agency. Different types of weeds and pests were targeted in this intervention so that the farmers could see the benefits of using different chemicals for different purposes. At the beginning of each growing year after the plots were set, training sessions were held at these sites, and farmers discussed the advantages of using specific chemicals in a group setting. During these training events, handouts and the video were also reviewed.

The livestock-handling intervention focused on the purchase of transportable equipment for vaccinating and pregnancy testing large animals, and the provision of training regarding its proper use. Stakeholders had agreed that most ranchers preferred to bring their cattle together for vaccination and pregnancy testing, and that the most useful intervention would be to train ranchers to use the safety equipment. Project funds were used to purchase a flatbed trailer, panels, squeeze chutes, and calf tables. Training sessions were organized and provided by the Shiprock CES staff. To borrow the equipment, individuals were required to attend the training and subsequently demonstrate that they could safely use the equipment and were provided reinforcing written instructions on safe handling practices when they borrowed it. To cover the costs of equipment maintenance, users were charged a small rental fee. The livestock-handling safety group translated into Navajo a video developed by Oklahoma State University. Toward the end of the project, NIOSH and the SW Center donated an additional \$50,000 of livestock-handling equipment.

Evaluation

Intervention Effects

The stakeholder group designed an evaluation to capture data on the results of the interventions, particularly the mediating effects of the constructs in the Diffusion of Innovation Theory. The stakeholders developed two pre/post-test surveys, one for each intervention, and the surveys were subjected to cognitive interviewing (Willis, 2004). The cognitive interview data suggested that the surveys were easy to understand and not burdensome to administer or complete.

The evaluation showed statistically significant changes in attitudes about trainees' perceptions of the attributes of applying pesticides and handling livestock. For pesticide safety, changes were found in attitudes about compatibility, social norms, and access. For livestock handling safety, changes were found in perceptions of observability, trialability, communicability, and access.

Enhanced Capacity

The data from the critical reflection process suggested that stakeholders increased their capacity from their participation in the project in the attributes they had originally articulated. Reflecting on his overall involvement over the course of several years, one stakeholder stated, "*[This experience] gives us the ability to pass this [our knowledge of planning projects] on to our neighbors and to educate people.*" Another stakeholder emphasized this point regarding education as a means to raise awareness of issues

surrounding agricultural injury. He noted, "We associate with other educators here also, in the local area... at least that's where my outreach goes to."

The quantitative evaluation of capacity was administered with the stakeholder group before the focus group began. At this meeting there were twelve stakeholders present. Forty-three percent of the respondents were female. Fifty-seven percent were farmers, 29% farmers and ranchers, and only 14% identified themselves as ranchers. Tables 1 and 2 show the results of the capacity-building evaluation. Table 3 lists

Table 1. Stakeholder group changes in capacity (n = 12).

As a result of participating in this agricultural injury prevention project, stakeholders (overall) are:	Disagree (%)	Agree (%)	Strongly Agree (%)
Better able to understand the issues related to agricultural injury.	0	78	22
Better able to list the different things that play a role in agricultural injury.	0	100	
Better able to choose from this list those things that the group can change in order to reduce or prevent agricultural injury.	0	50	50
Better able to develop a specific strategy for reducing or preventing agricultural injury.	0	75	25
Better able to understand why a specific strategy for reducing or preventing agricultural injury will work.	0	67	33
Better able to set goals and objectives for a safety program for reducing or preventing agricultural injury.	0	44	56
Better able to develop ways to determine whether the goals and objectives for a safety program have been met.	0	67	33
Better able to understand the role of research in designing and evaluating a safety program for reducing or preventing agricultural injury.	0	67	33
Better able to interpret research data.	0	100	
Better able to pay attention to other people's perspectives.	0	75	25
The stakeholder group as a whole is able to achieve consensus in most matters.	11	56	33
The overall planning process for a safety program and evaluation plan has been useful to members of the stakeholder group.	0	56	44

Table 2. Individual member's perceived changes in capacity (n = 12).

As a result of participating in this agricultural prevention project, the stakeholder states that:	Disagree (%)	Agree (%)	Strongly Agree (%)
My ability to analyze the problem of agricultural injury has increased.	22	56	22
My ability to identify the various factors that contribute to the problem of agricultural injury has increased.	22	67	11
My ability to link these various factors to a plan for reducing or preventing the problem of agricultural injury has increased.	11	78	11
My understanding has increased about why or why not a specific intervention targeting the problem of agricultural injury will work.	11	67	22
My ability to contribute to an evaluation plan for an intervention has increased.	0	89	11
My understanding of the role of research in designing and evaluating an intervention has increased.	0	56	44
My ability to interpret research data has increased.	11	89	
My participation in the stakeholder group has enhanced my capacity to pay attention to other people's perspectives.	11	44	44
My participation in the stakeholder group has enhanced my capacity to help others understand my perspective.	0	67	33
I found that the overall planning process for the intervention and evaluation plan was useful.	0	56	44

Table 3. Opportunities for improvement in capacity building process.

Is there anything else we could have done to support your ability to learn new skills?
"More workshops."
"More community involvement."
"Need more people at these sessions."

Are there any other comments you would like to make?
"Everything went accordingly to research methods."
"Gained knowledge in some issues I never noticed before."
"As a farmer, I think we've done a good job. Thank you very much."

comments that stakeholders wrote in response to two open-ended questions: Is there anything else we could have done to support your ability to learn new skills? Are there any other comments you would like to make?

The results suggested that stakeholders recognized that the building of community capacity was neither easy nor straightforward. For example, several stakeholders identified the challenges in increasing and maintaining community stakeholder involvement. *"We should have more people at these meetings"* was a generally held sentiment. Yet they acknowledged that time was a key challenge: a typical meeting required at least four hours for travel, lunch, and meeting time. Most farmers and ranchers have second jobs, further limiting their availability. Finally, the travel distances were another barrier to meeting participation, despite deliberate rotation of meeting locations from chapter to chapter and reimbursements for mileage.

Conclusion

As noted in the capacity evaluation data, stakeholders gained the knowledge, skills, and confidence necessary to participate in planning and evaluating agricultural injury prevention projects. The overall results of this project show that a CBPR process can help enhance community capacity to develop, implement, and evaluate agricultural safety projects. The academic-community partnership was intended to effect change; both groups brought their knowledge, positive attitudes, and respect for each other to the collaboration.

This stakeholder group and the SW Center met in Shiprock in November 2005 to discuss the challenges and successes of this CBPR endeavor. The community partners, in particular, stated that their initial uncertainty about the collaboration had been allayed when the academic partners demonstrated their integrity and commitment to work with them to alleviate agricultural injury. All partners in this iterative CBPR process remained mindful of the importance of leveling the playing field, ensuring that both groups taught each other and learned from each other. Without humility and a genuine willingness to engage in "a co-learning process" (Minkler and Wallerstein, 2003), this effort could not have been accomplished within the five-year funding period.

Credit must also be given to the funding agency (NIOSH) and the SW Center Advisory Board and staff for their flexibility and patience. Our project officers at NIOSH recognized the amount of time and effort needed to establish rapport with partners in community-based research. One of the project officers took the time to make a site visit and supported our carryover requests for unexpended funds when the project activities were delayed. He subsequently advocated for the project when timeline delays, resulting from the lengthy Institutional Review Board processes involving university

and community institutions, raised concerns at NIOSH headquarters. The SW Center Advisory Board members were supportive when the stakeholder group requested a change in the study design that eliminated a follow-up survey of agricultural injury. The Board believed that a rigid approach to the application of scientific design was not in the best interests of community engagement if the stakeholder group had legitimate reasons why they felt the follow-up survey was inappropriate. Furthermore, the substantial investment in the purchase of safety equipment by the SW Center staff illustrated that they understood the correlation between poverty and unsafe situations; while equipment is expensive, it is also cost-effective and may help to reduce the disparity in accidents and public health metrics in this population.

At the close of this specific project, the stakeholder group had increased in size, suggesting that the synergy created by the group's activities and increased capacity attracted others in the community (Lasker et al., 2001). When community members participate in CBPR projects, it is acknowledged that the work is conducted not under laboratory conditions but in "real-world" contexts where bumps along the road are likely, such as those encountered during the survey implementation process. The fact that collaboration enabled us to adjust strategies to address such challenges underscored commitment to the process from all stakeholders.

As Butterfoss (2006) clarifies, "Mobilizing community members to comprehensive action is difficult; it must be deliberate, persistent, coordinated, and funded." The project benefited greatly from the shared commitment of all members to the goal of improving agricultural safety on the Navajo Nation. However, in a project of this scope and magnitude, maintaining the enthusiasm and interest of local stakeholders proved challenging at times (Butterfoss, 2006). It was important, however, to persevere. For example, the length of time it took to undertake the survey was frustrating to many participants, but the result, that is, useable data to inform intervention activities, reenergized spirits and bolstered support for the project. The survey and subsequent analysis even served as an impetus to recruit new members. Many of the stakeholders took on active roles in disseminating project results within community settings, such as chapter meetings. While the interventions themselves could not demonstrate behavioral change, they laid the groundwork to increase safe practices among Navajo farmers and ranchers.

In addition to outreach that the community partners may undertake as individual citizens of the Navajo Nation or as members of farming and grazing committees, they have held firm to the project's final objective: sustainability. In research, sustainability has a different meaning than in other contexts. Sustainability in research does not require financial independence. Sustainability in research requires that researchers have the capacity to continue to apply for and responsibly utilize extramural funding to conduct subsequent studies, and that they can build up and maintain research teams who are trained to carry out scientifically sound research studies. In meetings with the SW Center and with the NNHRRB in September 2005, the stakeholders requested that the academic partners continue to support capacity development in research by agreeing to collaborate on subsequent projects. This unanimous support and approval, both from the community and from Navajo institutions, is indicative of the public health relevance of this work by this academic-community partnership.

Based on this entire experience, the stakeholder group conceived of and applied for a new five-year grant to conduct intervention research on strategies to improve the safety of integrated pest management and pesticide application practices. The group's

proposal outlines a plan to hire model farmers who would be trained as certified crop management experts, and who would then train other farmers in a consultative fashion. We successfully obtained funding for this initiative in October 2006. In this new project, the community is receiving the bulk of financial resources, demonstrating a substantial shift in how this academic-community partnership had initially been forged and constituting another marker of success. The subsequent project addresses some of the challenges that were identified. For example, this project focuses its efforts on a smaller geographic area to ensure a more consistent involvement. While this tradeoff limits the reach of the project, it helps to create a solid base of participation that can more easily be sustained over time.

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