# Farmworker Pesticide Exposure and Community-Based Participatory Research: Rationale and Practical Applications

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The consequences of agricultural pesticide exposure continue to be major environmental health problems in rural communities. Community-based participatory research (CBPR) is an important approach to redressing health disparities resulting from environmental causes. In this article we introduce a collection of articles that describe projects using CBPR to address the health disparities resulting from pesticide exposure in agricultural communities, particularly the communities of migrant and seasonal farmworkers. The articles in this collection are based on a workshop convened at the 1999 American Public Health Association meeting. The goals in presenting this collection are to provide those endeavoring to initiate CBPR projects needed information, guidelines, and procedures to improve the quality of the CBPR experience; to increase the scientific validity of CBPR projects; and to reduce the potential difficulties and stress of these collaborations. In this introduction we discuss the context in which these projects operate, summarizing background information about farmworkers in the United States, what is known about farmworker pesticide exposure, and the concept of community-based participatory research. Finally, the articles in this collection are summarized, and major themes common to successful CBPR projects are identified. These common features are taking the time to interact with the community, using multiple approaches to engage the different parts of the community, understanding different participants often have different goals, appreciating each group's strengths, valuing community knowledge, and being flexible and creative in conducting research. The final article in this collection describes the translational research program at the National Institute of Environmental Health Sciences (NIEHS) highlighting activities pertinent to the health of rural communities, giving an overview of NIEHS-supported projects addressing health concerns of Native Americans and rural African-American communities in addition to farmworkers, and discussing future plans for CBPR at NIEHS. *Key words:* agricultural health, community participation, environmental health, environmental justice, farmworkers, health disparities, migrant health, minority health, pesticides, translational research. — *Environ Health Perspect* 109(suppl 3):429–434 (2001). *http://ehpnet1.niehs.nih.gov/docs/2001/suppl-3/429-434arcury/abstract.html*

Community-based participatory research (CBPR) is an important approach to redress health disparities resulting from environmental causes (*1*). Several communities have experienced success in their efforts to delineate and reduce the health effects of environmental hazards using community-based approaches (*2–4*). Led by the translational research program of the National Institute of Environmental Health Sciences (NIEHS), as well as by efforts of U.S. Environmental Protection Agency (U.S. EPA), other federal agencies are implementing CBPR programs. While there is growing financial as well as ideologic support for CBPR, there is also growing awareness that the process of community-based research is fraught with potential problems that can arise from circumstances common to any field research project, as well as from the need for interaction and communication between two groups—scientists and community members—who bring very different backgrounds and goals to a project (*5,6*). Those endeavoring to initiate community-based research need information, guidelines, and procedures to improve the quality of the CBPR experience, increase the scientific validity of CBPR projects, and reduce the potential difficulties and stresses of these collaborations.

Community-based participatory health research occurs when trained health professionals and community members cooperate in a joint process to critically investigate and change the environment, both physical and social, in an effort to improve people's health (*7*). Participatory research has four elements: participation of the people being studied; use of the personal experiences and the perceptions of community members as data; a focus on "empowerment"; and the final product, action by the community and community members to change the conditions causing the problems. The research reported in all the articles in this issue used a CBPR design to reduce pesticide exposure of farmworkers in agricultural communities. Each article delineates how a CBPR project was implemented and draws from the project's experience to illuminate community participation processes that worked and those that failed. The articles are directed more toward community participation methods than toward specific research results. Each contribution is based on a presentation included in the workshop "Farmworkers and Pesticides: Community-Based Research," which was convened at the 1999 American Public Health Association meeting (*8*).

The articles in this collection report on collaborations between farmworker communities and environmental health researchers in Florida (two projects), North Carolina, Oregon, and Washington. The farmworkers from the different states are involved in the production of a variety of crops, including ferns, tobacco, orchard fruits, and vegetables. Each of the collaborations was supported by NIEHS, one as an intramural project and four as extramural projects. Each of the collaborations is several years in duration, but none had existed for more than 4 years at the time these articles were written. The research endeavor for each of these collaborations varies in its point on the trajectory toward completion: one is finished, two have completed their first collaborative project and continued to a second project, one is in its final project year, and the last is in its first project year.

In the remainder of this article we present background information on farmworkers in the United States: their numbers, their health, and the ways in which farmworker communities vary among the different regions of the country. We briefly review what is known about the level and effects of farmworker pesticide exposure. We provide background on the concept of CBPR. Finally, we discuss the articles in this collection, summarizing each and identifying the major themes common to successful CBPR.

This article is based on a presentation at the Workshop on Farmworkers and Pesticides: Community-Based Research held at the American Public Health Association Meeting on 7 November 1999 in Chicago, Illinois, USA.

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## Who are Farmworkers?

There are an estimated 4.2 million seasonal and migrant farmworkers and their dependents in the United States; 1.6 million are classified as migrant (*9*). Migrant and seasonal farmworkers work in more than 40 of the 50 states. As defined in federal statutes governing migrant health funds, a migrant farmworker is an individual or dependent whose principal employment is in agriculture on a seasonal basis and who, for purposes of employment, establishes a temporary home. The migration may be from farm to farm within a state, interstate, or international. A seasonal farmworker is an individual or dependent whose principal employment is in agriculture on a seasonal basis and who is not a migratory worker. In both cases the definition extends to employment obtained within the past 24 months.

National Agricultural Workers Survey (NAWS) data show the national farmworker population has become increasingly Latino and Mexican during the past decade. In 1995, 90% of all migrant and seasonal farmworkers in the United States were Latino, and 70% of all U.S. farmworkers were born in Mexico (*10*). While some areas of the United States have routinely employed large numbers of seasonal and migrant farmworkers, other areas have experienced a dramatic increase in these workers as family labor gives way to hired labor; at the same time there has been a change in the ethnic origin of workers. For example, in North Carolina, which ranks fifth in the size of its farmworker population, most farmworkers 15 years ago were African American. Today only 10% are African American; most, like the rest of the U.S. farmworker population, are Latino (*10–12*).

The social histories of farmworker communities vary greatly for the different regions of the United States. Although there are several ethnographic studies of farmworker communities (*13–15*), no analysis summarizes these regional differences. Some information about regional variation can be gleaned from discussions of the different migrant streams (*16*). The characteristics of the crops on which farmworkers labor also provide information about regional differences. Knowledge of regional variation is crucial for understanding the types of environmental health exposures faced by farmworker communities; for example, the pesticides that are used, when they are applied, and how they are applied will vary by region (*17*). Regional population characteristics are also important to the design of community-based studies. For example, in some regions, such as Florida and Washington, migrant farmworker communities are long established with families settled in specific areas. In other regions, such as North Carolina, the migrant farmworker community continues to experience rapid change as the proportion of workers from Mexico increases, and as production of tobacco, one of the major crops in which migrant and seasonal workers are employed, declines sharply. A major impetus for gathering the articles in this issue is to consider farmworker CBPR in the context of these regional differences.

Farmworkers and their families in all regions of the United States constitute a medically underserved population at great risk for numerous environmental and occupational health problems, and one that experiences the kinds of health disparities typically associated with poverty. Farmworkers hold low wage jobs that seldom provide health insurance, thus limiting their access to healthcare. Although farmworker families can access several sources of care (e.g., migrant health clinics), those sources cannot serve all of the nation's seasonal and migrant farmworkers and their dependents. At the same time, farmworkers and their families are at substantially greater risk than the general population for exposure to occupational injuries, communicable diseases, e.g., tuberculosis and human immunodeficiency virus/acquired immunodeficiency syndrome (HIV/AIDS), dental disease, and mental health problems (*18–32*).

Environmental health experts express considerable concern about occupational exposure of farmworkers to agricultural chemicals and the short- and long-term effects of this exposure (*17,33*). This concern extends to farmworker families. The dangers of pesticide exposure for children and the differences in risks between adults and children are highlighted in several recent publications (*34–36*).

Most available data on the health of farmworkers and their families are based on analyses using local data. This fact limits our ability to generalize to the health of the national farmworker population, or even to state populations, and to compare health status among farmworkers who live in different parts of the country. Although there are no currently available national data documenting the health status and health services needs of farmworkers in the United States, the situation may improve. A recently conducted round of the NAWS included health and health services items that will provide some of this information (*37*). A survey recently completed and designed to be generalizable to farmworkers in California will provide the only statewide data available on these issues (*38*).

## Farmworker Pesticide Exposure and Health Effects

Farmworker exposure to pesticides, and the health effects of that exposure, continue to be prominent occupational health concerns (*39,40*). Contemporary agriculture uses large amounts of pesticides in the production of food and fiber in the United States (*41,42*). Agricultural pesticides include those chemicals intended to kill insects, plants, fungi, rodents, and other organisms that interfere with the production, storage, and distribution of agricultural produce. Substances and procedures included in the category of pesticides are expanding (*43*). Most agricultural pesticides currently being used have detrimental effects on human health (*44*). The nature of farm work exposes everyone who works on a farm, farm owners and managers as well as farmworkers, to pesticides. The pesticide exposure of farmworkers is not of greater concern than that of farmers. However, farmworker pesticide exposure must be considered separately because of the extensive hand labor most farmworkers perform in the cultivation, harvesting, and storage of farm produce, and because farmworkers have limited power to influence workplace safety. Workplace safety and sanitation regulations have been implemented by the U.S. EPA Worker Protection Standard (WPS) and the Occupational Safety and Health Administration (OSHA) to control farmworker pesticide exposure; unfortunately, data indicate these regulations are not evenly enforced. Further, the states differ in their regulations for workplace safety and sanitation related to farmworker pesticide exposure.

Health effects of pesticide exposure can be immediate and may include rashes, headaches, nausea and vomiting, disorientation, shock, respiratory failure, coma, and, in severe cases, death (*44–46*). Pesticide exposure can also have long-term effects on health in the form of cancer, neurologic problems, and reproductive problems (*47–52*).

Epidemiologic research on actual farmworker exposure to pesticides in the workplace and on the direct link of this exposure to health and disease is meager. Farmworkers can be exposed to large amounts of pesticides in many ways, for example, if they are directly sprayed in the field, if they drink from mismarked containers, or if they are soaked from a spill. Such direct exposure can result in immediate injury and can also have long-term effects. Mandatory surveillance systems for reporting acute pesticide poisoning are limited to a dozen states (*53,54*). Recent studies have also documented pesticide exposure of agricultural workers in Mexico (*55*), the origin of the majority of farmworkers in the United States, as well as other Central American (*56*) and Caribbean (*57*) nations that send farmworkers to the United States.

Although the most extreme form of pesticide exposure occurs when pesticides are spilled or sprayed on a worker, exposure can also occur when a worker enters a field just after pesticides have been applied, when pesticides drift from a field in which they are

being applied to a field in which laborers are working, or when workers bring home contaminated clothing or materials (*46,58*). Most farmworker pesticide exposure occurs as exposure to residues, an active form of the pesticide that remains on plants and equipment for days or weeks after application. As with direct exposure to large amounts of pesticides, exposure to residues can have immediate as well as long-term health effects. However, there is little information about residue and low-level exposure in farmworkers. Zahm and Blair (*51*) have explored developing procedures to investigate the long-term effects of pesticide exposure on farmworkers, but the task is formidable. A few studies provide some insights into farmworker exposure to low-levels of pesticide. For example, Ciesielski et al. (*22*) collected data from farmworker clinic patients in North Carolina and found depressed cholinesterase levels. However, these data did not show any specific health effects related to this indicator of organophosphate pesticide exposure, and the source of these data limits their generalizability. Due to the limitations in the research literature, Arcury and Quandt (*17*) conclude

> that current data are insufficient to determine whether or not farmworkers are suffering negative consequences of chronic low level exposures to agricultural chemical residues. This is due primarily, however, to lack of good exposure measures. It is important to note that these null results do not indicate no effect, but rather reflect the limits of our capacity to detect effects (*59*) and the relative lack of attention to developing measures for this disenfranchised population. Traditional epidemiologic measures connecting exposure and outcome at individual levels are largely unsuitable for establishing the consequences of exposure in this population. It is, therefore, both prudent and ethical to make every reasonable effort to reduce exposure of all persons to chemical residues, including farmworkers. (p. 839)

Concern over workplace pesticide exposure has led to the development of federal and state safety regulations. The most prominent of these regulations is the WPS implemented by the U.S. EPA in 1992 (*60–62*). The WPS requires farmers maintain and post records of pesticide applications, post warning signs around fields in which pesticides have been applied, observe restricted-entry periods, and provide safety training to workers. Farmworker safety training must include eleven major points and be provided to farmworkers within 5 days of employment if they are to work in fields in which a restricted-entry pesticide has been applied in the previous 30 days. Other federal requirements (e.g., those of OSHA) that pertain to field sanitation and farmworker housing also affect pesticide safety, in that they mandate provision of facilities for handwashing in the fields, and for showering and laundering at farmworker housing sites. The WPS and OSHA regulations are enforced by the states.

There have been few evaluations of whether the pesticide safety regulations pertaining to farmworkers are being followed, and if followed, whether they have any effect on reducing exposure. Those evaluations that have been completed indicate the regulations are not being fully implemented. Nationally, a 2000 report by the General Accounting Office (*39*) concluded "EPA has little assurance that the protections called for in the [Worker Protection] Standard are actually being provided to farmworkers generally or to children who work in agriculture" (p. 5). A U.S. EPA sponsored evaluation of the WPS, based on interviews with farm employers and state government officials charged with implementing the regulations, concludes that the number of workers receiving WPS protection is unclear, and that the quality of most safety training is questionable (*63*).

Reports based on data collected in individual states also show there are limitations in the application of existing pesticide safety regulations. For example, in California, Villarejo et al. (*38*) found 57% of the workers interviewed had received pesticide training; 80% reported having both clean drinking water and disposable cups; and 82% reported having wash water. In North Carolina, Arcury et al. (*11*) found in 1998, 35% of the farmworkers interviewed stated they had never received pesticide safety training. In a second report, using data collected in 1998 and 1999, Arcury et al. (*64*) report from one third to over one half of the farmworkers that they interviewed indicated they did not regularly have separate water for washing and drinking or separate cups available for drinking water; there were no field toilets; they did not have adequate laundry facilities; and they had not received pesticide safety training. Fewer than half of the farmworkers indicated their employer told them what pesticides had been applied where they were working, posted in a central location accessible to workers information on pesticides that had been applied, or posted warning signs around fields to which pesticides had been applied. Few workers could name any pesticide used where they worked.

In summary, exposure to pesticides and the health effects of this exposure for farmworkers and their families is a continuing concern. There are limited data on the actual numbers of farmworkers who are exposed and the degree of that exposure. There are also limited epidemiologic data on the number of farmworkers whose health is affected by pesticide exposure. The available data indicate the regulations intended to protect farmworkers from pesticide exposure and to provide those workers with safety education are not being fully implemented. The use of CBPR in which farmworker communities and environmental health scientists collaborate provides an excellent opportunity to delineate the level of farmworker pesticide exposure, the health effects of that exposure, and the means of reducing it.

## Community-Based Participatory Research

Community-based research in public health is a partnership approach to research, which equitably involves community members, community organization representatives, and researchers in all aspects of the research process to enhance understanding of a given phenomenon and to integrate the knowledge gained with action to improve the health and well-being of community members (*1*). Israel and her colleagues (*1,65*) have reviewed the growing literature on community-based or community participation research, particularly regarding occupational health and safety (*66*).

Several investigators have identified the benefits of community-based collaborations for the success of public health research (*1,5–7,67–69*). Community-based approaches improve access to community members and help the researchers establish the trust needed for participation. Community participation increases the likelihood the project will be culturally and educationally appropriate; its format and content will better fit the cultural system(s) of the community. Community participation increases the sustainability of any intervention based on the research. Finally, community participation helps make a health intervention replicable in similar communities.

Although the benefits of CBPR can be great, the problems often encountered in community–scientist collaborations can appear insurmountable. Those who have worked on CBPR projects know that tensions in these collaborations can result in conflict. These tensions between communities and researchers have led some communities working with health researchers to develop protocols that establish the rules for community–researcher collaboration (*70,71*). Cornwall and Jewkes (*5*) discuss several causes of tensions in community-based research, including residents being skeptical of the value of the research, being uninterested in it, or feeling it lacks local relevance. Community members may lack motivation, time, or resources to participate, or they may simply not value participation. Finally, there are often different values, sentiments, and needs within even relatively small communities, so that there are competing definitions of what it means to represent a

community. Arcury et al. (6) specify potential causes of tension in community-based research that result from working with inaccessible or elusive populations such as farmworkers. Farmworker communities are occupational groups often not locality based. Individuals can leave and re-enter the community with changing employment. Farmworkers are highly mobile. There may be communication difficulties (farmworkers often do not speak English, and they often do not have telephones or mailing addresses) and transportation difficulties (many farmworkers do not own or have access to private cars). Farmworkers often lack community-based organizations. Efforts to delineate features of successful community-based research collaborations are important for continuing and expanding the CBPR approach to eliminating health disparities.

## Articles Presented in This Issue

The benefits of CBPR for researching and redressing environmental health disparities are real. The difficulties that can arise in community–science collaborations are also real. All who have collaborated on CBPR projects, both community members and scientists, can attest to the trials and travails of these endeavors. Those who have participated in CBPR projects now have the experience on which to base ongoing and future community-based participatory collaborations. Furthermore, if the use of CBPR is to expand to other communities, this experience can be used as a guide by which future problems can be circumvented.

The intentions for this collection of articles, and for holding the workshop on which these articles are based, are to show the value of CBPR in addressing environmental health disparities, to delineate the problems encountered, and to share what the investigators have learned works in developing strong community-scientist collaborations. The authors of the articles included in this collection include both scientists and community members. We hope these articles are accessible to community residents and professional investigators alike. The articles are directed primarily toward assisting those who wish to use a CBPR approach with farmworker communities, whether the health concern is environmental—as in the case of pesticide exposure, indoor air quality, or lead exposure—or another factor in the health disparities of farm labor communities, such as access to medical care or adequate mental health services. The processes that worked in the community-based collaborations reported here can be applied with equal success to any community–scientist collaboration to address health disparities in other communities.

The research reported in these articles uses CBPR to address pesticide exposure in agricultural communities. Five articles are based on collaborations with farmworker communities. Each of these collaborations is supported through grants from NIEHS, and each has been limited to a period of a few years. A comparison of the collaborative experiences of the five farmworker-scientist partnerships allows identification of those components of the collaborative process that transcend the regional variation in the farmworker population.

The first article in this collection by Quandt et al. (72) gives an overview of the collaboration of the North Carolina Farmworkers' Project and Wake Forest University School of Medicine. Quandt and her colleagues delineate several barriers to the establishment of successful academic-community partnerships (stereotypes each partner has of the other, cultural differences, competing demands for time and attention, and differences in orientation to power structures). They then discuss the strategies developed to overcome these barriers: clarifying the different goals of each partner, operationalizing a model of participation that could involve many community segments, and developing cultural sensitivity.

The contribution of Flocks et al. (73) is based on The Together for Agricultural Safety project being conducted with fernery and nursery workers in Florida. Flocks and her colleagues describe their use of different data collection methods to develop a social marketing approach to pesticide safety education. This collaboration involved an organized, empowered, and motivated community organization, the Farmworker Association of Florida. They draw on the Arcury et al. (6) multimode, multidomain model of CBPR to delineate the components of their collaboration.

Epidemiologic analyses of farmworker exposure to pesticides have been limited because the farmworker population is relatively inaccessible to investigators. Kamel et al. (74) focus their discussion on the importance of community collaboration to identifying and recruiting a valid sample for an epidemiologic survey. Working with the Farmworker Association of Florida, and relying on the association members' expertise in knowing how to locate farmworkers in their region, the investigators were able to obtain a representative sample with an adequate response rate.

McCauley et al. (75) discuss the development of the community participation model that has evolved through the collaboration of the Oregon Health Sciences University and the Oregon Child Development Coalition. This model reflects their conclusion that scientific knowledge, community experience, and community-held knowledge are all essential for participatory research. The community participation process they describe is successful because they seek ways to obtain input from the numerous stakeholder groups concerned about pesticide exposure of agricultural workers and their children. They also discuss the evaluation processes they have initiated to assess the effectiveness of their participatory model, and they present preliminary process evaluation and results.

Thompson et al. (76) discuss their use of qualitative research methods in the formative phase of their study in the Yakima Valley, Washington, USA. These methods allowed them to identify the disparate views held by the various groups important to farmworker pesticide exposure (workers, growers, cooperative extension agents, healthcare providers), as well as the commonalities in the views of these groups. Taking the time to understand the differences and similarities allowed them to develop a goal and a strategy each of their diverse constituencies could support.

In the final article O'Fallon and Dearry (77) discuss the ongoing commitment of NIEHS to CBPR for rural health. This places the work reported in this set of articles within NIEHS' larger translational research agenda to reduce health disparities, with a particular focus on efforts addressing rural health. The discussion provides an overview of the various NIEHS programs supporting CBPR projects, and describes some of the successes that NIEHS CBPR projects have had in improving health in rural communities.

Each of the projects included in this collection has successfully implemented a CBPR collaboration. In the process of implementing these projects, each has had to surmount barriers inherent to the collaboration. Projects that have involved migrant and seasonal farmworker communities have had the additional barriers to community participation and collaboration that result from engaging populations often relatively inaccessible because of differences in language, changing occupational status, and questions of immigration status. In their success, these projects underscored several common features and processes of community-based research collaborations. These features and processes include taking time, using multiple approaches, understanding the goals of the different participants, appreciating each group's strengths, valuing community knowledge, and being flexible and creative in conducting the research.

Community-based research requires investigators to take time to build relationships when projects are being planned, and it requires the continued investment of time to maintain those relationships throughout the project period. Some research activities in community-based collaborations, such as exchanging information with community residents through meetings and forum or

interviewing a broad spectrum of stakeholders, take time beyond that normally used in other research designs. However, the time requirement goes beyond tasks related to the research activity. Community groups, by definition, are social groups. The trust and understanding for community-based research requires researchers to participate in the social life of the communities with which they are working, whether this involves attending fiestas or having a cup of coffee at a local diner.

The researchers found that several stakeholder groups are concerned about pesticide exposure in agricultural communities. Multiple stakeholder interest is a factor related to any phenomenon that results in an environmental health disparity. Community-based public health research and intervention that address pesticide exposure must involve the affected communities, the general residents of rural communities as well as farmworkers, farmers, cooperative extension agents, healthcare providers, farmworkers' service and advocacy groups, and agricultural industry advocacy groups (e.g., commodity associations). Within any single stakeholder group, individuals differ in the amount of time, interest, and resources (intellectual and financial) they can invest in a collaboration. This is particularly true for members of the affected communities, as these individuals often have the fewest resources. One process in which the successful projects engaged was incorporating multiple avenues for collaboration. These avenues provided members of different stakeholder groups the opportunity to participate and air their viewpoints on the issues being investigated. This participation strengthened the project by forcing the investigators to consider varying views and beliefs on the environmental health problem being considered. It also highlighted points in the belief systems of the various groups that should be addressed in any intervention.

Using multiple avenues for participation broadens the number of members from the affected communities who are able to participate. Those who wish to be very much involved can participate in a number of activities, whereas those who wish to have limited involvement can still be informed about the project. However, when greater numbers of community members have the opportunity to participate at their own comfort levels, the greater the acceptance and success the investigators will have in involving residents in the project's research activities.

All of the participants in the CBPR projects reported in this issue shared one central goal: to improve the health of residents in farmworker and rural communities by decreasing their exposure to pesticides. However, the collaborators in the CBPR projects recognize that scientists and community members must be aware of their different goals for involvement. For community members, a specific research project may be a small part of a larger agenda to increase the capacity of their community to gain political power as well as improved quality of life. Researchers' goals include their desire to stay engaged in a particular research domain through the successful completion of a specific study.

As with their different goals, the participants in these CBPR projects also recognize community and researcher participants bring different strengths and talents to their projects. For example, the interviews conducted by the Together for Agricultural Safety project discussed by Flocks et al. (*73*) depended on the expertise of the scientists in the design, conduct, and analysis of qualitative data. Similarly, the systematic approach taken in several of the projects to the collection and analysis of qualitative data is based on the expertise of the scientists. However, each of the investigating teams also developed procedures for valuing indigenous or community knowledge. Learning from community members is not simply a means of showing respect for the community; it can show the researcher important variables or characteristics not previously considered. For example, the epidemiologic survey of Kamel et al. (*74*) succeeded because community members knew how to locate individuals selected to be in the sample. The discussion by Quandt et al. (*72*) of the PACE (Preventing Agricultural Chemical Exposure) project indicated they used several modes (in-depth interviews, community forums) to learn from the community.

Finally, the keys to the research discussed in these articles are flexibility and creativity. It is unlikely textbook research applications will work well in community-based projects. Rather, researchers and community members must be flexible in conducting research so that the needs of the community are met and, at the same time, the basic tenets of scientific integrity are maintained. Most of the projects discussed in this collection were multidisciplinary and combined qualitative and quantitative methods. One of the strengths of designs that incorporate qualitative methods is that those methods are more amenable to modification during the research process than are standard epidemiologic or toxicologic methods. However, innovation can improve the application of quantitative methods as well. As Kamel et al. (*74*) noted in their epidemiologic study of neurologic outcomes among Florida farmworkers, community-based organization resources (credit union membership lists and using community members to locate selected respondents) were engaged to accumulate the sample. Using these resources produced the high response rate that this study enjoyed.

These articles do not provide a specific blueprint that can simply be replicated in other communities to produce successful CBPR projects. The nature of CBPR research, with its requirement to tailor design and methods to the local context, precludes the prescriptive use of particular designs. Nevertheless, these articles as a collection provide insights, guidelines, and principles that can help shape other successful CBPR projects. The authors have attempted to present a balanced view, highlighting—from the perspectives of both communities and scientists—the tensions and struggles, as well as the successes.

CBPR research is one of the most recent forms in the evolution of public health research (*78*). Differing from its predecessors —academically driven research and research reactive to the needs of community agencies— CBPR brings academic scientists and community agencies together with community members in an interactive research process. Because most scientists are not yet trained in this mode of research (*79,80*), collections such as this can help scientists retool to meet the challenges of CBPR research.

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