

Casa a Campo: Pesticide Safety for Farmworker Families

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Final Report

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Abstract

Casa a Campo: Pesticide Safety for Farmworker Families was an environmental justice community education project with five specific aims: (1) to conduct research that (a) documents the knowledge and beliefs of farmworker families in North Carolina about pesticide exposure and prevention at work and in the home, (b) documents pesticide exposure among farmworker families in North Carolina, and (c) documents other environmental health concerns that arise from community discussions among farmworker families in North Carolina; (2) to develop culturally and linguistically appropriate educational materials and implement programs that will promote ways to prevent or reduce exposure among farmworker families in North Carolina; (3) to develop culturally and linguistically appropriate educational materials and implement programs that will better prepare health care providers in North Carolina to recognize and treat pesticide exposure-related illness among agricultural labor families and counsel families on ways to prevent or reduce exposure; (4) to increase the capacity of the North Carolina Farmworkers' Project to involve community members in the documentation of environmental and occupational health risks and in education for the reduction of environmental and occupational health risks; and (5) to evaluate the process and outcomes of community participation in this project so that it can be used by other community-based organizations to engage community residents in efforts to reduce environmental risks in their own communities.

Casa a Campo produced significant educational and research products and findings. The major educational product was a promotora or lay health advisor program for teaching farmworker families about residential and agricultural pesticide safety. The project produced a pesticide safety curriculum to be used by the promotora to teach adults in farmworker families about pesticide safety that includes lesson plans, brochures, comic books and a video. The project showed that a promotora provide an effective and efficient way to provide health and safety information to farmworker families. Another important educational product was the development of a health care provider educational program on pesticide exposure that provided information on clinical skills in the recognition and treatment of pesticide poisoning, and educate patients about pesticide safety.

Major research findings were in several domains. First, biomarkers showed that children in farmworker families had relatively high exposure to several different pesticides, and neurobehavioral performance tests indicated that Latino children in farmworker households had modestly lower scores compared to Latino immigrant children living in non-agricultural households. Second, farmworker housing was substandard in size and structural quality, resulting in a greater likelihood of exposure to residential as well as agricultural pesticides. Third, farmworkers experienced high levels of food insecurity, with a greater proportion of farmworker families with children reported food insecurity and food insecurity with hunger than does the national population. Fourth, farmworkers experienced significant levels of stress, anxiety, and depression. Anxiety was greater among farmworkers who were ambivalent about their migration to the US. Finally, farmworkers and their children had limited access to health services. Children do not have consistent health care providers nor do they have preventive health care visits on the recommended schedule. Workers reported a high number of unmet dental needs, and the high rate of unmet oral health needs is associated with poorer farmworker quality of life.

The Casa a Campo findings indicate several directions for future workplace intervention and research. First, required pesticide safety programs need to be fully implemented so that all farmworkers receive this training. Pesticide safety training programs should be expanded to address take home pesticide exposure pathways. Pesticide safety training programs should also be expanded to provide information to other adults, particularly spouses, who live with farmworkers. Second, regulations on pesticide application to reduce drift should be reviewed. Farmworker and all rural families must be educated about drift and how to reduce exposure. Third, regulations related to farmworker housing need to be enforced. Standards for farmworker housing quality need to be improved. Farmworker housing regulations must be improved to reduce the need for residential pesticide application. Fourth, research is needed that includes more precise measures of exposure pathways. Fifth, research on the health effects of pesticide exposure for farmworkers and their families is needed. Sixth, food policy needs to be evaluated to reconsider access to food programs in light of the level of food insecurity with hunger experienced by farmworker families, and its short and long term consequences. Finally, health services for farmworkers and their families need to be expanded to include child health services, mental health services, and oral health services.

Highlights

Casa a Campo: Pesticide Safety for Farmworker Families was an environmental justice community education project that produced significant educational and research products and findings.

The major educational product was a promotora or lay health advisor program for teaching farmworker families about residential and agricultural pesticide safety. The project produced a pesticide safety curriculum to be used by promotoras to teach adults in farmworker families about pesticide safety that includes lesson plans, brochures, comic books and a video. The project showed that promotoras provide an effective and efficient way to provide health and safety information to farmworker families.

Another important educational product was the development of a health care provider educational program on pesticide exposure. This continuing education program provides information to help health care providers improve their clinical skills in the recognition and treatment of pesticide poisoning, and educate patients about pesticide safety.

Major research findings were in several domains. Children in farmworker families were exposed to pesticides. They all had pesticide metabolites in their urine, and they had several different pesticide metabolites in their urine. The levels of pesticide metabolites in their urine were greater than the levels reported for national reference data. Farmworker housing was substandard in size and structural quality, resulting in a greater likelihood of exposure to residential as well as agricultural pesticides. Neurobehavioral performance tests indicated that Latino children in farmworker households had modestly lower scores compared to Latino immigrant children living in non-agricultural households.

Farmworkers experienced high levels of food insecurity. A greater proportion of farmworker families with children reported food insecurity and food insecurity with hunger than does the national population.

Farmworkers experienced significant levels of stress, anxiety, and depression. Anxiety was greater among farmworkers who were ambivalent about their migration to the US. Different types of stressors are associated with different indicators of mental health. Social isolation was associated with farmworker anxiety, while stressful working conditions were associated with depressive symptoms.

Farmworkers and their children had limited access to health services. Children do not have consistent health care providers nor do they have preventive health care visits on the recommended schedule. Workers reported a high number of unmet dental needs: 52% reported caries and 33%, missing teeth. The high rate of unmet oral health needs is associated with poorer farmworker quality of life.

Translation of Findings

Casa a Campo: Pesticide Safety for Farmworker Families was aimed at teaching farmworker families about pesticide safety and health care providers about treating pesticide exposure. The findings of this project indicate several directions for future workplace intervention and research.

1. Required pesticide safety programs need to be fully implemented so that all farmworkers receive this training. Pesticide safety training programs should be expanded to address take home pesticide exposure pathways. Pesticide safety training programs should also be expanded to provide information to other adults, particularly spouses, who live with farmworkers.
2. Regulations on pesticide application to reduce drift should be reviewed. Farmworker and all rural families must be educated about drift and how to reduce exposure.
3. Regulations related to farmworker housing need to be enforced. Standards for farmworker housing quality need to be improved. Farmworker housing regulations must be improved to reduce the need for residential pesticide application.
4. Research is needed that includes more precise measures of exposure pathways. Laboratory techniques

measuring pesticide metabolites in urine and other matrices, as well as environmental monitoring have improved substantially. However, measurement of exposure pathways in epidemiological research has not improved greatly. For example, asking about recent employment as a farmworker needs to be changed to the amount of farm work conducted in the three days before samples for biomonitoring are collected.

5. Research on the health effects of pesticide exposure for farmworkers and their families is needed.
6. Food policy needs to be evaluated to reconsider access to food programs in light of the level of food insecurity with hunger experienced by farmworker families, and its short and long term consequences.
7. Health services for farmworkers and their families need to be expanded, to include child health services, mental health services, and oral health services.

Outcomes/Relevance/Impact

Project outcomes include the development of a promotora program to teach farmworker families about pesticide safety and residential integrated pest management. This promotora program's curriculum and educational materials have been widely disseminated and adopted for use. For example, programs administered by Migrant Clinicians Network have adopted these materials for use.

The research results from this project have been relevant to policy issues on pesticide safety, food security and hunger, housing, mental health, and health services for farmworkers and their families.

The impact of Casa a Campo has been substantial and continues to grow. Project results led directly to the development of a coalition of service providers and advocates to address farmworker food issues. This coalition has received a grant from the U.S. Department of Agriculture to develop a community garden, community kitchen, and flea market for the sale of food. Casa a Campo investigators helped write the application for this grant, and one of these investigators serves as the program evaluator. Casa a Campo results are also being used in efforts to support changes in farmworker housing regulations in the North Carolina. Legislation to change these regulations has been proposed but not passed; however, the legislation will be brought to the state assembly in its next session. Finally, pesticide safety education materials developed by Casa a Campo are now widely used to train farmworkers in North Carolina and across the Southeast.

Scientific Report

Casa a Campo: Pesticide Safety for Farmworker Families was an environmental justice community education project with five specific aims.

1. To conduct research that (a) documents the knowledge and beliefs of farmworker families in North Carolina about pesticide exposure and prevention at work and in the home, (b) documents pesticide exposure among farmworker families in North Carolina, and (c) documents other environmental health concerns that arise from community discussions among farmworker families in North Carolina.
2. To develop culturally and linguistically appropriate educational materials and implement programs that will promote ways to prevent or reduce exposure among farmworker families in North Carolina.
3. To develop culturally and linguistically appropriate educational materials and implement programs that will better prepare health care providers in North Carolina to recognize and treat pesticide exposure-related illness among agricultural labor families and counsel families on ways to prevent or reduce exposure.
4. To increase the capacity of the North Carolina Farmworkers' Project to involve community members in the documentation of environmental and occupational health risks and in education for the reduction of environmental and occupational health risks.

5. To evaluate the process and outcomes of community participation in this project so that it can be used by other community-based organizations to engage community residents in efforts to reduce environmental risks in their own communities.

Each of these specific aims was attained by the project investigators and staff members. The project accomplishments for each specific aim are described in this section.

Specific Aim 1: To conduct research that (a) documents the knowledge and beliefs of farmworker families in North Carolina about pesticide exposure and prevention at work and in the home, (b) documents pesticide exposure among farmworker families in North Carolina, and (c) documents other environmental health concerns that arise from community discussions among farmworker families in North Carolina.

(a) Document the knowledge and beliefs of farmworker families in North Carolina about pesticide exposure and prevention at work and in the home.

Casa a Campo conducted in-depth interviews with 20 migrant farmworker women and 5 migrant farmworker men to document the knowledge and beliefs of farmworker families about pesticide exposure and prevention. The interviews were transcribed verbatim and translated to English. Each transcript was coded and entered into The Ethnograph (V5.0) for analysis. The coded segments were reviewed and summaries of the segments have been written. This systematic analysis documented farmworker family knowledge and belief about home pesticide exposure and prevention. These results were used in the development of culturally appropriate health education materials. The results of these interviews have been incorporated into papers reporting project results (Early et al. 2006; Quandt et al. 2007).

Health and human service providers have experience in working with migrant and seasonal farmworker families. Casa a Campo made special efforts to meet with representatives of clinics, local agencies and state agencies that have responsibility for providing health, social and educational services to farmworkers in the project area. These informal interviews helped to document the pesticide exposure of farmworker families. Casa a Campo project staff discussed issues of pesticide and other environmental and occupational health risks for farmworkers with a total of 35 agency staff from 26 different agencies. Each of these interviews was documented with extensive field notes. These results were used in the development of culturally appropriate health education materials for farmworkers and for health care providers.

(b) Document pesticide exposure among farmworker families in North Carolina.

Urine samples were collected from 60 farmworker children to document pesticide exposure among the members of farmworker families in North Carolina. Analysis of these samples has been reported in to papers

Organophosphorus Pesticide Urinary Metabolite Levels Of Children In Farmworker Households In Eastern North Carolina (Arcury et al. 2006): This investigation documents the organophosphorus pesticide urinary metabolite levels for a sample of farmworker children in North Carolina, compares these levels to national reference data, and delineates the relative importance of para-occupational, residential and environment risk factors. Urine samples were collected from 60 farmworker children 1-6 years of age, and interviews were completed by their mothers. Urine samples were analyzed for the dialkylphosphate metabolites of organophosphorus pesticides. Summed molar concentrations of the diethyl and dimethyl dialkylphosphate metabolites provided summary measures. The farmworker children had relatively high levels of OP pesticide urinary metabolites compared to national reference data; e.g., participating children had higher geometric means for diethylphosphate, diethylthiophosphate, and the summed diethyl metabolites. However, analyses found no pattern of significant associations between predictors and metabolite levels. Future research requires greater precision in sampling and measurement to determine the risk factors for pesticide exposure among farmworker children.

Pesticide Urinary Metabolite Levels of Children in Eastern North Carolina Farmworker Households (Arcury et al. n.d.): This investigation documents the pesticide urinary metabolite levels

of farmworker children in North Carolina, determines the number of different metabolites detected for each child, and delineates risk factors associated with the number of metabolites. Urine samples were collected from 60 farmworker children aged one to six years and interviews were completed by their mothers. Urine samples were analyzed for 14 pesticide metabolites, including metabolites of the organophosphate pesticides chlorpyrifos, coumaphos, diazinon, isazaphos, malathion, pirimiphos, and parathion and its methyl counterpart; a common metabolite of at least 18 pyrethroid insecticides; the repellent DEET; the herbicides or metabolites of 2,4,5-trichlorophenoxyacetic acid, 2,4-dichlorophenoxyacetic acid, acetochlor, atrazine and metolachlor. Predictors included measures of para-occupational exposure, residential exposure, environmental exposure, child characteristics, and mother characteristics. Thirteen of the 14 metabolites were present in the urine samples. Organophosphate pesticide metabolites were detected in a substantial proportion of children, particularly metabolites of parathion/methyl parathion (PNP) (90.0%), chlorpyrifos/chlorpyrifos methyl (TCPY) (83.3%), diazinon (IMPY) (55.0%), and malathion (MDA) (28.3%). The number of metabolites detected ranged from 0-7, with a mode of four detected (28.3%). Boys, those living in rented housing, and those with mothers working part-time had more metabolites detected. Children in farmworker homes are exposed to several pesticides, indicating multiple sources of exposure and that pesticides may remain in their environments for long periods. Environmental and occupational health practice changes are needed to address these exposures. Research is needed with more precise measures of exposure and on the health effects of concurrent exposure to multiple pesticides.

(c) Document other environmental health concerns that arise from community discussions among farmworker families in North Carolina.

Community members raised concerns about several important health problems. These concerns included the effects of pesticides on their children, food security, the quality of health services, housing, mental health, and oral health. Casa a Campo staff designed studies to collect data that would allow the project to provide data on each of these issues to members of the farmworker community, to farmworker services providers and advocate, and to policy makers. These studies have resulted in a series of analyses that have been published or that are being reviewed for publication.

Effects of Pesticide Exposure

Neurobehavioral Performance in Preschool Children from Agricultural and Non-Agricultural Communities in Oregon and North Carolina (Rohlman et al. 2005): Organophosphate (OP) pesticides produce acute toxic effects but little is known about low-level chronic exposures. Latino children of agricultural workers have a high risk of exposure to pesticides because of the close proximity of their homes to fields where pesticides are applied and from take-home exposure. Neurobehavioral performance of preschool children from agricultural (AG) communities was compared to performance of those from non-agricultural (Non-AG) communities in Oregon and North Carolina. Seventy-eight children aged 48 to 71 months completed a battery of neurobehavioral tests two times, approximately one month apart. Multiple regression analysis revealed that the AG children performed poorer on measures of response speed (Finger Tapping) and latency (Match-to-Sample) compared to the Non-AG children. These results demonstrate modest differences in AG children compared to Non-AG children that are consistent with functional effects seen in adults exposed to low concentrations of OP pesticides. As a number of potential confounders could have produced or masked differences in these groups, studies of other agricultural groups are needed to replicate the neurobehavioral findings seen here before definitive conclusions can be drawn about effects of OPs in children of agricultural workers.

Developing methods for assessing neurotoxic effects in Hispanic non-English speaking children (Rohlman et al. 2006): Many factors affect the growth and development of children, including chemicals in the environment. Children have greater exposure to toxicants than adults due to both behavior and their increased food: body-mass ratio. Furthermore, the developing brain and organ systems of infants and children and their immature metabolism also make them more vulnerable to environmental toxins. Children from all cultures and backgrounds are at risk. However, minorities may be at greatest risk. In order to evaluate the impact of environmental exposures on neurodevelopment it

is necessary to have effective methods that will allow accurate conclusions to be drawn. We have developed a battery to assess neurobehavioral performance in non-English speaking Hispanic children ages four years and older. This paper will examine the associations between age and performance and present test-retest correlations. Two hundred and forty one Hispanic children between the ages of four and nine years completed a neurobehavioral test battery twice, approximately one month apart. The battery consists of computerized tests from the Behavioral Assessment and Research System, tests selected from the Pediatric Environmental Neurobehavioral Test Battery, and the Object Memory Test. Multiple regression was used to examine the association between age, gender and mother's education on performance. All of the tests, except for Continuous Performance, showed that performance improved as the child gets older. Gender differences were found on several tests with females generally performing worse than males. Correlation coefficients on performance retest measures ranged from .51 to .88. This study has demonstrated the utility of using this test battery to assess cognitive and motor performance in non-English speaking Hispanic children. Tests in the battery assess a range of functions and the measures are sensitive to differences in ages. Test-retest correlations show the reliability of the battery. These support the use of this battery in both cross-sectional and longitudinal studies.

Food Security

Household Food Security among Latino Farmworkers in North Carolina (Quandt et al. 2004):

Food insecurity is defined as lack of access at all times due to economic barriers to enough food for an active and healthy life-style. While food insecurity is decreasing in the US population as a whole, less is known about vulnerable groups. The objective of this study is to characterize levels of food security, food insecurity, and hunger among Hispanic farmworkers, to assess predictors of food insecurity, and to describe strategies farmworkers use to cope with food insecurity. Adults in 102 farmworker households in North Carolina responded to a survey using a Spanish adaptation of the U.S. Household Food Security Survey Module, and questions about sociodemographic characteristics and food behaviors. Twenty-five farmworkers participated in in-depth interviews in which they described their households' food security situation and strategies used to cope. 47% of the sample households were food insecure, including 9.8% with moderate hunger and 4.9% with severe hunger. Households with children had a higher prevalence of food insecurity than those without children (56.4% vs. 36.2%). Those with children accessed food programs such as WIC, while those without children were more likely to access food pantries and to consume wild game or fish. Coping strategies included borrowing money, reducing food variety, and adults' consuming less food to protect children from hunger. Food insecurity is over three times more prevalent among farmworker households than the general US population. Policy changes to increase economic resources and access to federal programs are needed to decrease this food insecurity.

Experiences of Latino Immigrant Families in North Carolina Help Explain Elevated Levels of Food Insecurity and Hunger (Quandt et al. 2006): Household food insecurity is higher among minority households in the US, but few data exist on households of recent minority immigrants, in part because such households are difficult to sample. Four studies of a total of 317 Latino immigrant families were conducted in different regions and during different seasons in North Carolina. A Spanish translation of the 18-item US Food Security Survey Module was used to assess the prevalence of food insecurity and hunger; in three studies, a total of 76 in-depth interviews were conducted to gather information on immigrants' experiences of food insecurity. Households in the four studies classified as food secure ranged from 28.7% to 50.9%, compared to 82.4% in the US in 2004. Food insecurity without hunger ranged from 35.6% to 41.8%, compared to 13.3% in the US. The highest rates of hunger reported were 18.8% (moderate hunger) and 16.8% (severe hunger) in an urban sample. Qualitative data indicate that food insecurity has both quantitative and qualitative effects on diet. Immigrants experience adverse psychological effects of food insecurity. They report experiencing a period of adjustment to food insecurity leading to empowerment to resolve the situation. Reactions to food insecurity differ from those reported by others, possibly because immigrants encounter a new and not chronic situation. Overall, these findings suggest that immigrant Latinos experience significant levels of food insecurity that are not addressed by current governmental programs.

Health Services

Child Healthcare in Two Farmworker Populations (Gentry K et al. n.d.): Children in farmworker families are medically underserved. Little research has documented the healthcare of these children. This analysis uses data collected from two populations of Latino farmworker families, one located in western North Carolina and western Virginia, and the other located in eastern North Carolina, to describe and compare child healthcare utilization and mothers' satisfaction with their children's healthcare. Child, mother, household and health services characteristics are examined as causes of variation in child healthcare utilization and mothers' satisfaction for each farmworker population. Results highlight strengths in the provision of healthcare to farmworker children, including most receiving care at a consistent healthcare facility, age appropriate time since last visit, and satisfaction with the care received. Shortcomings in farmworker child healthcare include few having a consistent healthcare provider, and many not receiving visits with recommended frequency. Differences observed in child health services between the two populations include dissatisfaction with care received, perceptions that healthcare staff members are disrespectful, and difficulties with transportation. Further research is needed to determine the best means of providing care to this underserved population.

Housing

Housing Characteristics of Farmworker Families in North Carolina (Early et al. 2006): Adequate housing is a basic human right and an important determinant of environmental health. Little research has documented the housing quality of immigrant Latino farmworker families. This analysis uses data from four surveys of North Carolina farmworker communities conducted in 2001 and 2003 to document aspects of housing quality that could affect farmworker family health. Three housing domains are considered: dwelling characteristics, household characteristics and household behaviors. Most farmworker families live in mobile homes, and few own their dwellings. Many are located near agricultural fields. Most houses are small, but household size is large, containing adults in addition to the nuclear family. Crowding is common. Many farmworker households lack basic facilities such as washing machines. Farmworkers attempt to reduce exposure by frequently cleaning their dwellings. These findings suggest that the health of farmworker families is at risk due to inadequate housing. Further research on housing-related health effects among farmworker families is needed.

Housing Quality among North Carolina Farmworker Families (Gentry AL et al. n.d.): Substandard housing poses risks for health and safety. Few studies have documented the housing conditions experienced by Latino farmworker families in the US. The purpose of this analysis is to assess the quality of housing occupied by farmworker families in eastern North Carolina and determine how individual and family characteristics are associated with housing quality. Interviews were completed in six North Carolina counties in 186 Latino farmworker households that included a child under the age of 18 to document respondent, household and dwelling characteristics. Most households are crowded, with 69.4% having more than one person per room. Dwellings were often located adjacent to fields (46.0%), suffered from structural problems (e.g., 18.3% had roof leaks), and lacked facilities and appliances (e.g., 26.9% did not have a working oven). Most farmworker family dwellings did not meet the US Department of Housing and Urban Development's minimum criteria for health and safety. Respondents in their thirties, who lived in North Carolina for less than five years, moved two or more times in the past year to follow crops, and lived in grower-provided housing had the poorest housing quality. These results demonstrate that North Carolina Latino farmworker families lack adequate housing. Further research is needed to evaluate farmworker housing conditions in all areas of the US, and to document the relationship of these housing conditions to health outcomes. The collaboration of researchers, advocates, policy makers, housing developers, health care providers and educators is needed to improve the housing conditions of farmworker families.

Mental Health

Leaving Family for Work: Ambivalence and Mental Health among Mexican Migrant Farmworker Men (Grzywacz et al. 2006): Men migrating to the U.S. from Mexico and Central America confront opposing family norms. They need to leave their families to gain family economic security; yet, leaving

renders their families vulnerable. We examined the mental health implications of the opposing family norms inherent in migration using an ambivalence framework. We interviewed 60 Latino migrant farmworkers working in North Carolina. Most were from Mexico; each had left a wife and children in his country of origin. Analysis indicated that family ambivalence was common. Ambivalence was associated with anxiety symptoms (but not depression or alcohol dependence), especially among men who were unable to contact their families regularly. Results demonstrate the usefulness of the ambivalence framework, and suggest that the origins of poor migrant mental health may reside in circumstances preceding migration. Study recommendations include facilitating family contact by expanding access to telephones among migrant workers.

Gender Differences in Anxiety and Depression among Immigrant Latinos (Hiott et al. 2006a):

This study determines elements of a social history that could assist primary care providers in identifying and treating anxiety and depression among immigrant Mexicans. Cross-sectional data were obtained through interviewer-administered survey questionnaires from immigrant Latinos in the U.S. fewer than five years (N = 150). Interviews were conducted by native Spanish-speakers in community settings. Mental health was measured with the Center for Epidemiologic Studies-Depression Scale (CES-D) and the Personality Assessment Inventory (PAI). Mental health in this sample was poor with nearly 40% indicating levels of anxiety and depression that may impair functioning. Social marginalization was associated with higher depression symptoms in men, and separation from family stress was associated with more depressive symptoms among women. When caring for immigrant Latinos, questions about social isolation and separation from family may provide insight into stress and its contribution to clinically significant anxiety and depression. These characteristics should also be considered when offering a treatment plan for anxiety and depression.

Immigrant Farmworkers' Health-Related Quality of Life: An Application of the Job Demands-

Control Model (Grzywacz et al. nd): This study uses the job demands and control model to evaluate the organization of farm work and its potential implications for health among immigrants from Mexico. Cross-sectional data were obtained from 151 farmworkers in eastern North Carolina via face-to-face interviews conducted in Spanish during the summer of 2005. Results suggest that skill variety, decision authority, and psychological demands are lower among farmworkers than workers in heterogeneous, general population samples. Multivariate analyses indicated that physical health-related quality of life was associated with two types of job demands, isometric load and exposure to hazardous conditions, and unrelated to indicators of control. Mental health-related quality of life was associated with indicators of job demands (psychological demands and exposure to hazardous conditions) and with control (decision authority). The results of this study suggest the health-related implications of manual occupations would be better understood by an expanded job demands-control model that includes physical and environmental demands, and that these jobs can be organized in ways that protect worker health.

Migrant Farmworker Stress: Mental Health Implications (Hiott et al. n.d.): The numbers of Latinos in rural regions of the U.S. is increasing. Little is known about factors that undermine the mental health of this segment of the rural population. The goal of this study is to determine which stressors inherent in farm work and the farmworker lifestyle contribute to poor mental health. A sample of 125 male migrant farmworkers was interviewed and completed the Migrant Farmworker Stress Inventory (MFWSI). Additionally, participants were administered three mental health scales: the PAI (anxiety), CES-D (depression), and CAGE/4M (alcohol abuse). Factor analysis was used to differentiate discrete domains of stressors in the MFWSI. Regression models were used to specify the association of the MFWSI stressor domains with mental health outcomes. 38% of participants had significant levels of stress as determined by the MFWSI. The MFWSI reduced to five discrete domains of stressors: legality and logistics, social isolation, work conditions, family, and substance abuse by others. In terms of mental health, 18.4% were above the threshold for anxiety, 41.6% met caseness for depression, and 37.6% answered yes to two or more questions on the CAGE. Social isolation is associated with farmworker anxiety. Stressful working conditions are associated with depressive symptoms. Specific categories of stressors (social isolation, working conditions) inherent in farm work and the farmworker lifestyle are associated with mental health status of immigrant farmworkers. Isolating specific categories of stressors helps in designing programs and practice for the prevention and management of

mental health disorders in the immigrant, farmworker population.

Oral Health

Oral Health and Quality of Life of Migrant and Seasonal Farmworkers in North Carolina (Quandt et al. 2007): Oral health deficits can have a significant effect on workers' general health and their ability to carry out normal activities. Although farmworkers have been found to lack access to dental care, few studies have documented their oral health status or its impact on quality of life (QOL). This research (1) describes the oral health problems experienced and oral health care received by Latino farmworkers in North Carolina, and (2) explores the association between oral health and QOL. Data were collected using face-to-face interviews from a representative sample of 151 farmworkers; data included oral health-related QOL (OHIP-14) and general health-related QOL (SF-12 Health Survey). Workers reported a high number of unmet needs: 52% reported caries and 33%, missing teeth. Only 21% had received dental services in the past year, almost all in Mexico rather than the U.S. The dimensions of oral health-related QOL most impaired were psychological discomfort and physical pain caused by dental problems. Number of functional oral health problems was the strongest predictor of oral health-related QOL ($p < .001$) and physical health-related QOL ($p < .05$), but was unrelated to mental health-related QOL. These findings indicate that the high rate of unmet oral health needs is associated with poorer farmworker QOL. Consequences of suffering on-going dental pain for work performance, sleep, and nutritional status are unknown. Because national data indicate that fewer farmworkers are returning to their countries of origin, communities with large farmworker populations need to address their unmet needs for dental care.

Specific Aim 2: To develop culturally and linguistically appropriate educational materials and implement programs that will promote ways to prevent or reduce exposure among farmworker families in North Carolina.

Casa a Campo developed culturally and linguistically appropriate educational program to help teach farmworkers about residential pesticide safety. This program was based on a promotora or lay health advisor program. The promotoras received training in pesticide safety and in teaching methods. Two promotoras piloted the program in the second project year, while four promotoras delivered the program in the third and fourth project years.

Casa a Campo developed adult educational materials for the promotora program, including print materials and a six minute cartoon video. In addition to the video, Como Controlar Plagas (Lane & Arcury 2003), and a comic book in Spanish (Dígame Adiós a las Plagas, Lane et al. 2003a) and English (Send Pests Packing, Lane et al. 2003b), numerous topic specific brochures were developed in Spanish and English.

- (Pesticide Pictionary)
- Pesticidas – No Los Traiga A Su Casa / Pesticides – Leave Them At Work
- Guía Para Los Trabajadores Del Campo Sobre Como Lavar La Ropa De Trabajo / A Farmworkers' Guide To Laundering Work Clothes
- Brisa / Drift
- Mapa De Exposición A Los Pesticidas / Pesticide Exposure Mapping
- Cómo Están Los Niños Expuestos A Los Pesticidas / How Children Are Exposed To Pesticides
- Limieza De Pesticidas En Su Hogar / Cleaning Pesticides Out Of Your Home
- Mantenga Su Hogar Libre De Plagas / Keep Your Home Pest Free
- Mapa De Plagas / Pest Mapping
- Plagas: ¡No Las Dejes Entrar! / Pests: Keep Them Out!
- Plagas: ¡Mátelas de hambre! / Pests: Starve Them Out!
- Hablemos De Cambio / Talking About Change
- (How to Read a Pesticide Label)

Some materials were developed in Spanish only.

- Garrapatas y Enfermedades (Ticks and Disease)
- Virus del Nilo Occidental (West Nile Virus)
- Ratas y Enfermedades (Rats and Disease)
- Las Cucarachas y las Enfermedades (Cockroaches and Disease)

- Piojos y Enfermedades (Lice and Disease)

All of these materials are available, along with the promotora curriculum on a single CD (Arcury et al. 2004)

Specific Aim 3: To develop culturally and linguistically appropriate educational materials and implement programs that will better prepare health care providers in North Carolina to recognize and treat pesticide exposure-related illness among agricultural labor families and counsel families on ways to prevent or reduce exposure.

Casa a Campo staff conducted in-depth interviews with nine health care providers. These interviews were focused on the health care providers' training in recognizing and treating pesticide exposure, their experiences in actually treating farmworkers suffering from pesticide poisoning, their standards of care in regard to patient education about pesticide safety, and their preferences of content and format for continuing education about pesticide safety and treatment. The in-depth interviews were conducted with a common interview guide and they were tape recorded. The interviews were transcribed, and analyzed using systematic qualitative data procedures.

Casa a Campo staff also completed a systematic review of materials and programs that focus on providing health care providers with information and training about the recognition, treatment and prevention of pesticide poisoning. The materials reviewed included journal articles, reports, and curricula. A standard review guide was developed. Casa a Campo staff published a journal article based on this review (Hiott et al. 2006b).

Review of Pesticide Education Materials for Health Care Providers Providing Care to Agricultural Workers (Hiott et al. 2006): Pesticide exposure is an important environmental and occupational health risk for agricultural workers and their families, but health care providers receive little training in it. The purpose of this review was evaluate the medical resources available to providers caring for patients, particularly farmworkers, exposed to pesticides, and to recommend a selective bibliography for use in educating clinicians about pesticides and health care. These resources are divided into three domains: (1) the working knowledge; (2) the skill set; and (3) the references needed to care for these patients. We searched library databases dating back to 1995, as well as conference materials and internet resources. Materials were included only if they were readily available through customary sources. Materials were randomly divided into two groups. Two authors wrote detailed reviews for each group. The remaining authors read each document and review, making changes that were agreed upon by the team. Review procedures were standardized to examine the contemporary relevance, quality, and overall strengths and weaknesses of the material relative to guidelines developed for each domain. These guidelines were developed from the authors' experience, national focus groups, and literature review. While no one resource adequately addresses all needs, a number of resources were identified addressing the categories of working knowledge, skill set, and reference materials. Few of the reviewed materials address the cultural competence of providers treating farmworkers. Additional education resources are needed.

Casa a Campo staff developed a continuing education program for health care providers based on the interview data and the literature review. This continuing education program provides information to help health care providers improve their clinical skills in the recognition and treatment of pesticide poisoning, and educate patients about pesticide safety. The continuing education program was available on-line for one year through the Northwest Area Health Education Center, and remains available on CD (Hiott et al. 2005).

Specific Aim 4: To increase the capacity of the North Carolina Farmworkers' Project to involve community members in the documentation of environmental and occupational health risks and in education for the reduction of environmental and occupational health risks.

The North Carolina Farmworkers' Project staff, Wake Forest University School of Medicine staff and Student Action with Farmworker interns collaborated in three activities to involve community members in the documentation and reduction of environmental and occupational health risks. First, they have made collaborative presentations at several public events for migrant and seasonal farmworkers. These included resource and health fairs, Hispanic community coalition meetings, and the parent groups at the Migrant Head Start centers in Harnett, Johnston, and Sampson Counties. Second, they collaborated on the training of

Pesticide Safety Promoters and on the direct pesticide safety training of farmworkers. Using the model that they developed in an earlier project (Arcury et al. 2000), they trained 12 Pesticide Safety Promoters. They also completed direct pesticide safety training at 50 farmworker camps, with between 900 and 1,000 farmworkers receiving training. Finally, they conducted research on issues of importance to the farmworker community.

Specific Aim 5: To evaluate the process and outcomes of community participation in this project so that it can be used by other community-based organizations to engage community residents in efforts to reduce environmental risks in their own communities.

The process evaluation is focused on documenting the extent of community participation in all aspects of the project. Outcome evaluation is documenting the products of activities associated with each specific aim. All research activities were documented by the staff and entered in a project log so that we could compare the number of activities conducted, their content, and the participants (e.g., community forums with farmworkers) with the original plan.

References Cited

Arcury TA, Quandt SA, Austin CK, Saavedra R, Rao P, Cabrera LF : [2000] Preventing Agricultural Chemical Exposure: A Safety Program Manual – Participatory Education with Farmworkers In Pesticide Safety. Winston-Salem, NC: Wake Forest University School of Medicine

Arcury TA, Quandt SA, Rao P, Doran A, Early J, Lane C, Marín T: [2004] Programa La Promotora: Pesticide Safety Education Materials. Winston-Salem, NC: Department of Family and Community Medicine, Wake Forest University School of Medicine

Arcury TA, Grzywacz JG, Davis SW, Barr DB, Quandt SA: [2006] Organophosphorus pesticide urinary metabolite levels of children in farmworker households in eastern North Carolina. American Journal of Industrial Medicine 49:751-760

Arcury TA, Grzywacz JG, Barr DB, Tapia J, Chen H, Quandt SA: [n.d.] Pesticide Urinary Metabolite Levels of Children in Eastern North Carolina Farmworker Households, under review

Early J, Davis SW, Quandt SA, Rao P, Snively BM, Arcury TA: [2006] Housing characteristics of farmworker families in North Carolina. Journal of Immigrant and Minority Health 8:173-184

Gentry AL, Grzywacz JG, Quandt SA, Davis SW, Arcury TA: [n.d.] Housing quality among North Carolina farmworker families, under review

Gentry K, Quandt SA, Davis SW, Grzywacz JG, Hiott AE, Arcury TA: [n.d.] Child Healthcare in Two Farmworker Populations under review

Grzywacz JG, Quandt SA, Early J, Tapia J, Graham CN, Arcury TA: [2006] Leaving family for work: ambivalence and mental health among Mexican migrant farmworker men. Journal of Immigrant and Minority Health 8:85-97

Grzywacz JG, Quandt SA, Arcury TA: [n.d.] Immigrant farmworkers' health-related quality of life: An application of the job demands-control model, under review

Hiott A, Arcury TA, Quandt SA: [2005] Pesticide Recognition, Treatment, and Prevention in Farmworkers. [Continuing Medical Education workshop on CD]. Winston-Salem, NC: Department of Family and Community Medicine, Wake Forest University School of Medicine

Hiott A, Grzywacz JG, Arcury TA, Quandt SA: [2006a] Gender differences in anxiety and depression among immigrant Latinos. Families, Systems & Health 24:137-146

Hiott A, Arcury TA, Quandt SA, Early J, Jackson DS: [2006b] Review of pesticide education materials for

health care providers providing care to agricultural workers. *Journal of Rural Health* 22:17-25

Hiott AE, Grzywacz JG, Davis SW, Quandt SA, Arcury TA: [n.d.] Migrant farmworker stress: mental health implications under review

Lane CM, Jr., Arcury TA: [2003] *Comó Controlar Plagas (How to Control Pests) Residential Pesticide Safety*. [Spanish language residential pesticide safety education video.] 6.5 minutes. Winston-Salem, NC: Department of Family and Community Medicine, Wake Forest University School of Medicine

Lane CM, Jr., Arcury TA, Quandt SA, Marín A: [2003a] *Dígale Adios a las Plagas*. [Spanish residential pesticide safety education comic book]. Winston-Salem, NC: Department of Family and Community Medicine, Wake Forest University School of Medicine

Lane CM, Jr., Arcury TA, Quandt SA, Marín A: [2003b] *Send Pests Packing*. [English residential pesticide safety education comic book]. Winston-Salem, NC: Department of Family and Community Medicine, Wake Forest University School of Medicine

Quandt SA, Arcury TA, Early J, Tapia J, Davis JD: [2004] Household food security among Latino farmworkers in North Carolina. *Public Health Reports* 119:568-576

Quandt SA, Shoaf JI, Tapia J, Hernández-Pelletier M, Clark HM, Arcury TA: [2006] Experiences of Latino immigrant families in North Carolina help explain elevated levels of food insecurity and hunger. *Journal of Nutrition* 136:2638-2644

Quandt SA, Hiott AE, Grzywacz JG, Davis SW, Arcury TA: [2007] Oral health and quality of life of migrant and seasonal farmworkers in North Carolina. *Journal of Agricultural Safety and Health*, in press

Rohlman DS, Arcury TA, Quandt SA, Lasarev M, Rothlein J, Travers R, Tamulinas A, Scherer J, Early J, Marín A, Phillips J, McCauley L: [2005] Neurobehavioral Performance in Preschool Children from Agricultural and Non-Agricultural Communities in Oregon and North Carolina. *NeuroToxicology* 26:589-598

Rohlman DS, Bodner T, Arcury TA, Quandt SA, McCauley L: [2006] Developing methods for assessing neurotoxic effects in Hispanic non-English speaking children. *Neurotoxicology*, in press

Publications

Journal Articles

2004

1. Quandt SA, Arcury TA, Early J, Tapia J, Davis JD: [2004] Household food security among Latino farmworkers in North Carolina. *Public Health Reports* 119:568-576
2. Rao P, Arcury TA, Quandt SA: [2004] Student participation in community-based participatory research to improve migrant and seasonal farmworker health: issues for success. *Journal of Environmental Education* 35:3-15

2005

3. Rohlman DS, Arcury TA, Quandt SA, Lasarev M, Rothlein J, Travers R, Tamulinas A, Scherer J, Early J, Marín A, Phillips J, McCauley L: [2005] Neurobehavioral Performance in Preschool Children from Agricultural and Non-Agricultural Communities in Oregon and North Carolina. *NeuroToxicology* 26:589-598

2006

4. Arcury TA, Grzywacz JG, Davis SW, Barr DB, Quandt SA: [2006] Organophosphorus pesticide urinary metabolite levels of children in farmworker households in eastern North Carolina. *American Journal of Industrial Medicine* 49:751-760
5. Early J, Davis SW, Quandt SA, Rao P, Snively BM, Arcury TA: [2006] Housing characteristics of farmworker families in North Carolina. *Journal of Immigrant and Minority Health* 8:173-184
6. Grzywacz JG, Quandt SA, Early J, Tapia J, Graham CN, Arcury TA: [2006] Leaving family for work: ambivalence and mental health among Mexican migrant farmworker men. *Journal of Immigrant and Minority Health* 8:85-97
7. Grzywacz JG, Hovey JD, Seligman LD, Arcury TA, Quandt SA: [2006] Evaluating short-form versions of the CES-D for measuring depressive symptoms among immigrant Latinos. *Hispanic Journal of Behavioral Sciences* 28:404-424
8. Hiott A, Arcury TA, Quandt SA, Early J, Jackson DS: [2006] Review of pesticide education materials for health care providers providing care to agricultural workers. *Journal of Rural Health* 22:17-25
9. Hiott A, Grzywacz JG, Arcury TA, Quandt SA: [2006] Gender differences in anxiety and depression among immigrant Latinos. *Families, Systems & Health* 24:137-146
10. Quandt SA, Shoaf JI, Tapia J, Hernández-Pelletier M, Clark HM, Arcury TA: [2006] Experiences of Latino immigrant families in North Carolina help explain elevated levels of food insecurity and hunger. *Journal of Nutrition* 136:2638-2644

In press

11. Quandt SA, Hiott AE, Grzywacz JG, Davis SW, Arcury TA: [2007] Oral health and quality of life of migrant and seasonal farmworkers in North Carolina. *Journal of Agricultural Safety and Health*, in press
12. Rohlman DS, Bodner T, Arcury TA, Quandt SA, McCauley L: [2006] Developing methods for assessing neurotoxic effects in Hispanic non-English speaking children. *Neurotoxicology*, in press

Under review

13. Arcury TA, Grzywacz JG, Barr DB, Tapia J, Chen H, Quandt SA: [n.d.] Pesticide Urinary Metabolite Levels of Children in Eastern North Carolina Farmworker Households, under review
14. Gentry AL, Grzywacz JG, Quandt SA, Davis SW, Arcury TA: [n.d.] Housing quality among North Carolina farmworker families, under review
15. Grzywacz JG, Quandt SA, Arcury TA: [n.d.] Immigrant farmworkers' health-related quality of life: An application of the job demands-control model, under review
16. Gentry K, Quandt SA, Davis SW, Grzywacz JG, Hiott AE, Arcury TA: [n.d.] Child Healthcare in Two Farmworker Populations under review
17. Hiott AE, Grzywacz JG, Davis SW, Quandt SA, Arcury TA: [n.d.] Migrant farmworker stress: mental health implications under review

Theses

1. Etienne S: [2004] Provider Knowledge of Farmworker Agricultural Chemical Exposure: An Examination of Diagnostic, Treatment, and Prevention Issues from the GTS, PACE, and Casa y Campo Studies. Master's Paper, University of North Carolina at Chapel Hill

Educational Materials

2002

1. Arcury TA, Quandt SA, Lane, CM. Jr., Marin T, Rao P: [2002] El Terror Invisible: Pesticide Safety for North Carolina. [Spanish language pesticide safety education video.]
 - a. Safety with Pesticides: Pesticide Risk and the Invisible Terror (Seguridad con pesticidas: Riesgos de los pesticidas y el terror invisible): 27 minutes
 - b. Pesticide Handler: What's Important to be a Pesticide Handler (Manipulador ¿Qué significa ser un manipulador de pesticidas?: 17.5 minutes
 - c. The Green Monster: Green Tobacco Sickness (El monstruo verde: Enfermedad del tabaco verde): 9 minutesWinston-Salem, NC: Wake Forest University School of Medicine

2003

2. Lane CM, Jr., Arcury TA: [2003] Cómo Controlar Plagas (How to Control Pests) Residential Pesticide Safety. [Spanish language residential pesticide safety education video.] 6.5 minutes. Winston-Salem, NC: Department of Family and Community Medicine, Wake Forest University School of Medicine
3. Lane CM, Jr., Arcury TA, Quandt SA, Marín A: [2003] Dígame Adios a las Plagas. [Spanish residential pesticide safety education comic book]. Winston-Salem, NC: Department of Family and Community Medicine, Wake Forest University School of Medicine
4. Lane CM, Jr., Arcury TA, Quandt SA, Marín A: [2003] Send Pests Packing. [English residential pesticide safety education comic book]. Winston-Salem, NC: Department of Family and Community Medicine, Wake Forest University School of Medicine

2004

5. Arcury TA, Quandt SA, Rao P, Doran A, Early J, Lane C, Marín T: [2004] Programa La Promotora: Pesticide Safety Education Materials. Winston-Salem, NC: Department of Family and Community Medicine, Wake Forest University School of Medicine

6. Arcury TA, Quandt SA, Rao P, Doran A, Early J, Lane C, Marín T: [2004] Programa La Promotora: Nutrition Education Materials. Winston-Salem, NC: Department of Family and Community Medicine, Wake Forest University School of Medicine

2005

7. Hiott A, Arcury TA, Quandt SA: [2005] Pesticide Recognition, Treatment, and Prevention in Farmworkers. [Continuing Medical Education workshop on CD]. Winston-Salem, NC: Department of Family and Community Medicine, Wake Forest University School of Medicine

Reports

2003

1. Quandt SA, Arcury TA, Early J, Tapia J, Davis JD: [2003] Household Food Security among Latino Migrant and Seasonal Farmworkers in North Carolina. Center for Latino Health Research Working Paper 03-01. Winston-Salem, NC: Department of Family and Community Medicine, Wake Forest University School of Medicine
2. Quandt SA, Arcury TA, Early J, Tapia J, Davis JD: [2003] Hunger and Food Insecurity among Latino Migrant and Seasonal Farmworkers in North Carolina. Proceedings of the 2002-2003 Migrant Farmworker Stream Forums: 81-86

2004

3. Arcury TA, Early J, Davis SW, Quandt SA, Rao P, Snively BM: [2004] Housing Characteristics of Farmworker Families in North Carolina. Center for Latino Health Research Working Paper 04-02. Winston-Salem, NC: Department of Family and Community Medicine, Wake Forest University School of Medicine
4. Grzywacz JG, Quandt SA, Early J, Tapia J, Graham CN, Arcury TA: [2004] Leaving Family for Work: Ambivalence & Mental Health among Migrant Latino Farmworkers Center for Latino Health Research Working Paper 04-01. Winston-Salem, NC: Department of Family and Community Medicine, Wake Forest University School of Medicine

Inclusion of Gender and Minority Study Subjects

Study Title: Casa a Campo: Pesticide Safety for Farmworker Families

Total Enrollment: 719

Protocol Number: BG00-029

Grant Number: OH07611

PART A. TOTAL ENROLLMENT REPORT: Number of Subjects Enrolled to Date (Cumulative) by Ethnicity and Race				
Ethnic Category	Sex/Gender			
	Females	Males	Unknown or Not Reported	Total
Hispanic or Latino	325	368	0	693 **
Not Hispanic or Latino	18	8	0	26
Unknown (Individuals not reporting ethnicity)	0	0	0	0
Ethnic Category: Total of All Subjects*	343	376	0	719 *
Racial Categories				
American Indian/Alaska Native	0	0	0	0
Asian	0	2	0	2
Native Hawaiian or Other Pacific Islander	0	0	0	0
Black or African American	4	0	0	4
White	332	371	0	703
More than one race	7	3	0	10
Unknown or not reported	0	0	0	0
Racial Categories: Total of All Subjects*	343	376	0	719 *
PART B. HISPANIC ENROLLMENT REPORT: Number of Hispanics or Latinos Enrolled to Date (Cumulative)				
Racial Categories	Females	Males	Unknown or Not Reported	Total
American Indian or Alaska Native	0	0	0	0
Asian	0	0	0	0
Native Hawaiian or Other Pacific Islander	0	0	0	0
Black or African American	1	0	0	1
White	317	365	0	682
More Than One Race	7	3	0	10
Unknown or not reported	0	0	0	0
Racial Categories: Total of Hispanics or Latinos**	325	368	0	693 **

* These totals must agree.

** These totals must agree.

Inclusion of Children

Children were involved in Casa a Campo as study participants. First, 60 children in farmworker families participated in the measurement of pesticide exposure. These one to six year old children provided urine samples which were used to measure the presence of pesticide metabolites. Second, 27 children in farmworker families participated in the measurement of the neurobehavioral effects of pesticide exposure. These ages 49–79 month old children completed two rounds of neurobehavioral tests and provided urine samples to measure pesticide exposure.

The Casa a Campo program was also relevant to the conditions affecting children. The Casa a Campo promotora program was designed to reduce the exposure of farmworker family members, particularly children, to pesticide exposure. The ongoing use of these materials will continue the relevance of Casa a Campo for children.

Materials available for Other Investigators

The educational materials develop by Casa a Campo are available to other investigators. These materials include:

- Arcury TA, Quandt SA, Lane, CM. Jr., Marin T, Rao P: [2002] El Terror Invisible: Pesticide Safety for North Carolina. [Spanish language pesticide safety education video.]
- a. Safety with Pesticides: Pesticide Risk and the Invisible Terror (Seguridad con pesticidas: Riesgos de los pesticidas y el terror invisible): 27 minutes
 - b. Pesticide Handler: What's Important to be a Pesticide Handler (Manipulador ¿Qué significa ser un manipulador de pesticidas?: 17.5 minutes
 - c. The Green Monster: Green Tobacco Sickness (El monstruo verde: Enfermedad del tabaco verde): 9 minutes

Winston-Salem, NC: Wake Forest University School of Medicine

Lane CM, Jr., Arcury TA: [2003] Cómo Controlar Plagas (How to Control Pests) Residential Pesticide Safety. [Spanish language residential pesticide safety education video.] 6.5 minutes. Winston-Salem, NC: Department of Family and Community Medicine, Wake Forest University School of Medicine

Lane CM, Jr., Arcury TA, Quandt SA, Marín A: [2003] Dígale Adios a las Plagas. [Spanish residential pesticide safety education comic book]. Winston-Salem, NC: Department of Family and Community Medicine, Wake Forest University School of Medicine

Lane CM, Jr., Arcury TA, Quandt SA, Marín A: [2003] Send Pests Packing. [English residential pesticide safety education comic book]. Winston-Salem, NC: Department of Family and Community Medicine, Wake Forest University School of Medicine

Arcury TA, Quandt SA, Rao P, Doran A, Early J, Lane C, Marín T: [2004] Programa La Promotora: Pesticide Safety Education Materials. Winston-Salem, NC: Department of Family and Community Medicine, Wake Forest University School of Medicine

Arcury TA, Quandt SA, Rao P, Doran A, Early J, Lane C, Marín T: [2004] Programa La Promotora: Nutrition Education Materials. Winston-Salem, NC: Department of Family and Community Medicine, Wake Forest University School of Medicine

Hiott A, Arcury TA, Quandt SA: [2005] Pesticide Recognition, Treatment, and Prevention in Farmworkers. [Continuing Medical Education workshop on CD]. Winston-Salem, NC: Department of Family and Community Medicine, Wake Forest University School of Medicine

Some of these materials are available on the Wake Forest University School of Medicine, Department of Family and Community Medicine website:

http://www1.wfubmc.edu/fam_med/Research/occupational+Health/Pesticide+Ed+Materials.htm

All of the materials are available by contacting:

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