

Project	Reducing the Impact of Green Tobacco Sickness among Latino Farmworkers	
Nominees	Thomas A. Arcury, PhD Dept. of Family and Community Medicine Wake Forest University School of Medicine Winston-Salem, NC 27157 336-716-9438 tarcury@wfubmc.edu	Sara A. Quandt, PhD Dept. of Public Health Sciences Wake Forest University School of Medicine Winston-Salem, NC 27157 336-716-6015 squandt@wfubmc.edu
NORA Area	Special Populations at Risk	

Description of the Research Project

Green tobacco sickness (GTS) is acute nicotine poisoning due to transdermal nicotine absorption, characterized by headache, dizziness, nausea, and vomiting. GTS impairs the work productivity and threatens the health of minority farmworkers who supply most tobacco labor in the US and small farmers who cultivate much of the tobacco abroad. Prior to this project, fewer than 40 scientific papers had been published on GTS, many of them case studies or reviews and some of them attributing the causes of the condition to heat, pesticides, or unknown chemicals in tobacco. The primary advice given to workers for prevention was to smoke, and few culturally-appropriate and medically accurate educational materials were available. To address these deficiencies, the GTS project was designed to: (1) estimate the incidence of GTS in seasonal and migrant farmworkers employed in tobacco production in North Carolina; (2) determine the risk factors for GTS; (3) measure the association of the tobacco exposure biomarker cotinine with GTS symptoms and with risk factors such as work-related exposure to tobacco plants; (4) understand farmworker, grower, and health care providers interpretations of GTS symptomatology, self-care behaviors, and barriers to prevention and treatment seeking, and (5) disseminate findings concerning GTS risk factors to farmworkers and to those providing services to farmworkers. Combining epidemiology and ethnography, this project produced (1) the first body of scholarly work on GTS epidemiology, (2) culturally appropriate materials to empower farmworkers to prevent GTS, and (3) educational materials to increase the effectiveness of medical personnel treating GTS in farmworkers. Funding for the project came from NIOSH (R01-OH03648), NC Dept of Agriculture & Consumer Services, Albert Schweitzer Fellows Program, Bureau of Primary Healthcare, and private corporations.

Study Design

The GTS project used a multi-method design with three related research projects. In Study 1, a repeated measures design was used to estimate the incidence of GTS and identify its risk factors by recruiting and following a cohort of Latino farmworkers in eastern North Carolina over the course of one tobacco cultivation season. Study 2 used a case-control design to obtain data across two seasons from workers sick enough to seek treatment in migrant clinics and comparison data on workers in the same conditions who did not develop GTS. Study 3 used qualitative data collected from farmworkers, growers, and healthcare providers (HCPs) to identify and contrast their cognitive models of the etiology, symptomatology, pathophysiology, prevention, and impact of GTS.

Study Methods

For Study 1, 182 workers in 36 camps were interviewed 5 times over a 10-week period. At each contact, questionnaire data and a saliva sample were collected. The saliva samples provided a non-invasive measure of cotinine, the major metabolite of nicotine. All questionnaires were orally administered by bilingual interviewers. Data included recalls of work tasks, environmental conditions, and symptoms for each of the previous 7 days. Most data were collected in late evening at remote sites, requiring extra effort in refrigerating and shipping saliva samples. Despite these problems, over 700 individual interviews were conducted, producing a robust data set containing information on approximately 4,900 workdays for analyses of the primary study questions. Statistical methods used accounted for the probability of selection of workers in different camps, for missing data as workers migrated in and out of the study, and for clustering of workers within camps. Survey regression methods, logistic regression, and alternating logistic regression were used for data analysis.

Data from 36 cases and 40 controls were obtained in clinics for Study 2, using a stringent algorithm for differential diagnosis of GTS. Urine samples were collected to be analyzed for multiple nicotine metabolites, and questionnaire data were obtained on personal behaviors and environmental conditions.

For Study 3, 23 Latino farmworkers, 15 tobacco growers, and 11 HCPs participated in in-depth interviews structured for the elicitation of cognitive, explanatory models of GTS. Interviews were recorded and transcribed; systematic text analysis was used to identify components of models and to compare them across the three groups.

Results and Impact on Worker Health and Safety

GTS was experienced by 25/182 workers. The incidence density of GTS was 1.88 days per 100 days worked. Prevalence and incidence increased from early to late agricultural season. Major risk factors included lack of work experience, harvesting, and working in wet clothes $\geq 25\%$ of the time. Smoking was partially protective. Cotinine levels increased across the season, such that by the end of the season, non-smoking workers had nicotine levels equivalent to regular smokers, and smokers had doubled their nicotine levels. The case-control study demonstrated that wearing rainsuits was protective. Analysis of in-depth interviews showed that growers often attributed GTS to heat and bending, rather than tobacco exposure, and minimized its seriousness and need for medical treatment. They provided unproven methods of prevention to workers (e.g., anti-nausea drugs or vitamins) and recommended smoking. Workers frequently attributed their symptoms to pesticide poisoning and practiced a number of home remedies to prevent and treat GTS. In contrast to growers and HCPs who identified nausea and vomiting as the most serious aspects of GTS, workers identified anorexia and insomnia. These impaired their capacity to work and jeopardized their ability to send money home for their families. HCPs had received little training related to GTS and were unfamiliar with its differential diagnosis.

The combined results from the study indicate that a significant proportion of workers and workdays are affected by GTS. Modifiable risk factors (changing out of wet clothes, wearing protective clothing) have potential for protecting workers from GTS and can be recommended instead of smoking. Varied understanding of GTS by growers, workers, and HCPs suggests that better understanding of the causes and prevention of GTS can improve worker safety and health.

Translational Results

The GTS project has produced educational materials for farmworkers that translate the scientific results into three different media formats culturally and educationally appropriate for workers. The first is a 53-minute video/DVD on agricultural chemical safety in Spanish with English subtitles. This video uses the story of a group of workers exposed to tobacco and to pesticides to teach safety and prevention in a context of empowering workers to manage their own safety. Over 700 copies of this video have been distributed throughout the Southeast and into the tobacco-producing regions of New England, Canada, Mexico, Central America, and South America. The second is a fotonovela designed to teach about GTS and its prevention using a dramatic story format. Dialogue is presented in both Spanish and English. To date, over 10,000 copies have been distributed to workers in the US and another 2,000 in Canada. The third is a safety comic, “El Monstruo Verde,” that can be inexpensively reproduced by clinics and other service providers. These materials are currently used by a wide variety of entities, including the US EPA in training farmworkers across the South, by the Occupational Health Clinics for Ontario Workers, Inc., by the NC Department of Agriculture & Consumer Services in their worker education program, by the NC Growers Association which brings approximately 10,000 H2A workers to North Carolina annually, and by the outreach programs of the NC Migrant Health Program and community health clinics across North Carolina. The print materials are distributed as “.pdf” files free of charge on the website of the National Agricultural Safety Program at CDC.

The project has also produced materials to educate HCPs about GTS diagnosis, including differential diagnosis with pesticide poisoning and heat stress. These include papers in two publications directed specifically at HCPs serving farmworkers, seven conference presentations for HCPs, and a continuing medical education workshop that has been offered at six locations throughout North Carolina and Virginia for physicians, nurses, and outreach workers. It is also available for CME credit on line.

Research Innovation

Farmworkers in the US are a hard-to-reach population due to their mobility, as well as language and cultural barriers to communication. Workers and growers are reticent to call attention to worker health problems due to worker immigration documentation. Conducting epidemiological research in this population requires concerted effort to overcome these barriers and to develop methods for recruitment, retention, and data collection that are effective and acceptable to the population. By combining anthropological and epidemiological methods, this project was able to develop data collection as well as statistical analysis methods to accommodate these realities.

The direct translation of research results to worker safety and health education and to continuing education for HCPs serving this at-risk population is a model for taking basic research directly to workers and providers. The research was able to identify modifiable risk factors (wearing wet clothing) and provide positive actions available to workers and growers (taking dry clothes to the field; providing protective clothing) that protect worker health and decrease lost work time.

List of Relevant Publications and Products from the GTS Project

Scientific Results

Publications

- Quandt SA, Arcury TA, Preisser J, Norton D, Austin CK. Migrant farmworkers and green tobacco sickness: new issues for an understudied disease. *American Journal of Industrial Medicine* 37: 307-315, 2000
- Arcury TA, Quandt SA, Preisser JS, and Norton D. the incidence of green tobacco sickness among Latino farmworkers. *Journal of Occupational and Environmental Medicine* 43(7):601-609, 2001.
- Quandt SA, Arcury TA, Preisser JS, Bernert JT, Norton D. Behavioral and environmental predictors of salivary cotinine in Latino tobacco workers. *Journal of Occupational and Environmental Medicine*, 40(10): 844-852, 2001.
- Arcury TA, Quandt SA, Preisser JS. Predictors of incidence and prevalence of green tobacco sickness among Latino farmworkers in North Carolina, U.S.A. *Journal of Epidemiology and Community Health*, 55(11):818-824, 2001.
- Arcury TA, Quandt SA, Garcia DI, Preisser JS, Norton D, Rao P. A clinic based case-control comparison of green tobacco sickness among minority farmworkers. *Southern Medical Journal*, 95:1008-1011, 2002.
- Quandt SA, Preisser JS, Arcury TA. Mobility patterns of migrant farmworkers in North Carolina: Implications for occupational health research and policy. *Human Organization* 61:21-29, 2002.
- Rao P, Arcury TA, Quandt SA. Hispanic farmworker interpretations of green tobacco sickness. *Journal of Rural Health*, 18:503-511, 2002.
- Arcury TA, Quandt SA, Simmons S. Farmer health beliefs about an occupational illness that affects farmworkers: the case of green tobacco sickness. *Journal of Agricultural Safety and Health* 9: 33-45, 2003.
- Arcury TA, Quandt SA, Preisser JS, Bernert JT, Norton D, Wang J. High levels of transdermal nicotine exposure produce green tobacco sickness in Latino farmworkers. *Nicotine & Tobacco Research* 5:315-312, 2003.
- Preisser JS, Arcury TA, Quandt SA. The spatial clustering of an occupational illness: green tobacco sickness among Latino farmworkers. *American Journal of Epidemiology* 158:495-501, 2003.
- Rao P, Arcury TA, Quandt, SA. Student participation in community-based participatory research to improve migrant and seasonal farmworker health: issues for success. *Journal of Environmental Education* 35:3-15, 2004.

Conference Presentations

- Quandt SA, Arcury TA, Norton DR, Austin CK, Preisser J. Farmworkers and green tobacco sickness: new issues for an understudied disease. Society for Applied Anthropology, Tucson, AR, April, 1999.
- Quandt SA, Arcury TA, Preisser JS, Norton D. Green tobacco sickness among migrant and seasonal farmworkers. 11th World Congress on Tobacco OR Health. Chicago, IL, August 2000.
- Arcury TA, Quandt SA, Preisser JS, Rao P. Confronting green tobacco sickness (GTS): epidemiology and environmental justice among Latino farmworkers. Society for Applied Anthropology, Merida, Yucatan, Mexico, 2001.
- Quandt SA, Arcury TA, Rao P, Belflower A, Simmons S. Farmer, farmworker, and medical perspectives on green tobacco sickness (GTS). Society for Applied Anthropology, Merida, Yucatan, Mexico, 2001.

Rao P, Arcury TA, Quandt SA, Sherertz E, Neal S, Norton D. Green tobacco sickness (GTS) among Latino farmworkers: developing a continuing education program for healthcare providers. Society for Applied Anthropology, Merida, Yucatan, Mexico, 2001.

Translating Results for Minority Farmworkers

Quandt SA, Arcury TA. Aprenda sobre la enfermedad del tabaco verde: la experiencia de Juan – una fotonovela / Learning about Green Tobacco Sickness: Juan’s Experience. [Spanish and English fotonovel.] Winston-Salem, NC: Wake Forest University School of Medicine, 2001. <http://www.cdc.gov/nasd/docs/d001501-d001600/d001591/Juan%27s%20Experience.pdf>

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

Arcury TA, Quandt SA, Norton D. El Monstruo Verde: La Enfermedad del Tabaco Verde [Spanish language green tobacco sickness safety comic]. Winston-Salem, NC: Wake Forest University School of Medicine, 2002. <http://www.cdc.gov/nasd/docs/d000101-d000200/d000144/d000144.pdf>

Translating Results for Health Care Providers

Publications

Arcury TA, Quandt SA. Green tobacco sickness: Incidence and risk factors for farmworkers. Migrant Health Newsline 8(4):1-2.

Arcury TA, Quandt SA, Norton D. Green tobacco sickness among farmworkers in North Carolina. The Network Practitioner: A Journal for Primary Care Providers in Community Health Centers. Autumn/Winter: 7-9, 2001.

Continuing Education Workshops

Arcury TA, Quandt SA, Norton D, Neal S, Davis S, Sherertz E. Green Tobacco Sickness: An Agricultural Health Hazard. Presented at six locations in North Carolina and Virginia. Now available on-line. <http://www.cmecourses.com/gateway/cscatalog.cfm?method=CourseInfo&icourseid=6031&sid=&pid=494>.

Conference Presentations for Health Care Providers

Austin CK. Results from the field: research on pesticides and green tobacco sickness in North Carolina. 1999 East Coast Migrant Stream Forum, Miami, FL, December 1999.

Norton D, Arcury TA, Quandt SA. Green tobacco sickness: an occupational illness for farmworkers. 2000 East Coast Migrant Stream Forum, Philadelphia, PA, November, 2000.

Simmons S, Arcury TA. Farmer, farmworker, and medical perspectives on green tobacco sickness. Society of Teachers of Family Medicine. Denver, CO, April 2001.

Arcury TA. Explorations in occupational health among migrant and seasonal farmworkers in North Carolina. Presentation to the National Advisory Council on Migrant Health, East Coast Migrant Stream Forum, Asheville, NC, October 2001.

Quandt SA, Arcury TA, Norton D. Migrant farmworkers and green tobacco sickness: prevalence, risk factors, and

misconceptions. East Coast Migrant Stream Forum, Asheville, NC, October 2001.

Arcury TA. Migrant agricultural workers: green tobacco sickness and health hazards for migrant workers. NE Regional Occupational Disease & Injury Surveillance Conference, Farmington, CT, May 2002.

Quandt SA, Garcia VQ. Conducting participatory research with farmworkers. East Coast Migrant Stream Forum, Savannah, GA, October 2002.