Skin Disease Among Latino Farmworkers in North Carolina

J. Krejci-Manwaring, M. R. Schulz, S. R. Feldman,
Q. M. Vallejos, S. A. Quandt, S. R. Rapp, T. A. Arcury

ABSTRACT. *An estimated 4.2 million seasonal and migrant farmworkers and their dependents live in the U.S. Most of these farmworkers are Latino. These workers are exposed to numerous occupational and environmental risk factors that can result in skin disease. Few data exist on the prevalence of skin disease in this population. The purpose of this study was to estimate the prevalence and predictors of skin disease in a sample of Latino farmworkers in North Carolina. A sample of 59 farmworkers was recruited and interviewed at two camps during the 2004 agricultural season. A dermatologist completed a skin exam of each worker and recorded any skin disease present. Forty-two (77.7%) of the 54 men, and all five of the women examined had a diagnosed skin disease. For the men, onychomycosis (nail fungus, 31.5%), tinea pedis (foot fungus, 27.8%), and acne (24.1%) were the most commonly diagnosed skin diseases, with contact dermatitis diagnosed in 5.6% of the sample. Other diagnoses included scars, sunburn, and atopic dermatitis. Among the women, diagnoses included melasma (dark patches on the face, 2 cases), xerosis (excessively dry skin, 1 case), tinea pedis (2 cases), onychomycosis (1 case), acne (1 case), and insect bites (1 case). There were no statistically significant differences between workers in the two camps despite different growing seasons and different crops harvested. Skin disease is prevalent among the North Carolina Latino farmworkers who participated in this study, with fungal disease being the most prevalent.*

Keywords. *Farmworkers, Latino, Migrant and seasonal, Prevalence, Skin disease.*

Agriculture is one of the most dangerous industries in the U.S. Everyone who works in agriculture is exposed to numerous occupational and environmental risk factors (weather, mechanical devices, chemicals, animals, wild plants, organic and inorganic dust, fungi) that can result in skin disease or injury. Inflammatory skin disease is a widely acknowledged, but poorly documented illness among agricultural workers (Villarejo and Baron, 1999). The risk of developing a skin disease may be modified by the specific job activity, the use of personal protective equipment, hygiene, and individual susceptibility.

Article was submitted for review in July 2005 as manuscript number 5961; approved for publication by the Journal of Agricultural Safety and Health of ASABE in September 2005.

The authors are **Jennifer Krejci-Manwaring,** MD, Research Fellow, Department of Dermatology, Wake Forest University School of Medicine, Winston-Salem, North Carolina; **Mark R. Schulz,** PhD, Assistant Professor, Department of Public Health Education, University of North Carolina Greensboro, Greensboro, North Carolina; **Steven R. Feldman,** MD, PhD, Professor, Departments of Dermatology, Pathology, and Public Health Sciences, **Quirina M. Vallejos,** MPH, Research Associate, Department of Family and Community Medicine, **Sara A. Quandt,** PhD, Professor, Section on Epidemiology, Department of Public Health Sciences, **Stephen R. Rapp,** PhD, Professor, Department of Psychiatry and Behavioral Medicine, and **Thomas A. Arcury,** PhD, Professor, Research Director, Department of Family and Community Medicine, Wake Forest University School of Medicine, Winston-Salem, North Carolina. **Corresponding author:** Thomas A. Arcury, Department of Family and Community Medicine, Wake Forest University School of Medicine, Medical Center Boulevard, Winston-Salem, NC 27157-1084; phone: 336-716-9438; fax: 336-716-3206; e-mail: tarcury@wfubmc.edu.

  ISSN 1074-7583

An estimated 4.2 million seasonal and migrant farmworkers and their dependents live in the U.S., with 1.6 million classified as migrant (HRSA, 1990). Most (84%) farmworkers in the U.S. are Latino, with the vast majority (75%) being from Mexico (Carroll et al., 2005). Due to language barriers (81% are native Spanish speakers, and 44% indicate that they can speak no English), farmworkers have limited access to health education or to safety warnings that accompany many of the mechanical devices and chemicals with which they work. Farmworkers often live in crowded, substandard housing (Housing Assistance Council, 2001). In addition, farmworkers have high rates of infectious disease, limited access to health services (low incomes, no health insurance, few free services), and little control over workplace safety (Villarejo, 2003; Austin et al., 2001). Finally, knowledge of common skin disease in Latino immigrant populations is superficial, and research that considers the diverse backgrounds of Latino immigrants is needed (Sanchez, 2003).

Farmworkers in North Carolina cultivate and harvest vegetables (e.g., cucumbers, sweet potatoes), berries, orchard fruits (e.g., apples, peaches), tobacco, and Christmas trees. For 2004, the North Carolina Employment Security Commission (2004) estimated that there were 42,095 migrant farmworkers, of whom 39,410 were Spanish speaking, 35,050 seasonal farmworkers, 17,215 farmworkers who worked over 150 days, and 8,903 farmworkers with H2A visas (all of whom are Latino) employed in North Carolina. Surveys of North Carolina farmworkers have found them to be virtually all Latino, with over 90% being from Mexico (Arcury et al., 1999, 2001a, 2003). While the majority of farmworkers in North Carolina are Latino, surveys typically find that the primary language for 10% to 15% of the participants is an indigenous language, such as Mixteco, rather than Spanish (Arcury et al., 2001b). North Carolina farmworkers generally have fewer than nine years of education (*secondario* level in the Mexican educational system) and often have fewer than six years (*primario* level in the Mexican system) (Arcury et al., 2001a). Much of the housing in which North Carolina farmworkers live is crowded (36%) and substandard (Early et al., 2006).

Agricultural workers, including farmworkers, have the highest incidence of skin disorders of all industrial sectors. The annual incidence in 2003 was 18.5 per 10,000 workers for all agricultural production and 31.0 per 10,000 workers for crop production, as compared to an annual incidence for all private industry of 4.9 (Bureau of Labor Statistics, 2005). Probable causes of skin disease among agricultural workers are diverse and include exposure to wind and sun, pesticides, fertilizer, petroleum products, plants, and infectious agents (Villarejo and Baron, 1999).

McCurdy et al. (1989) found that among 183 grape and 43 tomato farmworkers in California, 46% reported a skin rash lasting two or more days within the past three months, but only 19% sought medical attention. When performing "waist-up" exams, 2% of the farmworkers had irritant or contact dermatitis. McCurdy et al. (1989) did not find any statistical difference in skin condition for the two groups, even though different harvesting methods are used for grapes and tomatoes. In a similar study of 759 grape, citrus, and tomato workers in California, Gamsky et al. (1992) found that 12% of workers reported a skin rash lasting more than two days in the past 12 months, and only one in five of these sought medical attention. When examined, 2% had contact dermatitis and 13% had lichenified hand dermatitis. Grape workers were more likely to have contact dermatitis and lichenified hand dermatitis than were citrus or tomato workers. Increasing hours per week in agriculture, being male, and not wearing gloves were associated with more lichenified hand dermatitis.

In a study of North Carolina farmworkers, Arcury et al. (2003) interviewed 293 Latino farmworkers who cultivated or harvested tobacco, cucumber, tomato, and blueberry crops. They found that 24% of workers in early season and 37% in late season reported

itching or burning skin or skin rash during the previous two months. Environmental, social, and behavioral components were also queried. Predictors of self-reported symptoms of skin rash included: blueberry work, not having a work contract, not showering after work, and age 25-34 years (vs. age >34 years). The prevalence of self-reported skin symptoms was quite high (27% to 37%), but no dermatological examinations were performed in this study.

Few studies have evaluated skin disease in migrant farmworkers in the U.S., but it appears to be a common problem. Epidemiologic data are needed to quantify its prevalence, identify the most common diagnoses, and delineate the relative risk of numerous occupational, environmental, social, and behavioral factors. This analysis considers skin diseases that were diagnosed by a dermatologist who performed skin examinations. It is difficult to separate work and non-work related skin disease among migrant and seasonal farmworkers because their jobs require that most live away from their homes in temporary housing that is often supplied by their employer. Therefore, skin disease observed for this study is not differentiated by occupational or non-occupational cause. This analysis documents the prevalence of skin disease among farmworkers in eastern North Carolina, and discusses the potential predictors of these skin diseases.

Methods and Materials

Participants were recruited from two farmworker camps in eastern North Carolina, one in Johnston County and the other in Nash County. Thirty workers were recruited from camp 1 (Johnston County), with data collection completed on 18 July 2004. Twenty-nine workers were recruited from camp 2 (Nash County), with data collection completed on 19 September 2004.

A common procedure was used to recruit participants at both camps. Health outreach workers from migrant health clinics who were familiar with the camps in the region contacted camps with at least 30 residents. The outreach workers met with the residents of each camp to gauge their interest in participating in the study. The residents of the first two camps contacted agreed to participate. Once the workers at the two camps agreed to participate, a date was chosen for the research team to visit. Investigators visited each camp on a Sunday when the residents would not be working. Camp 1 included approximately 45 workers, all adult males, while residents of camp 2 included about 15 adult women and 45 adult men, plus some children. Inclusion criteria for individual participants were being a camp resident and being currently employed doing farm work. Therefore, all adult residents in each camp were invited to participate in the study, and it was made clear to all potential participants that the presence of a skin problem was not required to participate.

Informed consent was obtained from individuals who agreed to participate using a form written by native Spanish speakers for those with limited literacy. The consent form was reviewed by native Mexican speakers who were former farmworkers to ensure that the language was appropriate. Each participant was first interviewed in Spanish by a trained bilingual interviewer. Participants were then examined by a single board-certified dermatologist who performed a waist-up exam and foot exam of male participants, and an examination of the hands, arms, neck and head, and feet of female participants. Each worker was given an incentive of $10 for participating, and a meal was provided for all workers and family members in the camps, whether or not they participated in the study. Participant recruitment and data collection procedures were approved by the Wake Forest University School of Medicine Institutional Review Board.

Table 1. Skin disease diagnosis recording form.

Inflammatory diseases	
1	Acne/folliculitis
2	Contact dermatitis (allergic and irritant) SPECIFY if poison ivy:
3	Atopic dermatitis (includes eczema/ lichen simplex/ prurigo)
4	Seborrheic dermatitis
5	Stasis dermatitis
6	Psoriasis
Pigmentary disorders	
7	Post-inflammatory changes (includes pityriasis alba)
8	Melasma
9	Vitiligo
Infections	
10	Warts
11	Tinea versicolor
12	Tinea pedis
13	Tinea, all other types
14	Onychomycosis
15	Molluscum
16	Impetigo
17	Scabies
18	Other infection (syphilis, leprosy, TB) SPECIFY:
Tumors	
19	Melanoma
20	Non-melanoma skin cancer (BCC, SCC, or SCC-in situ)
21	Suspicious for malignancy, needs biopsy (i.e., ICD-9-CM 238.2)
22	Cyst (ignore lesions smaller than 1 cm)
23	Hemangioma (ignore lesions smaller than 1 cm)
Hair disorders (ignore androgenic alopecia)	
24	Alopecia areata
25	Other hair loss SPECIFY:
Trauma	
26	Traumatic skin lesion
27	Traumatic nail lesion
28	Scars
29	Sunburn
30	Other burns
Other	
31	Bug bites
32	Other rash or inflammatory disease (include PR) SPECIFY:
33	Other malignancy or premalignancy SPECIFY:
34	Keratoderma (palmoplantar)

The outcome measure for this study is dermatological diagnosis. All dermatological diagnoses were coded using a standardized form consisting of seven major categories: inflammatory, pigmentary, infectious, tumor, hair disorder, trauma, and other. Each category contained two or more specific diagnoses (table 1). An individual could have more than one specific diagnosis in a category. Completely benign disorders such as dermatofibroma (type of scar), benign nevi (common moles), keratosis pilaris (small bumps on arms), birthmarks, cysts and hemangiomas (dilated capillaries) less than 1 cm, and androgenic alopecia (male pattern balding) were ignored. The independent variable,

camp, was an indicator of the crop with which participants were working: camp 1 workers were harvesting tobacco, camp 2 workers were harvesting cucumbers and sweet potatoes. Other independent variables collected included gender, country of origin, age, and educational attainment.

Results for women and men were analyzed and reported separately, with the analysis focusing on the male participants due to sample size. The sample included 54 men but only five women, and gender would have confounded the analysis. Data analysis was completed in three steps. First, male workers in the two camps were compared by age (in years), country of origin, and educational attainment. Mean age for each camp was calculated and compared using the Student t-test for two independent samples. Relative frequencies of country of origin and highest grade of education completed were compared with the likelihood ratio χ^2 statistic. Second, one-way ANOVA was used to compare the relative frequency of specific skin disease diagnoses and the relative frequency of the seven categories of skin diseases by camp. Finally, associations between the occurrence of skin disease and the individual characteristics camp, age, and education were estimated.

Dichotomous variables were created for the presence versus absence of any skin disease, as well as for the presence versus absence of the most prevalent disease categories, inflammatory skin disease and infectious skin disease. The mean age for the male farmworkers (28 years) was used to construct a dichotomous age variable, and the sample was divided into two nearly equal groups for highest education completed by choosing the completion of six years of education as the cutpoint. Binary logistic regression was used to estimate the unadjusted prevalence odds ratios (ORs) and 95% confidence intervals (CIs) for the association between the presence versus absence of any skin disease, any inflammatory skin disease, and any infectious skin disease for the two camps, the two age groups (<28, ≥ 28) and the two education groups (≤ 6 years, >6 years). SPSS v.12.0 (SPSS, Inc., Chicago Ill.) was used for all statistical analysis.

Results

All 30 participants from camp 1 were male, and 24 of 29 (82.8%) in camp 2 were male. Fifty-two of the 54 male participants were from Mexico, one was from Honduras, and one was born in the U.S. The five women included three from Mexico, one from Nicaragua, and one from Honduras. All participants were native Spanish speakers. The mean age of the men in camp 1 (30.4 years, SD = 8.97) was significantly greater than the mean age of the men in camp 2 (24.7 years, SD = 8.0) ($t = 2.42$, $p = 0.019$). The ages of the women included one in her teens, three in their 30s, and one in her 50s. The educational attainment of the men did not differ by camp; 29 (53.7%) had completed 1 to 6 years (*primario* or less in the Mexican system), 18 (33.3%) had completed 7 to 9 years (*secondario* in the Mexican system), and 7 (13.0%) had completed at least 10 years.

Of the 54 male participants, 42 (77.7%) were diagnosed with a skin disease. Eighty individual cases of skin disease were diagnosed, and 20 farmworkers had more than one diagnosis. Onychomycosis (nail fungus) was the most commonly diagnosed skin disease in this sample (31.5%), followed by tinea pedis (foot fungus, 27.8%), acne (24.4%), and all other types of tinea (11.1%) (table 2). Contact (allergic/irritant) dermatitis was present in 5.6% and atopic dermatitis (eczema) in 9.3% of the participants. When diagnoses were combined into the larger categories, infection was the most frequent (48.1%), followed by inflammatory diseases (38.9%), pigmentary disorders (14.8%), other (7.4%), hair disorders (3.7%), and trauma (3.7%). The "other" category included two cases of xerosis, one case of pityriasis rosea, and one case of hyperkeratosis. There were no tumors

Table 2. Skin disease diagnoses for male Latino farmworkers, North Carolina, summer 2004.

	Camp 1 (n = 30)		Camp 2 (n = 24)		Total (n = 54)	
Diagnosed Skin Disease	n	%	n	%	n	%
Inflammatory diseases	9	30.0	12	50.0	21	38.9
Acne/folliculitis	7	23.3	6	25.0	13	24.1
Contact dermatitis	1	3.3	2	8.3	3	5.6
Atopic dermatitis[a]	1	3.3	4	16.7	5	9.3
Seborrheic dermatitis	0	0	2	8.3	2	3.7
Psoriasis	1	3.3	0	0	1	1.9
Pigmentary disorders	3	10.0	5	20.8	8	14.8
Post-inflammatory changes	2	6.7	1	4.2	3	5.6
Melasma	1	3.3	3	12.5	4	7.4
Vitiligo	0	0	1	4.2	1	1.9
Infections	16	53.3	13	41.7	26	48.1
Tinea versicolor	2	6.7	0	0	2	3.7
Tinea pedis	9	30.0	6	25.0	15	27.8
Tinea, all other types	4	13.3	2	8.3	6	11.1
Onychomycosis[b]	12	40.0	5	20.8	17	31.5
Tumors	0	0	0	0	0	0
Hair disorders	2	6.7	0	0	2	3.7
Alopecia areata	1	3.3	0	0	1	1.9
Other hair loss	1	3.3	0	0	1	1.9
Trauma	1	3.3	1	4.2	2	3.7
Scars	1	3.3	0	0	1	1.9
Sunburn	0	0	1	4.2	1	1.9
Other	1	3.3	3	12.5	4	7.4
Other rash or inflammatory disease	1	3.3	2	8.3	3	5.6
Keratoderma (palmoplantar)	0	0	1	4.2	1	1.9

[a] $F = 2.866$, $p = 0.096$.
[b] $F = 3.584$, $p = 0.064$.

diagnosed. The difference in the prevalence of skin disease between the two camps only approaches statistical significance for two specific diagnoses: atopic dermatitis, and onychomycosis.

The five women from camp 2 all received diagnoses. They included melasma (dark patches on the face, 2 cases), xerosis (excessively dry skin, 1 case), tinea pedis (2 cases), onychomycosis (1 case), acne (1 case), and bug bites (1 case).

Differences in presence of any skin disease were not significant for camp or age, but were significant for education (table 3). The odds of having any skin disease were 80% lower among those with more than six years of education, in contrast to those with six or fewer years of education. There were no differences in the presence of inflammatory skin disease by camp, age, or education. Differences in presence of an infectious skin disease were not significant for camp or education, but those who were 28 years of age or older had 3.5 greater odds of having any infectious skin disease compared to those less than 28 years of age.

Table 3. Associations of any skin disease diagnosis, inflammatory skin disease diagnosis, and infectious skin disease diagnosis with participant camp, age, and education in 54 Latino male farmworkers, North Carolina, summer 2004.

Participant Characteristics	Any Skin Disease				Inflammatory Skin Diseases				Infectious Skin Disease			
	n	%	OR	95% CI	*n*	%	OR	95% CI	*n*	%	OR	95% CI
Camp												
1	20	66.7	0.4	0.1, 1.5	9	30.0	0.4	0.1, 1.3	16	53.3	1.6	0.5, 4.7
2	20	83.3	1.0		12	50.0	1.0		10	41.7	1.0	
Age (years)												
Less than 28	23	69.7	1.0		16	48.5	1.0		12	36.4	1.0	
28 or older	17	81.0	1.9	0.5, 6.9	5	23.8	0.3	0.1, 1.1	14	66.7	3.5	1.1, 11.1
Education (years)												
6 or fewer	25	86.2	1.0		13	44.8	1.0		17	58.6	1.0	
More than 6	15	60.0	0.2	0.1, 0.9	8	32.0	0.6	0.2, 1.8	9	36.0	0.4	0.1, 1.2

Conclusions

Skin disease is a common problem among farmworkers in North Carolina. A strength of this study is the determination of skin disease based on an exam by a board-certified dermatologist and not self-reported symptoms (McCurdy et al., 1989; Gamsky et al., 1992). Having the skin exam performed by a specialist allowed capture of all skin conditions that were present at the time of the exam. Over three-quarters of the study population was diagnosed with a skin disease. This is substantially higher than the rates previously reported (Arcury et al., 2003; Gamsky et al., 1992; McCurdy et al., 1989). The exam included the feet, which allowed identification of a large number of cases of onychomycosis and tinea pedis.

Infectious skin diseases, particularly fungal infections, were the most common diagnosis in this population. While these may not be a direct result of farm work, it is likely a result of the resources and living environment that accompany farm work. For example, at the time of the exam, many of the workers were noted to wear old high-top sneakers or work boots, often without socks. The socks of those who were wearing them were noted to be well-worn and stained. Some workers may have only one pair of shoes, as they were wearing work-type shoes when examined on a non-work day. Therefore, they likely do not change shoes or socks after a long sweaty workday, which provides a perfect environment (i.e., warm and moist) for the overgrowth of yeast and fungus. The workers must share shower facilities. While some farmworkers reported wearing shower shoes, it is not a universal practice (data from in-depth interviews conducted for this project). Other factors related to poor hygiene include crowded housing, limited access or poor-quality washing facilities, and limited access to stores for soaps and detergents (Housing Assistance Council, 2001; Early et al., 2006). In addition, some workers may be unaware of the nature or etiology of fungal infections and would then be unaware of prevention or treatment strategies; their knowledge was not assessed.

Contact dermatitis was present in 5.6% of the participants, which is higher than the 2% reported in studies by McCurdy et al. (1989) and Gamsky et al. (1992). But similar to McCurdy, differences in prevalence based on the type of crops harvested were not observed. The relation between contact dermatitis and farm work could be due to plants, chemicals, wet work, or other substances a worker comes in contact with throughout the workday or non-work hours. No skin exam was conducted by Arcury et al. (2003), which prevents comparison of contact dermatitis prevalence rates.

No statistically significant differences were found in skin disease between participants residing in the two camps, even though they harvested different crops and were visited during different times of the growing season. However, with the small size of our sample, we may have lacked the statistical power required to detect differences. Our results were similar to McCurdy et al. (1989), who found no differences in the comparison of grape and tomatoes harvesters. However, Gamsky et al. (1992) did find differences in the prevalence of contact dermatitis and lichenified hand dermatitis among grape workers compared to citrus and tomato workers. Arcury et al. (2003) found that harvesting blueberries was a significant risk factor for skin symptoms. Differences between the two camps in the prevalence of two conditions, atopic dermatitis and onychomycosis, did approach statistical significance.

There were differences in the odds of having any skin disease by education, and having an infectious skin disease by age. Those with more education were less likely to have any skin disease, while those who were older were more likely to have an infectious skin disease. Greater education might provide the individual with the knowledge to avoid the causes of a skin disease or to treat a skin disease. Greater age indicates longer tenure as a farmworker, and a greater chance to acquire an infectious disease. Infectious diseases, such as fungus, are particularly difficult to cure and are likely to become chronic.

This study should be considered in light of its limitations. One limitation is the potential for selection bias in that those willing to participate in a clinical study may over-represent workers with a skin problem. However, many of the workers from camp 2 who were diagnosed with a skin disease either did not report that they had a disease in the pre-exam interview or they reported that they had a different condition from what the dermatologist found. We cannot determine how well our sample represents the Latino farmworker population as a whole. However, the characteristics of the farmworkers who participated in this study are similar to the characteristics of farmworkers who have participated in other occupational health research in North Carolina (Arcury et al., 2001b, 2002). Another limitation is that a skin disease had to be present at the time of the exam in order to be reported. Transitory problems, including many forms of contact dermatitis, would be missed in an examination conducted on a non-work day. Finally, point prevalence estimates will always be lower than period prevalence estimates; thus, these data underestimate the occurrence of skin conditions over a growing season.

This study is the first to investigate the prevalence of skin disease diagnosed by a dermatologist among Latino farmworkers done outside California and only the second epidemiological study of migrant farmworker skin disease in over ten years. While large numbers of seasonal and migrant farmworkers are employed in the U.S. each year, the prevalence and predictors of injury and disease is understudied in this population. The results imply that skin disease is very common in this population and suggests that services to diagnose and treat such diseases should be made readily available. The results of this study will direct a larger study of North Carolina migrant farmworkers in which this research team will follow the workers over time during the growing season. This will help to further identify the prevalence of skin disease in migrant farmworkers and delineate more predictors in the development or exacerbation of skin disease. This may then lend itself to future education, prevention, and treatment strategies for the most common diseases that may influence their lives and ability to work.

Acknowledgement

This research was supported by Grant No. R01-ES012358 from the National Institute of Environmental Health Sciences. The authors greatly appreciate the assistance of the North Carolina Farmworkers Project, Benson, North Carolina, and Harvest Family Health Center, Elm City, North Carolina, in the completion of this study.

References

Arcury, T. A., S. A. Quandt, C. K. Austin, J. Preisser, and L. F. Cabrera. 1999. Implementation of U.S. EPA's Worker Protection Standard training for agricultural laborers: An evaluation using North Carolina Data. *Public Health Rep.* 114(5): 459-468.

Arcury, T. A., S. A. Quandt, and J. S. Preisser. 2001a. Predictors of illness incidence and prevalence of green tobacco sickness among Latino farmworkers in North Carolina, U.S.A. *J. Epidemiol. Comm. Health* 55(11): 818-824.

Arcury, T. A., S. A. Quandt, J. S. Pressier, and D. Norton. 2001b. The incidence of green tobacco sickness among Latino farmworkers. *J. Occup. Environ. Med.* 43(7): 601-609.

Arcury, T. A., S. A. Quandt, and G. B. Russell. 2002. Pesticide safety among farmworkers: Perceived risk and perceived control as factors reflecting environmental justice. *Environ. Health Perspect.* 110(suppl 2): 233-240.

Arcury, T. A., S. A. Quandt, and B. G. Mellen. 2003. An exploratory analysis of occupational skin disease among Latino migrant and seasonal farmworkers in North Carolina. *J. Agric. Safety and Health* 9(3): 221-232.

Austin, C., T. A. Arcury, S. A. Quandt, J. S. Preisser, R. M. Saavedra, and L. F. Cabrera. 2001. Training farmworkers about pesticide safety: Issues of control. *J. Health Care Poor Underserved* 12(2): 236-249.

Bureau of Labor Statistics. 2005. Occupational injuries and illnesses: Industry data (2003). Washington, D.C.: U.S. Department of Labor. Available at: www.bls.gov/iif/home.htm#data. Accessed 17 August 2005.

Carroll, D., R. M. Samardick, S. Bernard, S. Gabbard, and T. Hernandez. 2005. Findings from the National Agricultural Workers Survey (NAWS) 2001-2002: A demographic and employment profile of United States Farm Workers. Research Report No. 9. Washington, D.C.: U.S. Department of Labor.

Early, J., S. W. Davis, S. A. Quandt, P. Rao, B. M. Snively, and T. A. Arcury. 2006. Housing characteristics of farmworker families in North Carolina. *J. Immigrant Minority Health* 8(2): 173-184.

Gamsky, T. E., S. A. McCurdy, P. Wiggins, S. J. Samuels, B. Berman, and M. B. Shenker. 1992. Epidemiology of dermatitis among California farm workers. *J. Occup. Medicine* 34(3): 304-310.

Housing Assistance Council. 2001. No refuge from the fields: Findings from a survey of farmworker housing conditions in the United States. Washington, D.C: Housing Assistance Council.

HRSA. 1990. An atlas of state profiles which estimates number of migrant and seasonal workers and members of their families. Washington, D.C.: Health Resources and Services Administration.

McCurdy, S. A., P. Wiggins, M. B. Schenker, S. Munn, and A. M. Shaieb, et al. 1989. Assessing dermatitis in epidemiologic studies: Occupational skin disease among California grape and tomato harvesters. *American J. Ind. Medicine* 16(2): 147-157.

North Carolina Employment Security Commission. 2004. 2004 Estimate of Migrant and Seasonal Farmworkers During Peak Harvest by County. Raleigh, N.C.: North Carolina Employment Security Commission.

Sanchez, M. R. 2003. Cutaneous diseases in Latinos. *Dermatol. Clin.* 21(4): 689-697.

Villarejo, D. 2003. The health of U.S. hired farm workers. *Annu. Rev. Public Health* 24: 175-193.

Villarejo, D., and S. L. Baron. 1999. The occupational health status of hired farm workers. *Occup. Medicine: State of the Art Reviews* 14(3): 613-635.