

Self Report of Skin Problems Among Farmworkers in North Carolina

Quirina M. Vallejos, MPH,^{1*} Mark R. Schulz, PhD,² Sara A. Quandt, PhD,³
 Steven R. Feldman, MD, PhD,⁴ Leonardo Galvan,⁵ Amit Verma, MPH,²
 Alan B. Fleischer Jr., PhD,⁴ Stephen R. Rapp, PhD,⁶ and Thomas A. Arcury, PhD¹

Background *This study estimates the prevalence of self-reported skin problems among Latino farmworkers and identifies associated risk factors.*

Methods *The study used a longitudinal surveillance design. Participants were interviewed up to five times and reported skin problems and personal, work, and environment characteristics. Frequencies and counts were calculated for 13 skin problems. Adjusted odds ratios were obtained for six skin problems.*

Results *More than one-third of participants reported skin problems, including skin and nail fungus; sunburn; bumps, pimples, or acne; calluses; itching; rash; and insect bite. A variety of work and environment factors were associated with higher rates of skin problems. One of the strongest predictors was working in wet clothes or shoes.*

Conclusions *Programs are needed to educate farmworkers about measures they can take to decrease their risk of skin problems. Changes in work practices and personal protective equipment provided could help decrease the prevalence of skin problems.* Am. J. Ind. Med. 2008. © 2008 Wiley-Liss, Inc.

KEY WORDS: *acne; rash; work characteristics; occupational health; immigrant workers; Latino/Hispanic; minority health*

INTRODUCTION

Migrant and seasonal farmworkers are exposed to a variety of irritants and allergens that can cause skin problems,

including plants, biological agents, such as bacteria and fungi, and chemicals, such as pesticides, fertilizers, and petroleum products [Hogan and Lane, 1986; Lisi et al., 1987; Gamsky et al., 1992; McCurdy et al., 1989]. Farmworkers in the U.S. have high rates of skin diseases compared to workers from other industries. In 2004, workers in crop production had an incidence rate of 13.8 cases of skin diseases or disorders per 10,000 full-time workers, compared to rates of 3.7 and 7.4 for the industries of construction and manufacturing, respectively [Bureau of Labor Statistics, 2006]. The incidence of skin disease among farmworkers is likely to be higher than the Bureau of Labor Statistics data suggest because the data include only cases for which a report was filed [Azaroff et al., 2002, 2004].

Few studies have measured the actual prevalence of skin disease among migrant and seasonal farmworkers [Villarejo and Baron, 1999]. These studies document several physician diagnosed skin diseases including infectious diseases, pustular eruptions, eczematous rashes, facial acne, lichenified hand dermatitis, keratosis pilaris, and pigmentary disorders [McCurdy et al., 1989; Gamsky et al., 1992; Krejci-Manwaring et al., 2006]. Studies of self-reported skin

¹Department of Family and Community Medicine, Wake Forest University School of Medicine, Winston-Salem, North Carolina

²Department of Public Health Education, University of North Carolina at Greensboro, Greensboro, North Carolina

³Division of Public Health Sciences, Wake Forest University School of Medicine, Winston-Salem, North Carolina

⁴Department of Dermatology, Wake Forest University School of Medicine, Winston-Salem, North Carolina

⁵North Carolina Farmworkers Project, Benson, North Carolina

⁶Department of Psychiatry, Wake Forest University School of Medicine, Winston-Salem, North Carolina

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*Correspondence to: Quirina M. Vallejos, Department of Family and Community Medicine, Wake Forest University School of Medicine, Medical Center Boulevard, Winston-Salem, NC 27157-1084. E-mail: qvallejo@wfbumc.edu

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problems among farmworkers are limited to reports of rash and itching or burning. In a study of California farmworkers, 46% reported a rash lasting 2 or more days during the previous 3 months [McCurdy et al., 1989]. Gamsky et al. [1992] found that 11.9% of farmworkers reported a history of rash that lasted 2 or more days during the past year. Arcury et al. [2003] asked North Carolina farmworkers whether they had experienced itchy or burning skin or a rash during the 2 months prior to being interviewed. Workers were interviewed twice, once in early season and once in late season. Of the workers interviewed during early season, 24% reported itchy or burning skin or rash; the prevalence was 37% in late season [Arcury et al., 2003].

The prevalence of self-reported skin problems among farmworkers is of interest because the problems workers report are those that are bothersome to them. They are also the skin problems that workers are likely to self treat and for which they may seek medical treatment [Arcury et al., 2006]. Self-reported skin problems also have an impact on workers' quality of life. Individuals who report having a current skin problem have significantly lower health related quality of life compared to those who report no skin problem [Isacson et al., 2004].

Farmworkers have limited access to health services due to lack of health insurance, migration for work, language barriers, lack of transportation, and limited clinic hours [Littlefield and Stout, 1987; Lukes and Miller, 2002]. These barriers to accessing health services make treating skin problems difficult. Rather than seek medical care for skin problems, farmworkers tend to self-treat unless the illness affects the ability to work [Arcury et al., 2006]. Because farmworkers have limited access to health care, it is important to identify skin problems that are common among the population so efforts can be made to help farmworkers more effectively prevent and self-treat these problems.

This study estimates the prevalence of common self-reported skin problems among farmworkers, including fungal infections of the skin and nail; sunburn; bumps, pimples, or acne; calluses; itching; rash; insect bites; superficial wounds; warts; pigment change; blisters; and poison ivy. It also identifies factors associated with six self-reported skin problems, including personal, work, and environment characteristics.

MATERIALS AND METHODS

This study used a longitudinal surveillance design. Recruitment and data collection were scheduled at baseline and at four follow-up assessments approximately 3 weeks apart. Data collection began in May 2005 and ended in October 2005. The study recruited a total of 304 farmworkers from 45 residential sites and interviewed each participant up to five times, resulting in 1,048 data points.

Sampling

No census listing farmworkers in North Carolina exists. Therefore, 45 residential sites were randomly selected from lists of sites served the previous year by outreach staff from three cooperating clinics and service agencies (15 from each clinic or agency). A census was taken at each site in which residents gave preliminary consent to participate in the study. Farmworkers residing in each site were recruited from the census lists. Up to seven participants were recruited per residential site (sites often had fewer than seven residents). The sample after the first interview included 242 farmworkers. At the first through third follow-up interviews, 62 additional participants were recruited from the census lists to replace workers who had left the residential sites. A similar method has been used in previous farmworker health research [Arcury et al., 1999, 2001].

Data Collection

Data were collected by bilingual (Spanish, English) interviewers. A questionnaire, which included personal background questions for age, education, history of hay fever or asthma, and H2A visa (This is a guest worker program in which Mexican citizens are issued a temporary visa to work with a specific agricultural employer for a set period of time.), was administered at each interview. Questions related to work practices inquired about living conditions, crops worked, work tasks, clothing or protective equipment worn on each of the previous 7 days, and other possible risk factors encountered. Participants were also asked to indicate from a list of skin and other health problems those that they had experienced during the previous 7 days. The questionnaire and consent form were translated into Spanish by a professional translator familiar with Mexican Spanish and with the farmworker population in North Carolina. Prior to data collection, the questionnaire was pre-tested with farmworkers to ensure comprehension of all questions. Interviews were conducted in the participant's language of choice, which was Spanish in all cases.

Data collection procedures were approved by the Wake Forest University School of Medicine's Institutional Review Board. All participants gave signed informed consent and were given a copy of the consent forms. Participants received a cash incentive of ten dollars at each interview, and a hat with an occupational health message at the first interview.

Measures

The outcome measures for this analysis were the presence of thirteen self-reported skin problems including: (1) skin fungus (*hongos en los pies* and *hongos en la piel*); (2) sunburn (*quemadura del sol*); (3) bumps, pimples, or acne (*barros, espinillas, o acné*); (4) calluses (*callos*); (5) itching

(*comezón o quemazón/ardor*); (6) rash (*salpullido/sarpullido o ronchas*); (7) insect bite (*picadura de un animalito*); (8) nail fungus (*hongos en las uñas*); (9) superficial wounds (*llagas o heridas, cortaduras, and raspaduras/rozaduras*); (10) warts (*verrugas/mezquinos*); (11) spots or pigment change (*manchas/mal de pinto*); (12) blisters (*vejigas/ampollas*); and (13) poison ivy (*la hiedra*). Dichotomous measures of the presence of each outcome were constructed for each interview and across the season.

Predictors included personal, work, and environment characteristics. The data points were divided into six time periods based on the date of the interview; each participant appears only once in each period. Each time period covers approximately 3 weeks: Period 1 (5/29-6/19), Period 2 (6/20-7/10), Period 3 (7/11-7/31), Period 4 (8/01-8/21), Period 5 (8/22-9/11), and Period 6 (9/12-10/12). Personal characteristics included age (18–24, 25–30, 31–40, and 41 years and older) and a dichotomous measure of history of asthma or hay fever.

Measures of work and environment characteristics were based on participants' activities and experiences during the 7 days prior to each interview. Total hours worked was categorized into three levels (0–40, 41–55, and 56 or more hours). The characteristics worked with cucumbers, planted, cured tobacco (which includes the activities putting tobacco into barns to cure and baling cured tobacco), harvested, cultivated, topped tobacco (cut flowers off the top of the plant), worked in wet shoes or clothes, wore a rain suit, and worked in or next to fields with pesticide application are dichotomous measures of whether or not participants worked in these situations during the previous 7 days. Temperature represents the average temperature during the 7 days prior to the interview, as recorded at the weather station nearest to the residential site, and was divided into the categories 25°C or lower, 25.01–26.49°C, and 26.5°C or higher. The ultraviolet (UV) index is the amount of solar radiation expected to reach the earth when the sun is highest in the sky and can range from 0 to 16 [National Oceanic and Atmospheric Administration, 2006]. Higher index values represent stronger solar radiation. The UV index variable represents the average UV index for Raleigh, North Carolina, for the 7 days prior to the interview, divided into the categories low to moderate (0–6) and high (7–16).

Analysis

Prevalences of 13 skin problems were described with counts and frequencies for the season as a whole and for each time period. Dichotomous outcomes for skin fungus; sunburn; bumps, pimples, or acne; itching; rash; and nail fungus were modeled as a function of independent variables for personal, work, and environment characteristics with logistic regression. For each outcome, an initial model was constructed that included the covariates reported in Tables I and II. Each initial model was reduced to a final model by first identifying the one or two strongest predictors in the full

TABLE I. Personal Characteristics of Farmworkers, Eastern North Carolina, 2005 (N = 304)

Personal characteristics	n	%
Age		
18–24 years	79	26.0
25–30 years	69	22.7
31–40 years	104	34.2
41 years and older	52	17.1
Educational attainment		
0–6 years	184	60.5
7–9 years	85	28.0
10 or more years	35	11.5
H2A visa	191	62.8
Hay fever or asthma	44	14.5

model and then eliminating one by one covariates whose subtraction from the model did not change the association between the strongest predictor(s) and the outcome by more than 20%. The goal was to obtain the simplest final model that accurately described the association between the strongest predictor(s) and the particular self-reported skin problem. The regression coefficients (and their standard errors) in these multivariate logistic regression models were determined with the alternating logistic regressions estimation procedure to account for the typically correlated multiple observations from the same farmworker, as well as possibly correlated multiple observations from farmworkers employed at the same residential site [Cary et al., 1993]. Multivariate adjusted prevalence odds ratios (OR) and their 95% confidence intervals (CI) were determined in the usual way, via exponentiation of the log odds ratios from the multivariate logistic regressions. The magnitude of the clustering of the skin problem outcomes within farmworkers and between farmworkers within residential sites was estimated with pairwise odds ratios [Preisser et al., 2003]. The descriptive analyses used SPSS version 14.0 [SPSS, Inc., 2003] and the alternating logistic regressions used SAS version 9.1 [SAS Institute Inc., 2004].

RESULTS

The sample included 300 Hispanic men and four Hispanic women. Participant personal characteristics are described in Table I. Participant work and environment characteristics for each of the six time periods are described in Table II.

Prevalence

Skin fungus and sunburn were the two most commonly reported skin problems, each with a cumulative prevalence of 58.6% (Table III). Self-reported skin fungus increased from

TABLE II. Work and Environment Characteristics of Farmworkers by Data Collection Period, Eastern North Carolina, 2005

Work and environment characteristics	Period 1: 05/29 to 06/19 (N = 141)		Period 2: 06/20 to 07/10 (N = 187)		Period 3: 07/11 to 07/31 (N = 226)		Period 4: 08/01 to 08/21 (N = 199)		Period 5: 08/22 to 09/11 (N = 187)		Period 6: 09/12 to 10/12 (N = 95)	
	n	%	n	%	n	%	n	%	n	%	n	%
Total hours worked												
0–40 hr	53	37.6	52	27.8	41	18.1	72	36.2	44	23.5	19	20.0
41–55 hr	46	32.6	69	36.9	68	30.1	40	20.1	59	31.6	33	34.7
56 or more hours	42	29.8	66	35.3	117	51.8	87	43.7	84	44.9	43	45.3
Worked with cucumbers	0	0.0	49	26.2	15	6.6	1	0.5	0	0.0	0	0.0
Planted	37	26.2	30	16.0	12	5.3	6	3.0	0	0.0	0	0.0
Cured tobacco	0	0.0	0	0.0	32	14.2	78	39.2	118	63.1	39	41.1
Harvested	59	41.8	56	29.9	74	32.7	92	46.2	79	42.2	56	58.9
Cultivated	39	27.7	16	8.6	5	2.2	3	1.5	0	0.0	0	0.0
Topped tobacco	6	4.3	105	56.1	147	65.0	45	22.6	6	3.2	0	0.0
Worked in wet shoes or clothes	46	32.6	72	38.5	133	58.8	119	59.8	98	52.4	45	47.4
Wore rain suit	6	4.3	14	7.5	36	15.9	37	18.6	38	20.3	17	17.9
Worked in or next to field with pesticide application	27	19.1	64	34.2	93	41.2	32	16.1	10	5.3	5	5.3
Average temperature												
25°C or lower	57	45.6	20	10.7	0	0	0	0	53	28.3	46	48.4
25.01–26.49°C	68	54.4	147	78.6	118	52.2	179	89.9	119	63.6	44	46.3
26.5°C or higher	0	0	20	10.7	108	47.8	20	10.1	15	8.0	5	5.3
UV index												
Low to moderate	55	39.0	101	54.0	68	30.1	146	73.4	187	100.0	95	100.0
High	86	61.0	72	38.5	158	69.9	53	26.6	0	0	0	0
Missing ^a			14	7.5								

^aUV index data were unavailable for some of the dates about which interview data were collected.

TABLE III. Cumulative and Period Specific Prevalence of Reported Skin Problems Among Migrant Farmworkers

Skin problem or symptom	Cumulative prevalence ^a (N = 304)		Period 1: 05/29 to 06/19 (N = 141)		Period 2: 06/20 to 07/10 (N = 187)		Period 3: 07/11 to 07/31 (N = 226)		Period 4: 08/01 to 08/21 (N = 199)		Period 5: 08/22 to 09/11 (N = 187)		Period 6: 09/12 to 10/12 (N = 95)	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Skin fungus ^b	178	58.6	56	39.7	75	40.1	98	43.4	69	34.7	62	33.2	14	14.7
Sunburn	178	58.6	27	19.1	55	29.4	88	38.9	69	34.7	53	28.3	12	12.6
Bumps, pimples, or acne	147	48.4	55	39.0	61	32.6	65	28.8	36	18.1	40	21.4	16	16.8
Calluses	147	48.4	32	22.7	55	29.4	71	31.4	47	23.6	34	18.2	12	12.6
Itching	140	46.1	29	20.6	25	13.4	64	28.3	42	21.1	33	17.6	11	11.6
Rash	130	42.8	26	18.4	27	14.4	56	24.8	44	22.1	37	19.8	10	10.5
Insect bite	116	38.2	18	12.8	29	15.5	42	18.6	29	14.6	35	18.7	9	9.5
Nail fungus	110	36.2	36	25.5	32	17.1	53	23.5	36	18.1	37	19.8	11	11.6
Superficial wounds ^c	83	27.3	25	17.7	15	8.0	23	10.2	16	8.0	17	9.1	6	6.3
Warts	60	19.7	18	12.8	18	9.6	25	11.1	14	7.0	13	7.0	5	5.3
Spots/pigment change	49	16.1	8	5.7	10	5.3	20	8.8	11	5.5	10	5.3	5	5.3
Blisters	42	13.8	10	7.1	9	4.8	14	6.2	8	4.0	4	2.1	3	3.2
Poison ivy	32	10.5	12	8.5	10	5.3	11	4.9	5	2.5	3	1.6	1	1.1

^aNumber of people who reported the presence of the skin problem or symptom at least once.

^bIncludes questionnaire items "foot fungus" and "fungus on skin (but not on foot)".

^cIncludes questionnaire items "sores or wounds," "cuts," and "abrasions."

39.7% in Period 1 to 43.4% in Period 3 and then decreased to 14.7% in Period 6. Self-reported sunburn increased from 19.1% in Period 1 to 38.9% in Period 3 and then decreased to 12.6% in Period 6. Bumps, pimples, or acne and calluses were also common, with close to half of participants reporting their presence at some point during the agricultural season. Self-reported bumps, pimples, or acne decreased across the season from 39.0% in Period 1 to 16.8% in Period 6. Self-reported calluses increased from 22.7% in Period 1 to 31.4% in Period 3 and then decreased to 12.6% in Period 6.

Itching was a commonly reported problem, with 46.1% reporting itching at least once during the season. Itching fluctuated across the season with a high of 28.3% in Period 3 and a low of 11.6% in Period 6. Rash was reported by 42.8% of participants. Its prevalence decreased from Period 1 (18.4%) to Period 2 (14.4%) and then peaked in Period 3 at 24.8% before decreasing to 10.5% in Period 6. More than one-third (38.2%) of participants reported insect bites across the season; the prevalence was between 9% and 19% for each period. Fungal infection of the nails was reported by 36.2% of participants overall; period-specific prevalence fluctuated across the season with the highest prevalence (25.5%) in Period 1 and the lowest (11.6%) in Period 6. More than one-fourth (27.3%) of participants reported a superficial wound. The rate for each period was between 6% and 18%. Warts were reported by 19.7% of participants across the season; the rate was highest in Period 1 (12.8%), fluctuated across the season, and was lowest in Period 6 (5.3%).

Spots/pigment change were reported by 16.1% of participants with period-specific prevalence staying fairly steady at approximately 5% in all but Period 3, when it was 8.8%. Blisters were reported by 13.8% of participants; period-specific prevalence fluctuated across the season but stayed between 2.1% and 7.1%. Poison ivy was reported by 10.5% of participants, and its prevalence decreased across the season from 8.5% in Period 1 to 1.1% in Period 6.

Multivariate Analyses

Personal characteristics were associated with few skin problems. Age was inversely associated with bumps, pimples, or acne (Table IV). Those ages 31–40 (OR 0.35; 95% CI = 0.23, 0.54) and ages 41 and older (OR 0.12; 95% CI = 0.06, 0.22) had lower odds of reporting bumps, pimples, or acne compared to those ages 18–24. A reported history of hay fever or asthma was associated with rash; workers who reported such a history had an increased odds (OR 1.96; 95% CI = 1.31, 2.93) of reporting a rash.

Work and environment characteristics were associated with all of the reported skin problems. The total number of hours worked during the past 7 days was inversely associated with bumps, pimples, or acne. Those who worked 41–55 hr (OR 0.67; 95% CI = 0.50, 0.91) and those who worked 56 hr

or more (OR 0.43; 95% CI = 0.28, 0.66) had lower odds of reporting bumps, pimples, or acne. Having worked with cucumbers was positively associated with bumps, pimples, or acne and with itching. Those who worked with cucumbers had twice the odds of reporting bumps, pimples, or acne compared to workers who did not work with cucumbers. Cucumber workers had 2.6 times the odds of reporting itching (95% CI = 1.66, 4.08).

Specific tasks were also associated with skin problems. Workers who planted a crop had increased odds of reporting itching (OR 1.77; 95% CI = 1.11, 2.83) compared to those who did not plant any crops during the previous week. Curing tobacco was positively associated with reporting sunburn but negatively associated with bumps, pimples, or acne and with nail fungus. Workers who cured tobacco had 1.83 times the odds of reporting sunburn compared to workers who did not cure tobacco (95% CI = 1.15, 2.92). Those who cured tobacco had lower odds of reporting bumps, pimples, or acne (OR 0.53; 95% CI = 0.34, 0.85), and nail fungus (OR 0.69; 95% CI = 0.51, 0.94). The task of harvesting crops was associated with sunburn; those who harvested had 1.91 times the odds of reporting sunburn compared to workers who did not harvest any crops during the week prior to the interview. Cultivating crops was positively associated with itching. Farmworkers who cultivated a crop had a greater odds of reporting itching (OR 2.05; 95% CI = 1.04, 4.03) than those who did not cultivate. Workers who topped tobacco had an increased odds of reporting both skin fungus (OR 1.62; 95% CI = 1.22, 2.15) and sunburn (OR 1.87; 95% CI = 1.31, 2.67).

Work and environment characteristics such as the clothing worn, working wet, and working in or near fields to which pesticides had recently been applied or were being applied were also associated with reported skin problems. Those who reported working in wet clothes or shoes had increased odds of reporting bumps, pimples, or acne (OR 1.40; 95% CI = 1.03, 1.90); itching (OR 4.57; 95% CI = 3.08, 6.78); and rash (OR 2.63; 95% CI = 1.98, 3.50) compared to workers who did not work in wet clothes. Workers who wore a rain suit had increased odds of reporting sunburn (OR 1.95; 95% CI = 1.06, 3.60), itching (OR 2.77; 95% CI = 1.63, 4.74) and nail fungus (OR 1.57; 95% CI = 1.13, 2.17). Having worked in or next to a field with pesticide application was associated with sunburn. Workers who reported that they had worked in or next to a field with recent pesticide application had 2.17 times the odds of reporting sunburn (95% CI = 1.45, 3.25).

UV index was associated with four skin problems: skin fungus; sunburn; nail fungus; and bumps, pimples, or acne. When the UV index was low to moderate, workers had a lower odds of reporting skin fungus (OR 0.58; 95% CI = 0.42, 0.80); sunburn (OR 0.65; 95% CI = 0.46, 0.93); bumps, pimples, or acne (OR 0.68; 95% CI = 0.49, 0.95); and nail fungus (OR 0.73; 95% CI = 0.54, 0.99).

TABLE IV. Multivariate Alternating Logistic Models for Self-reported Skin Problems

Characteristics	Skin fungus		Sunburn		Bumps, pimples, or acne		Itching		Rash		Nail fungus	
	Odds ratio	95% CI	Odds ratio	95% CI	Odds ratio	95% CI	Odds ratio	95% CI	Odds ratio	95% CI	Odds ratio	95% CI
Personal												
Age (in years)												
18-24					1.00	—						
25-30					0.69	0.48, 1.01						
31-40					0.35	0.23, 0.54						
41 years and older					0.12	0.06, 0.22			1.96	1.31, 2.93		
Hay fever or asthma												
Work and environment												
Total hours worked												
0-40					1.00	—						
41-55					0.67	0.50, 0.91						
56 or more					0.43	0.28, 0.66						
Worked with cucumbers					2.00	1.22, 3.30		2.60	1.66, 4.08			
Planted								1.77	1.11, 2.83		0.69	0.51, 0.94
Cured tobacco			1.83	1.15, 2.92	0.53	0.34, 0.85						
Harvested			1.91	1.25, 2.93								
Cultivated							2.05	1.04, 4.03				
Topped tobacco			1.87	1.31, 2.67								
Worked in wet shoes or clothes			1.95	1.06, 3.60	1.40	1.03, 1.90		4.57	3.08, 6.78	2.63	1.98, 3.50	
Wore rain suit			2.17	1.45, 3.25				2.77	1.63, 4.74			1.57
Worked in or next to field with pesticide application												
UV index												
Low to moderate	0.58	0.42, 0.80	0.65	0.46, 0.93	0.68	0.49, 0.95					0.73	0.54, 0.99
High	1.00	—			1.00	—					1.00	—
Alpha 1 within person	3.20	1.99, 5.16	1.53	1.16, 2.02	4.93	3.52, 6.90		1.42	1.04, 1.94	2.96	2.02, 4.34	4.99, 16.31
Alpha 2 within residential site	1.54	1.27, 1.86	1.18	0.98, 1.42	1.81	1.28, 2.48		1.16	0.96, 1.40	1.14	0.92, 1.42	1.09, 1.65

All six skin problems were positively clustered within person. The estimated pairwise odds ratios relating the association between two observations from the same farmworker (alpha1) ranged from a weak positive association for itching (alpha1 1.42) to a strong positive association for nail fungus (alpha1 9.02). The skin problems were also positively clustered within residential site, but to a lesser extent. The estimated pairwise odds ratio relating two observations from the same residential site (alpha2) was greatest for bumps, pimples or acne (alpha2 1.81).

DISCUSSION

A large proportion of farmworkers are affected by various skin problems during a 5-month growing season in North Carolina. Approximately half of farmworkers reported each of the following skin problems: fungal infections of the skin; sunburn; bumps, pimples, or acne; calluses; and itching. More than one-third of farmworkers were affected by rash, insect bites, and fungal infections of the nails. These skin problems could impact workers' quality of life and, in severe cases, their ability to earn a living. Gaining a better understanding of the factors that are associated with these skin problems can aid in efforts to prevent and treat them. Risk factors that are related to work are of particular interest because these risk factors can be mediated through interventions to improve conditions.

The association of bumps, pimples, or acne and itching with working in cucumbers demonstrates the need for workers to wear protective clothing and equipment. Contact with the spines on cucumber plants is a physical cause of skin irritation and itching. Wearing gloves, a long sleeve shirt, and long pants would help limit the amount of contact workers' skin has with spiny plants. One way to increase the number of workers who wear gloves and long sleeves would be for employers to provide them with gloves and long sleeve shirts that breathe and wick away moisture.

Wet clothes or shoes may be associated with itching; rash; and bumps, pimples, or acne because wet clothes are likely to cling to the skin, resulting in irritation. It is also likely that farmworkers work in wet clothes on days when they are hot and sweat a lot; heat rash would be more likely on such days. Finally, when clothes are wet, pesticide residues on plants can more easily pass through the clothing and come into contact with the skin. Exposure to pesticides may be the cause of some of the cases of rash, bumps, and itching. If farmworkers were encouraged to bring an extra change of clothes with them to the field and allowed time to change clothes when they are wet, rashes, bumps, and itching might decrease.

The association of wearing a rain suit with itching highlights farmworkers' need for breathable, waterproof clothing that wicks away sweat. During the tobacco harvest, some workers wear rain suits in the morning when dew is on the tobacco to prevent their clothes from getting wet and to avoid

dermal absorption of nicotine, which can result in nicotine poisoning [Quandt et al., 2000]. The rain suits are usually rubber and do not breathe. Workers remove the suits once the dew evaporates, but temperatures are high even in the morning during July and August when tobacco is harvested. It is likely that workers would experience less skin irritation and itching if they were provided with rain suits that breathe because they would not get as hot and sweaty while wearing them.

The high prevalence of sunburn and its association with curing tobacco, harvesting, and topping tobacco, all of which are labor intensive tasks that involve working long days in the sun, suggest a need for educating workers about methods for protecting themselves from sun exposure. The majority of farmworkers are Latino and tend to have Fitzpatrick skin types III–V [Fitzpatrick, 1988]. People with darker skin types whose skin does not burn easily (types III through VI) have lower risk of skin cancer than those with fair skin that burns easily (types I or II) [Barbini et al., 1988; Andreassi et al., 1999]. That over half of our participants, despite having skin types that do not easily burn, reported sunburn shows that they are not accustomed to taking measures to protect their skin. The majority of farmworkers wear a hat while they work, but most wear a baseball cap rather than a wide brimmed hat [Salas et al., 2005]. Sunscreen and clothing that blocks UV rays are unfamiliar to this population. Although their skin type places them at low risk of skin cancer compared to people with fairer skin, working 8–14 hr in the sun every day for many years may increase farmworkers' risk of developing skin cancer. Educating farmworkers about the increased risk of skin cancer with increased sun exposure and methods for protecting their skin is likely to result in prevention of many cases of skin cancer in this population.

The moderate clustering of skin fungus and nail fungus among farmworkers within residential sites is consistent with the infectious nature of onychomycosis and tinea pedis, two of the most common superficial fungal diseases [Kemna and Elewski, 1996]. The communal housing typically available to migrant farmworkers is an environment that is conducive to the spread of infection. Bathrooms, bedrooms, and common areas are generally shared by many people, most of whom are men; it is uncommon for residential sites to have people who are assigned to cleaning tasks. The high prevalence of reported fungal infections is a concern because they are easily transmitted from person to person but are not easily cured. While a number of effective over the counter treatments exist for tinea pedis, effective treatment for onychomycosis involves costly prescription treatments that are not affordable for farmworkers who make little more than U.S. minimum wage and the majority of whom lack health insurance. Educating farmworkers on how fungal infections are spread and the importance of wearing shower shoes that are not shared with other workers would likely help decrease the rate of infection. Another potential intervention would be to give growers incentives for providing bathroom facilities

with surfaces that are easy to clean and making cleaning schedules in which residents take turns cleaning and sanitizing the bathrooms.

Three of the 13 predictors that were associated with skin problems were not directly related to work. The decrease in odds of bumps, pimples, or acne with age is consistent with standard medical models of acne prevalence [Schafer et al., 2001]. The association between rash and a history of hay fever or asthma is common among people with atopic conditions because they are more susceptible to allergic reactions to a variety of substances [Kanerva et al., 1997; Field, 1998; Paulsen et al., 1998]. The lower odds of sunburn with low to moderate UV index compared to high UV index is also expected because exposure to UV rays causes sunburns.

The variation in period-specific prevalence of some skin problems was consistent with the variation in prevalence of work characteristics with which they were strongly associated. The prevalence of both itching and rash was highest during Periods 3 (7/11-7/31) and 4 (08/01-08/21); these were also the periods when the highest percentage of workers reported working in wet clothes or shoes, which was the strongest predictor of both itching and rash. The prevalence of sunburn increased during periods 2 (6/20-07/10) through 5 (08/22-09/11), which were also the periods when topping, harvesting, and curing tobacco were most common.

The 42.8% cumulative prevalence of reported rash in this study is comparable to the 46% prevalence of reported history of rash within the past 3 months reported by McCurdy et al. [1989]. The 11.9% prevalence of reported history of rash during the past 12 months listed in Gamsky et al. [1992] is much lower than the prevalence in our study, despite the fact that it covers a longer time period. Recall error could account for this lower prevalence. Our overall prevalence represents the number of participants who reported a rash during the 7 days prior to the interview at any of the up to five interviews in which they participated. While this does not reflect every day in the 4-month period during which interviews were conducted, it is a measure of the prevalence during that time period that is less likely to be affected by recall error than the rates reported by Gamsky et al. [1992] and McCurdy et al. [1989]. The late season prevalence of 37% reporting rash during the past 2 months reported by Arcury et al. [2003] is lower than our reported prevalence. It is not appropriate to compare the early season prevalence because our rates do not measure rash at 2 months prior to the beginning of the season.

The Gamsky et al. [1992] study reports an association (OR 3.3) between reported rash and a history of hay fever, which is consistent with the association we identified. In contrast, McCurdy et al. [1989] reported no association between a history of atopy and report of rash.

The limitations of this study must be considered when reviewing the results. There is always a potential for recall error when people report problems or symptoms in the past. We attempted to minimize this error by limiting the period

over which we asked participants to recall their skin problems to the 7 days prior to the interview. Because we limited recall to 7 days and interviews were conducted every 3 weeks, it is possible we have missed some acute and rapidly resolving skin problems that were experienced between interviews. Because the associations we report are with prevalent rather than incident skin problems, we cannot be sure that the exposure preceded the skin problem. And finally, because the sample differed somewhat for each time period, we are not certain that the changes we report in prevalence across the season represent actual changes in prevalence among the study population; it is possible that they are attributable, in part, to changes in the farmworkers sampled each period.

This study also has important strengths. First, it provides the first report of prevalence of self reported skin problems, other than rash and itching or burning, among farmworkers. Second, the repeated measures design allowed us to capture the prevalence of skin problems across the agricultural season without relying on long term participant recall. The results of this study, therefore, are likely to be more accurate than those that have relied upon recall for a period of 2–12 months.

This study adds reports of prevalence and predictors for 11 skin problems to the existing literature. The majority of risk factors identified in this study are related to work and environment. Working long hours in the sun without using proper skin protection puts workers at increased risk of sunburn and potentially increases their risk of developing skin cancer. Performing job tasks that involve prolonged contact with plants and any pesticide residues that may remain on them, especially when working in wet clothes, puts workers at increased risk of bumps, pimples, or acne; itching; and rash. These results illustrate the need for programs that educate farmworkers about measures they can take to decrease their risk of skin problems and for policy changes that lead to improved work characteristics. Regulations that require improved sanitation in farmworker housing and the provision of sunscreen and personal protective equipment to limit dermal contact with plants and pesticide residues would also contribute to improved dermatological health of farmworkers.

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