## Latino Farmworker Perceptions of the Risk Factors for Occupational Skin Disease

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**Background** Farmworkers in the US constitute a medically underserved population at substantial risk for numerous environmental and occupational health problems. Most US farmworkers are Latino. Skin disease is one health problem to which farmworkers are particularly vulnerable. Interventions to reduce skin disease must be adapted to farmworkers' understanding of such disease, including their beliefs or knowledge of risk factors for skin disease.

**Methods** Structured by the Explanatory Models of Illness framework, this analysis uses a qualitative design based on in-depth interviews with 30 Latino farmworkers (6 females, 24 males) to determine beliefs and perceptions of the causes of common occupational skin diseases in this population. Computer assisted, systematic procedures are used to analyze the verbatim transcripts of these interviews.

**Results** *Skin disease is a major concern among farmworkers because it affects work, social interaction, and other aspects of their lives. Farmworker beliefs and perceptions of skin disease causation can be integrated into a general model in which perceived risk factors include sun and heat, chemicals, plants, insects, moisture, hygiene, and contagion. Each of these factors is moderated by the individual's personal susceptibility to that cause. The interaction or combination of two or more factors is thought to amplify their individual effects. Conclusions <i>The farmworker model of skin disease causation suggests important content for health education to reduce skin disease among farmworkers.* Am. J. Ind. Med. 49:434–442, 2006. © 2006 Wiley-Liss, Inc.

# KEY WORDS: skin disease; farmworkers; occupational health; agricultural health; health beliefs

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## INTRODUCTION

Over two-million migrant and seasonal farmworkers work in at least 42 of the 50 states in the US, as well as in several Canadian provinces. In 2002, 84% of migrant and seasonal farmworkers in the US self-identified as Latino and 75% of all farmworkers were born in Mexico [Carroll et al., 2005]. Farmworkers constitute a medically underserved population at substantial risk for numerous environmental and occupational health problems, as well as those health problems typically associated with poverty [Villarejo, 2003]. Farmworkers hold minimum wage jobs that seldom provide health insurance or workers' compensation, thus limiting workers' ability to obtain health care. While farmworkers

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have access to specific health care resources (e.g., Migrant Health Clinics) these cannot serve all seasonal and migrant farmworkers and their dependents.

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

Only three studies have measured the prevalence and predictors of OSD among farmworkers, but all show OSD is highly prevalent. Almost half (46%) of California grape and tomato workers reported a skin rash lasting 2 days or more within the past 3 months; however, few (19%) of these workers sought medical attention [McCurdy et al., 1989]. Another survey of California tomato, citrus, and grape farmworkers with a standard questionnaire and a physicianperformed "waist-up" skin examination found a range of conditions: pustular eruptions (27.1%), facial acne (17.4%), lichenified hand dermatitis (13.6%), keratosis pilaris (13.2%), conjunctival erythema (10%), paronychia (8.4%), excoriation of unclear etiology (8.2%), contact dermatitis (2.0%), and other eczematous rash (0.5%)[Gamsky et al., 1992]. Type of crop, being female, and history of hay fever were significantly associated with an increased prevalence of reported rash. In a survey of North Carolina farmworkers who harvested tobacco, cucumbers, tomatoes, and blueberries, 24% of workers in early season and 37% in late season reported itching or burning skin or skin rash during the previous 2 months [Arcury et al., 2003a]. Predictors of self-reported skin rash included blueberry work, not having a work contract, not showering after work, and age 25-34 years (vs. >34 years).

Investigations of farmworker perceptions, beliefs or knowledge of OSD have not been conducted. This research is essential to understanding farmworker health behavior related to skin disease and for improving the delivery of health education and health care to these workers. Several qualitative analyses that address Latino farmworker health beliefs in domains other than skin disease have been conducted and have served as the basis for interventions. These include analyses of workplace pesticide exposure beliefs [Quandt et al., 1998], residential pesticide exposure beliefs among women in farmworker families [Rao et al., in press], green tobacco sickness beliefs [Rao et al., 2002], and tuberculosis beliefs [Poss, 1998]. These studies have used the Explanatory Models of Illness for their analytical framework [Kleinman, 1980, 1988]. Analysts have also used the Explanatory Models of Illness framework in studies of grower beliefs about the exposure of farmworkers to pesticides [Rao et al., 2004] and to environmental nicotine [Arcury et al., 2003b].

Explanatory models (EMs) are the ideas individuals use to make sense of a condition or illness and to choose and evaluate possible treatment or prevention strategies [Kleinman, 1980, 1988]. EMs provide information on five aspects of illness: (a) etiology, (b) precipitating circumstances and mode of onset of symptoms, (c) an explanation of pathophysiology, (d) course of sickness and appropriate patient behavior, and (e) available treatments. People vary in the content of their EMs, which are usually only partly articulated and may be inconsistent or even self-contradictory. Individual models share common features to the extent that persons share a common cultural and social orientation [Rubel and Hass, 1995]. The five aspects of people's EMs of illness predispose persons to different health behaviors. The models of lay persons are often oriented to the significance of the condition to the patient or family, focusing on the social aspects of the sickness, including the ability to fulfill appropriate roles in the family (e.g., producing income) and community. For example, research on green tobacco sickness demonstrated that anorexia and insomnia, and consequent impaired work performance, were of greater concern to farmworkers than the nausea and dizziness identified by health care providers and growers as the most relevant symptoms [Rao et al., 2002]. EMs are usually a combination of both conscious and tacit knowledge, and they frequently differ substantially from established biomedical models.

This analysis uses a qualitative design to determine farmworker beliefs and perceptions of the causes of common OSD. The EM framework is particularly well-suited for exploring the beliefs and perceptions about OSD among Latino farmworkers. Because skin disease is a much more general domain than other health phenomena that have been investigated among Latino farmworkers, the present analysis focuses on only one component of Latino farmworker EMs of skin diseases, the risk factors or causes of these diseases. While the causes of skin disease are the focus of this analysis, mention is made of other components of farmworker skin disease EMs if needed to clarify the discussion.

#### MATERIALS AND METHODS

Seven or eight semi-structured in-depth interviews with 30 Latino farmworkers in North Carolina were conducted each month from May through August 2004. Interviews were spaced temporally to take into account the effects of the changing agricultural season on perceptions of OSD. Participants were recruited from several areas in western, central, and eastern North Carolina, with the assistance of health outreach workers who work with farmworker clinics, county health departments or service organizations in the different areas of the state. Efforts were made to recruit female as well as male workers, and to include individuals working in a variety of crops. Procedures were approved by the Wake Forest University School of Medicine Institutional Review Board.

Interviews lasting 45-90 min were conducted by two trained bilingual staff in the homes of the farmworkers. Respondents were first asked general open-ended questions about their experiences and beliefs about occupational skin problems. This section of the interview was designed to collect information on skin disease knowledge and beliefs structured by the EM framework [Kleinman, 1980, 1988]. Respondents were then presented with short vignettes describing situations workers might encounter while working and photos of skin problems that might result from these situations. Respondents were then asked to describe the cause and nature of the skin problem. Finally, respondents were presented with a series of 25 photos of skin problems and asked to name them and to discuss their causes. The skin problems were selected as those expected to be common among agricultural workers based on input from providers in farmworker clinics.

Interviews were transcribed verbatim and translated to English. The interviewers reviewed all translated transcripts for accuracy, and then the transcripts were entered into ATLAS.ti version 5.0 [Muhr and Friese, 2004] for analysis. The systematic analysis of the transcripts involved several steps. The investigators read all of the transcripts. A coding dictionary was developed based on this review. This dictionary included "Tags" divided into three domains, Signs and Symptoms, Causes, and Treatments, with specific tags for each of the major concepts and themes in each domain. Several of the concepts and themes reflect components of the EM framework; others arose from statements of the participants. The coding dictionary was tested on several transcripts, and modified to reflect problems and insights. Two investigators coded each transcript, with one completing the initial codes and a second reviewing the initial codes. All differences were resolved through discussion. For this analysis, transcript segments that were assigned the tags related to Causes were abstracted. Each of the sets of segments was reviewed and interpreted by the investigators for this analysis. Examples of quotations are reported to illustrate and support the interpretation. Quotations are labeled with respondent ID numbers, which start with F for females and M for males.

#### RESULTS

#### **Participant Characteristics**

Latino farmworkers in North Carolina are a diverse group with different backgrounds and potentially different exposures for skin disease (Table I). The in-depth interview participants included 6 women and 24 men. They ranged in **TABLE I.** Characteristics of North Carolina Farmworker In-Depth Interview Participants, N = 30

Participant characteristic	N	%
Gender		
Female	6	20.0
Male	24	80.0
Age (in years)		
18–29	11	36.7
30–39	12	40.0
40 and old	7	23.3
Counties		
Greene	7	23.3
Johnston	9	30.0
Nash	6	20.0
Surry	6	20.0
Wake	2	6.7
Crops <sup>a</sup>		
Tobacco	25	83.3
Sweet potatoes	6	20.0
Cucumbers	5	16.7
Peppers	2	6.7
Melons	2	6.7
Grapes	2	6.7
Other vegetables	3	10.0

<sup>a</sup>Percentages add to more than 100% because each participant could work in more than one crop.

age from 18 to 59, and came from 18 different Mexican states. All spoke Spanish; in addition, three spoke an indigenous language (2 Tarasco, 1 Mixteco). In 2004, they worked in five different counties with at least eight different commodities, with most working in tobacco, as well as sweet potatoes, cucumbers, and other vegetable and fruit crops.

### **Model of OSD Causation**

Latino farmworker beliefs and perceptions of OSD causation or risk factors are integrated into a general model (Fig. 1). There was overall agreement among the farmworkers on the major components of this model and of their inter-relationships. The model of OSD causation is complex, including several discreet causes as well as their interactions and combined effects. The major causes of OSD identified by farmworkers included sun and heat, chemicals, plants, insects, moisture, and hygiene-contagion. Each of these factors was believed to be moderated by the individual's allergy or personal susceptibility to that cause. While each of the individual factors was believed to be a cause of OSD, the interaction or combination of two or more factors was thought to increase their effects.



FIGURE 1. A general model of occupational skin disease causation for Latino farmworkers in North Carolina.

## Sun and Heat

Exposure to sun and heat while working was widely held among the farmworkers to cause several skin problems. These problems included color changes, such as redness, dark spots and light spots, burning, rash, itch, sores, and blisters.

This is an illness with a yellow color or it's the dark spots, which you get from the heat. ... That's from the heat and when the sun stops coming out so much, it goes away. No, it doesn't all go away, a little bit is left. You can't see it as much, but anyway, you have some left here and there. This is called dark spots (*paño*). (FI29:255)

That [rash] starts when you are working in the sun. That's what I think. That appears suddenly. You don't notice until you go to take a bath and change, but I think that they appear during the day, which is when you sweat more because there is a whole lot more heat. (MI27:233)

While most of the farmworkers discussed immediate effects of the sun and heat on the skin, long-term effects were seldom mentioned. For example, only three of the farmworkers mentioned cancer resulting from exposure to the sun. "... because a lot of people say that it [sun exposure] can cause skin cancer, but that if you protect yourself from the sun, it is not so easy for it to bother you" (MI06:267).

The effects of sun and heat are often amplified through exposure to other factors, including chemicals, plants, and moisture.

The sprays [pesticides] could affect you and that gets together with the sunburns. It's like it gets on your cheeks which, logically, gets the most sun. Notice that those spots were caused by the sun. And it also depends upon your job and if there are any sprays [pesticides]. And working in the fields depends upon the plants, carrying the buckets, and getting wet from what you are carrying. All of that can add up—the sunburns, the spray, and the water that might be there. (MI13:434)

Reaction to the sun and heat can be moderated in several ways. The first is to dress properly; wearing long-sleeve shirts and a hat. "When you like to wear just a T-shirt, you get burned and red because the sun burns" (MI10:208). Putting on creams and lotions can also protect against the sun. Finally, after a time, individuals become accustomed to working in the sun and heat. "... because a person is not used to the climate. So we change environments very quickly. Logically, sometimes, the skin gets irritated...." (MI09:828).

## Chemicals

All farmworkers have strongly held beliefs that pesticides and fertilizers cause skin problems.

For example, if I am harvesting or touching dirt that has liquids [pesticides] or fertilizers, it would be from that. For example, if I am harvesting, I could get harmed by touching it with the skin on my hand. And the green water from the leaves penetrates onto you or also the insecticide or fertilizer which the plant has on it could get on you and cause you to get calluses, dry the skin and leave you with spots. That is what causes that, but I wouldn't know what name to call this. (MI13:542)

Pesticides and fertilizers are believed to be omnipresent in the environment; therefore, farmworkers seldom mention their role in causing skin problems in isolation from other environmental factors. The effects of chemicals on the skin are believed to be magnified through their interaction with sun and heat, the plants to which they are applied, and their mixture with water. The mixture of pesticides with water on plants makes pesticides particularly toxic. Clothing can protect by keeping pesticides off the skin, but it can also expose the worker to pesticides and fertilizer when wet by holding the chemicals close to the body.

As I understand it there are many chemicals. They don't just spray one kind. There are some that are mixed together and that's what I think, most of the time, with the water on the tobacco, this is what causes rashes. ... And if they spray and later you go into the field they sprayed, that causes it, and the sun too. Well, the sun, the spray, and the water that's on the tobacco get on the skin, and that is what causes the rash. And from what they have told me and from what I've seen with people that it has happened to, that's what I think happens with that—more than any-thing the spray and a little bit of everything—a bit of sun and a bit of the spray.

#### Plants

Plants can cause skin problems through two mechanisms. First, chemicals in plants like tobacco and poison ivy can cause the skin to react. "The acid in the tobacco causes that to penetrate the skin and that is how that sickness is caused" (MI05:99). "... they got it because in the fields there is a lot [of poison ivy] on the edges of the fields. And when you go around there, pass by it, and step on it, you get it" (MI21:230). Second, contact with the plant structure, specifically spines, of crops such as cucumbers, squash,

watermelon, and tomatoes, irritates the skin. "During the squash harvest, I sometimes got a little bit of itching. It was like I would get covered with the spines (me aquataba), or dust would get on me, or something from the plant. I do not know if it was something from the plant. It caused a lot of itching, even on my neck. I felt it with the squash plant, with the squash plant, but not in the tobacco" (FI19:13). "I have seen women work there and they have scratches (raspadur*itas*) from the vines, because the cucumber vines are rough (áspera)" (MI01:253). The chemicals plants act in combination with other environmental factors to exacerbate these effects. "Because of the tobacco, by being wet by the tobacco. Yes, you are cutting and later, the plant is wet and it mixes with the pesticides and nicotine. And so it begins to accumulate here. It is pure poison that you accumulate here" (MI07:1006).

#### Insects

Discussion of insect bites as the cause of skin problems was limited. Workers did mention that the bites of mosquitoes, wasps, ants, spiders, and more exotic insects can cause skin irritation. "[W]hen you get bit by ants, you get little blisters (*vejiguitas*)" (FI14:532). Often more problematic than the actual bite are infections that result from scratching the bites.

Their bite causes itching. And at that time, you start to scratch and it gets infected (*se nos encona*). And since the sweat gets onto the mosquito bite and the body is hotter, the place where the mosquito bit us cooks and it gets infected. Notice that it is like a poison which when it gets wet, causes a greater effect on the skin. You could also say the same thing—like I just told you—it is because of the sweat and if a mosquito bites us it is contaminated with what they put on the plant. (M13:574)

In addition to bites from common insects, several of the farmworkers discussed the effects of exposure to insect urine on the skin. "It [a rash] looks like it is from animal urine. It looks like when some insect urinates on you. That is what happens when an insect urinates on you" (MI22:690). "This is from some little insects that excrete a liquid, which gives you bumps like that. Where we are from we call them *burras*. They get on you and excrete a liquid. And if you do not dry it off, you get those, but get rid of that with a swipe" (MI23:619).

#### Moisture

Getting wet from morning dew and from sweat, and occasionally from rain are common experiences among North Carolina's farmworkers. All farmworkers claim that getting and remaining wet are major factors in getting skin disease. Moisture or being wet alone can result in skin problems that include fungus, rashes, and itching.

[What causes fungus?] Moisture from when you get the soles of you feet wet. That's what I imagine. You get your feet wet every day and that's where that comes from. (FI14:452)

When I store it [tobacco]—which is during the harvest—you do have contact in the mornings because there is a lot of humidity and it's very wet. You get your body wet and you get a lot of rashes (*salpullidos*)—a lot of little bumps (*granitos*) which cause a lot itching (*comezón*). (MI08:14)

The belief that water acts as a conduit for other risk factors or amplifies the potency of other risk factors is universal among farmworkers, and a common theme throughout farmworker discussions of skin disease risk factors. Exposure to heat, pesticides, fertilizers, or the natural chemicals in plants like tobacco is magnified when the plants are wet and the water from the plants gets on skin. Heat and moisture together are believed to "cook" a person's feet, which causes fungus and cracks.

I haven't seen that problem with the peeling very often, but there are people who work a lot with tennis shoes-I mean in the tobacco. And since I've worked in the oranges and the tobacco, it's the same. You get wet with sweat from your head to your toes. And even if you're wet, you still have to work because you need the money. And a lot of the time, the water gets onto your feet. So then, the water runs down your pants and into your shoes. And that isn't clean water. It contains the spray [pesticide] that gets all over your body and then gets onto your feet. And since your feet are covered up, I think it's more likely that you will get an infection (infección) or an illness of the foot (enfermedad del pie). Besides that, since the feet are enclosed and wet without any air circulating, it gets more concentrated there. So the body gets dry faster-in two or three hours, and your feet don't. And if you wear wet shoes all day, it's easier for the spray to accumulate. And there is where all that-that you mentioned-comes from-where the skin is peeling and everything. (MI01:89)

The ways in which farmworkers can protect themselves from being wet are limited. Several workers mentioned wearing rain suits to reduce exposure to water on tobacco plants during harvest. Others mentioned changing into dry clothes or dry shoes and socks after the morning dew has evaporated. "Because, sometimes, when [my husband] comes home to eat, he comes home at 12:00. He comes home to eat and he changes his shoes and socks because he always has that problem" (FI02:148).

## Hygiene and Contagion

Personal and industrial hygiene are believed to be major factors in causing and preventing skin disease among farmworkers. Farm work is by its nature dirty and often wet. Poor personal hygiene, not having the time, the resources or the willingness to remove dirt and moisture during the work day or after work, and the infectious nature of some skin diseases are believed to be major skin disease risk factors.

... [I] never use socks, but if I put them on and tomorrow they are still clean, I will wear them again. And, sometimes, you get wet and you put those same wet socks on for one or two days. That can cause you to get an infection. The other thing is that you get your feet wet and you come home and you don't clean them. And you go around like that. And the fungus can come from that. You can also put on wet shoes or wet clothing. Like, right now, that we are working in the tobacco and we go around until noon very wet, our clothing dries off on our bodies. And since you have dirt on your body, that's where the dirt gets wet then dries off. And the fungus can come from that and also getting into dirty places, for example, getting into places in your bare feet that have a lot of mud. And the fungus can come from there. (MI16:322)

Beyond acknowledging that timely bathing is required to reduce skin disease, farmworkers discuss several other personal hygiene behaviors. First, several discuss the importance of applying "creams" to the skin after bathing to reduce drying and peeling.

Well, you get that when you have your skin really dry or tender (*blandita*). You get that from lack of hygiene, too, because you don't use cream or anything when you take a shower. You need to use cream because when you don't use cream you come out of the shower looking white like that, it causes peeling (*se despelleja*) because of lack of hygiene. For example, Don Jose's skin is white and if he doesn't put on cream or something, the sun burns him and his skin peels off (*se levantan los pellijitos*). You have to use something because that happens from bad hygiene. (MI10:136).

Second, the importance of properly laundering work clothes is a behavior that several farmworkers linked to skin problems. "Supposedly, it [rash] is from not washing your underwear and your work clothes well. You just go and wash them quickly and not too well" (MI26:73). Finally, scratching or even touching an affected area of the skin can spread a skin problem, such as poison ivy or blisters, or cause insect bites, poison ivy, and other problems to become infected. "Because the rash is like little bumps and they cause a lot of itching. And when he [person in photo] scratched, it would get irritated. He scratched a lot and irritated it. And so then, with the same sweat, I think it got infected. The sweat goes into the part where he was irritated and it began to get infected" (MI27:193).

Farmworkers also indicate that ignoring recommended hygiene behaviors at work, such as not washing hands, can cause skin disease. In particular, not wearing proper clothes for the work being done is often cited as a factor leading to skin problems. "Well, when you wear pants, you protect yourself and with your socks and shoes, too. But if you work in shorts, you do get the spines from the plants on you. There are people who are more delicate. They can get little blisters (*ampollitas*) with any little thing" (FI19:545).

Farmworkers understand that hygiene and contagion are factors in skin disease due to the conditions in which farmworkers often live. Farmworker housing is often crowded and poorly maintained. Workers also lack control over the unsanitary behaviors of the other workers with whom they live.

Well, talking about fungus, that's from lack of care, for example, with those of us who stay in the fields. There are several people who, or almost all of the people who have a sickness on their feet. It's our own fault because we don't even have sandals to take a shower in. We remove our shoes and take a bath just like that without sandals or anything. And there in the bathroom is where the sickness is. That's where you can get that sickness. That's why you get those fungi on your feet. In the bathroom and because there are also sons-of-bitches who like to take other people's shoes. And the person that took your shoes doesn't know if your feet are sick or not. Or if one day to be nice, you lend your sandals to someone else for a day or two, there you can get that sickness, which starts making you have itching over here. You can even bleed. That comes from carelessness. That doesn't come from work. In the bathroom is

where you get that sickness because you don't know how to take care of yourself. You get it from taking a shower barefooted. And that's where that sickness gets on your feet. (MI10:426)

## Allergy

The concept of allergy or of "being allergic" are prominent in farmworkers' discussions of the causes of skin disease. Individuals experience a skin problem when they are exposed to an agent, whether a chemical, a plant, or the sun, to which they are allergic. Those who are not allergic are protected from any reaction to that agent.

There are people who have blood that is, how do I say, very allergic blood. Allergic, and any weed or whatever that touches them—because as you know here on the job, they use a lot of chemicals and when the people—there are people who have good blood, there are people who are allergic these people with those allergies just brush by it, they start to get bumps, itching and all that. (MI10:104)

Not everyone is allergic or susceptible to a specific causal factor, and usually the individual participants claim that they are persons who are not susceptible.

[Foot fungus is] an allergy they have because the water is dirty and it stays there. That's why a lot of people get fungus on their feet. I hardly ever do. When I shower, I shower with sandals on, not barefoot, so that I won't get fungus. I'm not allergic, but I also don't want to take any risks because what happens is that you get fungus mostly in between your toes. That's where the fungus starts. People say that's where the fungus comes from. A lot of the time, that's why that happens, people shower without sandals. (MI23:385)

## **Combined Effects**

Farmworkers discussed the combined effects of several individual factors on the skin. Examples of these combined effects are included in the review of the individual factors. Figure 1 shows the degree to which the different individual risk factors work in combination. With the complex environment in which the farmworkers live and work, risk factors seldom act in isolation from other risk factors. Like tobacco. You know that they spray the tobacco a lot. Sometimes, we get there when the tobacco is wet. In the morning, you get there and the tobacco is wet and you don't cover yourself. I think that's the same thing. And later, if you don't shower at midday when you go to eat lunch, well, I think you need to shower at midday. ... Because of the same liquids [pesticides] that get on you—the wetness you get in the morning. When you shower and change your clothes, it's much better. (MI05:147)

#### DISCUSSION

Skin disease is a major concern among farmworkers because its symptoms, such as color, texture, and discomfort (itch, soreness, tenderness) are immediate and apparent to the individual and to others with whom they live. They indicate the presence of the problem and a susceptibility that is difficult to hide. Skin disease discomfort makes regular activities, such as work and sleep, difficult. Skin disease is an illness that farmworkers cannot ignore. They seek help in learning how to avoid and treat skin disease by discussing OSD among themselves. This leads to the high degree of shared knowledge and belief, and lends itself to the development of a complex model of skin disease causation.

Many components of the farmworkers' models of skin disease causation are similar to those of the biomedical model of skin disease, for example, roles of exposure to plants, pesticides, and sunlight, and the importance of hygiene and contagion. However, several components of the farmworkers' models of skin disease causation differ from those of allopathic medicine. For example, the farmworkers did not mention exposure to petroleum products as a cause of skin disease, although such exposure is a major risk factor for OSD [Cherry et al., 2000]. The farmworkers emphasize the concept of being allergic or personal susceptibility in their models of skin disease. While allopathic medicine also acknowledges allergy and individual differences in reaction to risk factors, the meaning of personal susceptibility is different for Latino farmworkers compared to physicians. For farmworkers, personal susceptibility is used to differentiate oneself from others, usually to show personal superiority. This meaning of personal susceptibility has also been encountered in other research examining farmworker beliefs about pesticide exposure and green tobacco sickness [Quandt et al., 1998; Rao et al., 2002]. This component of the model reflects the concept machismo, which is a widespread set of beliefs in Latino, particularly Mexican, society.

Within biomedicine, "skin disease" is a diverse set of conditions with different etiologies. In contrast, for farm-

workers' models of skin disease, the boundaries between specific conditions and their causes are blurred. The symptoms of the diseases, such as itch or texture, are more important than the specific condition. Different diseases are often grouped together due to the similarity of symptoms. The causes of these symptoms are often combined to reflect the reality that farmworkers face. They are always wet from rain, dew, or sweat; therefore, moisture is considered a component in the causes of most skin conditions.

Farmworkers do not acknowledge several skin diseases that should be of great concern given the risk factors to which they discuss being exposed. Foremost among these is skin cancer. However, cancer of any kind was only mentioned by three of the participants, and there was little elaboration in these discussions. Skin disease that does not have immediate symptoms is not included in the models held by these farmworkers. The lack of attention to long-term effects is similar to beliefs surrounding pesticide exposure among farmworkers in which immediate symptoms were emphasized and long-term effects are unknown [Quandt et al., 1998; Rao et al., in press].

This analysis informs occupational health practice and policy to reduce skin disease among farmworkers. Because the experience of many skin diseases among farmworkers is immediate and widespread, health education that is practical should be well received. Farmworkers believe hygiene is important to prevent skin disease. This knowledge should be emphasized in health education programs. The use of personal protection equipment, such as gloves, should also be emphasized. Regulations related to pesticide exposure and field sanitation for farmworkers have not been enforced [Arcury et al., 2001]. Housing conditions for most farmworkers are poor, often being crowded and lacking sufficient bathing and laundry facilities [HAC (Housing Assistance Council), 2001]. Enforcement of policies to reduce these exposures should accompany health education.

Several prominent beliefs need to be targeted in any intervention to reduce OSD. First, the notion that OSD affects only those who are susceptible needs to be dispelled because it allows any worker to believe he or she is not at risk. Second, delayed effects of some risk factors (e.g., sunlight exposure) need to be stressed.

This analysis has limitations similar to most qualitative studies. Caution must be used in generalizing due to the small sample and limited geographic area. However, the diversity of the sample (e.g., male and female respondents from 18 Mexican states working in a variety of crops) and the systematic analysis procedures increase confidence in the results. The use of qualitative methods is also a strength, as patterns of belief cannot be elicited with quantitative research techniques.

Skin disease is acknowledged by health care providers to be a major problem for farmworkers. However, there has been limited research investigating the prevalence of specific skin diseases or their causes in this population. This is the first analysis to examine the knowledge and perceptions of farmworkers about these skin diseases. Using a systematic qualitative design, this analysis shows that farmworkers have complex and widely shared EMs of skin disease. These results are important for informing public health practice and policy.

#### REFERENCES

Arcury TA, Quandt SA, Cravey AJ, Elmore RC, Russell GB. 2001. Farmworker reports of pesticide safety and sanitation in the work environment. Am J Ind Med 39:487–498.

Arcury TA, Quandt SA, Mellen BG. 2003a. An exploratory analysis of occupational skin disease among Latino migrant and seasonal farm-workers in North Carolina. J Agric Saf Health 9:221–232.

Arcury TA, Quandt SA, Simmons S. 2003b. Farmer health beliefs about an occupational illness that affects farmworkers: The case of green tobacco sickness. J Agric Saf Health 9:33–45.

Bureau of Labor Statistics. 2005. Bureau of Labor Statistics Data, Occupational Injuries and Illnesses: Industry Data for 2003, US Department of Labor. Available: http://www.bls.gov/iif/home.htm#data [accessed 17 August 2005].

Carroll D, Samardick RM, Bernard S, Gabbard S, Hernandez T. 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. U.S. Department of Labor.

Cherry N, Meyer JD, Adisesh A, Brooke R, Owen-Smith V, Swales C, Beck MH. 2000. Surveillance of occupational skin disease: EPIDERM and OPRA. Br J Dermatol 142:1128–1134.

Gamsky TE, McCurdy SA, Wiggins P, Samuels SJ, Berman B, Shenker MB. 1992. Epidemiology of dermatitis among California farm workers. J Occup Med 34:304–310.

HAC (Housing Assistance Council). 2001. No Refuge from the Fields: Findings from a Survey of Farmworker Housing Conditions in the United States. Washington, DC: Housing Assistance Council.

Kleinman A. 1980. Patients and healers in the context of culture. Berkeley: University of California Press.

Kleinman A. 1988. Illness narratives: Suffering, healing and the human condition. New York: Basic Press.

McCurdy SA, Wiggins P, Schenker MB, Munn S, Shaieb AM, Weinbaum Z, Goldsmith D, McGillis ST, Berman B, Samuels S. 1989. Assessing dermatitis in epidemiologic studies: Occupational skin disease among California grape and tomato harvesters. Am J Ind Med 16:147–157.

Muhr T, Friese S. 2004. User's Manual for ATLAS.ti 5.0, 2nd edition. Berlin, Germany: Scientific Software Development.

Poss JE. 1998. The meanings of tuberculosis for Mexican migrant farmworkers in the United States. Soc Sci Med 47:195–202.

Quandt SA, Arcury TA, Austin CK, Saavedra RM. 1998. Farmworker and farmer perceptions of farmworker agricultural chemical exposure in North Carolina. Hum Organ 57:359–368.

Rao P, Quandt SA, Arcury TA. 2002. Hispanic farmworker interpretations of green tobacco sickness. J Rural Health 18:503–511.

Rao P, Arcury TA, Quandt SA, Doran A. 2004. Growers' and extension agents' perceptions of farmworker pesticide exposure. Hum Organ 63:151–161.

Rao P, Quandt SA, Doran AM, Snively BM, Arcury TA. in press. Pesticides in the home of farmworkers: Latino mothers' perceptions of risk to their children's health. Health Educ Behav. In Press.

Rubel AJ, Hass MR. 1995. Ethnomedicine. In: Sargent CF, Johnson TM, editors. Anthropology: Contemporary theory and method. Medical Westport, CT: Praeger. p 113–130.

Villarejo D. 2003. The health of US hired farm workers. Annu Rev Public Health 24:175–193.

Villarejo D, Baron SL. 1999. The occupational health status of hired farm workers. Occup Med 14:613–635.