Dermatologist-diagnosed Skin Diseases among Immigrant Latino Poultry Processors and other Manual Workers in North Carolina, USA

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Abstract:

Background   Immigrant Latino workers represent an expanding workforce in rural areas of the USA, where their employment is concentrated in occupations such as poultry processing that entail chemical, infectious, and mechanical skin exposures. Occupation-related skin illnesses in this vulnerable population are not well characterized.

Objectives   This study was designed to describe the prevalences of skin diseases among immigrant Latino poultry processors and other manual workers in North Carolina.

Methods   Community-based sampling was used to recruit 742 immigrant Latino workers, 518 of whom underwent a physical examination supervised by a board-certified dermatologist. The presence or absence of skin disease on the face, neck, arms, hands, and feet was recorded.

Results   Workers ranged in age from 18 years to 68 years. Slightly over half of the sample were male (52.6%). Poultry workers represented 55.8% of the study sample. Infectious skin diseases were the most common diagnosis, present in 52.3% of workers. Inflammatory skin diseases were present in 28.2% and pigmentary disorders in 21.8% of workers. The most common skin conditions were tinea pedis (37.6%), onychomycosis (31.9%), scars (13.7%), acne (11.8%), and melasma (9.3%). Age, sex, first language, and work as a poultry processor accounted in part for the prevalence of these diseases.

Conclusions Several skin diseases are highly prevalent in immigrant Latino workers and may relate to work environment. These may impair the quality of life of these workers and predispose them to further illness.

Article:

Introduction

The skin is the biologically active barrier between the individual and the environment. Although the skin is designed to adjust to a wide range of external changes, environmental stressors may predispose skin to disease. Such exposures are a part of daily working conditions in a number of jobs. The US Bureau of Labor Statistics[1] reported that the incidence of skin disease resulting in missed work days among all private industry workers in 2009 was 2.9 per 10,000. Irritant contact dermatitis is the most common form of occupational skin disease and is estimated to constitute 70–80% of all occupation-related skin disorders.[2]

Latino populations have become the largest ethnic minority group in the USA.[3] The Latino workforce is growing rapidly as a result of immigration from Mexico and elsewhere in Latin America, expanding into "new settlement" communities that previously included few Latinos.[3] The southern USA, in particular, has experienced significant immigration. Latinos in these new settlement communities are concentrated in employment sectors that place them at high risk for occupational injuries and illnesses.[4] These sectors include poultry processing, in which immigrant Latinos represent the largest proportion by ethnic origin of the industry population of > 250,000 workers in the USA,[5] as well as the construction, farming, and hotel and food service sectors. The occupational hazards to which these workers are exposed include chemicals (such as pesticides and cleaning agents), extreme temperatures, humidity, long hours, and repetitive motion.[6]

Studies documenting skin disease in immigrant Latino workers have been largely limited to farmworkers. In a study of 304 farmworkers that employed a structured interview and a standard set of 10 digital photographs reviewed by a board-certified dermatologist, high levels of inflammatory skin disease (57.2%) and infectious skin disease (73.8%) were found.[7] A study of 79 farmworkers in the same area visiting a clinic for non-skin conditions found infectious and inflammatory skin diseases to be the most common types of disease, with the most frequent diagnoses being contact dermatitis (33.0%), melasma (12.7%), and tinea (defined as any dermatophytosis except onychomycosis, 12.7%).[8] A small study assessing skin conditions among 25 male Latino poultry workers found infections to be the most common ailments (onychomycosis, 76%; tinea pedis, 72%), followed by inflammatory diagnoses (acne or folliculitis, 64%).[6] Among workers in other manual occupations, such as butchery, fish processing, and construction, prevalences of skin disease have been high.[9–12] However, none of

these studies have shown the prevalence of skin disease among Latino immigrants. Few studies have looked at prevalences of dermatoses in poultry processing workers[6,13,14] and, of those, the majority have focused mainly on the prevalence of warts. Aside from the farmworker studies, there have been virtually no systematic examinations of occupational skin disease among Latino immigrants. Lack of such data prevents the development of evidence-based occupational health and safety interventions and prevents the identification of changes in work practices that prevent the occurrence of skin-related illness.

The purpose of this paper is to provide a description of the prevalence of skin diseases diagnosed by skin examination among immigrant Latino poultry workers and other manual workers in western North Carolina. The value of this study lies in its large size and its community sampling approach. The study focused on poultry workers because of their high frequency in the population,[5] self-report data suggesting high levels of skin injuries and illnesses were available, and workers in the poultry processing sector are known to be exposed to wet, cold conditions, animal meat and byproducts, and repetitive work.[6] We compared rates of skin disease in this group with rates in immigrant Latino non-poultry manual workers to distinguish the impact of poultry work from the background rate of skin disease in the immigrant Latino manual work force.

Materials and methods

Study design

The study was a cross-sectional survey to document the prevalences and predictors of selected occupational injuries and illnesses among Latino poultry and non-poultry manual workers. Data were collected in Burke, Surry, Wilkes, and Yadkin Counties in western North Carolina, which are "new settlement" areas for Hispanic/Latino residents in the USA.[3] The total population of the four counties is 272,331, and 19,310 (7.1%) residents are Hispanic.[15] Data collection, which occurred from June 2009 to November 2010, included an initial in-home interview and a subsequent physical examination.

Sampling

Community-based sampling was used to ensure that a representative sample would be selected.[16] A sample frame of 4376 dwellings likely to be inhabited by Latino immigrants was developed in collaboration with a community-based organization serving the local Latino population. Some dwellings were in known Latino enclaves; others were dispersed throughout the counties. The lists were enumerated and stratified, and specific dwellings were then randomly selected for potential recruitment to the study. Dwellings were selected so that approximately two thirds were in Latino enclaves, and one third were dispersed dwellings.

Recruitment

Well-known members of the Latino communities were hired as recruiters; two to four recruiters worked in each study county. Recruiters visited randomly selected dwellings, returning at different times and on different days if no-one was home. Residents were screened for inclusion criteria; they were required to self-identify as Latino or Hispanic, work $\geq$ 35 hours per week in a manual labor job, and to be aged $\geq$ 18 years. Manual labor jobs were defined as non-managerial jobs in poultry processing or industries such as landscaping, construction, restaurants, hotels, child care, or manufacturing. Non-poultry manual workers with previous work experience in poultry qualified only if their lifetime employment in poultry production or processing amounted to $\leq$ 6 months in total and had not occurred within the previous two years. Work in poultry processing was defined as any type of non-supervisory work in a poultry processing plant; job categories ranged from receipt of live chickens through to sanitation procedures and included hanging, killing, plucking, cutting, evisceration, wash-up, trimming, deboning, chilling, and packing tasks (for details on these tasks, see the Occupational Safety and Health Administration e-tool[17]). Employees of poultry production farms were excluded. More than one resident per dwelling could be recruited, if eligible. Of 1681 dwellings selected, 965 were screened, giving a screening rate of 57.4%. A total of 1526 residents were screened; 957 were eligible and, of these, 742 workers (77.5%) agreed to participate in the initial in-home interview, and 518 of those later attended a data collection clinic for a physical examination. The data collection clinics were held on seven Sundays evenly dispersed throughout the study period.

Data collection

The in-home interview was interviewer-administered. It included items on demographic information (i.e. age, country of origin, length of education, language preference) and current work characteristics. The physical examination included a skin examination, supervised by a Spanish-speaking, board-certified dermatologist. Signed informed consent was obtained from each of the participants; US$10 was given to the participant at the time of the in-home interview, and US$30 was given to the participant at the time of the physical examination. Participant recruitment and data collection procedures were approved by the Wake Forest School of Medicine Institutional Review Board.

Physical examination

The skin examination focused on the face, neck, arms, hands, and feet in order to capture the areas most at risk of occupational exposure. The presence or absence of disease was recorded for the following categories of disease: inflammatory diseases; pigmentary disorders; infections; malignant and pre-malignant tumors; and trauma. Specific occupational skin diseases referred to in the data collection instrument included folliculitis, atopic dermatitis, irritant and allergic contact dermatitis, onychomycosis, tinea pedis, tinea corporis, warts, and traumatic skin and nail lesions. Neither the sites nor the location of involvement were recorded except in the case of tinea, in which foot vs. other sites was recorded. An individual could have more than one specific diagnosis in a category. Completely benign disorders such as dermatofibroma, benign

nevi, keratosis pilaris, birthmarks, cysts, and hemangiomas (measuring < 1 cm), as well as androgenetic alopecia, were ignored.

Analysis

The objectives of the statistical analysis were to describe the prevalences of various skin diseases among immigrant Latino workers in North Carolina and to evaluate whether personal characteristics predict the presence of observed skin diseases. Descriptive statistics such as percentages and frequencies were calculated for discrete personal characteristics and the presence of various skin diseases. Bivariate associations between demographics and diseases of interest were examined using chi-squared tests or Fisher's exact tests. Dichotomous outcomes of skin diseases of interest (i.e. coded as 1 for the presence and 0 for the absence of disease) were modeled with multivariate logistic regression. Predictor variables in the models included gender, type of work (poultry workers, non-poultry workers), age (17–24 years, 25–30 years, 31–40 years, ≥ 41 years), length of education (0–6 years, 7–9 years, ≥ 10 years), and primary language spoken (indigenous, non-indigenous language). Adjusted odds ratios (AORs) and 95% confidence intervals (CIs) were estimated. Significance was accepted at a *P*-value of < 0.05, and all analyses were performed using sas Version 9.2 (SAS Institute, Inc., Cary, NC, USA).

Results

Poultry workers represented 55.8% of the sample (Table 1). Participants ranged in age from 18 years to 68 years (mean ± standard deviation [SD] 33.8 ± 10.2 years). Almost three quarters of participants (73.9%) were aged ≤ 40 years. Slightly over half (54.6%) were male. Over half (58.3%) had ≤ 6 years of education; 21.0% spoke a non-Spanish indigenous language as a primary language. Most of these languages were Mayan languages spoken in southern Mexico and Guatemala.

Table 1. Characteristics of the study sample (n = 518)

Characteristic	*n* (%)
Type of work	
Poultry processing	289 (55.8)
Other manual work	229 (44.2)
Age, years	
18–24	85 (16.4)
25–30	126 (24.3)

31–40	172 (33.2)
≥41	135 (26.1)
Sex	
Female	235 (45.4)
Male	283 (54.6)
Length of education, years	
0–6	302 (58.3)
7–9	121 (23.4)
≥10	95 (18.3)
First language spoken	
Non-indigenous language	404 (78.0)
Indigenous language	109 (21.0)

Infectious skin diseases were the most common diagnosis, present in 52.3% of participants. Inflammatory skin diseases were present in 28.2% and pigmentary disorders in 21.8% (Table 2). Overall, the 10 most common skin conditions were tinea pedis (37.6%), onychomycosis (31.9%), scars (13.7%), acne (11.8%), melasma (9.3%), post-inflammatory changes (8.5%), contact dermatitis (8.1%), acanthosis nigricans (6.6%), callus (5.4%), and folliculitis (4.1%).

Table 2. Most prevalent skin conditions in immigrant Latino workers in North Carolina (n = 518)

Skin disease	*n* (%)
Infections	
Any infection	271 (52.3)
Tinea pedis	195 (37.6)
Onychomycosis	165 (31.9)
Warts	17 (3.3)

Tinea (all other types)	8 (1.5)
Tinea versicolor	6 (1.2)
Inflammatory diseases	
Any inflammatory disease	146 (28.2)
Acne	61 (11.8)
Contact dermatitis	42 (8.1)
Folliculitis	21 (4.1)
Atopic dermatitis	20 (3.9)
Seborrheic dermatitis	8 (1.5)
Stasis dermatitis	7 (1.4)
Pigmentary disorders	
Any pigmentary disorder	113 (21.8)
Melasma	48 (9.3)
Post-inflammatory changes	44 (8.5)
Acanthosis nigricans	34 (6.6)
Trauma	
Any trauma	95 (18.3)
Scars	71 (13.7)
Traumatic skin lesion	15 (2.9)
Traumatic nail lesion	13 (2.5)
Others	
Callus	28 (5.4)

Bivariate analyses found tinea pedis was not associated with poultry work (Table 3). However, tinea pedis was associated with male gender, lower levels of education, and speaking an indigenous language. Onychomycosis was associated with poultry processing (62.4% vs. 37.6%). It was also associated with older age, male gender, and speaking an indigenous

language. Acne was not associated with poultry processing but was associated with younger age, longer education, and speaking a non-indigenous language. Melasma was associated with poultry processing (72.9% vs. 27.1%). It was also associated with female gender.

Table 3. Bivariate associations between skin conditions and personal characteristics (*n* = 518)

Characteristic	Total sample *n* (%)	Tinea pedis		Onychomycosis		Acne		Melasma	
		n (%)	*P*-value[a]	*n* (%)	*P*-value[a]	*n* (%)	*P*-value[a]	*n* (%)	*P*-value[a]
Type of work			0.389		0.031		0.103		0.011
Poultry processing	289 (55.8)	113 (57.9)		103 (62.4)		28 (45.9)		35 (72.9)	
Other manual work	229 (44.2)	82 (42.0)		62 (37.6)		33 (54.1)		13 (27.1)	
Age, years			0.234		0.039		<0.001		0.135
18–24	85 (16.4)	24 (12.3)		16 (9.7)		22 (36.1)		5 (10.4)	
25–30	126 (24.3)	52 (26.7)		45 (27.3)		19 (31.2)		11 (22.9)	
31–40	172 (33.2)	67 (34.4)		59 (35.8)		16 (26.2)		13 (27.1)	
≥41	135 (26.1)	52 (26.7)		45 (27.3)		4 (6.6)		19 (39.6)	
Sex			<0.001		<0.001		0.082		0.005
Male	283 (54.6)	139 (71.3)		108 (65.5)		27 (44.3)		17 (35.4)	
Female	235 (45.4)	56 (28.7)		57 (34.5)		34 (55.7)		31 (64.6)	
Education, years			0.010		0.244		<0.001		0.403
0–6	302 (58.3)	127 (65.1)		103 (62.4)		22 (36.1)		32 (66.7)	

7–9	121 (23.4)	44 (22.6)		38 (23.0)		17 (27.9)		8 (16.7)	
≥10	95 (18.3)	24 (12.3)		24 (14.6)		22 (36.1)		8 (16.7)	
First language			<0.001		<0.001		0.009		0.721
Indigenous	109 (21.2)	57 (29.4)		53 (32.5)		5 (8.3)		9 (19.1)	
Non-indigenous	404 (78.8)	137 (70.6)		110 (67.5)		55 (91.7)		38 (80.9)	

[a]*P*-values from Fisher's exact test are reported when cell frequency < 6.

The overall results of multivariate logistic regression analyses did not differ from those of bivariate analyses except that education was no longer a significant predictor of any skin condition (Table 4). Men were almost three times as likely as women (OR 2.96, 95% CI 2.0–4.4) and indigenous language speakers were almost twice as likely as non-indigenous language speakers (OR 1.86, 95% CI 1.1–3.0) to have tinea pedis ($P = 0.0124$). The odds of having onychomycosis were slightly higher for poultry processing workers (OR 1.52, 95% CI 1.1–2.3), males (OR 1.76, 95% CI 1.2–2.6), and moderately higher for indigenous language speakers (OR 2.82, 95% CI 1.7–4.6) but lower for workers aged 18–24 years (OR 0.35, 95% CI 0.2–0.7). Participants aged 17–24 years were almost 13 times more likely to have acne (OR 12.95, 95% CI 4.1–40.9), whereas participants who spoke an indigenous language were less likely to have acne (OR 0.26, 95% CI 0.1–0.7). Melasma was twice as likely to occur in poultry workers (OR 2.03, 95% CI 1.0–4.0) than in non-poultry workers and was less likely to occur in men (OR 0.43, 95% CI 0.2–0.8) than in women.

Table 4. Multivariate logistic regression analysis for selected conditions

Characteristic	Tinea pedis OR[b] (95% CI)	*P*-value	Onychomycosis OR[b] (95% CI)	*P*-value	Acne OR[b] (95% CI)	*P*-value	Melasma OR[b] (95% CI)	*P*-value
Type of work								
Poultry processing	1.14 (0.8–1.7)	0.5170	1.52 (1.1–2.3)	0.0407	0.97 (0.5–1.7)	0.9157	2.03 (1.0–4.0)	0.0420

Other manual work[a]								
Age, years		3 d.f.,$P = 0.1550$		3 d.f.,$P = 0.0146$		3 d.f.,$P < 0.0001$		3 d.f.,$P = 0.3532$
18–24	0.54 (0.3–1.03)	0.0231	0.35 (0.2–0.7)	0.0013	12.95 (4.1–40.9)	< 0.0001	0.44 (0.1–1.3)	0.3341
25–30	1.06 (0.6–1.8)	0.2603	0.91 (0.5–1.6)	0.9657	6.60 (2.1–20.6)	0.0487	0.62 (0.3–1.5)	0.9830
31–40	1.01 (0.6–1.7)	0.3467	1.00 (0.6–1.7)	0.0757	3.01 (1.0–9.4)	0.2739	0.57 (0.3–1.2)	0.7300
≥ 41[a]					18			
Sex								
Male	2.96 (2.0–4.4)	< 0.0001	1.76 (1.2–2.6)	0.0059	0.67 (0.4–1.2)	0.1785	0.43 (0.2–0.8)	0.0100
Female[a]								
Education, years		2 d.f.,$P = 0.2049$		2 d.f.,$P = 0.9416$		2 d.f.,$P = 0.0517$		2 d.f.,$P = 0.7355$
0–6[a]								
7–9	0.78 (0.5–1.3)	0.9652	1.09 (0.7–1.8)	0.7460	1.69 (0.8–3.5)	0.7899	0.72 (0.3–1.7)	0.5849
≥ 10	0.62 (0.4–1.1)	0.2003	1.01 (0.6–1.8)	0.9023	2.38 (1.2–4.8)	0.0645	0.84 (0.4–2.0)	0.9720

Language								
Indigenous	1.86 (1.1–3.0)	0.0124	2.82 (1.7–4.6)	< 0.0001	0.26 (0.1–0.7)	0.0084	1.04 (0.4–2.4)	0.9252
Non-indigenous[a]								

[a]Reference category
[b]Odds ratio adjusted for all other predictors
OR, odds ratio; 95% CI, 95% confidence interval; d.f. degrees of freedom.

Discussion

Skin disease is common among all immigrant Latino workers in western North Carolina. Most of the workers examined had infectious diseases, inflammatory diseases, or pigmentary disorders. Tinea pedis, onychomycosis, acne, and melasma were the most commonly diagnosed conditions. Of these, incidences of onychomycosis and melasma were 1.5 and 2.0 times higher, respectively, in poultry processing workers than in other Latino manual workers.

The reason for excess onychomycosis in poultry workers is not clear. The higher frequency of fungal nail infection may be related to factors particular to poultry. Poultry workers are often exposed to work environments that are cold or hot and humid and which require the use of occlusive footwear that may cause fungal nail infection. However, no relationship with type of work was found for tinea pedis. This may reflect overall poor and crowded living conditions in this economically disadvantaged population. We found age to be a protective factor against onychomycosis in individuals aged 17–24 years compared with those aged ≥ 41 years. Age is a well-recognized risk factor for onychomycosis because of slower rates of nail growth, cumulative trauma and microtrauma to the nail, and the greater likelihood of peripheral vascular disease in older adults.[18] The odds of having onychomycosis were 1.76 times higher for men than for women. Male gender has been associated with higher risk as a result of more trauma to the nail (e.g. from sports activities) and the more common use of occlusive footwear. The role of progesterone and related steroids as protective factors has also been proposed.[18,19]

The finding of an increased risk for melasma in poultry workers is also unexplained. Melasma was more common among women, which is in line with reports in the literature.[20–26] Unlike in our previous study, which used a small convenience sample of male poultry workers,[27] melasma was not associated with indigenous language, a possible proxy for Native American ancestry. The same previous study[27] suggested that artificial sources of light used in factories may play a role in this hyperpigmentation. Because environmental factors are more homogeneous among poultry workers, their link to the occurrence of melasma should be further investigated. Our

previous research shows that melasma, at least in men, is associated with decreased quality of life.[27]

It is difficult to compare the overall levels of skin disease observed in this study with the findings of previous research among Latinos in the USA because data sources and research designs differ. For example, Sanchez[24] reported that the most commonly observed conditions in the US Latino population were acne vulgaris (12.3%), eczema (20.1%), warts/condyloma (17.5%), and fungal infections (9.3%). However, these findings were obtained in a dermatology clinic setting, whereas our results reflect population-based sampling.

We found a lower frequency of contact dermatitis than might be expected among manual workers. Because the physical examinations were all conducted on a Sunday, some workers may not have been exposed to work conditions for > 24 hours. This may explain the relatively low level of contact and atopic dermatitis apparent in the study. Other possibilities include the healthy worker effect that emerges when workers with severe involvement drop out of these occupations.[28] Workers with less sensitivity may have developed resistance or strategies for avoiding exposures or controlling their impact.

The most common dermatological conditions in our sample were tinea pedis (37.6%) and onychomycosis (31.9%). Prevalences of tinea pedis and onychomycosis have been assessed in the general population in different countries. However, the results vary depending on the population studied, the sample size, the type of clinical assessment (medical examination vs. self-diagnosis), and microbiological studies (identification of the responsible pathogen vs. no microbiological examination). Prevalences vary from 2.1 to 12% for onychomycosis and from 3.8% to 61% for tinea pedis.[29–32] Data reviewed and summarized for the professional dermatological association in the USA indicate that onychomycosis affects 12% of the US population.[32]

Skin disease is common in the general population as well as in immigrant Latino workers in North Carolina.[19,24] The conditions recorded in this cohort are similar to those that appear in the general population, such as acne and tinea pedis. Melasma is also known to be prevalent in Latino populations.[24] Acne, as expected, was more common among the younger group of workers but also less frequent in the group with an indigenous first language.

The results of this study should be interpreted in the light of its limitations. Diagnoses were based on physical examination alone. The diagnoses of fungal skin and nail infections were not confirmed by either potassium hydroxide-treated scrapings or fungal culture. This limitation was required as a trade-off for obtaining a large sample size and as a result of the difficulty of recruiting this population. The physical examination focused on the head, neck, arms, hands, and feet and did not include a whole-body skin examination. The latter might have revealed additional skin conditions. However, the areas examined are those that are most likely to exhibit effects of occupational exposures. However, the study has several strengths. Data were gathered

by direct physical examination supervised by a board-certified, Spanish-speaking dermatologist. This ensured appropriate diagnoses, as well as the ability to query study participants for additional information concerning their skin conditions. Although a sizable proportion of the sample reported speaking an indigenous language, all participants knew enough Spanish to be examined and interviewed in that language. The sample size was large, and participants were enrolled without regard to skin conditions. Data were obtained from a sample recruited using a strategy designed to enumerate and recruit a sample representative of a population that is difficult to reach. Both of these aspects of the sample make this study unique among investigations into occurrences of occupational skin disease, providing a future basis for studies that might incorporate greater use of laboratory testing.

The novel results of this study suggest that this understudied, inaccessible population should be monitored for fungal skin and nail infections of the feet. These infections can predispose to more serious infections, particularly in individuals with diabetes, a condition that is common in the Latino population in the USA.[33] Evaluation of the sanitary and living conditions of these economically disadvantaged populations may also be needed, as well as further research on possible educational and engineering measures to reduce prevalences of these conditions. Findings from such research may indicate the need for intervention.

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