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ORIGINAL PAPER

"*…you earn money by suffering pain*:" Beliefs About Carpal Tunnel Syndrome Among Latino Poultry Processing Workers

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Abstract The nature of poultry processing puts workers at risk for developing neurological injuries, particularly carpal tunnel syndrome (CTS). Many poultry processing workers are Latino immigrants. This qualitative analysis uses an explanatory models of illness (EMs) framework to describe immigrant Latino poultry processing workers' (Guatemalan and Mexican) beliefs of CTS. Understanding these workers' CTS EMs provides a foundation for recommendations to reduce the risk factors for this occupational injury. In-depth interviews were completed with 15 poultry processing workers diagnosed with CTS. Systematic qualitative analysis was used to delineate beliefs about causes, symptoms, physiology, treatments, quality-of-life and health implications of CTS. Participants' EMs largely reflect current biomedical understanding of CTS. These EMs are similar for Guatemalan and Mexican workers. Beliefs about causes include factors in the work environment (e.g., repetition, cold) and individual physical weakness. Treatments include over-the-counter medicine, as well as traditional remedies. Most know the future impact of CTS will include chronic pain. These workers know what causes CTS and that curing it would require quitting their jobs, but feel that they must endure CTS to support their families. Latino poultry processing workers, whether Guatemalan or Mexican, have a fairly complete understanding of what causes CTS, how to treat it, and what they must do to cure it. However, situational factors force them to endure CTS. Policy changes are needed to change the structure of work in poultry processing, particularly line speed and break frequency, if the prevalence of CTS is to be reduced.

Keywords Immigrant workers · Health beliefs · Latinos · Minority health

Introduction

The per capita consumption of chicken in the United States has increased from 33.7 pounds in 1965 to 81.8 pounds in 2012 [1]. The poultry industry has established processing facilities in rural communities that are vertically integrated and mechanized to meet the high demand for chicken [2–4]. The majority of US chicken processing is now located in the South, including North Carolina [2]. Mechanization has led to great production line speeds, with potential impacts on worker health [5, 6]. Every 2 s during an 8–10 h work day, poultry processing workers must complete their assigned task to hang, cut, eviscerate, trim, debone, or pack chicken [6]. The repetitive nature of the work puts these workers at risk for developing neurological injuries, particularly carpal tunnel syndrome (CTS) [7]. CTS results from chronic compression of the median nerve as it passes through the rigid carpal tunnel in the wrist [8]. The common symptoms for CTS are numbness, tingling, and pain in the palmar and lateral aspects of the hand; weakness of hand muscles may occur as the condition progresses.

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The poultry processing industry employs a large number of Latin American immigrants [5, 7, 9]. These are vulnerable workers who are often recent immigrants without documents, with limited education and English language proficiency. They rarely advocate for their rights due to language barriers, lack of knowledge of these rights, and a fear of being deported. In western North Carolina, the majority of poultry workers are from Mexico and Guatemala. Cartwright et al. [10] report that the prevalence of CTS among immigrant Latino poultry processing workers (8.7 %) is greater than that among other immigrant Latino manual workers (4.0 %). This compares to a CTS rate in the general US population of 3.1 % [11].

Explanatory models of illness (EMs) [12, 13] provide a conceptual framework for understanding worker beliefs about an occupational injury and illness. This approach has been used in analyses of Latino farmworker beliefs about pesticide exposure [14], residential pesticide exposure beliefs among Latino women in farmworker families [15], green tobacco sickness among Latino farmworkers [16], and occupational skin disease among Latino farmworkers [17]. EMs have provided the framework for analyses of pesticide beliefs among American farmers and extension agents [14, 18]. An EMs approach has been used in investigating beliefs about chronic conditions common among Latino immigrant workers, such as tuberculosis [19], and diabetes [20].

The EMs framework is based on the idea that individuals make sense of a condition or illness in the context of their knowledge and experience, and based on this understanding choose and evaluate possible treatment or prevention strategies [12, 13]. EMs address different aspects of illness, including: name, causes, symptoms, physiology, treatments, and health consequences. EMs may be only partly articulated, inconsistent and even self-contradictory. Individual EMs can vary in content. To the extent that individuals' EMs involve shared beliefs, these persons share a common cultural and social orientation [21]. The aspects of people's EMs of illness predispose them to different health behaviors.

The EMs 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. These lay EMs may overlap with the EMs of health professionals, but differences generally exist between lay and professional EMs. For example, the green tobacco sickness EMs of Latino farmworkers emphasized the anorexia and insomnia, and consequent impaired work performance that resulted from this occupational illness; health care providers identified nausea and dizziness as the most relevant symptoms [16].

This qualitative analysis uses an EMs framework to describe the beliefs of immigrant Latino poultry processing workers with CTS surrounding the causes, symptoms, physiology, treatments, quality-of- life, and health implications of CTS. It also compares the CTS beliefs of Mexican and Guatemalan workers. Understanding these beliefs is important for the development of processes to prevent and treat CTS among Latino manufacturing workers.

Methods

Semi-structured in-depth interviews were conducted with 15 Latino workers who were working in poultry production at the time of the interview. The number of participants was selected as sufficient to provide a detailed discussion of CTS explanatory models. Participants were selected from a larger study (n = 287) conducted to assess the prevalence and incidence of illnesses among these workers [10, 22, 23]. Participants for the larger study were recruited in four counties (Burke, Surry, Wilkes, and Yadkin) in western North Carolina from June 2009 through November 2010. These counties are rural and considered "new settlement" areas for Latino residents [24]. Study participants completed a survey to assess their personal characteristics, work organization, and symptoms or injuries. Participants then attended a research clinic at which physicians examined them for any musculoskeletal and dermatological injuries.

Recruitment

Participants in the larger study had to be 18 years or older, self-identified as being Latino or Hispanic, and a current worker in poultry production. Those participants diagnosed with possible or definite CTS by a neurologist were eligible for this qualitative study [10]. A possible or definite CTS diagnosis was based on self-reported symptoms and nerve conduction. First, participants reported whether they had numbness, pain, or weakness in their hands for two or more days in the previous month using Katz hand diagrams [25]. Two clinicians, blinded to the participants' occupations and nerve conduction results, scored the hand diagrams as unlikely (0), possible (1), probable (2), or classic (3) for CTS. Second, nerve conduction results were used to compare peak median and ulnar sensory latencies. If the median was less than 0.49 ms longer than the ulnar, it was scored 0; if it was 0.50–0.79 ms longer, it was scored 1; and if it was greater than 0.80 ms longer, it was scored 2. The symptom score and nerve conduction score were added and a total score of 1 or 2 was defined as possible CTS, and 3 as definite CTS [10]. Participants diagnosed with possible or definite CTS were placed in random lists stratified by gender and national origin (Guatemala and

Mexico). Participants were approached in random order until approximately equal numbers of men and women, and Guatemalan and Mexican participants from across the study counties agreed to participate. Interviewers contacted participants and explained the nature of the in-depth interview study. Appointments were made with those who agreed to participate. All participants contacted agreed to participate; each of these individuals had already participated in the larger study. Participants who gave signed informed consent and completed the audio recorded interview were given an incentive of $20. The study protocol was reviewed and approved by the Wake Forest School of Medicine Institutional Review Board.

Data Collection

Interviews were conducted in Spanish by a native Spanish speaking interviewer who had experience and training in qualitative interview techniques and who was trusted by residents of the study area. Interviews were conducted from September, 2009 through July, 2010. Interviews took approximately 60 min to complete. Interview guides were constructed to reflect the EMs framework [12, 13]. Interview guides asked workers to describe their jobs and how their work was organized, how their jobs affected their health, their self-care behaviors and barriers to prevention and treatment, and injuries and illness reporting they had. Probes were used to elicit descriptions of their working conditions, and their perceptions of the health consequences of their jobs. The EM portion of the interview included seven sets of questions designed to elicit the worker's name for the condition, the explanation of etiology, symptoms attributed to the condition, the expected natural course of the condition, pathophysiology, best treatment, and effects on quality of life.

Data Analysis

The interviews were recorded, transcribed, and translated to English. An iterative data analysis process was used, with analysis starting as soon as data collection began. Interview transcripts were read by the study team, and topics were identified for further exploration by the interviewers. Once all data were collected, a list of codes was constructed for topics of interest, with mutually exclusive definitions established. The primary codes used in this analysis were those corresponding to the seven EMs components.

Transcripts and notes were entered into Atlas.ti (Version 6.2) text analysis software; codes were applied to segments of text by one of the study team members. The coding was reviewed by two other team members, and corrections and additions were made. A variable-based analysis was used, such that all segments associated with relevant codes were extracted, reviewed, and summarized. Revisions of these summaries were made until they adequately reflected the interview content. Threats to validity (e.g., focus on extreme cases) were considered in constructing and revising the summaries [26]. Saturation of beliefs appears to have been achieved based on the consistency in participants' discussions.

Table 1 Participant characteristics, Latino poultry processing workers with CTS, 2009–2010 (n = 15)

Participant characteristics	N	%
Country of origin		
Guatemala	7	47
Mexico	8	53
Gender		
Female	8	53
Male	7	47
Age		
20–29	4	27
30–39	6	40
40 years or older	5	33
Education		
6 years or less	10	67
7 or more years	5	33
Years in US		
Less than 10	6	40
10 or more	9	60
Years in poultry processing		
Less than 5	7	47
5 or more	8	53
Job tasks		
Receiving	1	7
Unloading	1	7
Hanging	2	13
Cutting	3	20
Deboning	2	13
Trimming	1	7
Packing	3	20
Sanitation	2	13

Results

Participant Characteristics

Participants included 8 women and 7 men (Table 1). They were all from either Guatemala or Mexico and ranged in age from 21 to 60 years of age. Most had less than 6 years of education. About half had been living in the US for less than 10 years, and about half had been working in poultry processing for more than 5 years. Participants worked at a variety of jobs: 1 in receiving, 1 in unloading, and 2 in hanging; the primary job for 3 was cutting, with 2 trimming, 1 deboning, 3 in packing, and 2 in sanitation.

CTS Explanatory Model

The participants presented a fairly consistent explanatory model of CTS which largely reflects the current western biomedical understanding of the condition. This model outlines the name, causes, symptoms and treatment of CTS as described and understood by the workers. Mexican and Guatemalan participants generally agreed on the name, causes, symptoms of CTS, and effects on quality of life. Mexican and Guatemalan participants differed in some aspects of their understanding of the pathophysiology and treatment of the condition.

Name

Although some workers called the illness CTS, the majority referred to the condition as hand pain (*dolor de las manos*). The participants were also inclusive when discussing the location of the pain associated with CTS. Almost all noted pain in the hands and wrists. However, many also included pain in the arms, shoulder, and back when discussing CTS.

Causes

Participants attributed the causes of CTS to the nature of their work environment in the poultry processing industry and how that work affects them physically (Table 2). Participants discussed five inter-related characteristics of their work environment as salient for developing CTS: repetition, line speed, weight, cutting, and cold. Participants discussed how the repetition of the same set of movements resulted in this condition.

> …from so much movement, from the time I start holding the pistol grip to wash the machines. We start at 7:30 p.m. till 2:00 in the morning. So, let's say we start from that time. We stop using the pistol grip for 30 min and use the brush. We have to brush the area where there is grease and our hands don't really get a change to rest, not even for a little bit because we put the pistol grip down and pick up the brush. We have our hands covered by cloth and rubber gloves, but our hands never get to rest, not even for a little while. When we pick up the brush, we have to do it hard again and again. It's almost the same movement. That's why - it's from using so much strength to do it and the strength goes away. (P21, Guatemalan, sanitation)

Table 2 Beliefs about the causes, symptoms, quality of life, and future impacts of CTS among Latino poultry processing workers with CTS, 2009–2010 (n = 15)

Causes, symptoms, quality of life, and future impacts	N	%
Causes		
Work environment		
Repetition	11	73
Line speed	8	53
Weight	6	40
Cutting	8	53
Cold	6	40
Physical weakness		
Fatigue	6	40
Lack of strength	3	20
Physiological		
Blood gets cold	1	6
Veins move or stretch	4	27
Bones get worn down	1	6
Body gets worn down (like a machine)	2	13
Hot–cold	7	47
Symptoms		
Location		
Hands/wrist	13	87
Arms	6	40
Shoulder	5	33
Back	6	40
Sensation		
Pain	14	93
Asleep/tingle/numb	6	40
Popping/swelling	4	27
Quality of life		
Awakened by pain/can't sleep	7	47
Limited in performing house chores	6	40
Limited in performing simple tasks	5	33
Bad mood/shame	2	13
Poor quality of work and not being able to work	3	20
Cannot pick up children and things	3	20
Tired or sluggish	5	33
Not do anything	3	20
Constant pain	8	53
Lack of mobility	3	20
Future impact		
Have to quit job	6	40
Get worse	5	33
Constant pain	3	20
Being incapacitated	3	20

This sentiment was echoed by a participant who packs chicken pieces in trays and seals them for shipment, who added the effect of lifting heavy weights.

I think my wrist problem is caused by doing the same job all day long. So then, I think that your muscles get tired. I think your bone might get worn down. Yes, you do the same thing all the time, and I don't think that's normal. How can I explain? Sometimes, the packs are very heavy, and you have to strain with one hand to pick it up. Let's say, you pick it up with one hand and use the other hand to grab it from there. If it were exercise outside of work, it wouldn't be bad because you can exercise, but it is heavy. (P05 Mexican, packing)

Related to the repetitive nature of the job causing CTS were beliefs that the speed of the production line increased the risk of developing CTS. For example, a participant reported,

Well, working too much is when I'm catching chickens and there are just seven of us, and we have to do it very quickly. Or sometimes, when we are dumping too much and the line is moving very fast. We have to do the job very quickly and, sometimes, I start getting pain right here. (P10, Guatemalan, receiving)

Another component of the repetitive work discussed by the participants was cutting with knives and scissors. Some participants further specified that CTS resulted from needing to use additional force when the knives or scissors were not sharp.

I think it's from cutting the neck because you have to put your knife in it and pull up, but sometimes the blade gets stuck. That's what I think causes the problem with my hands. That's the only one that makes your hands do awkward movements. (P10, Guatemalan, receiving)

It's [CTS] from the knife and scissors because you have to cut and cut and use the knife over and over again. It's different too because I'll use it and then, you might use it. And you have to clean it and sharpen it when it's dull. (P30, Guatemalan, trimming)

Imagine how you get *calambres* [cramps] from the knife. And when your knife isn't sharp, you can forget about it! You might even end up crying on the line. (P30, Guatemalan, trimming)

The workers noted that the work exposed them to cold, as the chickens had to be kept cold to maintain freshness. The cold from the birds added to the risk of injury to their hands.

And another thing is that if the tenders are very cold, I think that penetrates into your hands. When they aren't injected [with saline for flavor], they aren't as cold, but if they are injected or if they inject them with the water they use, they are colder and we feel that more. That's what we all say, that when the tenders are colder our hands hurt more. (P09 Mexican, packing)

Because it was very cold and you're there standing up…do you know how cold it is there? I couldn't tell you how cold it is there, but it's very cold and if you're standing there doing nothing, you feel like the cold is even getting into your bones. You feel like you are going to freeze…. Sometimes, they give us the wings with chunks of ice. Imagine how your hands hurt from the cold, especially if you need to remove chunks of ice. (P07 Mexican, packing)

Some workers also attributed the development of CTS to their physical weaknesses, such as fatigue and not having enough strength.

It could be from…how do you say it…*flojera de las manos*. I don't know. I don't know how to explain it. What I'm saying is that your hands aren't strong enough. It could be from that, too. (P19 Mexican, hanging)

Physiology

Workers attributed their illness to specific physiological processes. Some referred to changes in their bones, such as the cold getting into their bones or their bones getting worn down.

I think my wrist problem is caused by doing the same job all day long. All day long. All day long. So then, I think that your muscles get tired. I think your bone might get worn down. Yes, you do the same thing all the time and I don't think that's normal. (P05 Mexican, packing)

Others referred to the blood being cold, and veins moving or stretching.

I call it *cansancio de los nervios*. I feel that the nerves…by the time we get out of work, I feel debilitated from the hard, physical movements I do with my hand. I feel that all the strength is gone. I feel that the strength of the blood is the problem that I feel. (P21 Guatemalan, sanitation)

I imagine that with the heat and so much movement the temperature on the inside starts to get too hot. So, when you're working, you don't feel the pain. But when you rest, you do feel it. It starts to cool. It's like the grease from the machines because when the machine isn't working, it doesn't melt. But when we start working and putting hot water on it, it does melt

> because it gets hot. That's why I imagine that the bones do the same thing. (P21 Guatemalan, sanitation)

As noted in the previous quote, another physiologic factor leading to CTS discussed by the participants reflected beliefs about the mixing of hot and cold. Participants felt that working in the cold and handling cold materials could result in CTS if they too quickly placed their hands into anything warm.

> Maybe getting rid of the cold [would cure hand pain]. I'd say that's how because if you were working in a warm place at another company, like in furniture, I think it would be good because you'd be working in the heat, in a closed environment where you aren't getting exposed to the air conditioning that makes everything cold. (P30, Guatemala, trimming)

Symptoms

The majority of participants reported symptoms in their hand and wrist, with some mentioning symptoms in their arms and shoulders. The common symptom reported was pain. Some participants described the pain as being stuck by a piece of iron or pin.

> Sometimes I hurt a lot at night, and I'm awakened by the pain. Sometimes I'm profoundly asleep, and I wake up because of the pain. (P28 Guatemalan, cutting)
> My wrists hurt and that's pain there, and there's a pain in my arm. In my wrists, it's mild. They don't hurt me a lot. Well, in my arm it feels like a piece of iron is sticking in it all day. I mean that it feels like my arm is a scale and I'm holding up a kilogram all the time. My arm feels tired. (P05 Mexican, packing)

Participants explained the quality of the pain by referring to several different sensations. Over a third of the participants described the symptom as though their hands and arms "went to sleep."

> When it [arm] goes to sleep, it hurts a lot. Sometimes, when I'm sleeping and I roll over, I can feel that it happened; and it hurts. (P30 Guatemalan, trimming)

Participants who stated that their hands and arms went to sleep also stated their hands and arms tingled or were numb.

> Well, the pain in your hands wakes you up. You feel them tingling. They go to sleep. (P11 Mexican, cutting)
> My hands feel numb. I feel the pain in my hands when I'm doing the movements to pack and lift the trays. I feel like a sticking pain in my hands as if I had a needle or pin stuck in my hand here. (P09 Mexican, packing)

Finally, participants reported popping and swelling in their hands.

> It pops because it's bad. There was a time, over in cooked products, that I couldn't handle the boxes because it hurt and I couldn't stand anything. I could only lift the boxes up. (P08 Mexican, unloading)

Table 3 Treatments used for CTS among Latino poultry processing workers with CTS by Guatemalan and Mexican Nationality, 2009–2010 (n = 15)

Type of treatment	Total		Guatemalan		Mexican	
	n	%	n	%	n	%
Over-the-counter						
Pain relievers in pill form	9	60	3	43	6	75
Ointments to produce heat (on label)	7	47	2	29	5	63
Wrist band	5	33	2	29	3	38
Traditional						
Ointments to produce heat (off label)	2	13	0	–	2	25
Heat	5	33	3	43	2	25
Massages (including by a *sobador* or *curanderos)*	11	73	5	71	6	75
Vitamins (including injection)	6	40	6	86	0	
Medical						
Injection	3	20	0	–	3	38
Surgery	3	20	1	14	2	25

Treatments

The treatments used by the participants can be assigned to three categories of over-the-counter, traditional, and medical treatments (Table 3). The ways in which the participants reported treating their CTS was generally similar for those from Guatemala and Mexico. However, participants did differ by nationality in some treatment methods.

Regardless of country of origin, participants used similar *over-the-counter* treatments to relief the symptoms of CTS. The over-the-counter treatment most frequently mentioned were pain relievers in pill form, such as ibuprofen.

> Once when I had first started and my hands were bad and the other was when I went to ask for a pill for the pain. And the only way to obtain the pill was for the doctor to see me. I mean, I didn't go and see him because I wanted to; I went because I had to. (P09 Mexican, packing)

> Let's say that when I get to work and warm up my muscles, then the pain goes away. Later, it starts hurting a little worse and then, it goes away again. So, that's how it goes. If it hurts a lot, I take pills. I take ibuprofen and one thing or another, it either goes away or I forget about it. (P05 Mexican, packing)

Ointments that produced heat were widely used by Guatemalan and Mexican participants to ease pain. These included over-the-counter remedies that were used according to their labels, such as brand-name products as Bengay®, IcyHot®, and Cofal®. They also included ointments that were produced for veterinary use that were used off-label, such as La Tia® (*Unguento Veterinario De La Tia Ointment*).

> Sometimes, I've applied creams called "Icy Hot." I've used that and felt how it got absorbed into my skin. Or I've also applied a cream from Mexico called "La Tia," that also helps a lot. It helps with the inflammation. They are veterinary ointments which make the inflammation go away. (P05 Mexican, packing)
>
> Yes, Bengay®. This afternoon, I'm going to apply a little bit because my whole hand hurts. And in the morning, I'm going to be ready to work. (P22 Guatemalan, hanging)

Other forms of heat, particularly soaking hands in hot water, were also used to treat CTS.

Both Guatemalan and Mexican workers used wraps to treat the pain, believing that the pressure of the wraps kept the nerves and muscles tight and thus relieved the pain.

> I've just applied wraps. I wrap it here so that it won't hurt and it does calm down a little bit. I think that happens because of the force the nerves make. It's like the nerves get loose, but I put on a wrap here and I feel an improvement. (P10 Guatemalan, receiving)

Massage, a traditional remedy, was commonly used to relieve the pain by Guatemalan and Mexican participants. Participants massaged their hands, usually after their workday, in order to alleviate the pain. Several indicated that they had received hand massages from traditional healers, including a *sobador* or *curandero,* for CTS.

> I would come home and ask my husband to massage my hands because they hurt a lot. That's what I had to do…. I had to go to a *sobador*, those people who massage your hands. I've gone to visit one of them before…. They also put some warm cream on you, and they start to rub your hands. They are people who are trained especially for that. Sometimes, you have a pinched nerve that is causing you pain; and they make it better, which makes the pain go away. (P11 Mexican, cutting)

All but one of the Guatemalan but none of the Mexican participants reported use of vitamins as a treatment for their hand pain. They believe that the vitamins give then strength and will make the pain go away. Several Guatemalan participants indicated that they used vitamin injections.

> In order to have a longer period of good health, I think that I should take some vitamins. I should give my body some vitamins so that I will feel better, since I already have the illness and it's not going to go away. The most I can do is calm it down. (P22 Guatemalan, hanging)
>
> I used to get some [vitamins] that were called Nervio-Bron. They'd send it from Guatemala, and you found someone who could inject it. You went ahead and took it. It helps you. I had an aunt who always felt weak and tired. So, she recommended it to me and I used it. It did help me. (P31, Guatemalan, deboning)

Mexican participants were more apt to discuss a medical treatment. Four mentioned receiving an injection from a physician. Three participants who discussed getting an injection from a physician referred to a physician working for one of the poultry processing companies as the physician who provided this therapy. The other participant referred to a private physician.

> I don't even remember what the doctors said it was called. They even gave me an injection right here and after that, it didn't hurt anymore. Since I've changed jobs from there it hasn't hurt…. [Company Name] doctor did. (P07 Mexican, packing)
>
> I went to see the doctor. He gave me an injection and the pain here went away. Sometimes, you take a pill for the pain to see if it will lessen. (P09 Mexican, packing)

Several of the Mexican, but only one of the Guatemalan, participants discussed having surgery to treat CTS. When speaking about surgery, participants indicated that employers would allow individuals who had surgery to return to work, but they would not hire individuals who had had surgery.

Quality of Life

Participants reported how CTS affected their everyday life. Many reported that the pain either would not let them sleep or would wake them up at night, which consequently affected their performance at work and at home. They also reported the constant pain in their hands as annoying, causing them to be in a bad mood as a consequence of the pain. Some reported that the pain made them feel tired or sluggish and they felt like they did not want to do anything except lie down.

> You can't stand the pain. All you want to do is lie down and rest, and not do anything. (P30 Guatemalan, trimming)

Performing household chores and simple personal tasks such as dressing, undressing, and combing hair was difficult. It was physically difficult for some to lift their children because of the pain, so they would have to tell their children that they were tired or ask someone else to pick them up. Others reported not being able to perform their work properly or calling into work sick because of the hand pain.

> [The hand pain] affected me a lot because I couldn't do the things I needed to do. This little girl is the one who helped me remove my blouse. I would just bend down and she would take it off for me. (P09 Mexican, packing)
>
> Changing my clothes or when I take a shower, I always feel pain. If I want to scrub myself, I feel pain. (P21 Guatemalan, sanitation)

Future Impact

A third of the participants believed they would have to quit their job to stop having CTS. However, they also stated that they could not stop working because they needed an income.

> To cure that problem, I will have to stop working. Because if I stop working, [my hand] might start to get its energy back, or I need to let my hand rest during the whole job. (P21 Guatemalan, sanitation)
>
> … you earn money by suffering pain. (P20 Guatemalan, cutting)

Several participants stated that if they keep doing their job, the pain would get worse, possibly to the point of their permanently being disabled.

> What I think is that it's better to stop working so that, in that way, I have a little better health. If I keep working, it's going to get worse; and it's going to keep hurting more and more. It's going to hurt so bad that I'm not going to be able to stand it. (P22 Guatemalan, hanging)
>
> If I continue like this with my problems, the moment will arrive that I won't even be able to move, I won't even be able to do things for myself - take care of my home. There are so many things that you have to do with your hands; and when the moment arrives that you can't do them because I know what having CTS is like and I know the consequences that are going to happen and that the time could come when I wouldn't be able to move, that I might not be able to take care of myself. I know that those could be the consequences. (P05 Mexican, packing)

Discussion

These poultry processing workers with diagnosed CTS present a very clear understanding of its causes, its treatment, its long-term consequences, and its cure. The CTS EMs of these Guatemalan and Mexican workers generally reflect current western biomedical understanding of this occupational injury. As with lay people from most societies, some part of their CTS EMs are not completely congruent with medical knowledge. For CTS among these workers, these components include the pathophysiology of CTS and some traditional therapies that they use to treat CTS.

CTS is a common occupational injury among all poultry processing workers, especially among those who are Latino immigrants [10]. Many of these immigrant Latino workers are undocumented, making them particularly vulnerable, as they lack access to most health care safety net services. CTS can result in long-term disability for these workers. Even among those who are documented, most do not qualify for workers compensation in North Carolina because state rules require that such claims be based on specific traumatic injuries. The participants in this study all had CTS as diagnosed by neurologists using stringent criteria [10, 25, 27].

The participants are generally consistent with the biomedical model about the actual causes of CTS, particularly characteristics in their work environments: line speed, repetitive motions, and dull tools. They also consider cold temperature to be a cause of CTS. Although this may reflect beliefs related to humoral medicine [28, 29], cold temperatures are now considered a risk factor for CTS within a medical model [30]. Beyond the work environment, participants also state that their own physical failings, whether being weak or fatigued, cause CTS. Latino workers in other industries, particularly agriculture, discuss the importance of physical strength or a strong constitution as protective of occupational injury or illness, such as pesticide poisoning [14, 31].

Although realistic about the actual cause of CTS, participants understand that they can do little to prevent or cure CTS in the current context of poultry processing. The best ways to reduce the incidence and prevalence of CTS are to reduce the speed with which repetitive motions are required (reduce the line speed), and to include rest breaks in the work schedule [32, 33]. However, such changes would raise the costs of poultry processing. In fact, a current policy proposal from the US Department of Agriculture, known as "Modernization of Poultry Slaughter Inspection," will give companies the option to increase, rather than decrease, line speeds for poultry processing workers [34–36].

The manner in which the participants treat CTS reflects medical pluralism documented for Latin America [37, 38]. Participants select from a range of treatments from multiple health care traditions. Over-the-counter pain relievers (non-steroidal anti-inflammatory drugs) reflect current western medical practice. Participants used standard over-the-counter ointments, off-label ointments meant for livestock, and warm water as treatment, although a recent biomedical review recommends that heat therapy not be used to treat CTS, as it is less effective than placebo [39]. Participants draw on biomedicine in the form of injections and surgery, although the injections appear to be imposed by employer hired physicians, and surgery may mark an individual for job loss. Mexicans use western medical practitioners more than Guatemalans. Most participants use massage, but massage is obtained informally from family members, as well as from traditional practitioners, particularly *sobadores* [40, 41]. Massage is not considered an effective treatment by biomedicine [39]. The use of *sobadores* among the participants extends beyond those being treated for CTS; they make conscious decisions about when the therapy is appropriate for this condition. Guatemalan participants use vitamins to treat CTS, while Mexican participants do not. The use of vitamins in Guatemala is long standing [37]. Injection of vitamins reflects observations by others about the value Latinos place on this mode of treatment [42]. Vitamins or injections of substances other than steroids are not considered effective by biomedicine [39].

These workers are creative in seeking relief for CTS. Other than surgery, little helps with the pain of CTS, and surgery, which is considered effective by biomedicine, [39] may mark them for job loss. Therefore, as with the use of diverse therapies for arthritis [43], it is difficult to refute the use of any of the therapies discussed. However, the use of these therapies may mask the long-term effects of this occupational injury.

The participants' models of CTS include the belief that it will have long-term negative effects on their health. Although they do know how to limit future injury through quitting their jobs in the poultry processing plant, they face the conundrum of needing to work to live and support their families. However, the work they are doing is destroying their health and diminishing their quality of life. They have few other options for employment because few other jobs are available and these jobs often require documents. This is the core of occupational injustice [44, 45]. Policy change reducing line speed and providing rest breaks is needed to limit the occupational exposures of these workers.

This study should be considered in light of its limitations. As with many qualitative studies, the small sample, with participants from only two Latin American countries who work in one industry and who live in one area, may limit generalizability to other populations. However, the analysis was conducted among a diverse, vulnerable, and understudied group of workers, which provides credibility in the results. An additional strength is that all participants were diagnosed as having CTS by neurologists using stringent diagnostic criteria. This analysis also provides insightful information that would be difficult to assess through quantitative methods.

Delineating the models of Latinos for work injuries such as CTS is important for improving occupational health and safety. Analyses show that the prevalence and incidence of CTS among these workers is high [10, 46]. The CTS EMs of these workers is largely in accordance with current medical knowledge about the causes, treatment, and long-term sequelae of CTS. However, due to their vulnerable status, organizing and asking for the solutions is not possible. Workers at poultry processing plants in western North Carolina have attempted to organize since 1996, but without success [47–49]. Safety training is not the appropriate response to the problem of CTS among poultry processing and other vulnerable workers, as they know the solutions to this occupational injury but cannot implement them. The most proximate solution would be slowing the line speed and providing rest breaks, or hiring additional workers. Policies are needed that force such changes on employers; yet current policy proposals will increase these speeds [50]. The need these vulnerable workers have for a paycheck keeps them at these jobs, which they consider to be good jobs. The occupational injustices faced by these workers requires continued research to document the prevalence and risk factors for CTS and to develop needed occupational safety policy.

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References

1. National Chicken Council. Per capita consumption of poultry and livestock, 1965 to estimated 2013, in pounds. 2013. http://www.nationalchickencouncil.org/about-the-industry/statistics/per-capita-consumption-of-poultry-and-livestock-1965-to-estimated-2012-in-pounds/. Accessed 16 April 2013.
2. Striffler S. Chicken: the dangerous transformation of America's favorite food. New Haven: Yale University Press; 2005.

3. Stull DD. Meat and (wo)men: meatpacking's consequences for communities. Kans J Law Public Policy. 1994;3:112–8.
4. Stull DD, Broadway MJ. Slaughterhouse blues: the meat and poultry industry in North America. Belmont: Wadsworth/Thomson; 2004.
5. Quandt SA, Grzywacz JG, Marín A, Carrillo L, Coates ML, Burke B, Arcury TA. Illnesses and injuries reported by Latino poultry workers in western North Carolina. Am J Ind Med. 2006;49:343–51.
6. Lipscomb HJ, Epling CA, Pompeii LA, Dement JM. Musculoskeletal symptoms among poultry processing workers and a community comparison group: Black women in low-wage jobs in the rural South. Am J Ind Med. 2007;50:327–38.
7. Government Accountability Office. Workplace safety and health: safety in the meat and poultry industry, while improving, could be further strengthened. 2005 (Report No. GAO-05-096). Washington: U.S. GAO.
8. Gelberman RH, Hergenroeder PT, Hargens AR, Lundborg GN, Akeson WH. The carpal tunnel syndrome. A study of carpal canal pressures. J Bone Joint Surg Am. 1981;63:380–3.
9. U.S. Bureau of Labor Statistics. Occupational employment statistics, occupational employment and wages, May 2012. http://www.bls.gov/oes/current/oes513022.htm. Accessed 14 April 2013.
10. Cartwright MS, Walker FO, Blocker JN, Schulz MR, Arcury TA, Grzywacz JG, Mora D, Chen H, Marín AJ, Quandt SA. The prevalence of carpal tunnel syndrome in Latino poultry processing workers and other Latino manual workers. J Occup Environ Med. 2012;54:198–201.
11. Luckhaupt SE, Dahlhamer JM, Ward BW, Sweeney MH, Sestito JP, Calvert GM. Prevalence and work-relatedness of carpal tunnel syndrome in the working population, United States, 2010 national health interview survey. Am J Ind Med. 2012;56(6):615–24.
12. Kleinman A. Patients and healers in the context of culture. Berkeley: University of California Press; 1980. p. 427.
13. Kleinman A. Illness narratives: suffering, healing and the human condition. New York: Basic Press; 1988. p. 284.
14. Quandt SA, Arcury TA, Austin CK, Saavedra RM. Farmworker and farmer perceptions of farmworker agricultural chemical exposure in North Carolina. Hum Organ. 1998;57:359–68.
15. Rao P, Quandt SA, Doran AM, Snively BM, Arcury TA. Pesticides in the home of farmworkers: Latino mothers' perceptions of risk to their children's health. Health Educ Behav. 2007;34(2):335–53.
16. Rao P, Arcury TA, Quandt SA. Hispanic farmworker interpretations of green tobacco sickness. J Rural Health. 2002;18:503–11.
17. Arcury TA, Vallejos QM, Marín AJ, Feldman SR, Smith G, Quandt SA. Latino farmworker perceptions of the risk factors for occupational skin disease. Am J Ind Med. 2006;49:434–42.
18. Rao P, Arcury TA, Quandt SA, Doran A. Growers' and extension agents' perceptions of farmworker pesticide exposure. Hum Organ. 2004;63:151–61.
19. Poss JE. The meanings of tuberculosis for Mexican migrant farmworkers in the United States. Soc Sci Med. 1998;47:195–202.
20. Arcury TA, Skelly AH, Gesler WM, Dougherty MC. Diabetes meanings among those without diabetes: explanatory models among immigrant Latinos in rural North Carolina. Soc Sci Med. 2004;59:2185–93.
21. Rubel AJ, Hass MR. Ethnomedicine. In: Sargent CF, Johnson TM, editors. Medical anthropology: contemporary theory and method. Westport: Praeger; 1996. p. 113–30.
22. Arcury TA, Grzywacz JG, Anderson AM, Mora DC, Carrillo L, Chen H, Quandt SA. Personal protective equipment and work safety climate among Latino poultry processing workers in Western North Carolina, USA. Int J Occup Environ Health. 2012;18(4):320–8.
23. Pichardo-Geisinger R, Muñoz-Ali D, Arcury TA, Blocker JN, Grzywacz JG, Mora DC, Chen H, Schulz MR, Feldman SR, Quandt SA. Dermatologist-diagnosed skin disease among Latino immigrant poultry processing and other manual workers in North Carolina. Int J Dermatol. 2013;52(11):1342–8.
24. Kochhar R, Suro R, Tafoya S. The new Latino South: the context and consequences of rapid population growth. Pew Research Hispanic Center 2005. http://www.pewhispanic.org/2005/07/26/the-new-latino-south/. Accessed 11 April 2013.
25. Katz JN, Stirrat CR. A self-administered hand diagram for the diagnosis of carpal tunnel syndrome. J Hand Surg Am. 1990;15:360–3.
26. Miles MB, Huberman AM. Qualitative data analysis: an expanded sourcebook. 2nd ed. Thousand Oaks: Sage; 1994. p. 338.
27. Werner RA, Gell N, Franzblau A, Armstrong TJ. Prolonged median sensory latency as a predictor of future carpal tunnel syndrome. Muscle Nerve. 2001;24:1462–7.
28. Rubel AJ. Concepts of disease in Mexican-American culture. Am Anthropol. 1960;62:795–814.
29. Weller SC. New data on intracultural variability: the hot-cold concept of medicine and illness. Hum Organ. 1983;42:249–57.
30. Conolly WB, McKessar JH. Carpal tunnel syndrome—can it be a work related condition? Aust Fam Physician. 2009;38:684–6.
31. Arcury TA, Estrada JM, Quandt SA. Overcoming language and literacy barriers in safety and health training of agricultural workers. J Agromedicine. 2010;15:236–48.
32. Dababneh AJ, Swanson N, Shell RL. Impact of added rest breaks on the productivity and well being of workers. Ergonomics. 2001;44:164–74.
33. Tucker P, Folkard S, Macdonald I. Rest breaks and accident risk. Lancet. 2003;361(9358):680.
34. Almana A. Setting the record straight on the proposed chicken inspection rule. USDA Food Safety and Inspection Service. 2012. http://www.fsis.usda.gov/News_&_Events/NR_041312_01/index.asp. Accessed 30 April 2013.
35. Philpott T. USDA ruffles feathers with new poultry inspection policy. 2013. http://www.motherjones.com/tom-philpott/2013/04/usda-inspectors-poultry-kill-lines-chicken. Accessed 30 April 2013.
36. Southern Poverty Law Center. Unsafe at these speeds: Alabama's poultry industry and its disposable workers. Mongomery, AL: Southern Poverty Law Center and Alabama Appleseed Center for Law & Justice; 2013.
37. Cosminsky S, Scrimshaw M. Medical pluralism on a Guatemalan plantation. Soc Sci Med B Med Anthropol. 1980;14(4):267–78.
38. Belliard JC, Ramirez-Johnson J. Medical pluralism in the life of a Mexican immigrant woman. Hisp J Behav Sci. 2005;27(3):267–85.
39. Keith MW, Masear V, Amadio PC, Andary M, Barth RW, Graham B, Chung K, Maupin K, Watters WC 3rd, Haralson RH 3rd, Turkelson CM, Wies JL, McGowan R. Treatment of carpal tunnel syndrome. J Am Acad Orthop Surg. 2009;17:397–405.
40. Anderson R. The treatment of musculoskeletal disorders by a Mexican bonesetter (sobador). Soc Sci Med. 1987;24(1):43–6.
41. Hinojosa SZ. The Mexican American sobador, convergent disease discourse, and pain validation in South Texas. Hum Organ. 2008;67(2):194–206.
42. McVea KL. Lay injection practices among migrant farmworkers in the age of AIDS: evolution of a biomedical folk practice. Soc Sci Med. 1997;45(1):91–8.
43. Arcury TA, Bernard SL, Jordan JM, Cook HL. Gender and ethnic differences in alternative and conventional remedies use among community dwelling rural adults with arthritis. Arthritis Care Res. 1996;9:384–90.

44. Baron S, Sinclair R, Payne-Sturges D, Phelps J, Zenick H, Collman GW, O'Fallon LR. Partnerships for environmental and occupational justice: contributions to research, capacity and public health. Am J Public Health. 2009;99(Suppl 3):S517–25.
45. Durocher E, Gibson BE, Rappolt S. Occupational justice: a conceptual review 2013. http://www.tandfonline.com/doi/abs/10.1080/14427591.2013.775692. Accessed 3 May 2013.
46. Cartwright MS, Walker FO, Blocker JN, Schulz MR, Arcury TA, Grzywacz JG, Mora D, Chen H, Easton B, Quandt SA. One-year incidence of carpal tunnel syndrome in Latino poultry processing workers and other Latino manual workers. Am J Ind Med. 2013. doi:10.1002/ajim.22250.
47. Fink L. The Maya of Morganton: work and community in the Nuevo New South. Chapel Hill: University of North Carolina Press; 2003.
48. Risso F. Immigrant workers at non-union chicken plant stop work over dangerous conditions. Facing South (The Institute for Southern Studies). 2010. http://www.southernstudies.org/2010/07/immigrant-workers-at-non-union-chicken-plant-stop-work-over-dangerous-conditions.html. Accessed 23 Aug 2013.
49. Whitlock C. Immirant poultry workers' struggle for respeckt draws national attention: Labor unions test Case. Raleigh News & Observer, November 30, 1996. http://www.laborers.org/Raleigh_Chichen_11-30-96.html. Accessed 23 Aug 2013.
50. Musolin K, Ramsey JG, Wassell JT, Hard DL, Mueller C. Musculoskeletal disorders and traumatic injuries among employees at a poultry processing plant. Interim Report HHE No. 2012-0125. National Institute for Occupational Safety and Health. 2013.