

## Research Note

# North Carolina Hispanic Farmworkers and Intestinal Parasitism: A Pilot Study of Prevalence and Health-Related Practices, and Potential Means of Foodborne Transmission

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## ABSTRACT

Migrant and seasonal farmworkers provide much of the necessary labor to harvest and process agricultural commodities desired by consumers. Little is known about the health status (especially the parasitic burden) of farm laborers, who handpick agricultural items such as fruits and vegetables, despite being implicated as a means of foodborne pathogen transmission. The goal of this research was to develop a framework to investigate enteric parasitic infections among Hispanic farmworkers in Eastern North Carolina. Seventy-one interviews were conducted, 16 stool samples were collected, and two parasite-positive workers were found. In addition, some potentially harmful health practices (e.g., self-medication) were identified. Further research is necessary to fully understand the scope of farmworker health issues and the potential risk of disseminating foodborne pathogens to humans. The study model presented provides a geographically expandable format to allow for various types of health investigations including the prevalence of other pathogens.

Enteric parasites cause human illness with key routes of transmission being direct and indirect contact with fecally contaminated food or water. Contamination of food can occur at many points along the food production and processing continuum with ill farmworkers playing a potentially important role in transmission. For example, Guatemalan raspberries were implicated in a large outbreak of cyclosporiasis in 1996. Certain farm-related practices (e.g., use of contaminated water to mix insecticide and/or fungicide and direct contact between workers' hands and berries as the fruit were picked and sorted) were identified as possible means of *Cyclospora* transmission on multiple farms (6). In the case of the cyclosporiasis outbreak of 1996, humans are thought to have been the only source of *Cyclospora* oocysts, and surveillance activities conducted the following spring found several Guatemalan raspberry workers infected with *Cyclospora*, most of them asymptotically (5). Approximately 85% of fruits and vegetables produced in the United States are harvested by hand, and the intensive processes of harvesting and premarket handling (e.g., lettuce coring)

provide numerous opportunities for human contact (8). Ingestion of parasites through contaminated foods that are minimally processed or consumed raw is of particular concern since preparatory measures (e.g., cooking) that may reduce or eliminate parasites are often bypassed.

In 2002, North Carolina (NC) had the fifth largest farmworker population (approximately 108,900) in the United States (11). Studies have found that migrant and seasonal farmworkers have poorer physical health than the general population due to occupational hazards and inadequate living conditions (11). A population-based study conducted in 1987 reported that workers in NC had parasite prevalence rates ranging from 20 to 80%. Parasites identified included helminths (e.g., *Ascaris lumbricoides*), protozoans (e.g., *Giardia lamblia*), and nonpathogens (e.g., *Entamoeba coli*) (4). Decades later, this population has grown 394%, yet neither a health update nor a framework for migrant health surveillance exists (12).

Our objective was to implement a pilot study, involving collaboration with local community health centers that serve migrant communities, to determine the prevalence of intestinal parasitism, identify health-related practices, and highlight potential dissemination routes of foodborne pathogens with respect to Hispanic migrant and seasonal farmworkers in Eastern NC during the 2007 planting and harvesting season.

## MATERIALS AND METHODS

**Terms.** "Hispanic" describes those persons originating from Mexico, or Central or South America. "Migrant or seasonal

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farmworker” is a person who is or has been employed in hand labor operations the majority of the time and/or who has changed residence for purposes of employment in agriculture. The term “H-2A worker” is a worker with a visa to work seasonally in agriculture. “Latrines” are commonly used in developing countries as a more hygienic alternative to open defecation and characteristically consist of multiple toilets with no running water for flushing. Waste is collected and undergoes decomposition within a pit dug into the ground. “Portable bathrooms” are self-contained, single-toilet, free-standing structures designed to be drained and cleaned on a regular basis. They are often used as temporary toilets for large public gatherings or on work sites.

**Participants.** Study participants were recruited on a volunteer basis through three collaborating NC community health centers. Criteria for eligibility included the following: (i) adult status (at least 18 years of age); (ii) self-reported Hispanic ethnicity; and (iii) classification as H-2A, migrant, or seasonal farmworker.

**Questionnaire.** Questionnaires were verbally administered in Spanish and documented characteristics including demographics, occupation, lifestyle (e.g., household size, availability of sanitation facilities, and hygienic practices), and self-medicating practices (self-reported intake of medications used specifically to treat parasitic infections). To maintain confidentiality, questionnaires were numerically coded. EpiInfo was used for data entry and descriptive analysis (1).

**Stool specimens.** Participants who completed the questionnaire were also asked to provide a stool sample. Those who agreed were provided with a sample collection kit (specimen containers, newspaper, gloves, alcohol wipes, and a plastic bag), detailed verbal instructions, and brochures in Spanish on the proper collection procedure. Stool samples were retrieved approximately 1 week following the initial visit. Ova and parasite examinations were performed at the NC State Laboratory of Public Health (2). The NC State Laboratory of Public Health is a certified reference laboratory routinely receiving reference specimens for confirmation of intestinal parasitic worms and protozoa. All test results were reported to participants through the community health centers.

## RESULTS

**Respondent characteristics.** Of the 71 farmworkers surveyed from 25 camps in five counties, 55 (77.5%) were aged between 20 and 40 years, with a median age of 27 years. The majority (86%) were men, with 96% born in Mexico. Forty-three (61%) worked one primary job, 26 (37%) worked two jobs, and 1 (1%) worked three jobs during the harvesting season. Most worked on tobacco (73%) and/or produce (51%) farms between April and September 2007. All workers shared living quarters with four to six people. Comparison of sanitation facility availability at home (versus work) found that 75% (27%) used private toilets, 7% (11%) used latrines, and 7% (41%) used portable bathrooms. Workers reported washing their hands after using the bathroom at home (90%) and work (73%) and before cooking (89%). Affliction with parasitism during childhood was reported by 38% of workers, and 3% reported testing positive for intestinal parasites in the United States. Thirty-four percent reported intake of specific medication to treat parasitic infection. Data are presented in Table 1.

**Parasitism in the studied population.** Fifty-two collection kits were distributed, and 16 stool samples were analyzed. Intestinal parasites were recovered from two individuals, with a proportion of infection of 12.5%. Single-species parasitic infection was reported among the two cases for either *G. lamblia* or *E. coli*. The infected cases were men between the ages of 33 and 45 years, foreign-born in Mexico, working with one or more food crop, traveling between Mexico and the United States on a yearly basis, and self-medicating for parasitic infections before entering the United States.

## DISCUSSION

Inherent complexities exist when conducting migrant worker health studies including (i) the transient and inaccessible nature of the population; (ii) documentation of workers or lack thereof; and (iii) sensitivities related to study requirements (i.e., stool collection). We were able to overcome these barriers by partnering with community health centers, and more specifically, integrating ourselves with migrant outreach teams that provided certain free services (e.g., blood pressure checks and rapid human immunodeficiency virus tests). Importantly, this framework is geographically expandable and flexible enough to allow for various types of health investigations including the prevalence of other pathogens. While monetary compensation would have encouraged a greater response rate, providing rewards (e.g., items donated to the project such as hats, gloves, and hygiene products) for survey completion was effective.

In addition to providing data on prevalence, this study identified areas of public health concern. Self-medication for symptoms of parasitism occurred among 34% of workers. Medication may include both prescription and nonprescription products obtained in Mexican pharmacies. A recently published study found that 30% of Latinos surveyed acknowledged carrying antibiotics, herbal medication, and other medicine into the United States from other countries (10). Respondents in our study did not always recall the specific name of their medication, but many indicated taking Vermox (mebendazole), a broad-spectrum antihelminthic medication not recommended for the treatment of intestinal protozoan parasites. Workers reported taking doses, with or without symptoms, before leaving Mexico and while in the United States. However, it was not clear if the medicine was being stored or taken properly, i.e., at the correct dosage and frequency, leading to concerns of efficacy, safety, and the development of drug resistance.

Additionally, this study identified workers infected with a parasite implicated in past foodborne outbreaks, *G. lamblia*. For instance, outbreaks of giardiasis associated with vegetables and lettuce-based salads were reported in 2005 and 2007 causing a total of 65 illnesses (3). Infected food handlers are very often implicated in giardiasis outbreaks, suggesting the ease of foodborne transmission. For example, an infected food handler preparing raw vegetables that were later served in an office cafeteria was the probable cause of nearly 30 cases (7).

Raw produce typically undergoes minimal postharvest treatment and may be packed immediately after picking, thus

TABLE 1. Characteristics of Hispanic farmworkers in eastern North Carolina

Characteristic	No. (%) of farmworkers with indicated characteristic		
	All farmworkers (n = 71)	Subset with worker status:	
		H-2A (n = 29)	Non-H-2A (n = 42)
<b>Demographics</b>			
Age (yr)			
<20	8 (11.4)	3 (10.3)	5 (11.9)
21–30	31 (44.3)	13 (44.8)	18 (42.9)
31–40	24 (34.3)	10 (34.5)	14 (33.3)
41–50	4 (5.8)	3 (10.3)	1 (2.4)
>50	1 (1.4)	0 (0)	1 (2.4)
Missing <sup>a</sup>	3 (4.2)	0 (0)	3 (7.1)
Gender			
Male	61 (86.0)	29 (100)	32 (76.2)
Female	10 (14.0)	0 (0)	10 (23.8)
Birth country			
Mexico	68 (95.8)	28 (96.6)	40 (95.2)
United States	2 (2.8)	1 (3.4)	1 (2.4)
Missing	1 (1.4)	0 (0)	1 (2.4)
<b>Occupation</b>			
No. of crops/jobs			
One	43 (61)	19 (65.5)	24 (57.1)
Two	26 (37)	10 (34.5)	16 (38.1)
Three or more	1 (1)	0 (0)	1 (2.4)
Missing	1 (1)	0 (0)	0 (0)
Type of work <sup>b</sup>			
Fruits and vegetables	36 (50.7)	9 (31)	27 (64.3)
Tobacco	52 (73.2)	26 (89.7)	26 (61.9)
Construction	5 (7.0)	2 (6.9)	3 (7.1)
Pork (swine)	1 (1.4)	0 (0)	1 (2.4)
Beef	0 (0)	0 (0)	0 (0)
Poultry	0 (0)	0 (0)	0 (0)
<b>Lifestyle</b>			
Sanitation facilities at home			
Private	53 (74.6)	25 (86.2)	28 (66.8)
Latrine	5 (7.0)	2 (6.9)	3 (7.1)
Portable	5 (7.0)	2 (6.9)	3 (7.1)
Missing	8 (11.4)	0 (0)	8 (19.0)
Sanitation facilities at work			
Private	19 (26.8)	3 (10.3)	16 (38.1)
Latrine	8 (11.3)	5 (17.3)	3 (7.1)
Portable	29 (40.8)	17 (58.6)	12 (28.6)
Missing	15 (21.1)	4 (13.8)	11 (26.2)
<b>Hand washing</b>			
After bathroom at home			
Yes	64 (90)	29 (100)	35 (83)
After bathroom at work			
Yes	52 (73.3)	24 (82.8)	28 (66.7)
Before preparing food			
Yes	63 (88.7)	24 (82.8)	39 (92.9)

TABLE 1. Continued

Characteristic	No. (%) of farmworkers with indicated characteristic		
	All farmworkers (n = 71)	Subset with worker status:	
		H-2A (n = 29)	Non-H-2A (n = 42)
<b>Self-medicating practices</b>			
Self-reported intake			
Yes	24 (33.8)	10 (34.5)	14 (33.3)
No/missing	47 (66.2)	19 (65.5)	28 (66.7)

<sup>a</sup> Missing refers to data that were not provided by respondents.  
<sup>b</sup> Data are nonexclusive; respondents were allowed to answer more than one choice.

bypassing critical control steps used to mitigate potential foodborne pathogens. Importantly, *G. lamblia* is not killed by chlorine levels typically used to rinse produce postharvest, and the organism is especially difficult to wash off complex food surfaces (9). The transfer of parasites to food via fecally contaminated hands (e.g., picking, sorting, and packing produce by hand), field implements (e.g., lettuce corer), irrigation water, or potable water used for washing food items prior to packaging for transport are potential ways transmissible stages of parasites can be disseminated.

Factors such as availability of sanitation facilities and inadequate personal hygiene may enhance the transmission and increase the risk of parasitic infection among farmworkers. While a majority of workers (68%) reported access to toilets while working, only 73% stated washing their hands prior to returning to work. Several explanations for this small discrepancy exist including the possibility of stand-alone hand washing facilities without access to toilets, the overreporting of good hygiene, and possible misinterpretation of the question by the interviewee. While field sanitation requirements exist in NC (29 CFR 1928.110) stating that workers must be provided with hand washing facilities and toilets, follow-up is needed to determine why a higher percentage of workers reported washing hands at home (90%). More emphasis should be placed on worker outreach activities that promote good hygienic practices and stress the important role that farmworkers play in food safety and in reducing the risk of transmission of foodborne parasites from agricultural commodities to consumers.

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