

Migrant Farmworker Housing Regulation Violations in North Carolina

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Background *The quality of housing provided to migrant farmworkers is often criticized, but few studies have investigated these housing conditions. This analysis examines housing regulation violations experienced by migrant farmworkers in North Carolina, and the associations of camp characteristics with the presence of housing violations.*

Methods *Data were collected in 183 eastern North Carolina migrant farmworker camps in 2010. Housing regulation violations for the domains of camp, sleeping room, bathroom, kitchen, laundry room, and general housing, as well as total violations were assessed using North Carolina Department of Labor standards.*

Results *Violations of housing regulations were common, ranging from 4 to 22 per camp. Housing regulation violations were common in all domains; the mean number of camp violations was 1.6, of sleeping room violations was 3.8, of bathroom violations was 4.5, of kitchen violations was 2.3, of laundry room violations was 1.2, and of general housing violations was 3.1. The mean number of total housing violations was 11.4. Several camp characteristics were consistently associated with the number of violations; camps with workers having H-2A visas, with North Carolina Department of Labor Certificates of Inspection posted, and assessed early in the season had fewer violations.*

Conclusions *These results argue for regulatory changes to improve the quality of housing provided to migrant farmworkers, including stronger regulations and the more vigorous enforcement of existing regulations.* Am. J. Ind. Med. 55:191–204, 2012.

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INTRODUCTION

The number of migrant farmworkers employed in the United States is large, and these farmworkers are essential for the production of food and fiber across the country [Carroll et al., 2005; Kandel, 2008]. However, migrant farmworkers experience high rates of exposure to environmental as well as occupational hazards [Quandt et al., 2006]; they endure high rates of occupational injury and illness [Villarejo, 2003; Steege et al., 2009]; and they have limited access to health services [Arcury and Quandt, 2007]. A major source of occupational and environmental exposures for migrant farmworkers is their housing [Villarejo et al., 2010], who provides housing to farmworkers varies in different regions. In California, most migrant farmworkers must find their own housing [Villarejo, 2011]. In the Atlantic Coast states, farmers generally provide housing for the migrant farmworkers whom they employ [Arcury and Marin, 2009]. In all areas of the country, the quality of migrant farmworker housing is often cited as a concern by those who provide health and other services to this population. However, little research has documented farmworker housing quality. The few studies that have investigated housing conditions universally decry the abysmal state of this housing [Harrison, 1995; Peck, 1999; Housing Assistance Council, 2001; Holden, 2002; Jones, 2004; Early et al., 2006; Flocks and Burns, 2006; Ziebarth, 2006; Gentry et al., 2007].

Reasons for concern about migrant farmworker housing are both ethical and practical. Ethically, adequate housing is a basic human right; and the provision of adequate housing reflects occupational justice [United Nations, 1991; World Health Organization, 2006]. Practically, housing quality is important to health [Collins, 1993; Krieger and Higgins, 2002; Evans, 2003; Shaw, 2004; Bradman et al., 2005; Chew et al., 2006]. Poor housing increases the risks for injury, the transmission of infectious disease, exposure to toxicants, such as pesticides and lead, exposure to mold and particulates that increase the risk of respiratory disease, and mental illness [Collins, 1993; Krieger and Higgins, 2002; Evans, 2003; Shaw, 2004; Bradman et al., 2005; Chew et al., 2006].

Migrant Farmworkers: Definition and Characteristics

Migrant farmworkers are individuals who establish a temporary residence for the purpose of employment in agriculture on a seasonal basis. Migrant farmworkers may move within a state, between states, or internationally. Although migrant farmworkers in the United States number in the hundreds of thousands, their exact numbers are not known [Kandel, 2008]. Migrant farmworkers in the United States are largely Latino immigrants, with the majority

from Mexico [Carroll et al., 2005]. Most migrant farmworkers are men. Many have little formal education. An increasing number of farmworkers speak an indigenous language rather than Spanish as their primary language [Carroll et al., 2005; Farquhar et al., 2008, 2009].

About one-half of migrant farmworkers do not have the appropriate documents to work in the United States [Carroll et al., 2005]. The H-2A visa program is the only current agricultural guest-worker program. This program allows individuals to work for a specific agricultural employer for a determined period; individuals with H-2A visas must return to their home nation each year. The number of migrant farmworkers with H-2A visas varies among states; North Carolina has a relatively large number of farmworkers with H-2A visas.

Migrant Farmworker Housing: Current Knowledge

Although migrant farmworkers make up 38% of all agricultural workers [US Department of Agriculture Economic Research Service, 2008], systematic documentation of migrant farmworker housing characteristics and quality is limited. A few studies have examined the housing of seasonal farmworker families in California [Bradman et al., 2005, 2007] and in North Carolina [Quandt et al., 2004; Early et al., 2006; Gentry et al., 2007]. Flocks and Burns [2006] commented on migrant farmworker housing policy, and Villarejo [2011] has reviewed the history of migrant farmworker housing in California.

Analyses of migrant farmworker housing have been based on national and regional data [Housing Assistance Council, 2001; Holden, 2002], as well as being focused on California [Villarejo, 2011], Minnesota [Ziebarth, 2006], and North Carolina [Vallejos et al., 2011]. Each of these analyses documented severe problems with migrant farmworker housing. For example, the Housing Assistance Council [2001] and Holden [2002] found that over half of farmworker housing was crowded; 22% of housing units lacked a toilet, bathtub, stove, or refrigerator; 22% had serious structural damage; 36% had broken windows or torn screens; 29% had evidence of water leakage; and 19% had signs of rodent or insect infestation. The Housing Assistance Council publication was based on data collected in the 1990s and was not peer-reviewed. However, more recent peer-reviewed research is in substantial agreement. An analysis of Minnesota migrant farmworker housing reported that farmworkers had negative comments about the bathroom (26%), kitchen (18%), water quality (11%), crowding (13%), lack of privacy (6%), and need for repairs (7%) [Ziebarth, 2006]. The author concluded that "...Minnesota's...[migrant] workers face severe housing difficulties. In general, migrant workers in Minnesota are typically housed in the least desirable

housing that is available within the community. Housing occupied by...[migrant] farmworkers tends to be in substandard condition, often structurally inadequate, lacking basic plumbing and kitchen facilities, as well as being over-crowded” [Ziebarth, 2006: 355]. Analysis of migrant farmworker housing in North Carolina based on data collected in 2007 and 2008 found that substandard conditions were common in migrant farmworker camps [Vallejos et al., 2011]. At any point in the 2007 agricultural season, between 11% and 44% of camps had inadequate bathing, laundry, or storage facilities. The 2008 data showed that 89% of camps had more than one condition that violated the North Carolina Migrant Housing Act, with two-thirds of camps being moderately substandard and more than 20% being severely substandard.

Migrant Farmworker Housing Regulations

Migrant farmworker housing is regulated by the Migrant and Seasonal Farmworker Protection Act (MSPA), which is administered by the US Department of Labor (<http://www.dol.gov/compliance/laws/comp-msawpa.htm>; accessed March 16, 2011). In North Carolina, migrant farmworker regulations are enforced by the NC Department of Labor [2008], based on the North Carolina Migrant Housing Act. The North Carolina Migrant Housing Act reflects the MSPA, but imposes some more stringent requirements. Migrant farmworker housing regulations provide standards for living and sleeping space, kitchen facilities, bathroom facilities, laundry facilities, and general safety and sanitation. These regulations require that all migrant farmworker housing be inspected before it is occupied. Post-residency inspections are generally limited to responses to complaints for regulatory violations.

Some characteristics of migrant farmworker housing quality may be considered “optional” and subject to personal taste; these are not subject to current regulations. Having dividers between toilets or showers for privacy are such characteristics. The importance of these optional characteristics for safety, health, or quality of life is subject to interpretation. However, migrant farmworker housing characteristics which are based on the regulations stated in the MSPA and the North Carolina Migrant Housing Act are not optional. These regulations are in place because they are considered necessary for the safety and health of migrant farmworkers. This analysis focuses on violations to these regulations to provide objective indicators of migrant farmworker housing quality.

Aims

This analysis has three aims: (1) to describe the general characteristics of migrant farmworker camps located

in North Carolina; (2) to determine the number of migrant farmworker camps with total violations and individual violations in six domains of housing regulations: the camp, sleeping rooms, bathrooms, kitchens, laundry rooms, and general housing; and (3) to determine the associations of migrant farmworker camp characteristics with the presence of housing violations.

METHODS

This analysis is part of an ongoing program of community-based participatory research that involves investigators at Wake Forest School of Medicine, the North Carolina Farmworkers Project, Student Action with Farmworkers, and other clinics and organizations serving farmworkers in North Carolina. Data were collected from June to October, 2010. This research was approved by the Wake Forest School of Medicine Institutional Review Board.

Sample

The research was conducted in a 16 county area of east-central North Carolina in which a large number of migrant farmworkers are employed. The counties are Caswell, Craven, Cumberland, Duplin, Edgecombe, Greene, Halifax, Harnett, Johnston, Lenoir, Nash, Person, Sampson, Wake, Wayne, and Wilson. These counties are served by the organizations that participated in the research: North Carolina Farmworkers Project, Carolina Family Health Center, Kinston Community Health Center, and Piedmont Health Services.

This research focused on housing occupied by migrant farmworkers. All participants in this research resided in employer provided housing. In North Carolina, all migrant farmworkers reside in employer provided housing. Lists of camps were obtained from the partner organizations. Over the course of data collection, the list of camps was expanded as new camps were encountered. All unidentified camps were contacted to participate in the study. When a camp was selected, project field staff traveled to the camp and explained the nature of the study to residents. If camp residents reached a general consensus to participate in the study, a camp census was conducted to assess general camp characteristics and to determine eligibility. A total of 186 camps were enrolled in the study. Residents in an additional 36 camps declined to participate, and the grower or contractor refused to permit participation in another four camps. The resulting camp participation rate was 82.3% (186/226). In 5 of the 186 participating camps, data collection were not completed due to the intervention by the grower. For three of these camps, insufficient information was collected on adherence to housing regulations, and they could not be

included in this analysis. Therefore, the final sample for this analysis included 183 camps. Camps that participated in the study were given a volley ball as a token of appreciation.

Three residents at each camp volunteered to be study participants. Inclusion criteria were being male, currently employed as a farmworker, migrating for employment, and residence in the camp. Two farmworkers were asked to complete an interview questionnaire, to help with assessing their sleeping rooms, and to provide biological samples. One farmworker was asked to help with a camp and housing assessment. The final sample included 371 men who completed interviews and 182 men who assisted in the camp assessments; 231 men refused to participate when asked. The participation rate was 70.5% (553/784); however, the rate could be lower as individuals who did not want to participate could have avoided the recruiters. The three farmworkers who completed the interviews and who helped with the camp and housing assessment were each given a \$30 cash incentive. All participants provided written informed consent.

Data Collection

Data for this analysis are based on three components of the research: (1) interviews with two farmworkers in each camp; (2) camp assessments assisted by one of the resident farmworkers; and (3) evaluation of water contamination in the camps. All data collection forms were developed in English and translated into Spanish by a native Spanish speaker familiar with Mexican Spanish. The forms were reviewed by staff members of the community partners who were native Spanish speakers. Revised forms were field tested, with the interview questionnaires being pretested with four male migrant farmworkers. All materials were revised based on the field test.

Farmworker interviews were completed by trained staff members who were fluent Spanish speakers. Interviews assessed demographic information, housing features, and perceptions of housing quality. Farmworkers who completed the interviews helped with an assessment of their sleeping rooms. Interviews took approximately 90 min to complete.

Housing assessments were completed by trained staff members who were fluent Spanish speakers with the assistance of a farmworker. During the course of the housing assessment, the inspector observed, asked questions, and used instruments such as a flashlight and an extending mirror to inspect inside cabinets and behind appliances for signs of pest infestation and exposed wires. The housing assessment form consisted of five sections: (1) general camp, (2) toilet facilities, (3) bathing and showering facilities, (4) kitchen/eating area, and (5) laundry facilities. The housing assessment form included 129 items, 79 of which

were designed to assess compliance with the standards as summarized in the North Carolina Department of Labor Introduction to Migrant Housing Inspections [NC Department of Labor, 2008]. Thirteen standards were not assessed due to feasibility. For example, the standards in the Heating Section are specific to housing being used in the winter, and the test for hot water supply adequacy requires that no one have showered or done laundry in the previous hour. Assessment of the sleeping room was included in the interview and only the bedrooms of the two questionnaire participants were inspected. The sleeping room assessment was included in the questionnaire because over the course of the interview, the interviewer established the rapport necessary to enter, inspect, and photograph the participants' bedrooms.

One housing regulation, drinking water safety, was based on laboratory analysis. Water samples were collected according to the guidelines laid out by the Public Water Supply Section of the NC Department of Environment and Natural Resources [Public Water Supply Section, n.d.]. The water samples were delivered to state-certified laboratories within 24 hr, where the samples were tested for total coliforms and *Escherichia coli* following standard method 9223 [Standard Methods, 2006]. The laboratories used a selective and differential medium for the determination of the presence or absence of total coliforms and *E. coli* in drinking water based on enzyme activity. Quality control procedures consisted of a total of 23 duplicates (12.6% of the entire sample) collected across the four data collection regions. Duplicate samples were collected at the same time as the actual samples, and then a special ID was created to blind the laboratory. All duplicate samples had the same results.

Measures

The outcome measures for this analysis were the number of violations in six domains of housing regulations: (1) camp, (2) sleeping room, (3) bathroom, (4) kitchen, (5) laundry room, and (6) general housing. The total number of regulation violations was the seventh outcome measure. The total number of potential violations included in each measure is listed in Table I. The number of violations included in each measure is limited so that redundant violations are not included. For example, potential sleeping room size violations included ceiling height in each participant's room and the area of each participant's sleeping room in square feet. From one to four violations were possible, but only one violation was counted. Similarly, the potential number of camp violations for refuse disposal included three potential violations; but if one to all three violations were noted, only one violation for refuse disposal was counted. The number of general housing violations includes two specific items, fire escape

TABLE I. Migrant Farmworker Housing Regulation Domains, Migrant Farmworker Housing Eastern North Carolina, 2010

Violations in each domain	Individual violations	Number of violations tallied
Camp		
Drinking water safety	1	1
Refuse disposal: trash bin is provided outside, trash bin lid is tight-fitting, frequency of trash collection	3	1
Cleanliness of camp grounds	1	1
Standing water in camp	1	1
Camp proximity to commercial animal housing	1	1
Total general camp violations possible	7	5
Sleeping room violations		
Sleeping room size: proper ceiling height for both participants' sleeping rooms, adequate square footage per sleeping room resident in both participants' sleeping rooms	4	1
Proper bed provision: one bed per resident in both participants' sleeping rooms, beds raised off floor in both sleeping rooms, no triple bunks observed in both sleeping rooms	6	1
Adequate personal item storage in participants' sleeping rooms	2	1
Windows and doors: windows provided in both participants' sleeping rooms, windows open, windows screened, screens damaged, exterior doors properly screened	10	1
Smoke alarms for both participants' rooms	2	1
Exposed wiring ^a	1	—
Lighting ^a	1	—
Electrical outlet(s) ^a	1	—
Cockroach infestation ^a	1	—
Rodent infestation ^a	1	—
Weather protection (no holes or leaks) ^a	1	—
Appropriate flooring ^a	1	—
Floor condition ^a	1	—
Fire extinguisher: provision and appropriate rating ^a	1	—
Total sleeping room violations possible	14	5
Bathroom		
Proper sex-specific bathroom provision: provided, clearly indicated, sufficient privacy provided	3	1
Latrine distance from housing	1	1
Bathroom access not through sleeping room	1	1
Toilet adequacy: general and sex-specific	2	1
Proper bathroom ventilation	1	1
Window properly screened	1	1
Functioning drain	1	1
Showerhead adequacy	1	1
Hand washbasin adequacy	1	1
Bathroom cleanliness: clean upon inspection, cleaned daily	2	1
Toilet paper provision	1	1
Exposed wiring ^a	1	—
Lighting ^a	1	—
Electrical outlet(s) ^a	1	—
Cockroach infestation ^a	1	—
Rodent infestation ^a	1	—
Weather protection (no holes or leaks) ^a	1	—
Appropriate flooring ^a	1	—
Floor condition ^a	1	—
Hot and cold water supply ^a	1	—
Total bathroom violations possible	20	11

(Continued)

TABLE I. (Continued)

Violations in each domain	Individual violations	Number of violations tallied
Kitchen		
Dining room table provision	1	1
Proper kitchen countertop material	1	1
Stove adequacy: there is a stove, number of burners is adequate	2	1
Refrigerator adequacy: refrigerator provided, temperature meets standard	2	1
Kitchen cleanliness	1	1
Exposed wiring ^a	1	—
Lighting ^a	1	—
Electrical outlet(s) ^a	1	—
Cockroach infestation ^a	1	—
Rodent infestation ^a	1	—
Weather protection (no holes or leaks) ^a	1	—
Appropriate flooring ^a	1	—
Floor condition ^a	1	—
Fire extinguisher: provision and appropriate rating ^a	1	—
Hot and cold water supply ^a	1	—
Total number of kitchen violations possible	15	5
Laundry room		
Laundry tub/washing machine adequacy	1	1
Slop sink adequacy	1	1
Facilities for drying clothes: dryer or clothesline	1	1
Cockroach infestation ^a	1	—
Rodent infestation ^a	1	—
Weather protection (no holes or leaks) ^a	1	—
Total number of laundry room violations possible	6	3
General housing		
Fire escape provision	1	1
Exposed wiring in bathroom, sleeping rooms, kitchen	—	1
Lighting in bathroom, sleeping rooms, kitchen	—	1
Electrical outlets in bathroom, sleeping rooms, kitchen	—	1
Cockroach infestation in bathroom, sleeping rooms, kitchen, laundry room	—	1
Rodent infestation in bathroom, sleeping rooms, kitchen, laundry room, other room	—	1
Rodent infestation in "other" room ^a	1	1
Weather protection (no holes or leaks) in bathroom, sleeping rooms, kitchen, laundry room	—	1
Appropriate flooring in bathroom, sleeping rooms, kitchen	—	1
Floor damage in bathroom, sleeping rooms, kitchen	—	1
Fire extinguisher provision in sleeping rooms and kitchen with appropriate ratings for each room	—	1
Hot and cold water supply in bathroom and kitchen	—	1
Total general housing violations possible	2	12
Total number of violations possible per camp	102	63

^aVariables that are counted individually in the domain violations tally, but are aggregated in the general housing violations tally. The domain violations tally is intended to assess violations on a room-by-room basis, whereas the general housing violations tally aggregates certain violations so that they are only counted once (e.g., roach infestation, weather protection).

provision and rodent infestation in other room, plus the non-duplicated violations from each of the specific rooms. Non-duplicated violations include specific violations that can occur in more than one room; for example, if exposed wiring was present in the bathroom, sleeping rooms, and

kitchen, only one exposed wiring violation would be included. The number of total violations is the sum of the non-duplicated violations in the camp, general housing, and each room. Several regulations are based on the number of farmworkers in a camp per facility. These include

the number of farmworkers per shower head (10), per toilet (15), per hand washbasin (6), and per washing machine or washtub (30).

The distribution of sleeping room, bathroom, kitchen, general housing, and total violations allowed these to be maintained as continuous outcomes for analysis. However, for description, each is also grouped into categories: sleeping room violations were grouped into the categories 0, 1 or 2, 3 or 4, 5–10; bathroom violations were grouped into the categories 2, 3, 4, 5, 6–10; kitchen violations were grouped into the categories 0, 1, 2, 3, 4–6; general housing violations were grouped into the categories 0, 1 or 2, 3 or 4, 5–7, and total violations were grouped into the categories 4–9, 10–14, 15–22. The skewed distribution of the camp and the laundry room violations resulted in their being grouped into categories for analysis. Camp violations were grouped into the categories 0, 1, 2, 3, or 4; laundry room violations were grouped into the categories 0, 1, 2–4.

Seven camp characteristics were included as predictors in this analysis based on previous analyses [Whalley et al., 2009; Vallejos et al., 2011]: camp H-2A status, housing types in camp, number of camp residents, number of camp housing units, presence of female residents, Certificate of Inspection posted, and data collection period. H-2A status was a dichotomous measure indicating whether any farmworkers with H-2A visas were living in the camp. Housing type was based on the presence or absence of barracks in the camp. Camps with barracks could also have non-barrack housing, such as houses and trailers. Non-barracks camps had only houses or trailers. Number of camp residents was divided into three categories: 1–10, 11–20, and 20 or more. Number of housing units in the camp had the values, 1, 2, and 3 or more. Presence of female residents was a dichotomous measure. North Carolina Department of Labor inspection certificate posted was a dichotomous measure. All camps inspected by the North Carolina Department of Labor should post the inspection certificate; as all of the camps included in this study housed migrant farmworkers, all should have been inspected. The final measure is data collection period, which had the values of early season (June–mid-July), mid season (mid-July–August), and late season (September and October).

Analysis

Descriptive statistics were used to describe the various camp characteristics. Bivariate associations of the number of violations in each domain of housing regulations with camp characteristics were assessed using chi-squared or Fisher's exact test when necessary. The sleeping room, bathroom, kitchen, general housing, and total violations approximated normal distributions. Therefore, multiple

linear regression models were used to identify camp characteristics that are predictive of these domains of housing violations. Least square means of estimated number of violations were reported for each categorical predictor. All statistical analyses were performed using SAS 9.2 (Cary, NC) and a two-sided *P*-value of <0.05 was considered statistically significant.

RESULTS

Camp Characteristics

About two-thirds of the camps participating in this study had residents with H-2A visas (Table II). Barracks were present in 31.1% of the camps. Camps ranged widely in the number of residents present, with almost half (48.6%) having 1–10 residents, one-quarter having 11–20 residents, and another quarter having 21 or more residents. Most camps (61.1%) had only 1 housing unit, while 18.9% had 2 housing units, and 18.9% had 3 or more housing units. About one-quarter of the camps had female residents. Little more than one-third of the camps had a North Carolina Department of Labor (NCDOL) Certificate of Inspection posted. Data were collected across the agricultural season, with data collected at 28.5% of the camps during June through mid-July, at 44.6% of the camps from mid-July to August, and at 26.9% of the camps in September and October.

TABLE II. Migrant Farmworker Camp Characteristics, Eastern North Carolina, 2010 (n = 183)

Camp characteristics	n	%
Workers with H-2A visas present	125	68.8
Housing type		
Barracks present	55	31.1
No barracks present	128	69.9
Number of residents in camp		
1–10	89	48.6
11–20	47	25.4
21 or more	47	25.4
Number of housing units in camp		
1 Housing unit	113	61.1
2 Housing units	36	20.0
3 or More housing units	34	18.9
Female residents	44	24.7
NCDOL Certificate of Inspections posted	62	34.4
Data collection period		
Early season (June–mid-July)	51	28.5
Mid season (mid-July–August)	83	44.6
Late season (September–October)	49	26.9

Migrant Farmworker Housing Regulations Violations

Violations of migrant farmworker housing regulations were detected in each of the six domains (Table III). The mean number of camp violations was 1.6. Although 15 (8.2%) of the camps were found to have no camp violations, 29 (15.8%) had 3 or 4 camp violations. The camps averaged 3.8 sleeping room violations, with 3 (1.6%) having no violations, and 61 (33.4%) having 5–10 violations.

TABLE III. Number of Violations in Housing Regulation Domains, Migrant Farmworker Camps in Eastern North Carolina, 2010 (n = 183)

Number of violations	Camps		Violations	
	n	%	Mean	SD
Camp			1.6	0.9
0	15	8.2		
1	77	42.1		
2	62	33.9		
3 or 4	29	15.8		
Sleeping room			3.8	1.9
0	3	1.6		
1 or 2	45	24.6		
3 or 4	74	40.4		
5–10	61	33.4		
Bathroom			4.5	1.7
2	21	11.5		
3	43	23.5		
4	25	13.7		
5	44	24.0		
6–10	50	27.3		
Kitchen			2.3	1.5
0	18	9.8		
1	41	22.4		
2	51	27.9		
3	39	21.3		
4–6	34	18.6		
Laundry room			1.1	0.9
0	50	27.3		
1	82	44.8		
2–4	51	27.9		
General housing			3.1	1.5
0	7	3.8		
1 or 2	60	32.8		
3 or 4	80	43.7		
5–7	36	19.7		
Total violations			11.4	3.2
4–9	47	25.7		
10–14	110	60.1		
15–22	26	14.2		

Bathroom violations averaged 4.5 per camp. Every camp had at least 2 violations, and 50 (27.3%) had 6–10 violations. The mean number of kitchen violations was 2.3, with 18 (9.8%) having no violations and 34 (18.6%) having 4–6 violations. Camps averaged 1.2 laundry room violations. Although 50 (27.3%) had no laundry room violations, 51 (27.9%) had 2–4 violations. The mean number of general housing violations was 3.1. Seven (3.8%) camps had no general housing violations, but 80 (43.7%) had 3 or 4 violations, and 36 (19.7%) had 5–7 violations. The mean number of total violations was 11.4. Every camp had at least 4 total violations, with 110 (60.1%) having 10–14 total violations, and 26 (14.2%) having 15–22 violations.

Camp Characteristics Associated With Housing Violations

Camp characteristics were associated with the number of violations for different regulation domains (Table IV). The mean number of sleeping room violations was lower for camps in which workers with H-2A visas lived (3.6 vs. 4.3), in which housing included barracks (3.1 vs. 4.2), and in which a NCDOL Certificate of Inspection was posted (3.4 vs. 4.1). The mean number of sleeping room violations was greater during the middle of the agricultural season (4.3) and late in the season (3.8), compared to early (3.3) in the season. The mean number of bathroom violations was lower for camps in which workers with H-2A visas lived (4.3 vs. 5.1) and in which no females lived (4.3 vs. 5.3). The mean number of kitchen violations was lower for camps in which workers with H-2A visas lived (2.1 vs. 2.6), with a smaller number of housing units (2.1 for 1 housing unit, 2.2 for 2 units, 2.8 for 3 or more units), and in which a NCDOL Certificate of Inspection was posted (1.9 vs. 2.5). The mean number of general housing violations tended to be lower for camps in which workers with H-2A visas lived (2.9 vs. 3.4). The mean number of general housing violations was greater during the middle of the agricultural season (3.5) and late in the season (2.9), compared to early (2.7) in the season. The mean number of total violations was lower for camps in which workers with H-2A visas lived (10.8 vs. 12.7), in which housing included barracks (10.7 vs. 11.3), in which there were no female residents (11.1 vs. 12.5), and in which a NCDOL Certificate of Inspection was posted (10.4 vs. 12.8). The mean number of total violations was greater during the middle of the agricultural season (12.1) and late in the season (11.4), compared to early (10.4) in the season. The number of camp violations was lower in camps in which workers with H-2A visas were present (8.8% vs. 31.0% with 3 or 4 violations), and in camps with the smallest and the largest number of residents. The number of laundry room violations was lower in camps in which barracks

TABLE IV. Bivariate Associations of Number of Violations in Each Domain of Housing Regulations With Camp Characteristics, Migrant Farmworker Camps in Eastern North Carolina, 2010 (n = 183)

Regulation domains	Number of violations																
	Workers with H-2A visas present		Housing type		Number of residents in camp			Number of housing units in camp			Female residents		NCDOL Certificate of Inspection posted		Data collection period		
	Yes	No	Barracks	No Barracks	1-10	11-20	21+	1	2	3+	Yes	No	Yes	No	Early	Middle	Late
Number of camps	128	60	56	130	89	47	47	113	37	35	46	140	62	124	53	83	50
Sleeping room																	
Mean	3.6	4.3*	3.1	4.2*	4.0	4.0	3.4	3.8	4.0	4.0	4.0	3.8	3.4	4.1*	3.3	4.3	3.8*
SE	0.2	0.3	0.3	0.2	0.2	0.3	0.3	0.2	0.3	0.3	0.3	0.2	0.2	0.2	0.3	0.2	0.3
Bathroom																	
Mean	4.3	5.1*	4.7	4.5	4.4	4.6	4.6	4.5	4.5	4.5	5.3	4.3*	4.4	4.6	4.1	4.7	4.6
SE	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.2	0.3	0.3	0.3	0.1	0.2	0.2	0.2	0.2	0.2
Kitchen																	
Mean	2.1	2.6*	2.4	2.2	2.2	2.5	2.3	2.1	2.2	2.8*	2.6	2.2	1.9	2.5*	2.0	2.5	2.2
SE	0.1	0.2	0.2	0.1	0.2	0.2	0.2	0.1	0.2	0.3	0.2	0.1	0.2	0.1	0.2	0.2	0.2
General housing																	
Mean	2.9	3.4 [§]	3.0	3.1	3.1	3.0	3.0	2.9	3.3	3.4	3.1	3.1	2.9	3.2	2.7	3.5	2.9*
SE	0.2	0.2	0.1	0.2	0.2	0.2	0.2	0.1	0.3	0.3	0.1	0.2	0.2	0.1	0.2	0.2	0.2
Total violations																	
Mean	10.8	12.7*	10.7	11.3*	11.5	12.0	10.8	11.4	11.4	11.5	12.5	11.1*	10.4	12.8*	10.4	12.1	11.4*
SE	0.3	0.4	0.3	0.4	0.3	0.5	0.5	0.3	0.5	0.6	0.5	0.3	0.4	0.3	0.4	0.4	0.5

Regulation domains	Number of violations																
	Workers with H-2A visas present		Housing type		Number of residents in camp			Number of housing units in camp			Female residents		NCDOL Certificate of Inspection posted		Data collection period		
	Yes (%)	No (%)	Barracks (%)	No barracks (%)	1-10 (%)	11-20 (%)	21+ (%)	1 (%)	2 (%)	3+ (%)	Yes (%)	No (%)	Yes (%)	No (%)	Early (%)	Middle (%)	Late (%)
Camp																	
0	8.0	8.6*	9.1	7.8	7.9	2.1	14.9*	8.0	8.3	8.8	9.1	7.9	12.9	5.9	7.8	7.2	10.2
1	50.4	24.1	40.0	43.0	47.2	38.3	36.2	42.5	50.0	32.4	34.1	44.6	41.9	43.2	51.0	36.1	42.9
2	32.8	36.2	38.2	32.0	31.5	31.9	40.4	35.4	22.2	41.2	29.6	35.3	32.3	33.9	29.4	37.4	32.7
3 or more	8.8	31.0	12.7	17.2	13.5	27.7	8.5	14.2	19.4	17.7	27.3	12.2	12.9	17.0	11.8	19.3	14.3
Laundry room																	
0	25.6	31.0	45.5	19.5*	14.6	31.9	46.8*	22.1	27.8	44.1	31.8	25.9	24.2	28.0	37.3	20.5	28.6
1	45.6	43.1	41.8	46.1	51.7	44.7	31.9	47.8	41.7	38.2	50.0	43.2	48.4	43.2	45.1	47.0	40.8
2-4	28.8	25.9	12.7	34.4	33.7	23.4	21.3	30.1	30.6	17.7	18.2	30.9	27.4	28.8	17.7	32.5	30.6

*P < 0.05.
[§]P < 0.10.

were present (12.7% vs. 34.4% with 2-4 violations), and with more residents.

Camp characteristics remained significantly associated with the number of violations in the multivariate analysis (Table V). Controlling for all of the camp characteristics,

camp characteristics remained significantly associated with the number of violations in the multivariate analysis (Table V). Controlling for all of the camp characteristics, camps with residents having H-2A visas had fewer sleeping room violations (3.3) than did camps with no residents having H-2A visas (4.1), as did camps with barracks (3.1) compared to those without barracks (4.3). Camps that were assessed in the middle and late in the season tended

TABLE V. Multivariate Analysis of General Housing, Sleeping Room, Bathroom, Kitchen, and Total Violations of Housing Regulations for Migrant Farmworker Camps in Eastern North Carolina, 2010 (n = 183)

Regulation domains	Number of violations																
	Workers with H-2A visas Present		Housing type		Number of residents in camp			Number of housing units in camp			Female residents		NCDOL Certificate of Inspection posted		Data collection period		
	Yes	No	Barracks	No barracks	1-10	11-20	21+	1	2	3+	Yes	No	Yes	No	Early	Middle	Late
Sleeping room																	
Mean	3.3	4.1*	3.1	4.3**	3.8	3.7	3.7	3.5	3.7	4.0	3.7	3.7	3.5	3.9	3.3	4.1	3.7 [§]
SE	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.2	0.3	0.4	0.3	0.2	0.3	0.2	0.3	0.2	0.3
Bathroom																	
Mean	4.5	4.9	4.7	4.7	4.7	4.7	4.8	4.9	4.8	4.5	5.1	4.3*	4.7	4.8	4.4	4.9	4.9
SE	0.2	0.3	0.3	0.2	0.3	0.3	0.3	0.2	0.3	0.3	0.3	0.2	0.3	0.2	0.3	0.2	0.3
Kitchen																	
Mean	2.2	2.6	2.6	2.2	2.5	2.6	2.0	2.1	2.3	2.7	2.3	2.4	2.1	2.6*	2.2	2.6	2.4
SE	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2
General housing																	
Mean	2.8	3.4 [§]	3.1	3.4	3.0	3.0	3.0	2.7	3.2	3.4 [§]	3.3	3.0	3.0	3.2	2.8	3.5	2.9*
SE	0.2	0.2	0.2	0.3	0.3	0.3	0.2	0.1	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Total violations																	
Mean	11.0	12.3**	10.9	12.0	11.5	11.8	11.0	11.4	11.4	11.5	11.7	11.2	11.0	11.9 [§]	10.7	12.1	11.6*
SE	0.3	0.5	0.5	0.3	0.5	0.5	0.5	0.4	0.6	0.6	0.5	0.3	0.5	0.3	0.5	0.4	0.5

*P < 0.05.
 **P < 0.01.
 §P < 0.10.

to have more sleeping room violations (4.1 and 3.7, respectively) than camps assessed in the early (3.3) season. Camps with female residents had more bathroom violations (5.1 vs. 4.3). Camps with a Certificate of Inspection posted had fewer kitchen violations (2.1) than camps without a Certificate of Inspection posted (2.6). Camps that were assessed in the middle of the season had more general housing violations (3.5) than camps assessed in the early (2.8) or late (2.9) season. Camps with residents having H-2A visas tended toward fewer general housing violations (3.3) than did camps with no residents having H-2A visas (3.9). Camps with 3 or more housing units tended to have more general housing violations (3.4) than camps with 2 units (3.2) or 1 unit (2.7).

Camps with residents having H-2A visas had fewer total violations (11.0) than did camps with no residents having H-2A visas (12.3). Camps that were assessed in the middle or late in the season had more total violations (12.1 and 11.6, respectively) than camps assessed early (10.7) in the season. Camps with a Certificate of Inspection posted tended to have fewer total violations (11.0)

than camps without a Certificate of Inspection posted (11.9).

DISCUSSION

Violations of housing regulations are common in North Carolina migrant farmworker camps. Using the number of housing violations based on current migrant farmworker housing regulations, every camp that was assessed was found to have more than 1 violation of housing regulations, with the range in the number of violations being from 4 to 22. Housing regulation violations were common in each of the six domains considered.

These results focus only on actual violations of migrant housing regulations. They do not consider characteristics of housing quality that affect the quality-of-life of migrant farmworkers. For example, migrant farmworker housing that did not have dividers and doors on toilets and showers for privacy did not violate regulations. However, the lack of privacy does affect quality-of-life. Camps that provide at least one washing machine or wash tub for 30

or fewer residents did not violate a regulation. However, a single washing machine or wash tub is not realistically adequate to meet the laundry needs of 30 adult men whose employment exposes them to dirt, pesticides, and large amounts of perspiration. These issues will be addressed in additional analyses.

These results correspond with the findings from previous reports that focus on migrant farmworker housing. National analyses [Housing Assistance Council, 2001], as well as for areas of Minnesota [Ziebarth, 2006] and North Carolina [Vallejos et al., 2011], have reported substantial problems with the general quality of migrant farmworker housing, with the overall structural integrity, and with bathroom, kitchen, and laundry facilities. The data for these studies were based solely on interviews. However, the data for this analysis are based on direct assessment of housing characteristics as related to specific housing regulations. With these detailed data, the current analysis documents more deficiencies than do these earlier studies. For example, the Housing Assistance Council [2001] reported nationally that 8.3% of farmworker housing had deficiencies in terms of the bath or shower and 9.4% had deficiencies with their toilets. Ziebarth [2006] reported that 26% of migrant farmworkers in Minnesota made negative comments about the quality of the bathroom. Vallejos et al. [2011] reported that 74.1% of North Carolina migrant farmworker housing had one or more bathroom problems. The current analysis found that all of the housing assessed had at least 2 violations of a bathroom regulation, and 27.3% had 6 or more violations. The specific violations of bathroom regulations included cockroach infestation (41.2%), rodent infestation (25.1%), inadequate number of showers (6.0%), and an inadequate number of toilets (2.8%). The Housing Assistance Council [2001] reported nationally that 10.6% of farmworker housing had deficiencies for the stove and 5.7% had deficiencies with the refrigerator. Ziebarth's [2006] reported that 18% of Minnesota migrant farmworkers made negative comments about the quality of the kitchen, and Vallejos et al. [2011] reported that 29.6% of North Carolina migrant farmworker housing had one or more kitchen problems. This analysis found that 90.2% of the housing assessed had at least one violation of a kitchen regulation, and 18.6% had 4 or more violations. Among the specific kitchen violations were cockroach infestation (45.9%), rodent infestation (28.9%), and refrigerators not maintaining an appropriate temperature (65.5%).

Three camp characteristics were consistently associated with the number of violations across the housing regulation domains. The presence of workers with H-2A visas in a camp was associated with fewer violations. The presence of a NCDOL Certificate of Inspection in a camp was also associated with fewer violations. Camps assessed in the middle of the season had more violations than camps

assessed early or late in the season. The presence of workers with H-2A visas being associated with better housing conditions has been reported in earlier research on migrant farmworker housing in North Carolina; Vallejos et al. [2011] reported that camps with any residents having an H-2A visa are more likely to have adequate housing facilities than camps with no residents having an H-2A visa. Whalley et al. [2009] also reported that farmworkers with H-2A visas experience better housing and field sanitation conditions than do farmworkers who do not have H-2A visas. No previous literature has reported on the association of inspection certification or time in the agricultural season with farmworker housing quality.

Female residents, housing type, and camp size, in terms of number of residents and number of housing units, are all associated with the number of violations. Camps with female residents had more bathroom violations and total violations in the bivariate analysis, with the association to the number of bathroom violations remaining significant in the multivariate analysis. Vallejos et al. [2011] report that farmworker camps in North Carolina with female and child residents were more likely to have severely substandard housing than camps not having women and children present. Two factors may be associated with this finding. First, camps housing women and men are required to have separate bathrooms and these bathrooms must be clearly marked. Second, women are less likely to be in camps that have workers with H-2A visas, as women are not recruited for H-2A visas. This makes them also less likely to reside in H-2A camps, which were found to have fewer housing violations.

Camps with barracks present had fewer sleeping room violations in the bivariate and multivariate analysis. Laundry room and total violations were reduced in the bivariate analysis. Vallejos et al. [2011] also reported better housing in farmworker camps that have barracks, particularly related to sleeping rooms. Arcury et al. [2010] found that farmworkers living in barracks had a lower number of pesticide urinary metabolite detections than farmworkers living in other housing. This may be due to barracks being built specifically for housing migrant farmworkers with better designs and cleaning facilities, while old houses and trailers cannot be easily modified to fit the needed housing standards.

Camp occupancy and number of dwellings revealed mixed associations with housing violations. In the bivariate analysis, camps with fewer residents had more camp and laundry room violations, while camps with more housing units had more kitchen violations and fewer laundry violations. In contrast, Vallejos et al. [2011] reported that camps with more residents (11 or more vs. 10 or fewer) had worse sleeping room (crowding), bathroom (showerheads), and general facility conditions. Neither measure of camp size retained a statistically significant association

with any regulation domain in the multivariate analysis. Further analysis of camp size and housing characteristics is needed.

Taken together, two of the camp characteristics consistently associated with the number of violations, the presence of a Certificate of Inspection and the presence of workers with H-2A visas, indicate the importance of regulations and enforcing regulations for the quality of housing provided for migrant farmworkers. First, camps with evidence of having followed regulations by having a Certificate of Inspection posted generally had fewer violations when they were independently assessed by this project. Second, employers who hire workers with H-2A visas are required to have their camps inspected. Employers of workers with H-2A visas are monitored more closely for adherence to regulations by the H-2A visas programs of which they are members and by the Farm Labor Organizing Committee (FLOC). FLOC has a union contract with most employers who hire workers with H-2A visas in North Carolina. If these employers do not adhere to regulations, they can be held responsible by this union. Employers who do not adhere to regulations may be denied the opportunity to hire workers with H-2A visas in the future.

Other research has shown that the employers of workers with H-2A visas are more adherent to regulations [Arcury et al., 1999; Robinson et al., 2011]. The H-2A visa program has been criticized because the control and intimidation exerted by employers limits farmworkers' ability to voice concerns over unsafe working conditions [Bauer, 2007]. However, Robinson et al. [2011] showed that workers with H-2A visas reported fewer minimum wage violations compared to workers without H-2A visas (3.6% vs. 45.3%). Workers with H-2A visas were also more likely to report that their employers follow pesticide safety regulations than do workers without H-2A visas [Arcury et al., 1999; Robinson et al., 2011].

The period of the season in which the camps were assessed also indicates the importance of regulations for improving the quality of migrant farmworker housing. Housing is generally only inspected before occupancy by migrant farmworkers. Earlier in the season, which is closer to the time camps are inspected, fewer violations are present. However, as the season progresses and the time from official inspection increases, the possibility of violations increases as camp conditions decline due to normal deterioration and the lack of maintenance, and the possibility of larger numbers of workers living in a camp during the most intense period of crop production. Inspection throughout the agricultural season when camps are occupied would help ensure the continued adherence to housing regulations.

The results of this study should be evaluated in terms of its limitations. The data come from one region of one

state in 1 year. Generalizations of results to other regions should be made with caution. This study uses a cross-sectional design; therefore, the causal relationships of independent measures and the number of violations can only be inferred. Although all identified migrant farmworker camps were asked to participate, not all migrant farmworkers were identified; the conditions in unidentified camps may differ from those in the camps identified for the study. Data collectors were not allowed into a number of camps; the conditions in these camps may have differed for better or worse compared to the camps that participated in the study. Finally, farmworkers who volunteered to participate in the study may differ from those who did not volunteer.

Although this study has several limitations, it also has several strengths. The study sample included a large number of camps representative of the agricultural region of Eastern North Carolina, ensuring an accurate view of the housing conditions for migrant farmworkers. The camp assessments conducted for this study are based on the North Carolina Department of Labor guidelines providing an established, standardized, and reproducible collection methodology. The data collectors for this study were familiar with the farmworker communities. This allowed access to the majority of camp sites and uninhibited data and sample collection during the study.

This study found that the housing provided to migrant farmworkers in North Carolina is in violation of the regulations that govern the quality and safety of this housing. Violations were present in each housing domain investigated. The most prominent factors associated with greater numbers of violations were the absence of workers with H-2A visas resident in the camps, the lack of a NCDOL Certificate of Inspection being posted in the camps, and the camps being assessed in the middle and later part of the agricultural season. These results argue for several recommendations to improve the quality of housing provided to migrant farmworkers. The first recommendation is the need to abandon "agricultural exceptionalism" related to migrant farmworker health and safety regulations [Wiggins, 2009]. Few "family farms" hire migrant workers. Exempting farms that employ migrant workers from health and safety regulations that apply to other industries is no longer appropriate. The second recommendation is the need for rigorous enforcement of existing regulations. The results of this study indicate that in situations with greater enforcement, such as in camps in which workers with H-2A visas live, fewer housing violations are present. More rigorous enforcement of migrant farmworker regulations will require a greater number of inspectors. More rigorous enforcement should be supported with penalties that are sufficient to serve as deterrents. Finally, migrant farmworker housing regulations and their enforcement need to be evaluated to document their effectiveness in

protecting this vulnerable population throughout the growing season. The regulations and enforcement should be modified if they are not found to be effective in protecting the health and dignity of agricultural workers.

REFERENCES

- Arcury TA, Marín AJ. 2009. Latino/Hispanic farmworkers and farm work in the eastern United States: The context for health, safety, and justice. In: Arcury TA, Quandt SA, editors. *Latino farmworkers in the eastern United States: Health, safety, and justice*. New York: Springer, pp. 15–36.
- Arcury TA, Quandt SA. 2007. Delivery of health services to migrant and seasonal farmworkers. *Ann Rev Public Health* 28:345–363.
- Arcury TA, Quandt SA, Austin CK, Preisser J, Cabrera LF. 1999. Implementation of US-EPA's Worker Protection Standard training for agricultural laborers: An evaluation using North Carolina data. *Public Health Rep* 114:459–468.
- Arcury TA, Grzywacz JG, Talton JW, Chen H, Vallejos QM, Galván L, Barr DB, Quandt SA. 2010. Repeated pesticide exposure among North Carolina migrant and seasonal farmworkers. *Am J Ind Med* 53:802–813.
- Bauer M. 2007. *Close to slavery: Guestworker programs in the United States*. Montgomery, AL: Southern Poverty Law Center, pp. 1–52.
- Bradman A, Chevrier J, Tager I, Lipsett M, Sedgwick J, Macher J, Vargas AB, Cabrera EB, Camacho JM, Weldon R, Kogut K, Jewell NP, Eskenazi B. 2005. Association of housing disrepair indicators with cockroach and rodent infestations in a cohort of pregnant Latina women and their children. *Environ Health Perspect* 113:1795–1801.
- Bradman A, Whitaker D, Quirós L, Castorina R, Claus Henn B, Nishioka M, Morgan J, Barr DB, Harnly M, Brisbin JA, Sheldon LS, McKone TE, Eskenazi B. 2007. Pesticides and their metabolites in the homes and urine of farmworker children living in the Salinas Valley, CA. *J Expo Sci Environ Epidemiol* 17:331–349.
- Carroll DJ, Samardick R, Gabbard SB, Hernandez T. 2005. Findings from the National Agricultural Workers Survey (NAWS) 2001–2002: A demographic and employment profile of United States farm workers. http://www.dol.gov/asp/programs/agworker/report9/naws_rpt9.pdf (accessed February 2009).
- Chew GL, Carlton EJ, Kass D, Hernandez M, Clarke B, Tiven J, Garfinkel R, Nagle S, Evans D. 2006. Determinants of cockroach and mouse exposure and associations with asthma in families and elderly individuals living in New York City public housing. *Ann Allergy Asthma Immunol* 97:502–513.
- Collins KJ. 1993. Cold and health-related illnesses in the indoor environment. In: Burridge R, Ormandy D, editors. *Unhealthy housing: Research, remedies, and reform*. New York: Spohn Press, pp. 117–140.
- Early J, Davis SW, Quandt SA, Rao P, Snively BM, Arcury TA. 2006. Housing characteristics of farmworker families in North Carolina. *J Immigr Minor Health* 8:173–184.
- Evans GW. 2003. The built environment and mental health. *J Urban Health* 80:536–555.
- Farquhar S, Samples J, Ventura S, Davis S, Abernathy M, McCauley L, Cuilwik N, Shadbeh N. 2008. Promoting the occupational health of indigenous farmworkers. *J Immigr Minor Health* 10:269–280.
- Farquhar SA, Goff NM, Shadbeh N, Samples J, Ventura S, Sanchez V, Rao P, Davis S. 2009. Occupational health and safety status of indigenous and Latino farmworkers in Oregon. *J Agric Saf Health* 15:89–102.
- Flocks J, Burns AF. 2006. Stakeholder analysis of Florida farmworker housing. *J Agromed* 11:59–67.
- Gentry AL, Grzywacz JG, Quandt SA, Davis SW, Arcury TA. 2007. Housing quality among North Carolina farmworker families. *J Agric Saf Health* 13:323–337.
- Harrison P. 1995. Safe, clean, and affordable: California farmworker housing needs. *J Archit Plan Res* 12:19–34.
- Holden C. 2002. Bitter harvest: Housing conditions of migrant and seasonal farmworkers. In: Thompson Jr CD, Wiggins MF, editors. *The human cost of food: Farmworkers' lives, labor, and advocacy*. Austin: University of Texas Press, pp. 169–193.
- 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.
- Jones M. 2004. Migrants no more. *Mother Jones* 29:78–84.
- Kandel W. 2008. Profile of hired farmworkers: a 2008 update. Economic Research Service, U.S. Department of Agriculture. Report No. 60.
- Krieger J, Higgins DL. 2002. Housing and health: Time again for public health action. *Am J Public Health* 92:758–768.
- North Carolina Department of Labor. 2008. *Introduction to Migrant Housing Inspections in North Carolina (with revisions through January 2008)*. http://www.nclabor.com/ash/ash_blue_book.pdf (accessed March 2011).
- Peck S. 1999. Many harvest of shame: Housing for farmworkers. In: Belden JN, Wiener RJ, editors. *Housing in rural America*. Thousand Oaks, CA: Sage, pp. 83–90.
- Public Water Supply Section. A sampling guide for transient non-community water systems. <http://www.deh.enr.state.nc.us/pws/Publications/TransientSamplingGuide.pdf> (Accessed March 2011).
- Quandt SA, Arcury TA, Rao P, Mellen BG, Camann DE, Doran AM, Yau AY, Hoppin JA, Jackson DS. 2004. Agricultural and residential pesticides in wipe samples from farmworker family residences in North Carolina. *Environ Health Perspect* 112:382–387.
- Quandt SA, Hernández-Valero MA, Grzywacz JG, Hovey JD, Gonzales M, Arcury TA. 2006. Workplace, household, and personal predictors of pesticide exposure and health outcomes for farmworkers. *Environ Health Perspect* 114:943–952.
- Robinson EN, Nguyen HT, Isom S, Quandt SA, Grzywacz JG, Arcury TA. 2011. Wages, wage violations, and pesticide safety experienced by migrant farmworkers in North Carolina. *New Solut* 21: 251–268.
- Shaw M. 2004. Housing and public health. *Annu Rev Public Health* 25:397–418.
- Standard Methods. 2006. 9223 Enzyme substrate coliform test. <http://www.standardmethods.org/store/ProductView.cfm?ProductID=313> (accessed March 2011).
- Steege AL, Baron S, Chen X. 2009. Occupational health of hired farmworkers in the United States: National Agricultural Workers Survey Occupational Health Supplement, 1999. DHHS Publication No. 2009-119.
- United Nations. 1991. *The right to adequate housing*. UN Commission on Economic, Social, and Cultural Rights. <http://www.unhcr.ch/tbs/doc.nsf/0/469f4d91a9378221c12563ed0053547e?Opendocument>.
- US Department of Agriculture Economic Research Service (ERS/USDA). *Rural labor and education: Farm labor*. <http://www.ers.usda.gov/Briefing/LaborAndEducation/FarmLabor.htm#migrating>.
- Vallejos QM, Quandt SA, Grzywacz JG, Isom S, Chen H, Galván L, Whalley L, Chatterjee AB, Arcury TA. 2011. Migrant farmworkers' housing characteristics across an agricultural season in North Carolina. *Am J Ind Med* 54:533–544.

- Villarejo D. 2003. The health of U.S. hired farm workers. *Annu Rev Public Health* 24:175–193.
- Villarejo D. 2011. The challenge of housing California's hired farm laborers. In: Marcouiller D, Lapping M, Furuseth O, editors. *Rural housing, exurbanization and amenity-driven development: Contrasting the "haves" and the "have nots."* Burlington, VT: Ashgate, pp. 193–206.
- Villarejo D, Schenker M, Joyner AM, Parnell A. 2010. (Un)Safe at home: The health consequences of sub-standard farm labor housing. San Francisco, CA: California Rural Legal Assistance, Inc.
- Whalley LE, Grzywacz JG, Quandt SA, Vallejos QM, Walkup M, Chen H, Galván L, Arcury TA. 2009. Migrant farmworker field and camp safety and sanitation in eastern North Carolina. *J Agromed* 14:421–436.
- Wiggins M. 2009. Farm labor and the struggle for justice in the eastern United States fields. In: Arcury TA, Quandt SA, editors. *Latino farmworkers in the eastern United States: Health, safety, and justice.* New York: Springer, pp. 201–220.
- World Health Organization (WHO). Constitution of the World Health Organization. Basic Documents, 40–50th edition, supplement, October 2006. http://www.who.int/governance/eb/who_constitution_en.pdf.
- Ziebarth A. 2006. Housing seasonal workers for the Minnesota processed vegetable industry. *Rural Sociol* 71:335–357.