



Published in final edited form as:

J Agromedicine. 2016 ; 21(4): 327–334. doi:10.1080/1059924X.2016.1211053.

Associations of Poor Housing with Mental Health Among North Carolina Latino Migrant Farmworkers

Dana C. Mora¹, Sara A. Quandt^{3,2}, Haiying Chen^{4,2}, and Thomas A. Arcury^{1,2}

¹Department of Family and Community Medicine, Wake Forest School of Medicine

²Center for Worker Health, Wake Forest School of Medicine

³Department of Epidemiology and Prevention, Division of Public Health Sciences, Wake Forest School of Medicine

⁴Department of Biostatistical Sciences, Division of Public Health Sciences, Wake Forest School of Medicine

Abstract

This analysis examines the associations of housing conditions with mental health among migrant farmworkers. Data are from a 2010 cross-sectional study conducted in 16 North Carolina counties. Interviews and housing inspections were completed with 371 farmworkers in 186 camps. Mental health measures included depression (Center for Epidemiological Studies-Depression, CES-D), anxiety (Personality Assessment Inventory, PAI), and alcohol misuse (AUDIT-C). Housing measures were number of people per sleeping room, perceived security of self and belongings, having a key to dwelling's door, having bedroom storage, toilet privacy issues, and number of housing regulation violations. Sixty (16.7%) participants had substantial depressive symptoms (CES-D ≥ 10), 31 (8.8%) had substantial anxiety (PAI ≥ 27), and 185 (50.1%) had the potential for alcohol misuse (AUDIT-C ≥ 4). Those with 5+ persons sleeping per room were more likely to have a depression score ≥ 10 (31.5% vs. 13–14%, $p=.01$), and an anxiety scores ≥ 27 (19.6% vs. 5–9%, $p=.02$). Those who did not feel they or their belongings were secure were more likely to have a depression score ≥ 10 (19.4% vs. 9.1%, $p=.01$). Those without a key were more likely to have an anxiety score ≥ 27 (11.5% vs. 5.1%, $p=.04$). Those with no bedroom storage were more likely to have a depression score ≥ 10 (28.9% vs. 14.9%, $p=.03$). This paper suggests links between poor housing and farmworkers' mental health. These results inform regulations surrounding farmworker housing and inform healthcare providers on how to prevent and treat poor mental health among migrant farmworkers.

Keywords

migrant farmworkers; health disparities; occupational health; minority health; agricultural safety

Introduction

Most of the housing in which migrant farmworkers live is substandard.^{1,2} Migrant workers are individuals who migrate from place to place within a state, between states, or internationally whose principal employment is in agriculture on a seasonal basis and who establish temporary housing. Although migrant farmworker housing is regulated by federal and state regulations,³ analyses show that adherence to these regulations is limited.⁴⁻⁷ For example, Arcury and colleagues⁴ found that none of the 183 North Carolina migrant farmworker camps investigated met all of the applicable regulations, with the number of violations ranging from 4 to 22 of the 63 regulations considered. In addition to regulatory violations, other characteristics of migrant farmworker housing are deficient.⁵⁻⁷ For example, Vallejos et al.⁶ found that of 43 migrant farmworker camps inspected, all had at least one exterior structural problem, 93% had at least one interior structural problem, and about two-thirds of farmworkers lived in crowded conditions with more than 3 people sharing a room. In the 183 North Carolina migrant farmworker camps inspected by Arcury et al.,⁷ 83.5% of participants reported that they did not feel they or their possessions were secure; and 46.2% of the camps lacked bathing or toileting privacy.⁷

Farmworkers experience high levels of anxiety, depression, and alcohol misuse, with poor mental health being documented for between 20% and 50% of migrant farmworkers.^{1,8-16} The high prevalence of mental illness among farmworkers has been linked to several stressors. Farmworkers often face acculturative stress, discrimination, isolation, strenuous work, and lack of control of their social and environmental circumstances. Hovey et al.¹⁰ found that those who reported elevated levels of acculturative stress also had high levels of depression and anxiety. Grzywacz et al. found that stressors like being married, fast pace of work, crowded living conditions, and concerns about documentation predicted depressive symptoms among farmworkers.¹⁷

The effects that poor housing condition has on physical and mental health in the general United States population are well documented in the literature.¹⁸ Housing affects health through multiple mechanisms including physical dwelling conditions, housing affordability, and social environment.¹⁹ Inadequate housing has also been found to affect mental health. Housing characteristics like crowding, dwelling location, structural hazards, lack of control over maintenance, management practices, and fear of crime are linked to poor mental health such as depression and anxiety.^{20,21}

Although research documents the associations of poor housing with poor mental health in the general United States population, research assessing the association of specific housing conditions with farmworker mental health does not exist.¹ Examining the association of poor housing with mental health among this population is important because this is an underserved population whose living arrangements differ from those of most of the general population. This analysis examines the associations of housing conditions with mental health (depression, anxiety, alcohol misuse) among migrant farmworkers in North Carolina.

Methods

This analysis is part of a cross-sectional community-based participatory research study in which Wake Forest School of Medicine collaborated with organizations and clinics serving farmworkers in North Carolina, including the North Carolina Farmworkers Project, Carolina Family Health Center, Kinston Community Health Center, and Piedmont Health Services. Participants were recruited in 2010 from 16 North Carolina counties in which a large number of migrant farmworkers are employed and which are served by the collaborating community organizations and clinics: Caswell, Craven, Cumberland, Duplin, Edgecombe, Greene, Halifax, Harnett, Johnston, Lenoir, Nash, Person, Sampson, Wake, Wayne, and Wilson. The research study was approved by the Wake Forest School of Medicine Institutional Review Board.

Sample

All participants lived in grower provided housing called camps. Lists of camps were developed by collaborating organizations and clinics; these lists were expanded during the research as new camps were encountered. All identified camps were contacted to participate in the research. A total of 186 camps enrolled in the research, with residents at 36 camps declining to participate and growers or contractors refusing participation in another 4 camps. The camp participation rate was 82.3% (186/226). The majority (72%) of data collection took place during the mid and late season. Camps that participated in the research were given volleyballs as tokens of appreciation. Further details of recruitment and methods are discussed by Arcury et al.⁴

Three residents at each camp volunteered to be study participants. The study specifically recruited males currently employed as farmworkers who migrated for work and resided in one of the camps. Two farmworkers at each camp were asked to complete an interview questionnaire, and to help with assessing their sleeping rooms. One farmworker at each camp was asked to help with a camp and housing assessment. The final sample included 371 men who completed the interviews and 182 who assisted in the camp assessments; 231 men refused to participate when asked. The participation rate was 70.5% (553/784). The farmworkers who completed the interviews and helped with the camp and housing assessments were each given a \$30 cash incentive. All participants provided written informed consent. Interviews were administered by trained Spanish speaking data collectors.

Measures

The outcome measures for this analysis were depression, anxiety, and alcohol misuse. Depression was measured using a Spanish validated short version of the Center for Epidemiological Studies Depression scale (CES-D), which has demonstrated utility in immigrant Latino samples.^{17, 22} Items were scored using a 4-point scale (ranging from rarely or none of the time, to most or all of the time) and summed, with possible scores ranging from 0 to 30 (Cronbach's alpha of 0.73). Higher scores reflect higher levels of depressive symptoms. Scores for this analysis were dichotomized to the categories "less than 10," and "10 or greater;" a score of 10 or greater suggests caseness for depression.²²

Anxiety was measured using the anxiety scale of the Personality Assessment Inventory (PAI).²³ The total scale consists of 24 items rated on a 4-point scale (“false, not at all true” to “very true”). Higher scores indicate higher anxiety levels. The PAI Anxiety scale has been translated into Spanish and found to have adequate internal consistency reliability (.80-.90), test-retest reliability (.85-.88), and construct validity among general, farmworker, and Mexican-American samples.^{10,11,23-25} The Cronbach’s alpha for this study was 0.85. Scores were dichotomized in the categories “less than 27,” and “27 or greater;” a score of 27 or greater suggests caseness for anxiety.¹⁰

Alcohol abuse was measured using the AUDIT-C scale. This scale is a modified version of the 10 question AUDIT instrument. The 3-item scale has been validated among Hispanic populations.²⁶ Items asked “How often do you have a drink containing alcohol?,” “How many drinks containing alcohol do you have on a typical day when you are drinking?,” and “How often do you have six or more drinks on one occasion?,” Each item could be score from 0–4; therefore, it is scored on a scale of 0–12. A score of 4 or greater indicates alcohol misuse among men.²⁷

Individual level housing measures included the number of people who slept in the same room as the participant during the week of the interview (an indicator of crowding), with the values of “one,” “two,” “three or four,” and “five or more.” Perceived security of self and belongings had the value of “secure” versus “somewhat or not secure.” Key to outside door of dwelling had the values of “yes” and “no.” Whether the participant had bedroom storage had the values “at least some storage” versus “no storage.”

Camp-level housing measures included number of toilet privacy issues⁷ based on an inspection of the toilet facilities in the camp; privacy issues reflect the absence of privacy screens between toilets, between showers, and between toilets and showers. Values were one, two or three privacy issues. Privacy issues are not included in the state of North Carolina or federal housing regulations. Number of housing violations is the sum of violations to state and federal housing regulations in the general camp, toilet facilities, bathing facilities, kitchen, and laundry facilities based on inspection using standards promulgated by the North Carolina Department of Labor²⁸ and described in Arcury et al.⁴ The number of violations was divided into the categories of “3 to 7,” “8 to 12,” “13 to 17,” and “18 to 23” of the 69 regulations examined.

Participant characteristics included age in the categories “18–29 years,” “30–39 years,” “40 years and older.” Marital status had the values of “married or living as married” versus “not currently married.” Spoke an Indigenous language was dichotomous. Visa status had the values of “H2-A visa” versus “non-H2-A visa.” Years working in agriculture in the US were categorized into “1–5 years,” “6–10 years,” “11 years or more.”

Analysis

We used frequency counts and percentages to summarize the participant and housing characteristics for the overall sample. Next we examined the bivariate association between each housing characteristic and each mental health outcome (depression, anxiety, and alcohol abuse). The Rao-Scott chi-square tests were used to account for the clustering of

farmworkers within the same camp. All analyses were performed using SAS 9.4. (SAS Institute Inc., Cary, N.C.). A p-value of less than 0.05 was considered statistically significant.

Results

Participant characteristics

Most participants were between 18 and 29 years old (44.5%), and were married or living as married (65.0%) (Table 1). Almost one-in-five (18.3%) spoke an Indigenous language. Those who reported speaking an indigenous language were bilingual and spoke Spanish. Most had H2-A visas (65.2%), and had worked in agriculture for five or fewer years (51.8%). Sixty (16.7%) participants had a score of 10 or greater on the CES-D, with 31 (8.8%) participants having a score of 27 or greater on the PAI anxiety scale, and 185 (50.1%) have a score of 4 or greater on the AUDIT-C scale, indicating potential alcohol misuse.

Housing characteristics

The majority (84.4%) of farmworkers lived in rooms occupied by two or more people, with 54 (14.5%) living in rooms occupied by five or more people (Table 2). Most farmworkers (69.3%) reported not feeling that they or their belongings were secure. Over half (55.0%) of the farmworkers reported not having a key to the exterior doors of where they lived. More than one-in-ten (12.4%) of the farmworkers reported having no storage in their bedrooms. Farmworker camps commonly had one (18.6%) or more (24.0%) toilet privacy issues. All farmworker camps had violations of the housing regulations, with 8.0% having at least 18 violations, 28.0% having 13 to 17 violations, and 56.5% having 8 to 12 violations.

Housing characteristics and mental health

Depression was associated with age, such that more of those in the 18 to 29 year age group (22.2%) had a depression score of 10 or greater, than did those in the 30 to 39 age group (9.2%) and those in the 40 and older age group (14.8%) ($p=0.023$). Anxiety and alcohol misuse were not associated with any of the personal characteristics.

Number of persons per sleeping room (crowding) was significantly associated with depression and anxiety. More participants with five or more persons per room reported a depression score of 10 or greater (31.5%) and an anxiety scores of 27 or greater (19.6%), than did those with less than five people per room (Table 3). The percentage of those with depression scores greater than 10 was around 14% for each of the remaining categories (e.g. 1, 2, 3–4 people). Among those that reported anxiety and lived in a room with less than five people the percentages ranges from 5–9%. There was no significant association among number of people per room and alcohol misuse.

Security was associated with depression and, to a lesser extent, anxiety. Significantly more of those who did not feel that they or their belongings were secure (19.4%) had a depression score ≥ 10 , than of those who did feel these were secure (9.1%). More of those without a key to the outside door (19.9%) had a depression score ≥ 10 , than of those who did have a key

(12.5%) ($p=.06$). Significantly more of those without a key to the outside door (11.5%) had an anxiety score ≥ 7 , than of those who did have a key (5.1%). Significantly more of those with no bedroom storage (28.9%) had a depression score ≥ 10 , than of those who had any bedroom storage (14.9%).

Camp level measures of toilet privacy issues of and housing violations were not related to depression or anxiety. None of the individual or camp housing characteristics were associated with alcohol misuse. There was, however, a significant association between high depression scores and alcohol misuse, 21% of those that had a CES-D score of 10 or greater also had a score of 4 or greater in the Audit test ($p= 0.02$). There was no significant association between anxiety and alcohol misuse. Bivariate analysis was conducted for mental health outcomes and personal characteristics (i.e., marital status, H-2A status), but there were no significant associations.

Discussion

Most farmworkers are of Mexican descent and have poor physical and mental health, due, in part, to the poor working and living conditions they endure.^{1, 7, 9, 29–32} The purpose of this paper is to describe the mental health and housing conditions of farmworkers, and to delineate housing factors associated with their mental health. Previous analyses have not reported associations of housing conditions and mental health among farmworkers.¹ The results of this analysis indicate low prevalence of depression and anxiety, and high prevalence of alcohol misuse among farmworkers. The results also show associations between the number of people who share a room and reports of depression and anxiety; as well as a significant association between not having a key to the outside door and reports of anxiety. There was also an association between a high level of depression and not feeling secure or feeling somewhat secure.

The results from this paper are consistent with those with other analyses of farmworker housing. Vallejos et al.⁶ reported that 64% of the workers stated that their room felt crowded and the majority of the workers reported living in a room with two or more people. Previous studies⁶ have speculated that stress and anxiety among farmworkers were associated with crowding; however, our study looked at the association between both variables and found a correlation between them. Adequate shelter includes being able to have adequate privacy.³³ Living in crowded conditions can lead to excessive social stimulation that can, in turn, lead to a withdrawal reaction accompanied by feelings of sadness, helplessness, and hopelessness that culminate in depression and anxiety.³⁴ Furthermore, studies in non-farmworker populations have shown that crowding leads to sadness, less perceived support, less perceived control, and less social affection.³⁵

Being adequately secure is an important characteristic of adequate housing. A house represents a safe place and any intrusions limit the sense of safety, intimacy, and control which could lead to mental health illness, such as depression and anxiety, and alcohol misuse.³² Housing providing insufficient protection from the outside, from noise, from scrutiny, and from intrusion can be the source of major suffering that can be expressed in manifestations of anxiety, insomnia, paranoid feelings, and social dysfunction.³² This

analysis shows that housing security and depression are significantly associated, and that not having a key to an outside door is correlated to high anxiety. Our findings are corroborated by the existing literature, which documents that fear of crime can cause mental distress.^{36,37} Although a feeling of insecurity is produced by not having locks on windows and doors, that feeling of insecurity could also be exacerbated by the effects of structural inequality that people from ethnic minorities and of low socioeconomic status have to face. Also fear of crime decreases cohesion and trust and leads to withdrawal.^{35, 37} Withdrawal in turn could be linked to the alcohol misused reported in this paper.^{29, 32} As our results show depression is significantly linked to alcohol misuse.

This analysis found less depression and anxiety, but similar alcohol misuse in comparison to other studies of farmworkers.^{9, 38, 39} The majority (72%) of the data collection for this study was conducted during the mid and end of the season, and may help us understand the lower mental health illnesses prevalence levels. Grzywacz et al.⁹ reported lower depression scores during the middle and closing months of the agricultural season.⁹ Half of our participants misused alcohol. This level of alcohol misuse is consistent with other studies.^{8, 13, 15, 40–42} In North Carolina, 49% of farmworkers report heavy episodic drinking in the previous 3 months.⁸ Possible causes of alcohol abuse among farmworkers are related to non-traditional living arrangements, social isolation and absence of family and friends.^{43, 44}

This study has limitations. The study was conducted only in North Carolina, largely among participants with H-2A visas, which limits its generalizability. This study included only housing where male farmworkers live. Hence it is important to acknowledge that there are different types of farmworker housing. Many of those housing types also include women and children and for them issues such as lack of privacy might have an even greater impact on their mental health. This is a cross-sectional study, hence causation cannot be inferred from the results. Also, all the participants volunteered to participate in the study, so it is possible that those with worst mental health did not participate, and mental health problems could be worse than what our study found. Regardless of its limitation, this study contributes to the literature because it examines housing variables that could lead to poor mental health outcomes among farmworkers. While such a relationship has been hypothesized, it has not been examined among farmworkers.¹ All H-2A housing is inspected yet many violations were found by our team,⁴ showing the need for multiple inspections throughout the season. This analysis included a large number of camps and farmworkers representative of the agricultural region of eastern North Carolina, and data collection was standardized and followed the inspection guidelines used by the North Carolina Department of Labor.²⁸

This paper is consistent with the existing literature that states that poor farmworker housing is prevalent in the US, as well as with the literature related to alcohol misuse among farmworkers. Furthermore, this paper suggests factors that link poor housing to farmworkers' mental health. These results inform regulations surrounding farmworker housing and inform healthcare providers on how to treat poor mental health among migrant farmworkers. The results of this study can be used to help reinforce existing regulations and to bring attention to the need of more strict regulations and enforcement. By knowing some of the effects that housing factors have on mental health, health care providers are aware of what some of the causes of mental illness are and can provide workers with different tools to

manage their anxiety and depression (e.g., relaxation and meditation techniques). Further research is needed to identify other housing factors that could affect the mental health of farmworkers (i.e., relationships with roommates, correlation between work organization, housing conditions, and mental health). Unfortunately substandard housing cannot be easily solved or regulated, so further research should also concentrate on how to educate and empower workers to report violations and to ask for better working condition without fear of retaliation.

Acknowledgments

This research was supported by grant R01-ES012358 from the National Institute of Environmental Health Sciences.

References

1. Quandt SA, Brooke C, Fagan K, Howe A, Thornburg TK, McCurdy SA. Farmworker housing in the United States and its impact on health. *New Solut.* 2015; 25:263–286. [PubMed: 26320122]
2. Vallejos, QM.; Quandt, SA.; Arcury, TA. The condition of farmworker housing in the eastern United States. In: Arcury, TA.; Quandt, SA., editors. *Latino farmworkers in the eastern United States: health, safety, and justice.* New York: Springer; 2009. p. 37-69.
3. Joyner AM, George L, Hall ML, Jacobs JJ, Kissam ED, Latin S, Parnell A, Ruiz V, Shadbeh N, Tobacman J. Federal farmworker housing standards and regulations, their promise and limitations, and implications for farmworker health. *New Solut.* 2015; 25:334–352. [PubMed: 26378154]
4. Arcury TA, Weir M, Chen H, Summers P, Pelletier LE, Galván L, Bischoff WE, Mirabelli MC, Quandt SA. Migrant farmworker housing regulation violations in North Carolina. *Am J Ind Med.* 2012; 55:191–204. [PubMed: 22237961]
5. Whalley LE, Grzywacz JG, Quandt SA, Vallejos QM, Walkup M, Chen H, Galván L, Arcury TA. Migrant farmworker field and camp safety and sanitation in Eastern North Carolina. *J Agromedicine.* 2009; 14:421–436. [PubMed: 19894164]
6. Vallejos QM, Quandt SA, Grzywacz JG, Isom S, Chen H, Galván L, Whalley LE, Chatterjee AB, Arcury TA. Migrant farmworkers' housing conditions across an agricultural season in North Carolina. *Am J Ind Med.* 2011; 54:533–544. [PubMed: 21360725]
7. Arcury TA, Weir MM, Summers P, Chen H, Bailey M, Wiggins MF, Bischoff WE, Quandt SA. Safety, security, hygiene and privacy in migrant farmworker housing. *New Solut.* 2012; 22:153–173. [PubMed: 22776578]
8. Arcury TA, Talton JW, Summers P, Chen H, Laurienti PJ, Quandt SA. Alcohol consumption and dependence among male Latino migrant farmworkers compared to Latino non-farmworkers in North Carolina. *Alcohol Clin Exp Res.* 2016; 40:377–384. [PubMed: 26842256]
9. Grzywacz JG, Quandt SA, Chen H, Isom S, Kiang L, Vallejos Q, Arcury TA. Depressive symptoms among Latino farmworkers across the agricultural season: Structural and situational influences. *Cultur Divers Ethnic Minor Psychol.* 2010; 16:335. [PubMed: 20658876]
10. Hovey JD, Magaña C. Acculturative stress, anxiety, and depression among Mexican immigrant farmworkers in the Midwest United States. *J Immigr Health.* 2000; 2:119–131. [PubMed: 16228745]
11. Hiott AE, Grzywacz JG, Davis SW, Quandt SA, Arcury TA. Migrant farmworker stress: mental health implications. *J Rural Health.* 2008; 24:32–39. [PubMed: 18257868]
12. Kim-Godwin YS, Bechtel GA. Stress among migrant and seasonal farmworkers in rural southeast North Carolina. *J Rural Health.* 2004; 20:271–278. [PubMed: 15298103]
13. Kim-Godwin YS, Fox JA. Gender differences in intimate partner violence and alcohol use among Latino-migrant and seasonal farmworkers in rural southeastern North Carolina. *J Community Health Nurs.* 2009; 26:131–142. [PubMed: 19662561]

14. Kraemer Diaz AE, Weir MM, Isom S, Quandt SA, Chen H, Arcury TA. Aggression among male migrant farmworkers living in camps in Eastern North Carolina. *J Immigr Minor Health*. 2016; 18:542–551. [PubMed: 26022146]
15. Sánchez J. Alcohol use among Latino migrant workers in South Florida. *Drug Alcohol Depend*. 2015; 151:241–49. [PubMed: 25891232]
16. Winkelman SB, Chaney EH, Bethel JW. Stress, depression and coping among Latino migrant and seasonal farmworkers. *Int J Environ Res Public Health*. 2013; 10:1815–1830. [PubMed: 23644829]
17. Grzywacz JG, Alterman T, Muntaner C, Shen R, Li J, Gabbard S, Nakamoto J, Carroll DJ. Mental health research with Latino farmworkers: A systematic evaluation of the short CES-D. *J Immigr Minor Health*. 2010; 12:652–658. [PubMed: 20024622]
18. Shaw M. Housing and public health. *Annu Rev Public Health*. 2004; 25:397–418. [PubMed: 15015927]
19. Novoa AM, Ward J, Malmusi D, Díaz F, Darnell M, Trilla C, Bosch J, Borrell C. How substandard dwellings and housing affordability problems are associated with poor health in a vulnerable population during the economic recession of the late 2000s. *Int J Equity Health*. 2015; 14:1–11. [PubMed: 25566790]
20. Evans GW. The built environment and mental health. *J Urban Health*. 2003; 80:536–555. [PubMed: 14709704]
21. Evans GW, Wells NM, Chan HYE, Saltzman H. Housing quality and mental health. *J Consult Clin Psychol*. 2000; 68:526–530. [PubMed: 10883571]
22. Grzywacz JG, Hovey JD, Seligman LD, Arcury TA, Quandt SA. Evaluating short-form versions of the CES-D for measuring depressive symptoms among immigrant Latinos. *Hisp J Behav Sci*. 2006; 28:404–424.
23. Morey, LC. Personality assessment inventory professional manual. Odessa, FL: Psychological Assessment Resources; 1991.
24. Fantoni-Salvador P, Rogers R. Spanish versions of the MMPI-2 and PAI: An investigation of concurrent validity with Hispanic patients. *Assessment*. 1997; 4:29–39.
25. Rogers R, Flores J, Ustad K, Sewell KW. Initial validation of the personality assessment inventory--Spanish version with clients from Mexican American communities. *J Pers Assess*. 1995; 64:340–348. [PubMed: 7722858]
26. Frank D, DeBenedetti AF, Volk RJ, Williams EC, Kivlahan DR, Bradley KA. Effectiveness of the AUDIT-C as a screening test for alcohol misuse in three race/ethnic groups. *J Gen Internal Med*. 2008; 23:781–787. [PubMed: 18421511]
27. Bradley KA, DeBenedetti AF, Volk RJ, Williams EC, Frank D, Kivlahan DR. AUDIT-C as a Brief Screen for Alcohol Misuse in Primary Care. *Alcohol Clin Exp Res*. 2007; 31:1208–1217. [PubMed: 17451397]
28. North Carolina Department of Labor. [Accessed March 2011] Introduction to Migrant Housing Inspections in North Carolina (with revisions through January 2008). 2008. http://www.nclabor.com/ash/ash_blue_book.pdf
29. Marsh B, Milofsky C, Kissam E, Arcury TA. Understanding the role of social factors in farmworker housing and health. *New Solut*. 2015; 25:313–333. [PubMed: 26315036]
30. Diaz AE, Weir MM, Isom S, Quandt SA, Chen H, Arcury TA. Aggression among male migrant farmworkers living in camps in eastern North Carolina. *J Immigr Mino Health*. 2016; 18:542–551.
31. Keim-Malpass J, Spears Johnson CR, Quandt SA, Arcury TA, Johnson JK, Arcury SQ. Perceptions of housing conditions among migrant farmworkers and their families: implications for health, safety and social policy. *Rural Remote Health*. 2015; 15(3076)
32. Ramos AK, Su D, Lander L, Rivera R. Stress Factors Contributing to Depression Among Latino Migrant Farmworkers in Nebraska. *J Immigr Mino Health*. 2015; 17:1627–1634.
33. Bonnefoy X. Inadequate housing and health: an overview. *Int J Environ Pollut*. 2007; 30:411–429.
34. Schwab JJ, Nadeau SE, Warheit GJ. Crowding and mental health. *Pavlov J Biol Sci*. 1979; 14:226–233. [PubMed: 264018]

35. Regoeczi WC. Crowding in context: an examination of the differential responses of men and women to high-density living environments. *J Health Soc Behav.* 2008; 49:254–268. [PubMed: 18771062]
36. Green G, Gilbertson JM, Grimsley MF. Fear of crime and health in residential tower blocks. *Eur J Public Health.* 2002; 12:10–15. [PubMed: 11968514]
37. Lorenc T, Clayton S, Neary D, Whitehead M, Petticrew M, Thomson H, Cummins S, Sowden A, Renton A. Crime, fear of crime, environment, and mental health and wellbeing: Mapping review of theories and causal pathways. *Health Place.* 2012; 18:757–765. [PubMed: 22542441]
38. Hiott A, Grzywacz JG, Arcury TA, Quandt SA. Gender differences in anxiety and depression among immigrant Latinos. *Fam Syst Health.* 2006; 24:137–146.
39. Arcury TA, O'Hara H, Grzywacz JG, Isom S, Chen H, Quandt SA. Work safety climate, musculoskeletal discomfort, working while injured, and depression among migrant farmworkers in North Carolina. *Am J Public Health.* 2012; 102:S272–S278. [PubMed: 22401520]
40. Grzywacz JG, Quandt SA, Isom S, Arcury TA. Alcohol use among immigrant Latino farmworkers in North Carolina. *Am J Ind Med.* 2007; 50:617–625. [PubMed: 17579343]
41. Cherry DJ, Rost K. Alcohol use, comorbidities, and receptivity to treatment in Hispanic farmworkers in primary care. *J Health Care Poor Underserved.* 2009; 20:1095–1110. [PubMed: 20168021]
42. Daniel-Ulloa J, Reboussin BA, Gilbert PA, Mann L, Alonzo J, Downs M, Rhodes SD. Predictors of heavy episodic drinking and weekly drunkenness among immigrant Latinos in North Carolina. *Am J Mens Health.* 2014; 8:339–348. [PubMed: 24457467]
43. Garcia V. Meeting a binational research challenge: substance abuse among transnational Mexican farmworkers in the United States. *J Rural Health.* 2007; 23(Suppl):61–67. [PubMed: 18237326]
44. Garcia V. Problem drinking among transnational Mexican migrants: exploring migrant status and situational factors. *Hum Organ.* 2008; 67:12–24. [PubMed: 21990944]

Table 1

Participant Characteristics, Migrant Farmworkers, Eastern North Carolina, 2010. (N=371)

Participant characteristics	N	%
Age of participants		
18 to 29 years	165	44.5
30 to 39 years	107	28.8
40 years or older	99	26.7
Married or living as married	241	65.0
Indigenous language spoken	68	18.3
H2A Status		
H2A	242	65.2
Non-H2A	129	34.8
Years worked in agriculture in the US		
1 to 5 years	192	51.8
6 to 10 years	108	29.1
11 or more years	71	19.1
CESD 10	60	16.7
Anxiety Score 27	31	8.8
Alcohol Misuse Score 4	185	50.1

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript

Table 2

Housing Characteristics

Housing Characteristics	N	%
Number of People in Same Sleeping Room *		
One person	58	15.6
Two people	130	35.0
Three or four people	129	34.8
Five or more people	54	14.6
Perceived Security of Self and Belongings *		
Secure	113	30.7
Somewhat or not secure	255	69.3
Key to Outside Door *		
Yes key to outside door	165	45.0
No key to outside door	202	55.0
Bedroom Storage *		
At least some storage	325	87.6
No storage	46	12.4
Number of Toilet Privacy Issues Per Camp **		
None	105	57.4
One	34	18.6
Two or more	44	24.0
Total Housing Violations **		
3 to 7	14	7.5
8 to 12	105	56.5
13 to 17	52	28.0
18 to 23	15	8.0

* Individual participant level measure, n = 371

** Camp level measure, n=186

Table 3

Differences in Mental Health Outcomes by Housing Characteristics

Variable	Depression			Anxiety			Alcohol Misuse		
	Score <10 n (%)	Score >=10 n (%)	p-value*	Score <27=no n (%)	Score >=27=yes n (%)	p-value*	Score <4 n (%)	Score >=4 n (%)	p-value*
Number of People in Same Sleeping Room									
One Person	49 (86.0)	8 (14.0)	0.01	51 (92.7)	4 (7.3)	0.02	28 (49.1)	29 (50.9)	0.63
Two people	106 (86.2)	17 (13.8)		112 (91.1)	11 (8.9)		69 (53.1)	61 (46.9)	
Three or four people	108 (85.7)	18 (14.3)		116 (95.1)	6 (4.9)		58 (45.3)	70 (54.7)	
Five or more people	37 (68.5)	17 (31.5)		41 (80.4)	10 (19.6)		29 (53.7)	25 (46.3)	
Perceived Security of Self and Belongings									
Secure	100 (90.9)	10 (9.1)	0.01	97 (94.2)	6 (5.8)	0.25	52 (46.8)	59 (53.2)	0.44
Somewhat or not secure	199 (80.6)	48 (19.4)		222 (90.2)	24 (9.8)		131 (51.4)	124 (48.6)	
Key to Outside Door									
Yes key to outside door	140 (87.5)	20 (12.5)	0.06	148 (94.9)	8 (5.1)	0.04	76 (46.3)	88 (53.7)	0.26
No key to outside door	157 (80.1)	39 (19.9)		170 (88.5)	22 (11.5)		105 (52.2)	96 (47.8)	
Bedroom Storage									
At least some storage	268 (85.1)	47 (14.9)	0.03	278 (90.8)	28 (9.2)	0.58	162 (25.2)	161 (49.8)	0.77
No storage	32 (71.1)	13 (28.9)		42 (93.3)	3 (6.7)		22 (47.8)	24 (52.2)	
Number of Toilet Privacy Issues Per Camp									
None	169 (83.7)	33 (16.3)	0.99	178 (91.8)	16 (8.2)	0.78	109 (52.4)	99 (47.6)	0.46
One	54 (83.1)	11 (16.9)		61 (92.4)	5 (7.6)		30 (44.1)	38 (55.9)	
Two or more	73 (83.0)	15 (17.0)		78 (89.7)	9 (10.3)		42 (47.7)	46 (52.3)	
Total Housing Violations									
3 to 7	22 (81.5)	5 (18.5)	0.75	21 (87.5)	3 (12.5)	0.79	13 (48.1)	14 (51.9)	0.37
8 to 12	171 (82.6)	36 (17.4)		187 (91.2)	18 (8.8)		101 (48.6)	107 (51.4)	
13 to 17	80 (83.3)	16 (16.7)		90 (90.9)	9 (9.1)		51 (49.0)	53 (51.0)	
18 to 23	27 (90.0)	3 (10.0)		22 (95.7)	1 (4.3)		19 (63.3)	11 (36.7)	

* Adjusted for clustering of farmworkers