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## Migrant Farmworker Nutritional Strategies: Implications for Diabetes Management

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### ABSTRACT

**Objectives:** Diabetes is a chronic disease prevalent in Hispanic/Latino adults, including migrant farmworkers in the US. Its management requires that individuals follow dietary guidelines, which may be difficult for migrant farmworkers due to work and environmental constraints. This analysis is designed to explore potential barriers to and supports for migrant farmworkers' practice of effective dietary self-management.

**Methods:** Interviews were conducted with 200 Latino migrant farmworkers in North Carolina, including workers with and without diabetes, recruited at housing sites throughout the 2017 agricultural season. The survey instrument included questions designed to elucidate how workers obtain food, prepare and consume food, and maintain food security.

**Results:** Most purchased food is obtained once per week at large grocery stores, with most farmworkers depending on others for transportation. Less than 1 in 5 supplement with garden produce and food from food pantries, farmers markets, and hunting and fishing. About half of lunches and a quarter of dinners are purchased from vendors or other commercial sources. More than 2 in 5 workers report they have to compromise on or lack control of meal content. About 1 in 5 report issues with food security.

**Conclusions:** The food-related practices of farmworkers would require change to accommodate effective dietary self-management of diabetes. Greater use of sources of fresh produce and other nutrient-dense foods, coupled with greater control over meal content and cooking techniques would be needed. While some accommodations could be encouraged through education, others would require policy change in housing or access to community resources.

### KEYWORDS

Chronic disease management; diet; rural

## Introduction

Diabetes is a chronic disease that requires patients to implement behavioral strategies to control blood glucose levels. In particular, patients are usually instructed to follow a diet that spreads food consumption throughout the day to prevent hyper- and hypoglycemic events, as well as to consume a healthy diet low in fats or carbohydrates, and high in nutrient dense foods such as lean meat, fruits, and vegetables. Portion control and limited sugar-sweetened foods are often recommended.<sup>1</sup>

The prevalence of diabetes in US adults is estimated to be 12.2%.<sup>2</sup> For the Hispanic population, the prevalence is high (16.4%), compared with the non-

Hispanic white (9.3%) segment of the population. Among Hispanics, those of Mexican ancestry have higher prevalence than other Hispanic groups.<sup>2</sup> Diabetes is more prevalent among men than women and among those with lower educational attainment. Persons with diabetes have elevated age-adjusted risks of morbidity, including cardiovascular and kidney disease, and mortality.

Although US prevalence data suggest that Latino migrant farmworkers should have high rates of diabetes, there are few trustworthy estimates. A review of medical records in 164 Migrant Health Clinics in 2012 found a prevalence rate of 7.8%.<sup>3</sup> This cannot be used as a population estimate, however, due to

farmworkers' frequent lack of access to medical care and due to the fact that a large proportion of person with diabetes are not diagnosed until they enter the medical system for some other reason. Like other patients with diabetes, farmworkers with the disease who have access to medical care are often treated with medications and can be offered diabetes self-management classes that teach them to manage blood glucose levels.<sup>4</sup> Included in such classes are recommendations for dietary self-management.

Latino farmworkers face a variety of barriers in managing their diet. They work long hours in demanding conditions<sup>5</sup> and often lack basic housing and kitchen accommodations for food storage and preparation.<sup>6</sup> Their housing and work sites are isolated and they frequently lack vehicles or drivers' licenses, which may limit access to healthy food sources.<sup>7</sup>

The literature on diabetes in migrant farmworkers is limited. It includes limited data on diabetes prevalence in particular populations,<sup>3</sup> and focuses largely on models of health care service delivery appropriate for migrant farmworkers. Such models emphasize efficient service delivery (e.g., cluster clinics<sup>4,8</sup> and use of promotoras<sup>9,10</sup>) and cultural tailoring of service format and content.<sup>11</sup> Some of the models for service delivery note barriers farmworkers face in following appropriate dietary self-management behaviors, including limited income and the practice of preparing communal meals where the food preferences of the larger group determine the food prepared and the preparation methods used.<sup>9</sup>

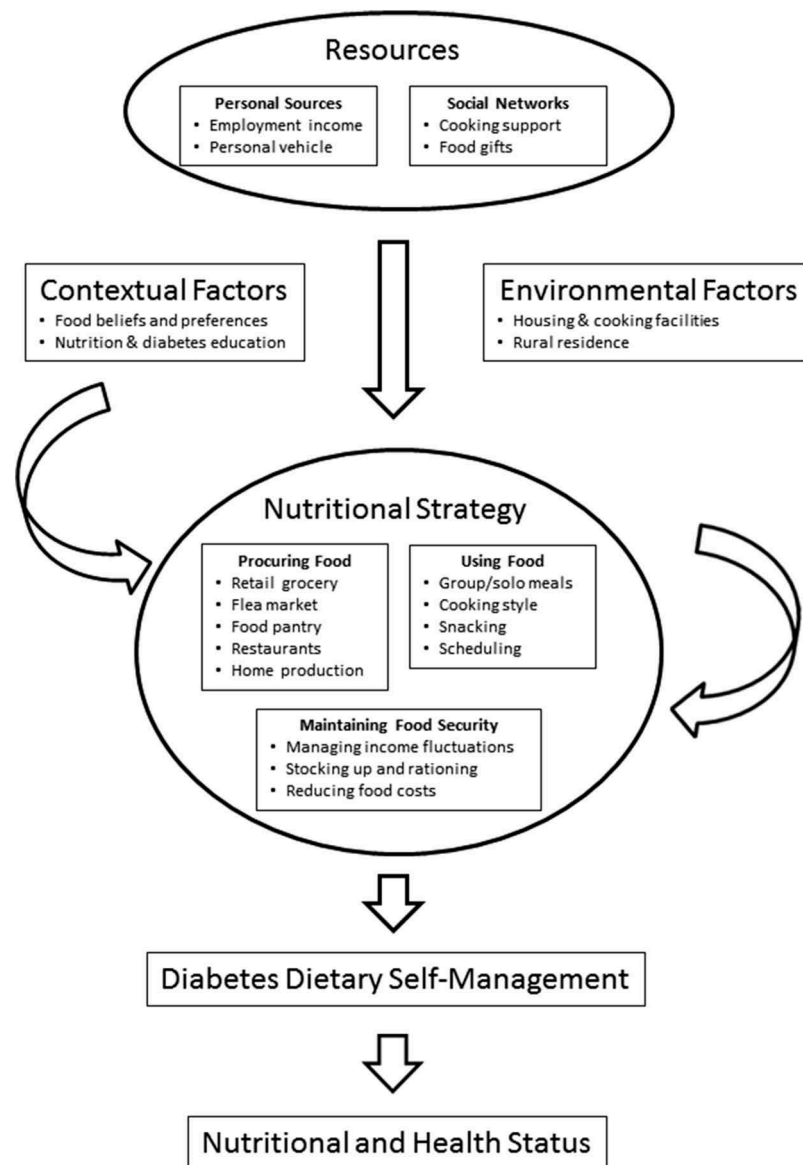
The goal of this paper is to explore potential barriers to and supports for migrant farmworkers' practicing effective dietary self-management. We use survey data collected among migrant farmworkers in North Carolina in 2017. While some of the farmworkers surveyed did report having diabetes, the sample was not restricted to those with diabetes because the goal was to explore resources and barriers that would affect self-management for farmworkers. We employed a conceptual model of nutritional self-management developed in other rural populations<sup>8</sup> to design the survey instrument and to analyze the data.

## Methods

**Conceptual Framework:** Nutritional strategy, the conceptual framework of this study, is the complex of

behaviors that surround food consumption for an individual or household.<sup>12</sup> The three primary elements of a nutritional strategy are *obtaining food*, *preparing and consuming food*, and *maintaining food security*. Deficiencies in any one of these can lead to nutritional and health status deficits. These elements depend on the resources individuals have at their disposal, as well as contextual and environmental factors. **Figure 1** shows an adaptation of the original conceptual framework for diabetes self-management. For obtaining food, resources might include economic resources to purchase food and transportation to grocery stores; environmental factors might include land on which to produce food. For preparing and consuming food, resources could include kitchen equipment and time to prepare food, with contextual and environmental factors including knowledge of appropriate foods to eat, having access to diabetes self-management education, and the presence of cooking facilities. For maintaining food security, resources could include a guaranteed paycheck and access to aspects of the food safety net such as Supplemental Nutrition Assistance Program (SNAP) benefits; environmental factors could include access to food storage facilities such as refrigerators and rodent-proof pantries. When applied to farmworker families, Quandt et al. have noted the importance of the rural environment, which can exert positive influences on nutritional strategies through garden space or roadside produce stands, and negative influences through isolation, limited transportation, immigration concerns that reduce driving, and distance from retail sources of healthy food.<sup>13</sup>

**Study Design:** This study was based on a community-based participatory research relationship that exists between occupational health researchers at Wake Forest School of Medicine (WFSM) and the North Carolina Farmworkers Project (NCFP), a nonprofit agency providing health and social services to migrant and seasonal farmworkers. NCFP requested the study in order to design ways to help migrant farmworkers with diabetes better manage their disease. A survey of farmworkers in rural North Carolina was conducted from May 2017 through September 2017. Workers were recruited at camps, which were obtained from a list of all active camps in southeastern North Carolina maintained by YYY. Camps are residential locations for farmworkers, and may be barracks, trailers, old



**Figure 1.** Model for nutritional self-management strategies for farmworkers with diabetes.

houses, or apartments, either owned or rented by growers or labor contractors. Many of the camps in this region employ workers with H-2A guest worker visas. H-2A visas are given to foreign nationals to come to work in the US as temporary agricultural workers. A few additional workers were recruited from residences known to be occupied by migrant farmworkers who were not in the H2-A program. Those hired in North Carolina arrive in late Spring and return to their home base, at the latest, in late Fall. Recruitment was limited to 40 farmworkers per month because the project was a research training opportunity for occupational medicine residents from Meharry Medical College,

each of whom was present for 1 month. Farmworkers were eligible if they were currently engaged in farm work, were at least 18 years of age, and self-identified as Latino or Hispanic. Workers were recruited at 23 camps and 7 residences. From 1 to 5 workers were recruited at each camp; one worker was recruited at each of the residences. Preference was given in recruitment to farmworkers who had been told by a medical professional that they had diabetes and to older workers; this was done in order to collect data from those workers whose nutritional strategies likely most closely align with persons diagnosed with diabetes. All procedures were reviewed and

approved by the WFSM and Meharry Medical College Institutional Review Boards.

**Data collection:** All data were collected face-to-face by a native Spanish speaker. The interviewer first obtained signed informed consent. Workers were told that the interview would take 15–20 min, their responses would be confidential, they could stop participation at any time, and they would receive an incentive of \$20 for completing the interview. Questions were drawn from previous surveys conducted by the WFSM/NCFP team. The questionnaire was developed in English, and translated to Spanish by a native Spanish speaker familiar with Mexican Spanish and farmworker vocabulary. The survey instrument contained questions asking about components of the nutritional strategies conceptual model. All questions focused on the time workers were living in North Carolina. Interviewers recorded responses on paper forms; data were later entered into a data file using Research Electronic Data Capture (REDCap) software hosted at WFSM.<sup>14</sup>

**Measures:** For “obtaining food,” workers were asked where they obtained most of their food, with options of “superstores” such as Walmart, supermarkets, convenience stores, food provided by the employer either through a camp kitchen or vendors, restaurants, another person paid to provide food, or free food pantries or soup kitchens. Workers who reported purchasing their own food were asked the frequency of purchase and about transportation to the purchase sites. Workers were read a list of alternative food sources and asked whether or not they had obtained food from each one. These included obtaining food from gardening, fishing, or hunting; an employer, flea market, farmers market; or roadside produce stand, church, or food pantry. For “using food,” workers were asked which option best described their breakfast, midday meal, and evening meal preparation. Options were prepared by self at home; prepared by a coworker; coworker and the worker herself/himself took turns; prepared by paid camp cook or vendor; purchased at restaurant, convenience store, or from a food stand or vendor; or meal usually skipped. Workers were asked whether or not they ate a snack during the morning at work, afternoon at work, or after work but before dinner. For “maintaining food security,” workers were

asked whether or not they had adequate food storage space for refrigerated and non-refrigerated food. They were also asked if problems such as nonfunctioning refrigerators or pests kept them from storing food. Finally, they were asked three screeners from the US Household Food Security Module.<sup>15</sup> The workers were read three statements (“I worried whether my food would run out before I got money to buy more”; “The food I bought just didn’t last, and I didn’t have money to get more”; and “I couldn’t afford to eat proper meals”). The response options were often true, sometimes true, and never true. The number of workers who answered “never true” to all three questions was calculated, as was the number of workers who affirmed (answered either “sometimes true” or “often true”) one, two, or all three questions.

The survey instrument also contained demographic questions about gender, age, highest education completed, country of birth, and whether or not the worker had an H-2A visa. Workers were also asked to rate their overall health; response options were excellent, very good, good, fair, or poor. They were asked if a medical professional had ever told them they had diabetes; if so, they were asked if they were currently taking a prescription medication for diabetes.

**Data analysis:** Descriptive statistics (counts and percentages) were used to describe participant demographics and characteristics related to obtaining food, using food, and food security. All analyses were performed using SAS 9.4 (Cary, NC).<sup>16</sup>

## Results

Almost all of the workers (97%) were men (Table 1). They ranged in age from 18 to 68, with a median age of 38. Over a third of the sample (35%) had a primary education or less. About three-quarters of the sample (76%) had a secondary education or less. All of the workers had been born in Mexico, and 91.5% (all men) reported having an H-2A visa. Only 5% rated their health as very good or excellent; 44% reported their health as fair or poor. Twenty-three workers had been diagnosed with diabetes; of those, 18 reported they were currently taking prescription medications for diabetes. Diabetes diagnosis was more common in non-H-2A workers (35.3% vs. 9.3%) and among women (71.4% vs. 9.3%).

**Table 1.** Participant characteristics, Latino migrant farmworkers, North Carolina 2017.

	<i>n</i>	%
Gender		
Male	193	97
Age		
18–25	17	9
26–35	55	28
36–45	83	42
46–55	36	18
>55	9	5
Highest education attained		
None	2	1
Primary (1–6)	67	34
Secondary (7–9)	82	41
Preparatory (10–12)	43	22
Some college	6	3
Country of birth		
Mexico	200	100.0
H-2A work visa	183	91.5
Self-rated health		
Excellent	6	3
Very good	3	2
Good	104	52
Fair	84	42
Poor	3	2
Diabetes diagnosis	23	11.5
Percentage with diabetes reporting medications	18	78.3

Almost all of the workers (91%) reported they obtained most of their food while in North Carolina from a superstore like Walmart. The remaining 9% obtained their food from a supermarket such as Food Lion. None of the workers reported that their main source of purchase was a smaller convenience store or restaurant or that meals were provided by another source such as a food pantry or a camp kitchen. All but five workers reported shopping for groceries once per week; three reported they shopped several times per week, and two said that they shopped only once every two weeks. Eighty-seven percent of workers ( $n = 174$ ) were dependent on someone else for transportation to grocery shop (Table 2). Four relied on a relative, 21 on their employer, and the remainder on a friend, coworker, or neighbor.

A number of alternative food sources were reported to be used while in North Carolina (Table 3). Church or food pantry (18.5%), household or camp garden (18%), and food given by the employer (17.5%) were most common. Smaller percentages of workers reported buying food at flea markets, and at farmers markets or roadside produce stands. Some also reported fishing and hunting.

**Table 2.** Transportation to grocery store, Latino migrant farmworkers, North Carolina, 2017.

Source	<i>n</i>	%
Walk	1	.5
Drive self	25	12.5
Someone else drives or public transportation	174	87
Employer	21	12.9
Friend, coworker, or neighbor	149	85.6
Relative	4	2.3

**Table 3.** Alternative food sources reported by Latino migrant farmworkers, North Carolina, 2017.

Source	<i>n</i>	%
Church or food pantry	37	18.5
Household/camp garden	36	18
Employer	35	17.5
Flea market	22	11
Fishing	15	7.5
Hunting	3	1.5
Farmers market or roadside produce stand	3	1.5

Food preparation varied by meal (Table 4). Four in five workers prepared breakfast for themselves, while less than half prepared lunch and about two-thirds, dinner. About 7% reported taking turns with a coworker for each meal. Only a few reported for each meal that there was a camp cook or vendor paid by the camp who prepared the meal. Only a few (4.5%) reported purchasing breakfast from a restaurant, convenience store, or vendor, but that percentage rose to almost half (46.5%) at lunch and over a quarter (26%) at dinner. Most workers reported consuming morning, afternoon, and pre-dinner snacks (94.5%, 94.5%, and 85.5%, respectively). Over half of workers (57.5%) reported they thought they had total control over what food was prepared for their meals, while 13% reported having to compromise with others eating the meals, and 29.5% reported

**Table 4.** Food preparation by meal reported by Latino migrant farmworkers, North Carolina, 2017.

Preparation	Breakfast	Lunch	Dinner
	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)
Self-prepared	163 (81.5)	89 (44.5)	126 (63)
Take turns preparing food with coworker	13 (6.5)	13 (6.5)	15 (7.5)
Paid camp cook or vendor paid by camp	3 (1.5)	5 (2.5)	5 (2.5)
Purchased at a restaurant, convenience store, or from a food stand/vendor	9 (4.5)	93 (46.5)	52 (26)
Does not eat this meal	12 (6)	0 (0)	2 (1)

**Table 5.** Statements about food security, Latino migrant farmworkers, North Carolina, 2017.

Was this often, sometimes, or never true for you since you have been in North Carolina?	Often		Sometimes		Never	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
"I worried whether my food would run out before I got money to buy more."	3	1.5	29	14.5	168	84
"The food that I bought just didn't last, and I didn't have money to get more."	4	2	14	7	182	91
"I couldn't afford to eat proper meals."	7	3.5	14	7	179	89.5

that the person cooking chose the food and the workers had no say in what was prepared.

Most workers reported that they had sufficient refrigerator (96%) and non-refrigerator (96.5) food storage space. Only 5% reported problems such as refrigerators that did not get cold enough to keep food from spoiling.

Of the three food security screening questions, "I worried whether my food would run out before I got money to buy more" was the most frequently affirmed, with 16% indicating that was sometimes or often true (Table 5). When the screening questions were examined by worker, 81% reported no food insecurity (responded "never" to all three questions), while 7.5% affirmed one indicator, 3.5% affirmed two indicators, and 8% affirmed all three indicators.

## Discussion

The results demonstrate that aspects of the three components of the nutritional strategies of the farmworkers in this study—to obtain food, to prepare and use food, and to maintain food security—have both positive and negative connotations for successfully self-managing diet in the case of diabetes. Diabetes education could address some of the negative aspects, and while previous research and programs with farmworkers have used *promotoras de salud* as diabetes educators and other culturally appropriate approaches to improve self-management,<sup>8,9</sup> it is clear that structural constraints that cannot be addressed through education must also be considered.

Most farmworkers obtain their food from Walmart superstores, purchasing food once per week and depending on someone else for a ride to the store from camps, which are usually located at

considerable distance from the store. Such stores have a wide variety of food, including fresh produce and reduced fat options for dairy and meat products, and prices may be lower than at local convenience stores or smaller grocery stores. However, persons with diabetes relying on infrequent shopping at such stores would have to do considerable planning to successfully negotiate the grocery store promotions of low-quality foods and achieve balanced meals through an entire week. According to current housing regulations, each worker is guaranteed only .75 cubic feet of refrigerator space.<sup>6</sup> This may be inadequate for the storage of fresh produce and other foods needing refrigeration, which are preferred by this population over canned, dried, or frozen foods.<sup>17</sup> Less than one in five report using home gardens or gifts of food from employers (likely fresh fruits or vegetables from the farm). These sources could add substantially to the purchased food, and have the benefit of being available more evenly through the week and (for gardens) having less need for refrigerated storage. Potentially less beneficial is the reported use of churches and food pantries to obtain extra food. Although larger food banks have developed policies in recent years to accept only donations of healthy food and to find ways to accommodate the distribution of fresh produce,<sup>18</sup> such policies are less common among smaller, local food pantries.<sup>19</sup> The percentage of farmworkers using these resources is small and access is likely constrained by transportation, hours of operation, and other access issues.

Data on preparing and using food show that most workers take responsibility for their own food, and only a few live in camps where meals are provided. Most prepare their own breakfast, but over half obtain lunch and about a third obtain dinner from a vendor, convenience store, or restaurant (likely, fast food). Vendors are often local Latinas who home cook culturally appropriate and appealing food and bring it warm in insulated containers to the fields; lunches are sold with drinks that may include water, but are largely bottles or cans of sugar-sweetened beverages. When workers prepare food for themselves, they may be able to make more healthy choices, whereas the purchased meals likely reflect the constraints of mass-producing food inexpensively that will appeal to the majority of worker customers. Efforts to work with these vendors to increase healthy food offerings could benefit workers

with diabetes. This might include encouraging them to offer drinks that are acceptable but not sugar-sweetened (e.g., flavored waters) and to stock whole fruit. For the large number of workers who prepare dinner at home for themselves, the condition of the kitchen, number of workers trying to use limited space, and the heat in the house may limit what can be prepared.<sup>6,20</sup> Workers with diabetes might fare better in home meal preparation if current housing regulations were enforced<sup>6</sup> or if they were strengthened to require more storage space for food and more cooking facilities per worker. Most workers report consuming one or more snacks between meals. While this spreads caloric consumption more evenly through the day, which is of value for persons with diabetes, the choice of food or beverages to be consumed may not be appropriate. For workers with diabetes, encouraging convenience stores to offer whole fruit and other healthier snacks could improve diet.

About four in five workers report no problems maintaining food security in their time in North Carolina, and the remainder reported varying degrees of food insecurity. The proportion of food insecure is less than that reported in earlier studies,<sup>21–24</sup> though many of those other studies included families with children where the farmworker income may have been insufficient to provide for the whole family. Over 90% of the current sample consists of H-2A workers, who are guaranteed a wage and hours work over the season; they may experience little food insecurity. Although workers report that their access to refrigerated and non-refrigerated storage space is adequate, previous research shows that objective measurement of space and of refrigerator temperature refutes worker perceptions of adequacy.<sup>6,25</sup> If workers with diabetes are encouraged to change food habits and food preparations, it is likely that additional storage beyond what is currently required by housing regulations will be needed.

**Limitations and Strengths.** This data collection was conducted among farmworkers in North Carolina who were mostly H-2A visa holders. The results may not apply to migrant farmworkers in other parts of the country who arrive at their worksites through different means. The confounding of H-2A status, gender, and diabetes in a relatively small sample prevented disentangling these and comparing the nutritional strategies of those workers with and without diabetes.

Nevertheless, this study extends previous research conducted on programs for farmworkers with diabetes, which have primarily focused on provision of medical resources and patient education. By surveying the farmworker population without regard to diabetes status and by grounding the survey on an established conceptual framework, it identifies the context in which farmworkers must self-manage diabetes and suggests features of this context that would impede appropriate diabetes self-management behaviors.

## Conclusions

This study, conducted with migrant farmworkers chosen without regard to diabetes status, demonstrates the nutritional strategies typical of Latino farmworkers. While education might improve the nutritional strategies and diet of these workers, structural constraints also exist for them to consume a healthy diet consistent with positive diabetes dietary self-management. Addressing these constraints would require additional resources that might be provided by employers (e.g., additional transportation, garden space, and gardening inputs) and local service providers such as migrant clinics (e.g., dietary assessment and counseling) and social service agencies (e.g., increased access to and improved standards for food pantries; educating and incentivizing vendors and stores to provide greater availability of healthy foods). Beyond these resources, policy changes are needed to overcome constraints. These might include changes to housing policy that would improve cooking and food storage facilities, and changes to the H-2A program to require provision of greater transportation to obtain food. As the farmworker population ages and greater medical resources are used to screen for diabetes, the number of workers will increase for whom diabetes self-management will need to be encouraged.

## Disclosure statement

Authors have no conflicts of interest to disclose.

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## References

- American Diabetes Association. Lifestyle management: standards of medical care in diabetes—2018. *Diabetes Care*. 2018;41(Suppl 1):S38–S50. doi:10.2337/dc18-S004.
- Centers for Disease Control and Prevention (CDC). *National Diabetes Statistics Report, 2017*. Atlanta, GA: Centers for Disease Control and Prevention, U.S. Dept of Health and Human Services; 2017.
- Bogges B, Ochoa Bogue H. *The Health of U.S. Agricultural Workers: An Ecological Analysis of over 790,000 Agricultural Worker Patients of Migrant Health Centers*. Buda, TX: The National Center for Farmworker Health; 2014.
- Heuer LJ, Hess C, Batson A. Cluster clinics for migrant Hispanic farmworkers with diabetes: perceptions, successes, and challenges. *Rural Remote Health*. 2006;6:469.
- Arcury TA, Summers P, Talton JW, Nguyen HT, Chen H, Quandt SA. Job characteristics and work safety climate among North Carolina farmworkers with H-2A visas. *J Agromedicine*. 2015;20:64–76. doi:10.1080/1059924X.2014.976732.
- Quandt SA, Summers P, Bischoff WE, et al. Cooking and eating facilities in migrant farmworker housing in North Carolina. *Am J Public Health*. 2013;103:e78–e84. doi:10.2105/AJPH.2012.301141.
- Summers P, Quandt SA, Talton JW, Galvan L, Arcury TA. Hidden farmworker labor camps in North Carolina: an indicator of structural vulnerability. *Am J Public Health*. 2015;105:2570–2575. doi:10.2105/AJPH.2013.301857.
- Heuer L, Hess CW, Klug MG. Meeting the health care needs of a rural Hispanic migrant population with diabetes. *J Rural Health*. 2004;20:265–270. doi:10.1111/jrh.2004.20.issue-3.
- Bergland JE, Heuer L, Lausch C. Diabetes lay educator case study: one woman's experience working with the Hispanic migrant and seasonal farmworkers. *J Cult Divers*. 2006;13:152–157.
- Thompson RH, Snyder AE, Burt DR, Greiner DS, Luna MA. Risk screening for cardiovascular disease and diabetes in Latino migrant farmworkers: a role for the community health worker. *J Community Health*. 2015;40:131–137. doi:10.1007/s10900-014-9910-2.
- Cartwright E, Schow D, Herrera S, et al. Using participatory research to build an effective type 2 diabetes intervention: the process of advocacy among female Hispanic farmworkers and their families in Southeast Idaho. *Women Health*. 2006;43:89–109. doi:10.1300/J013v43n04\_06.
- Quandt SA, Arcury TA, Bell RA. Self-management of nutritional risk among older adults: a conceptual model and case studies from rural communities. *J Aging Stud*. 1998;12:351–368. doi:10.1016/S0890-4065(98)90024-X.
- Quandt SA, Grzywacz JG, Trejo G, Arcury TA. Nutritional strategies of Latino farmworker families with preschool children: identifying leverage points for obesity prevention. *Soc Sci Med*. 2014;123:72–81. doi:10.1016/j.socscimed.2014.10.029.
- Harris PA, Taylor R, Thielke R, Payne J, Gonzalez N, Conde JG. Research electronic data capture (REDCap): a metadata-driven methodology and workflow process for providing translational research informatics support. *J Biomed Inform*. 2009;42:377–381. doi:10.1016/j.jbi.2008.08.010.
- Bickel G, Nord M, Price C, Hamilton W, Cook J. *Measuring Food Security in the United States. Guide to Measuring Household Food Security*. Alexandria, VA: US Department of Agriculture, Food and Nutrition Service; 2000.
- SAS Institute Inc. *Base SAS 9.4 Procedures Guide*. 5th ed. Cary, NC: SAS Institute Inc. 2015.
- Fish CA, Brown JR, Quandt SA. African American and Latino low income families' food shopping behaviors: promoting fruit and vegetable consumption and use of alternative healthy food options. *J Immigr Minor Health*. 2015;17:498–505. doi:10.1007/s10903-013-9932-3.
- Institute of Medicine. *Hunger and Obesity: Understanding a Food Insecurity Paradigm Workshop Summary*. Washington, DC: The National Academies Press; 2011.
- Companion M. Constriction in the variety of urban food pantry donations by private individuals. *J Urban Affairs*. 2010;2010(32):633–646. doi:10.1111/j.1467-9906.2010.00511.x.
- Quandt SA, Wiggins MF, Chen H, Bischoff WE, Arcury TA. Heat index in migrant farmworker housing: implications for rest and recovery from work-related heat stress. *Am J Public Health*. 2013;103:e24–e26. doi:10.2105/AJPH.2012.301141.
- Kilanowski JF, Moore LC. Food security and dietary intake in Midwest migrant farmworker children. *J Pediatr Nurs*. 2010;25:360–366. doi:10.1016/j.pedn.2009.05.003.
- Hill BG, Moloney AG, Mize T, Himelick T, Guest JL. Prevalence and predictors of food insecurity in migrant farmworkers in Georgia. *Am J Public Health*. 2011;101:831–833. doi:10.2105/AJPH.2010.199703.
- Weigel MM, Armijos RX, Hall YP, Ramirez Y, Orozco R. The household food insecurity and health outcomes of U.S.–Mexico border migrant and seasonal farmworkers. *J Immigr Minor Health*. 2007;9:157–169. doi:10.1007/s10903-006-9026-6.
- Quandt SA, Shoaf JI, Tapia J, Hernandez-Pelletier M, Clark HM, Arcury TA. Experiences of Latino immigrant families in North Carolina help explain elevated levels of food insecurity and hunger. *J Nutr*. 2006;136:2638–2644. doi:10.1093/jn/136.2.343.
- Quandt SA, Arcury TA. Farmworker housing: implications for food security and food safety. *Rural Voices*. 2013;18:12–14.