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Collecting Comparative Data on Farmworker Housing and Health: Recommendations for Collecting Housing and Health Data Across Places and Time

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Abstract

The substandard nature of the housing in which most farmworkers live has detrimental effects on their health, as well as on their children's health and development. However, little research has directly documented associations between farmworker housing and health; existing research is not always comparable due to differences in design and measurement. Comparative data can help determine actual causal links between housing characteristics and farmworker health and help to evaluate the efficacy of current housing policy. The goal of this paper is to provide guidelines promoting comparable research on farmworker housing and the association of this housing with health. This paper reviews general concepts relevant to measuring farmworker housing and health, issues that should be considered in designing farmworker housing and health research, data collection methods, and measures. It concludes with recommendations for a research agenda on farmworker housing and health.

Keywords

migrant and seasonal farmworkers; environmental health; migrant labor; housing; housing policy; research design

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Introduction

Farmworker housing is abysmal.[1–11] Although migrant farmworker housing should meet the minimum standards established by the Migrant and Seasonal Agricultural Worker Protection Act (MSPA), and seasonal farmworker housing should meet the minimum standards established by local ordinances, all current research indicates that housing for farmworkers across the United States is limited in availability, quality, and amenities. This situation has detrimental effects on farmworkers' physical and mental health and on their children's health and development.

Farmworkers are a vulnerable population. Most farmworkers are immigrants, often without legal documentation, most do not speak English, most have limited formal education, and most have limited income. Farmworkers are hesitant to contact government authorities when they need assistance, because of negative experiences with such authorities in their countries of origin and in the United States. Their jobs increase their risk for immediate occupational injuries and illness,[12,13] and for long-term health problems, such as neurodegenerative disease, cancer, and musculoskeletal problems, due to environmental and occupational exposures.[14]

Housing affects the health of its residents.[15] Substantial evidence links the quality of housing to health and disease through environmental exposures.[16–18] Housing characteristics can result in exposures to chemicals (e.g., pesticides, toxic gases, lead); allergens (e.g., dust, environmental tobacco smoke); molds and moisture; and pests.[3,19–22] These exposures are associated with health outcomes, including cancer,[23,24] neurobehavioral developmental and behavioral impairment,[25–28] atopic respiratory and dermatological conditions,[29–33] and sleep disturbance.[34,35] Social characteristics, such as crowding and noise, have also been associated with mental health outcomes, including depression, anxiety, social withdrawal, and increased rates of infectious diseases.[36–39]

Little research has documented the characteristics of farmworker housing, and less research has delineated its effects on farmworker health.[40] Most existing research on the effects of housing on farmworker health is difficult to compare due to variation in design and measures. Comparative data can help determine actual causal links between housing characteristics and farmworker health and would facilitate evaluating the efficacy of current housing policy and regulations. Several groups have argued that changes are needed in farmworker housing policy and its implementation.[41]

The broad aims of this paper are to (a) increase the comparability of housing data by providing information on measurement domains and instrumentation important to measuring health and housing interactions among farmworkers and (b) encourage benchmarking of farmworker health and housing studies to each other—and to national studies—by including common measures and including items from existing instrumentation.

A copious literature documents methods for investigating housing quality and health.[15] therefore, here we concentrate on topics and measures specific to physical and social

environments of farmworkers, including housing location, migration status, links between employment and housing, income, and visa status.

Housing

General Concepts

Several concepts and topics are important for research on farmworker housing and health. Projects investigating farmworker housing must be clear about their definitions and measures for these concepts and topics to enhance comparability.

Farmworker.—The definition of "farmworker" varies among regulatory agencies, service providers, and researchers.[13] Most frequently, the term is reserved for workers employed directly in crop or livestock production and excludes nonproduction workers such as mechanics, clerical, and managerial workers on farms. Some definitions require that the work be seasonal. Migrant farmworkers are individuals who change their place of residence for temporarily agricultural employment. Seasonal farmworkers have a single place of residence and work in agriculture on a temporary basis.

Farmworker household.—A household is a group who lives together and shares common resources; they are usually related, but need not be. Eligibility for some health and social services is determined by household composition. Measures of housing conditions, such as crowding and privacy, include household size and composition in their definitions. Household composition can be complicated for low-income populations such as farmworkers. Farmworkers living in group quarters such as camps often share space with nonrelatives (e.g., bedrooms and cooking, bathing, and laundry facilities) and pay for food rather than cook. Among farmworkers living in individual dwellings, a family (parents and children) may have a single room in a house or trailer and share cooking, bathing, and laundry facilities with other families. Employers who provide housing may require a family to allow unrelated adults to live with them in a single-family house. Farmworkers often live as groups of unrelated individuals, reducing individuals' control over their housing conditions.

Farmworker housing and types.—Definitions of farmworker housing must consider several dimensions. The distinction between seasonal and migrant farmworkers is important, because federal regulations (MSPA) apply only to employer-provided migrant housing. Standards for nonmigrant housing are governed by local building and zoning codes and in some cases by state statutes. Local codes can be quite limited in scope. Other dimensions are whether the housing is (a) private or public, and if public, whether it is subsidized; (b) employer- or worker-provided; (c) if employer-provided, whether it is provided as part of the worker's compensation or the worker pays rent; (d) individual unit or group quarters; (e) standard housing or nonstandard; and (f) whether the farmworker is homeless.

Farmworker housing encompasses the standard types found in most communities, including private single-family detached dwellings; multifamily dwellings, like duplexes and apartments; and trailers, which farmworkers own or rent (Table 1). Farmworkers may also rent rooms in private motels. In addition, states may host a variety of government-licensed

or subsidized housing arrangements specifically for farmworker populations. In 2006, 747 active Farm Labor Housing-funded programs accounted for 14,000 units nationwide, mostly in Florida, California, and Texas.[42] Employer-provided farmworker housing can include single-family and multifamily dwellings, trailers, converted motels, and various types of barracks. Unusual types of units are also used by farmworkers for housing, such as refurbished barns and other outbuildings, and storefronts; these may be rented or employer-provided. Finally, some farmworkers are homeless and live in their vehicles, in self-constructed temporary dwellings, and in spider holes (holes dug into hill sides). Because farmworker housing varies regionally, investigators need to consider the types of housing used in the region where they are conducting research.

Farmworker community.—Several dimensions of the communities in which farmworker housing is located are important for housing conditions and health. The first is whether the housing is located in a farmworker-specific community, such as a "camp," trailer park, or subsidized housing development, or if the community or neighborhood includes a mixture of farmworker and nonfarmworker residents. The general social and ethnic composition of the community is the second dimension; this should also include the size of the community in area and population, and the degree of residential segregation. A third dimension is the presence or relative location of facilities and amenities in the community. These facilities and amenities include full-service grocery stores, health care, childcare, schools, community centers, churches, and parks. If these facilities and amenities are not located in the community, or if the farmworker dwelling is not located in a neighborhood (a location with a number of dwellings versus an isolated dwelling), the researcher should consider the distance or travel time to the facilities and amenities.[43] The final dimension is the presence of noxious conditions and facilities in the community; these include heavy traffic, confined animal feeding operations, convenience stores, bars, or other locally unwanted land uses.

Topics With Special Relevance

Regulations.—Regulations related to migrant farmworker housing are detailed by Joyner et al.[44] Research should include measures to determine whether housing conforms to these regulations.[1,45] Housing provided to migrant farmworkers is governed by the MSPA, which is administered by the U.S. Department of Labor (http://www.dol.gov/compliance/laws/comp-msawpa.htm; accessed 10 June 2014). States generally enforce these regulations and can impose more stringent requirements; for example, in North Carolina, the Department of Labor[46] enforces migrant farmworker regulations outlined in the North Carolina Migrant Housing Act. Local building and zoning codes govern seasonal farmworker housing.

Location.—Important dimensions of location include whether housing is in a rural or urban area.[47] on-farm or off-farm; in a community solely occupied by farmworkers; and near facilities, amenities, and noxious conditions. Also important is the proximity of the farmworker housing to agricultural production, including fields and pasture; livestock, including confined animal feeding operations; processing and packing facilities; and storage areas.

Affordability, availability, and tenure.—Understanding the cost of housing is particularly important, as is whether employer-provided housing is part of a farmworker's compensation. When employers control housing, they have added control over individual employees. Availability of housing is a major concern because housing options are often limited in rural communities. Availability is further limited when owners do not want to rent housing when it is only needed for the few months of the agricultural season. Therefore, assessing housing tenure, whether the farmworker owns the dwelling or the land where the dwelling is located, is important.

Social characteristics.—Social characteristics of farmworker housing are discussed by Marsh et al.[48] The primary one is isolation, which can occur in several forms. Farmworker housing can be located in rural areas distant from any town, store, paved roads, and farmworker or Spanish-speaking communities. Individual farmworkers can be isolated when they share housing with individuals whom they do not know. Farmworkers are sometimes segregated by ethnic and racial group by those providing the housing. Lack of access to transportation can compound this isolation.

Farmworker housing is often crowded. The number of persons and families sharing a dwelling or a bedroom can indicate crowding, as can the use of common rooms (e.g., living rooms) for sleeping. Other indicators include the size of a bedroom for the number of residents; the use of triple-decker bunk beds; hot bedding (the practice of more than one person sleeping per bed—workers sleep in shifts);[49] and the number of persons who must share kitchen, bathing, toileting, and laundry facilities.

Privacy is another dimension of crowding.[2] Crowding affects privacy in terms of the number of individuals in a bedroom, sharing a bed, or sharing a bathroom. Shared kitchen and food storage facilities compromise family privacy. Other factors indicating compromised privacy include a lack of personal storage space; a lack of privacy screens between toilets or showers; and group sleeping, bathing, and toilet facilities that are not gender-specific.

Transportation.—Research should include questions about means and cost of transportation and the association of available transportation with isolation. Dimensions to consider include whether individuals in a house have personal vehicles or depend on crew leaders or employers for transportation. Additional considerations are whether individuals must pay for transportation and whether they have drivers' licenses.

Communication.—The growth of communication technology means that farmworkers do not depend on landlines for communication.[50] Research should document ownership or access to cellphones, smartphones, tablets, computers, and Internet, as well as connectivity in a dwelling. It may also be important to document access to electronic media in the communities in which farmworkers are living, including computer access in community libraries, centers, Internet cafes, and wireless hotspots.

Emergency services and preparedness.—Farmworker communities may be at greater risk from disasters than other populations. They are generally located in rural areas with less developed public infrastructure, and they are often geographically and socially

isolated. Documenting the geographic location of farmworker housing relative to emergency services such as fire service, ambulance service, and hospitals, and the level of emergency preparedness is critical to obtaining a clearer picture of farmworker vulnerability and the effects of farmworker housing on health outcomes.

Research Design

Several challenges make research on farmworker health and housing a difficult undertaking. Farmworkers constitute a hidden population.[51–53] No sampling frame exists for the population, so its size and boundaries are unknown. Many members of the population experience discrimination because of their lack of lawful permanent residence or work visas. Therefore, to protect their privacy, farmworkers may refuse to participate in research, or give unreliable information. Powerful individuals and institutions in some communities are antagonistic to research that might indicate that farmworkers are treated unfairly. Finally, the definition of a farmworker rests on a seasonal and contingent occupation; an individual who is a farmworker this week may be working in a different occupation next week. Therefore, a major issue is developing a design that reduces the bias of underrepresentation of the most difficult-to-reach individuals, who are also usually the worst off and most vulnerable.

Investigators should consider designs that incorporate a community-based participatory research approach when conducting research on farmworker housing and health.[54,55] Community-based participatory research incorporates members and organizations from the community in the design, implementation, and dissemination of research. Community member coinvestigators will help ensure that the research includes all community members in the research, no matter how informal their housing, and that the research measures all housing characteristics that are important to residents.

Sampling.—Locating and recruiting a representative farmworker sample is a major challenge. No sampling frame, or list, of farmworkers exists. Because “farmwork” is an occupation, an individual’s eligibility for participating can change rapidly. Official lists of farmworker housing are often incomplete or inaccurate. Farmworker housing is often hidden and includes unusual housing types. Some farmworker housing is on the property of employers who may not want their employees to participate in research. Therefore, researchers need to be creative in applying locale knowledge to enumerate farmworker housing.

In designing a sampling method, two dimensions are important: approach and unit. One approach is the use of a clinic design, in which the investigator recruits participants through health-care providers. For example, the CHAMACOS study followed a cohort of pregnant women associated with a particular hospital.[56,57] This approach allows recruiting participants with a health concern related to housing (e.g., asthma), and a comparison group (patients without asthma). However, only individuals receiving health care can be recruited, and they are generally not representative of the community.

A second approach is a community survey in which dwellings within a geographical area are randomly selected, using either a simple or complex design. For example, the California Agricultural Workers Health Study[58] used information on characteristics of Medical Service

Study Areas and Census Blocks, including agricultural employment levels, to select study sites for housing enumeration. This approach is easier in a small area, as in a single, geographically limited community. However, for larger areas (groups of counties, an entire state, a region, or nationally), the cost and logistics of a community survey sample are often prohibitive.

A third approach is the respondent-driven sample.[51] Mines et al.[59] used this approach to develop a sampling frame by identifying locations and origins of indigenous farmworkers in California. Quandt et al.[43] developed a sampling frame of farmworker families with young children by enumerating the nodes used by farmworker families (e.g., Migrant Head Start or Women, Infant and Children programs). The standard practice of having several entry nodes to overcome bias is particularly important with farmworkers. Low use of services makes service providers a biased network that tends to overrepresent families.

Researchers can develop a sampling frame either of housing units or of farmworkers that is independent of their residences. Employer-based and respondent-driven surveys sample farmworkers directly. A challenge for employer-based surveys is obtaining a list of agricultural employers. In some cases, lists are publicly available, for example, employers using H-2 A workers. Commercial vendors usually have lists of farm employers, although these may require verification. Alternatively, investigators can work with employer groups or agencies to generate a list of employers. The National Agricultural Worker Survey (NAWS) of the U.S. Department of Labor is an employer-based survey and uses multiple approaches and considerable resources to develop an agricultural employer frame. Arcury et al.[1] have used a community-based participatory research approach in which they work with community partners to select farmworker labor camps located on farms that are served by the partners.

Any residence-based survey of farmworker housing must map housing units. This step is critical, because many farmworkers live in hidden or unusual units and several households may share what appears to be a single unit. Aerial photography or geographic information systems (GIS) may be used for mapping. However, once an area is selected, researchers need to go there to enumerate each dwelling unit, including unusual or hidden units.[60]

After completing the sampling frame and selecting a sample of housing units, residents within units are selected. Most data collection protocols involve obtaining information on all residents and collecting data from one or more resident farmworkers. The number and types of residents selected will depend on the research protocol. In order to calculate the sampling probabilities for residents in a unit, it is important to count all the individuals living within a residence. A household composition table can identify the number of people living in the household and their relationships, the number of adults and children, and level of crowding.

Data collection methods.—Researchers must identify what methods and measures to use when collecting data on the housing unit and from the sampled resident(s).

Interviews: The individual interview remains the core method for collecting housing data. Fixed-response interviews provide data needed for statistical analysis. The interview allows

the resident to report on the conditions and facilities that cannot be observed and provide an evaluation of the conditions and facilities.

Inspection: Physical inspection of the housing unit can add "objective" data documenting characteristics, including the presence of pests,[3] the availability of facilities and appliances (e.g., washing machines, showers, and toilets); privacy, storage, and locks for security,[1,61] and compliance with regulations.[1] Inspection requires a detailed protocol directing the data collector about what should be collected and how it should be collected; inspection also benefits if a resident helps provide access to the private areas of a dwelling.[1]

Photography: Photographs can assist in documenting conditions[2,62] and can be analyzed in their own right as textual data.[63,64] They also document conditions that can verify field inspection observations or inform the construction of measures based on systematic coding of photo content.

Exposure assessment: Various types of residential exposure can be determined using standard environmental sampling procedures (Table 2). Some used in research on farmworker housing include biological water quality,[65] presence and extent of mold and mildew,[1] and pesticides,[20,66–69] air quality,[67] room temperature and humidity,[70] and refrigerator temperature.[61]

GIS: The GIS can graphically display important data about farmworker housing and health.[71] It can assist in locating farmworker housing and relevant census data, generating statistics about spatial isolation and access to essential services, and evaluating proximity to natural and human-induced environmental hazards. GIS works by layering submaps of specific kinds of spatial data, demography, roads, services, and hazards to quantify or describe the spatial relationships among factors.

Locations of studied housing should be recorded as part of the data management process. A standard method on the ground is to take a latitude–longitude reading or Universal Transverse Mercator coordinates of the main door of a unit with a technical-grade Global Positioning System unit. This reading will be accurate to within a few meters. Google Earth provides remarkable capacities unattainable only a few years ago. Known housing units can be marked in the imagery and locations extracted, usually to tens of meters of accuracy. Google Earth can be used to identify possible housing sites for field investigation by scanning imagery for appropriately sized buildings in heavily used landscapes.

Other data that can be linked to farmworker housing locations include U.S. Bureau of the Census community demographic and socioeconomic characteristics, and community infrastructure data. The latter can include data such as public water supply or sewer service characteristics, school attendance regions, land use zoning, emergency services and police patrol characteristics, crime rates, public health statistics, and subsidized housing units. Diverse geospatial sources provide information and spatial statistics about hazards and noxious facilities that may lie near farmworker housing. Conventional geophysical "natural hazards," such as floods and tornados, are well mapped by the Federal Emergency Management Agency and the U.S. Geological Survey.

Qualitative methods: Qualitative research can provide insights into complex behaviors and decision-making processes related to housing. This approach can be particularly useful with farmworkers because these methods allow more time and interactions to solicit farmworker perspectives. Previous research with farmworkers has addressed health beliefs, knowledge of regulations, and housing conditions.[62,72–76] Data are collected through interviews, focus groups, diaries, journals, and photographs. Common methods include individual in-depth interviews, Photovoice,[77] group interviews,[78] and observation.

Public Data Sources: Multiple public data sources can provide information on farmworker housing location and characteristics, and data needed for sampling and recruitment. Public data sources that describe farmworker housing and exposures include the California Pesticide Use Reporting System (http://calpip.cdpr.ca.gov/main.cfm), which provides the GIS coordinates and dates for all commercial pesticide applications. The North Carolina Department of Labor provides a list of registered farmworker camps that includes the address of the grower, the county where the camp is located, the dates workers are present, the number of units registered for workers with H-2 A visas, the last inspection date, and the number of occupants certified for each camp (https://www.dol.communications.its.state.nc.us/ash/scripts/pa_1a.cfm). However, investigators must be cautious in using public data sources; they should be familiar with their limitations and biases.

Measures.—In reviewing potential benchmarks, the discussion focuses on inspection forms and resident surveys. Several well-known instruments measure housing type and quality for the general population. Jacobs et al.[18] reviewed several major healthy home surveys, including the Hazard Assessment and Reduction Program, American Healthy Homes Survey, American Housing Survey, Public Housing Assessment System, Housing Quality Standards, Community Environmental Health Resource Center, and the National Energy Audit Tool. They assessed comparability across these instruments, noting the inclusion or exclusion of specific items in several domains: electrical, structural, moisture and mold, and injury hazards; presence of pests, ventilation, and fire.

Several measurement domains unique to farmworker housing require expansion of the usual questions found in benchmark surveys. Farmworker surveys draw on all the measurement domains generally available for rural housing studies, as well as domains heavily used in studies of low-income and immigrant populations. These domains include employer-provided housing and its specific regulations under the MSPA; on-farm or off-farm location; attention to camps/barracks housing, seasonal or migratory housing; unusual units such as hidden secondary units, garages, outbuildings; extreme crowding within units, multihousehold, multisingle men; farm proximity; and unique exposures from dust, chemicals nearby, or chemicals brought home through the pesticide pathway.

Identifying and assessing instruments that cover these additional domains should focus on four methodologies used to collect housing information: visual inspection, resident surveys or interviews, environmental assessments, and photography. Survey questions that reflect standard measures, such as affordability (measured as the percent of income spent on housing), the U.S. Census Bureau’s definition of crowding, the American Housing Survey’s

definition of housing with “moderate or severe physical problems,” and the Housing Assistance Council’s (HAC) definition of “moderately and severely substandard” housing[9] are encouraged.

Assessing each concept requires including several measures, many of which will require adaptation to farmworker housing. For example, the crowding definition requires knowing the total number of certain rooms in the house and number of occupants. Assessments of the physical adequacy of housing for HAC and the American Housing Survey require detailed information on the physical structure. Affordability requires information on household, the household income, and the cost of the housing. This concept is complicated for farmworkers when housing is included as part of a compensation package. Another example is that measures of physical adequacy that include heating may need to be adapted for temporary housing, which is not intended to be used during cold months.

Benchmarking to national housing surveys is limited to comparing data from a study on farmworkers to the general population. It is often difficult to find a subset of national studies corresponding to farmworker housing. Frame issues and lack of critical variables to identify housing, such as employer-provided or on-farm location, limit data comparability. For benchmark surveys, the temporary nature of migrant and seasonal housing may result in such housing being considered vacant, depending on the survey’s timing.

Two national surveys provide benchmarking information: HAC’s ground-breaking national survey.[9] and the NAWS. The NAWS instrument and methodology are available online (http://www.doleta.gov/agworker/naws.cfm). A third benchmark specific to farmworkers is the MSPA inspection standards. Though not a national instrument, these national requirements for employer-provided housing provide a set of common standards for the physical inspection of farmworker housing.

Health

Farmworkers and their families experience high rates of disease and injury,[12,14,79,80] and have limited access to health services.[13] The diseases and injuries are related not only to the difficult work in which farmworkers are engaged but also to their housing. Current knowledge of the association of farmworker housing with farmworker health is reviewed by Quandt et al.[81] The focus here is on common health outcomes related to housing characteristics that should be considered in research on farmworker housing.

Topics

Several components of physical and mental health among farmworker family members are particularly related to their housing conditions.[81] These include respiratory health,[82,83] dermatological health,[84,85] injuries and trauma; infectious diseases, such as tuberculosis, hepatitis, sexually transmitted diseases, and HIV,[86] parasites,[87] the neurobehavioral development of children,[88] and sleep quality.[89] Components of mental health affected by housing conditions include stress, anxiety, depression, and alcohol dependence[39,90] as well as interpersonal conflict, domestic violence, and sexual assault.[91,92]

Research Design

Comparability and benchmarking for the health components of health and housing surveys is facilitated because, although various health conditions may be more prevalent among farmworkers, standard medical screeners and assessment indices for the major conditions and factors usually exist in the general medical and health literature. Several national health assessment surveys are generally used as benchmarks, including the National Health and Nutrition Examination Survey (http://www.cdc.gov/nchs/nhanes/nhanes_questionnaires.htm), Hispanic Health and Nutrition Examination Survey (http://www.cdc.gov/nchs/nhanes/hhanes.htm), the National Health Interview Survey (http://www.cdc.gov/nchs/nhis/nhis_questionnaires.htm), and Behavioral Risk Factor Surveillance System (http://www.cdc.gov/brfss/questionnaires.htm). It is important to focus on aspects of health specific to the unique factors of farmworker housing.

Primary data.—Primary data collection methods that can be used to examine farmworker health associated with housing include interview questionnaires, biomarkers, and clinical examinations. Interview questionnaires are the easiest approach; existing validated instruments are available for many components of physical and mental health. The European Community Respiratory Health Survey questionnaire[93] is a standard tool that can be used with farmworkers.[82] The Nordic Occupational Skin Questionnaire (NOSQ-2002),[94] can be used for skin conditions. Infectious disease questions have been developed and used with farmworkers.[95,96] The Epworth Sleepiness Scale,[97,98] Sleep Timing and Sleep Quality Screening Questionnaire,[88,99] and Pittsburgh Sleep Quality Index questionnaire[100] have all been used to measure farmworker sleep quality. Neurobehavioral and cognitive function have been measured among farmworkers using standard measures.[101–103] These include tests for visual memory, such as the Benton Visual Retention Test,[104] and assessments of psychomotor speed, such as the Trailmaking Test B (Trail B).[105] Rohlman et al.[88] have developed tools to measure neurobehavioral development for farmworker children.

Several standard mental health measures have been widely used with farmworkers. The Center for Epidemiological Studies Depression Scale is often used to measure depression.[106,107] The Personality Assessment Inventory has been used to measure anxiety.[90,108] Stress is often measured with the Migrant Farmworker Stress Inventory.[109–111] Finally, the CAGE (4 M) is used to measure alcohol abuse.[112,113]

Biomarkers, such as blood, urine, and saliva, provide several measures of health and exposure (Table 3). Infectious diseases can be measured with blood, urine, and saliva samples. The presence of parasites can be measured with blood and stool samples. Aspects of reproductive health can be measured with urine and semen samples. Pesticides and cholinesterase can be measured in blood; pesticide metabolites can be measured in urine; and lead and other metals can be measured in blood, urine, and hair. Cotinine, a metabolite of nicotine, can be measured in urine and saliva.

Several clinical examinations can be used to measure farmworker health related to housing. Some, such as anthropometrics (height, weight) and blood pressure, are simple. Dermatologic exams can be accomplished through direct examination[114] or using

photographs,[84] but require a trained physician. Spirometry provides clinical measures of lung function, but requires a skilled technician.[115]

Documentary data.—Several types of documentary data can provide information on farmworker health. Health records can provide information on several conditions that are affected by housing quality. Similarly, emergency room records can provide information on trauma and injury related to housing. Each source should be used with caution, because they require that (a) the individual be seen at a clinic or emergency room, (b) the health record indicates that the individual is a farmworker or in a farmworker family, and (c) clinicians have sufficient knowledge to correctly record the health outcome and its cause.

Discussion

Research on farmworker housing and how it affects health is limited. A few research programs have begun to identify the immediate and long-term health consequences of farmworker housing; these include the CHAMACOS study,[26,67] the Mexican Immigration to California: Agricultural Safety and Acculteration study,[116,117] and the Wake Forest Study.[1,2] This research is restricted in geographic scope (e.g., California, North Carolina). Although these states have large farmworker populations, they do not represent all states where farmworkers are employed. This limited geographic scope is amplified when the known regional variation in farmworker housing is considered.

A substantial research literature on the associations of housing and health exists.[15] This literature includes housing of low-income and vulnerable populations (e.g., low-income minority residents in urban centers[19,118]), and addresses some issues pertinent to farmworkers (e.g., residential pesticide exposure[21]). However, special characteristics of the farmworker population and their housing require additional focus. These include the rural location of much farmworker housing in the United States, the regional variation in the housing stock available to farmworkers, the immigrant and Latino ethnic background of most farmworkers, the migratory status of many farmworkers, and the fact that housing is often provided by employers.

The provision of adequate-quality housing for farmworkers is an issue of social justice. Adequate housing is a fundamental human right.[119,120] Systematic research with comparable measures is needed to document the status of housing available to farmworkers that can inform housing policy and regulations at the local, state, and federal levels. The only national study focused on farmworker housing, conducted by the HAC,[9] is more than fifteen years old and was limited in its measurement of housing physical characteristics; its results were not published in the peer-reviewed literature. The NAWS has collected valuable housing data, but limited health data, and it does not collect housing inspection or environmental assessment data. Additional NAWS health data were collected in some years via supplements sponsored by the National Institute for Occupational Safety and Health and other agencies.

A national longitudinal study of farmworker housing and health is needed but may not be feasible due to its costs. A series of comparative local studies conducted nationwide

may provide the data to document the need for specific farmworker housing policy and regulations. A goal of this report is to provide a framework for such comparative local studies. The following are recommendations for accomplishing this goal:

Recommendation 1:

A consortium of organizations should be formed to conduct systematic, comparable research on farmworker housing and health that will provide data needed to address policy and improve regulation. This consortium can build on the efforts of California Rural Legal Assistance,[121] ongoing local studies of farmworker housing and health (e.g., the CHAMACOS and Mexican Immigration to California: Agricultural Safety and Acculteration projects), and national farmworker health organizations (e.g., Farmworker Justice, National Center for Farmworker Health, Migrant Clinicians Program), and those of the HAC.

This consortium should consult with local researchers addressing farmworker housing and health and provide research results for those addressing local, state, and federal policy and regulations. Support for the consortium should be sought from interested foundations and federal agencies responsible for housing and health.

Recommendation 2:

Investigators should develop a standard core instrument on housing issues to use in diverse studies conducted with farmworkers. This core instrument should include items on health outcomes directly affected by housing characteristics. Such core questionnaires have been developed for other health-related topics.

Recommendation 3:

Future research on farmworker housing should include basic health measures for adult and child residents.

Recommendation 4:

Research on farmworker health should include basic measures of housing characteristics.

Recommendation 5:

Health researchers should work with architects and construction specialists, with guidance from farmworkers, on research that can document how better quality farmworker housing can be designed and constructed.

Recommendation 6:

Research on farmworker housing should include policy recommendations to address the systemic changes needed to improve farmworker housing. Policies are needed on the number of housing units available to farmworkers, their location, and their ownership. Policies and regulations should be consistent across states, and there should be adequate resources to enforce them. Finally, these policies should lead to systemic changes, to

ensure individual dignity of housing that meets the requirements established by the United Nations[119] and the World Health Organization.[120]

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Table 1.

Types of Farmworker Housing.

Private housing
Single-family dwellings
Multifamily dwellings (duplex, apartment)
Trailers or mobile homes
Motels
Public government-financed housing
Nonprofit housing
Employer-provided housing
Single-family dwellings
Multifamily dwellings (duplex, apartment)
Trailers or mobile homes
Motels
Refurbished barns and outbuildings
Barracks
Dormitory
Bullpen
Horse stall
Unusual units
Garages
Outbuildings
Hidden secondary units
Homelessness
Vehicles
Self-constructed temporary structures
Spider holes

Table 2.

Common Techniques for Environmental Monitoring in Farmworker Housing.

	Environmental sample						
Environmental marker	**Water samples**	**Chip and soil samples**	**Surface wipe samples**	**Surface vacuum samples**	**Air monitoring**	**Inspection, observation, photographs**	**Instruments**
Water quality, biological	X						
Water quality, chemical	X						
Lead		X	X				
Pesticides		X	X	X	X		
Mold and mildew						X	
Allergens			X	X	X		
Air quality					X	X	
Room temperature							X
Room humidity							X
Wall moisture							X
Refrigerator temperature							X

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Table 3.

Biomarkers for Farmworker Health.

	Biological samples					
Biomarker	**Blood**	**Urine**	**Saliva**	**Hair**	**Feces**	**Semen**
Infectious disease	X	X	X			
Parasites	X				X	
Reproductive health		X				X
Pesticides	X					
Pesticide metabolites		X				
Cholinesterase	X					
Lead and other metals	X	X		X		
Cotinine		X	X			