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Review Article

Organization of Work in the Agricultural, Forestry, and Fishing Sector in the US Southeast: Implications for Immigrant Workers' Occupational Safety and Health

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Background *There is widespread agreement that work organization is an important element of occupational safety and health, but the health effects of many aspects of work organization are likely to vary considerably across different sectors of work and geographies.*

Methods *We examined existing employment policies and work organization-related research relevant specifically to immigrant workers in the Agriculture, Forestry, and Fishing (AgFF) Sector of the US workforce focusing, when possible, on the southeastern US.*

Results *A number of specific aspects of work organization within AgFF subsectors have been described, but most of this literature exists outside the purview of occupational health. There are few studies that directly examine how attributes of work organization relevant to the AgFF Sector affect workers', much less immigrant workers', occupational health exposures and outcomes.*

Conclusions *In contrast to the broader literature, research linking occupational health outcomes to work organization in the AgFF Sector is limited and weak. A systematic program of research and intervention is needed to develop strategies that eliminate or substantially mitigate the deleterious health effects of occupational exposures whose origins likely lie in the organization of AgFF work.* Am. J. Ind. Med. 56:925–939, 2013. *© 2013 Wiley Periodicals, Inc.*

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INTRODUCTION

There is substantial documentation of work-related injuries, illnesses, and fatalities in the Agricultural, Forestry, and Fishing (AgFF) Sector [Quandt et al., Report 3; Villarejo, 2003]. Many jobs in this Sector, particularly pine straw bailing and crop agriculture of commodities that use human rather than mechanistic harvesting (e.g., tobacco, palm fruit, melons), increasingly rely on immigrant and contingent workers [Carroll et al., 2005; Casanova and McDaniel, 2006]. There is a rich literature on the role precarious work situations, like those in the AgFF Sector, play in health disparities [Quinlan et al., 2001; Lipscomb et al., 2006; Ahonen et al., 2009, 2010; Kompier et al., 2009; Muntaner et al., 2010; Porthe et al., 2010; Benach et al., 2010b; Landsbergis et al., 2012]. Contingent, part-time, and informal work arrangements create vulnerabilities such that workers may lack the basic protections granted by health and safety standards and the social benefits of work often enjoyed by others. Reliance on contingent labor also creates substantial complexities in work practices and regulatory oversight by employers and enforcement agents.

The organization of work includes the way jobs are designed and performed (i.e., work processes), management and human resource policies, production methods, as well as labor market policies and the dialectic between the welfare state and labor market that shape all work processes [NIOSH, 2002]. The organization of work is not a single attribute that exists at a single level. Rather, work organization is a constellation of geopolitical, sociostructural, organizational, and interpersonal factors that operate at multiple levels to affect worker health [NIOSH, 2002; Muntaner et al., 2010; Benach et al., 2010b; Landsbergis et al., 2012]. Within this constellation, job-specific or task-level factors are nested within organizational-level factors, which are, in turn, nested within broader social, political and economic external contextual factors that shape and drive employment [Muntaner et al., 2010; Benach et al., 2010b; Landsbergis et al., 2012].

Increasing world-wide attention is being directed toward the role that work organization plays in health inequalities, including those related to immigrant workers [Benach and Muntaner, 2007; Siegrist et al., 2009; Bambra, 2011; Landsbergis et al., 2012]. Many hazards in the AgFF Sector are ''built into'' the way the work is done. Immigrant workers live and labor in remote rural areas, on waters or in coastal regions of the Atlantic and Gulf of Mexico, in mountain highlands of Appalachia, or on the coastal plains. Many jobs occupied by immigrants in the AgFF Sector are exempt from federal protections offered through the Fair Labor Standards Act and the National Labor Relations Act. Many workers within the AgFF Sector are paid by the piece. Piece rate compensation systems motivate attention to quick work and high production with potential negative consequences for safe work practices [Johansson et al., 2010]. These risks are likely exacerbated for workers who are separated from their families and who want to maximize the financial benefit of that separation. Jobs are frequently monotonous, and they generally allow workers little discretion over how their work is performed [Grzywacz et al., 2008]. Such organizational features likely play a substantial role in injury, illness and fatality in the AgFF Sector, yet few have considered, much less studied, work organization in this diverse and multifaceted employment sector [Watterson et al., 2008].

The goal of this paper is to provide a foundation for advancing occupational health-related research focused on the organization of work among immigrant workers in the AgFF Sector. To accomplish this goal, we summarize and characterize existing research focused on the health-related implications of work organization for immigrant workers in the AgFF Sector generally and in the Atlantic southeast, particularly. To guide future research we present a conceptual model and discuss high priority areas for research that could help to promote the organization of work as a means of protecting worker health in the AgFF Sector.

THE ORGANIZATION OF WORK AS A DETERMINANT OF OCCUPATIONAL HEALTH AND SAFETY

Consistent with broader National Occupational Research Agenda (NORA) initiatives, our approach to understanding the organization of work as a determinant of occupational health sees it as consisting of a range of factors operating at multiple levels, all of which can have consequences for occupational health. These factors include external contextual factors, employer or organizational-level factors, and job-specific or task level factors.

External Contextual Factors

Macro-level forces external to organizations shape not only job design and management methods used by broad sections of the national and international labor force but also overall employment and the division of labor [Muntaner et al., 2010; Benach et al., 2010b]. These factors draw attention to such forces as the expanding global

marketplace and subsequent implications for global value chains and vertical integration of the food industry [e.g., Stull, 2000; Thorpe and Bennett, 2004], and the worldwide recession that fundamentally shapes job growth and employment offerings. Likewise, the ability of communities and regions to retain existing jobs or stimulate job growth depends, at least in part, on regulatory, trade, and economic laws and policies. Laws related to unionization and the related strength and penetration of organized labor can shape the boundaries and activities of the jobs performed by workers, as well as available protections [Muntaner et al., 2010]. Technological innovation creates new jobs and forms of work, and influences the way existing jobs are conceived, implemented and evaluated. Finally, shifts in the demographic composition of the available labor force, such as via aging, growing gender and ethnic diversity and changing citizenship can influence job design and management methods.

Employer or Organizational Factors

Organizations within the same industry can use very different strategies to compete in the marketplace and labor market. Staffing models, such as reliance on a contingent or ''just-in-time'' workforce rather than permanent employees, and corresponding differences in compensation and benefit systems, illustrate two common employer or organizational factors that contribute to variability in the organization of work within a common industry. Similarly, process improvement methods such as ''high performance work systems'' and subsequent organizational initiatives, such as those related to workplace flexibility and employee training and development, further illustrate points of divergence in how core functions are accomplished by employing organizations within the same industry.

Job-Specific or Task-Level Factors

Job attributes like the level of worker autonomy, breadth of task variety, and complexity inherent in job responsibilities are the work organization factors most proximal to individual workers. They all speak to the way that a given job (either within an employing organization, within an industry, or across industries) is designed. Similarly, social aspects of the work including interpersonal relationships among co-workers and between supervisors and workers, job-role clarity, and growth opportunities for workers reflect work organization.

The organization of work can affect worker health through several independent and potentially synergistic pathways [NIOSH, 2002; Landsbergis et al., 2012]. External factors like regional unemployment levels, job availability, gender, and racial stereotypes influence the types of jobs workers are offered, accept and the hazards they confront (and are willing to confront) while on the job. Factors at the level of the organization like workplace design and location, the degree of mechanization, the pace of production, systems of remuneration, training, and health and safety policy influence the chemical, biological, mechanical, ergonomic, and psychosocial hazards workers confront and how they deal with them. More generally, workplace culture, including shared values and attitudes or more simply ''the way things are done around here'' affects occupational health and safety (OHS). Finally, job-specific factors like worker-management relations and the degree of autonomy workers have over how work-related tasks are performed can affect hazard exposure.

ORGANIZATION OF WORK IN THE SOUTHEAST US AgFF SECTOR

This section applies elements and principles of the generic organization of work model to a discussion of existing research on OHS in the AgFF Sector that draws, where possible, on research from the southeast US. Key attributes of work organization that are common across agriculture, forestry, and fishing are discussed, starting with external contextual factors, followed by employer and organizational factors, and concluding with job-specific or task-level factors. When relevant, noteworthy contrasts within the AgFF Sector are highlighted, such as enhancements to the temporary worker program for those in agriculture relative to those in forestry or fishing.

External or Contextual Factors

Globalization

Historically the US has been a dominant exporter of AgFF products and is the leading global producer of many products [Hanrahan, 2010]. In terms of export products dominant in the southeastern US, the US is the number one producer of blueberries and chicken meat in the world; the number two producer of shelled hen eggs, apples, and oranges; and the number four producer of peaches and nectarines, tobacco, and pumpkins, squash and gourds. The southeastern US is also a meaningful exporter of wood pellets and biomass as a renewable energy source, and it contributes meaningfully to the global supply of shrimp, tilapia and striped sea bass.

Total US agricultural, forestry, and fishing exports have remained relatively steady over the past decade (Fig. 1). The number of metric tons of agricultural and fishing exports increased, particularly in the later part of the past decade, although exports of forestry products have remained relatively stable. However, the US has seen substantial growth in the value of its AgFF exports (Fig. 2) with the value of US agricultural, forestry, and

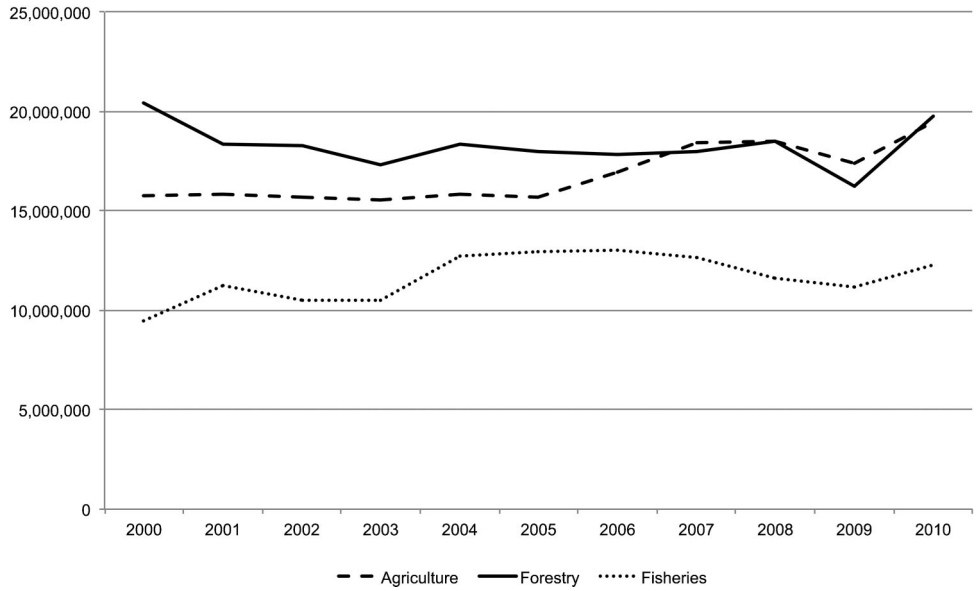

FIGURE 1. Number agricultural, forestry, and fishing exports‡: 2000–2010. ‡Unit of measures for agriculture is tenths of metric tons, the unit of measure for forestry export is cubic meters, the unit of measures for fisheries is tenths of metric tons. *Source*: United States Department of Agriculture, Foreign Agricultural Service, Global Trade System Online.

fishing exports increasing an average of 35% between 2000 and 2010. Growth in the per-unit value of agricultural exports was particularly striking: in 2010, the average value of US agricultural exports was $594 per metric ton, an 85% increase over the average per unit value of $325 for agricultural exports in 2000. A variety of factors have contributed to these value gains, but it is likely that a substantial proportion comes from savings in labor costs as they comprise 30–40% of overall production costs in agriculture [Runyan, 2000] and a presumably large proportion of production costs in forestry and fishing. Heavy reliance on immigrant labor is one way to reduce production costs in an increasingly competitive global economy [Oxfam, 2004].

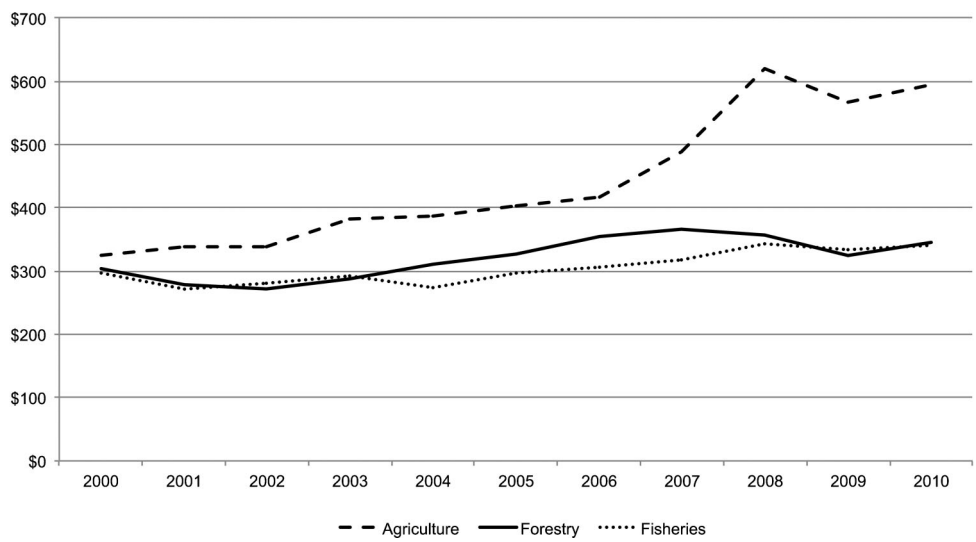

FIGURE 2. Dollar value† obtained for each unit‡ of agricultural, forestry, and fishing exports: 2000–2010. †Value of fishery export is expressed in tenths of dollars. ‡Unit of measure for agricultural and fisheries exports is metric tons, the unit of measure for forestry exports is cubic meters. *Source*: United States Department of Agriculture, Foreign Agricultural Service, Global Trade System Online.

Trade, economic, and development policies

The North American Free Trade Agreement of 1994 (NAFTA) and similar trade policies in the region have been critiqued for the way they have stimulated low wage immigration to the US [Zabin, 1997]. AgFF workers within and outside the Southeast are ''global actors'' in that they are being displaced from their homes in largely rural areas of Mexico, Central America, and the Caribbean, due to trade policies, worsening local economies, changing farming patterns, and opportunities for employment in the migrant labor streams [Cornelius and Martin, 1993; Massey and Durand, 2002; Griffith, 2006; Fernandez-Kelly and Massey, 2007]. Remittances from family members working in the US have helped impoverished communities survive the effects of NAFTA in the region but these decline when low-wage, immigrant friendly jobs disappear in the US [Massey et al., 1987; Massey and Durand, 2002; Ratha et al., 2008]. During the current US recession, AgFF has been one of the few sectors to maintain employment levels (http://www.bls.gov/oco/ocos349.htm#outlook) while other sectors such as construction, are seeing a contraction in immigrant employment [Kochhar, 2008].

While macro level forces, like NAFTA or other global or regional trade agreements, do not determine working conditions in the fields, forests, and waterways of the Southeast, they help determine who predominates in the labor pool and the legal, cultural, and linguistic issues they face regarding safety and health [Benach et al., 2010b]. For example, during the mid-1990s, pulp and paper companies sold land and began to subcontract work that was not directly involved in processing [Sinclair et al., 2003]. Non-industrial private landowners now supply the timber and pulp necessary to manufacture paper, lumber, and other forest products, often relying on immigrant workers. With this restructuring, jobs like tree planting, herbicide spraying, and logging were deskilled and became more contingent. Vertical integration is another example of a macro-level factor that is influencing employment arrangements and thus who is exposed to hazards in the AgFF Sector. Vertical integration is the practice of combining different external production units along the value chain to create one integrated unit [Gereffi, 1994]. When a firm vertically integrates, it acquires upstream suppliers of its inputs and downstream purchasers of its output. Metaphors like ''seed to shelf'' in agriculture [Woods, 2005] and ''trawler to table'' [e.g., Thorpe and Bennett, 2004] in fishing characterize the meaning of vertical integration. Vertical integration allows for the use of one unit's output as another unit's input during the production process within the same firm, thereby reducing production costs and increasing profits. Vertical integration can contribute to the development of a dual labor market or dual sectors within the same industry with vertically integrated firms putting downward pressure on prices to those outside of the firm, thereby increasing the pressure to cut costs in order to survive. The necessity of reducing production costs creates substantial pressure to purchase labor as cheaply as possible, which contributes to the growth of lower cost immigrant labor, and to cut corners in other ways through work intensification and reduced investment in health and safety.

Fisheries are mobile and dynamic. Occupational health in fishing is sensitive to a whole range of direct and indirect influences, including changes in the resource base and fisheries management initiatives [Windle et al., 2008]. As prices or resource availability decline, operations that have the resources to do so may abandon the pursuit of one species (e.g., crabs) in favor of another [McDonald et al., 2004]. Protection of local markets from international competition shapes when, where and how fishing is done, as well as by whom [Durrenberger, 1993]. Coastal development is changing such that watermen have declining access to fish houses which, in turn, influences where they go to deliver and sell their catch with potential consequences for occupational health. In North Carolina, for example, there have been numerous fish house closures in recent years because of loss of waterfront access due to development related to tourism and increased property taxes [Garrity-Blake and Nash, 2007]. Canadian research suggests that occupational injury, illness, and fatality in the industry are sensitive to market- and, more generally, interactive social-ecological restructuring in fishing [Dolan et al., 2005], but no fishing research has focused on the potential cascading effects of these forces for immigrant workers in the US Southeast fisheries or elsewhere.

Regulatory oversight: Exceptions, complexities, and gaps

Immigrant workers in the AgFF Sector in the Southeast are uniquely situated under US law in comparison to other workers because of their immigrant status and, in comparison to other sectors, by exceptions to various labor laws and regulations associated with these sectors and this region. The US Fair Labor Standards Act (FLSA) guarantees a minimum hourly wage, overtime compensation at one and a half times the regular rate of pay, and child labor protections to most employees in most industries. However, employees engaged in agricultural [Runyan, 2000] and certain fishery activities are not entitled to overtime and only guaranteed minimum wage if the employer is over a certain size. Likewise, child labor protections under the FLSA are substantially weaker for children engaged in agriculture. There are similar exceptions and exclusions under the National Labor Relations Act, which

guarantees most workers the right to participate in a union but excludes agricultural workers.

Complex regulatory oversight of fishing shapes how the work is managed and performed, with potential consequences for occupational health [Windle et al., 2008]. In the US, fishing is influenced by both federal and state regulations designed to protect dwindling stocks, not workers in fishing. State marine fisheries (such as NC Division of Marine Fisheries) govern fishing in waters surrounding land up to three miles offshore; the National Marine Fisheries Service (NMFS), part of the National Oceanic and Atmospheric Administration, governs waters up to 200 miles offshore. Regulations set by these bodies set fishing limits and establish catch seasons, both of which influence how the work of fishing is organized because they establish when and where fishing is allowed, and catch seasons (along with weather) determine the intensity of work within defined windows. Conservation and endangered species regulations, such as those requiring shrimp trawlers to use turtle extruder devices (§20 C.F.R. 223.206–207), add costs, additional work tasks, and additional exposures. Depleted and more tightly regulated fisheries as well as increasing costs of doing business, have created an environment where fishermen need to work harder, longer, and more efficiently in order to break even [Kaplan and Kite-Powell, 2000; Crosson, 2007; Garrity-Blake and Nash, 2007]. Although not explicitly discussed in the fisheries literature, one potential strategy for making ends meet is to employ immigrant workers as crew members.

In large part, OHS in US commercial fishing is unregulated. The Commercial Fishing Industry Vessel Safety Act of 1988 was the first safety legislation designed specifically for commercial fishing vessels; the Coast Guard published the Commercial Fishing Industry Regulations [1991] several years later. Between 1991 and 2010 there were no requirements that boats have licensed captains or dockside safety. It is estimated that only 6% of boats participated in voluntary inspection programs. In the absence of strong regulation, Windle et al. [2008] argued that US commercial fishing, relative to other countries, placed strong reliance on ''reactive strategies that focus on the worker rather than the workplace, did not cover many of the risks associated with fishing activities, and lacked substantial enforcement of its mandatory requirements.'' In 2010 the Coast Guard Authorization Act was signed into law with the express purpose of enhancing worker safety in the commercial fishing fleet. Fundamental protections created by the Coast Guard Authorization Act, in addition to more robust requirements for constructing new commercial fishing vessels, include: (1) mandatory dockside inspections and issuance of a Certificate of Compliance for all fishing vessels operating beyond three nautical miles from baseline (effective October 16, 2012), (2) exclusion of life floats and buoyancy apparatuses as meeting ''survival craft'' on commercial fishing vessels operating beyond three nautical miles from baseline, and (3) required training of fishing vessel operators to ensure familiarity with basic personal survival, emergency medical care, emergency communication and basics of seamanship and navigation. The requirements imposed by the Coast Guard Authorization Act will likely contribute to enhanced occupational health outcomes among personnel working on boats operating beyond the three nautical mile boundary. Unfortunately, there are no similar protections for workers operating within the three nautical mile boundary, or for those working in shore operations.

Strength and penetration of organized labor

Organized labor has a long history of protecting the health of workers through collective bargaining; however, the southeastern US has historically lacked strong worker organization. This is particularly the case in the AgFF Sector despite the presence of the Coalition of Immokalee Workers (e.g., the Campaign for Fair Food) in Florida and the Farm Labor Organizing Committee in North Carolina. One factor contributing to the relative weakness of organized labor is that nearly all of the states in the Southeast are ''right to work'' states. Right-to-work states are those (23 in total) with statutes that prohibit making union membership or paying union dues a requirement or condition of employment.

Technological advancement

Technological developments have fundamentally changed practices across the AgFF Sector in ways that affect the occupational health of workers. For instance, farmworkers are continuously exposed to a variety of pesticides across the agricultural season [Arcury et al., 2010]. Similarly, pesticides are routinely used in the fisheries to minimize parasites [Watterson et al., 2008] and herbicides are commonly used by immigrant workers in forestry to clear unwanted growth prior to planting on pine plantations or in preparation for harvest [McDaniel and Casanova, 2003a, 2005; Casanova and McDaniel, 2006]. Mechanical advancements have fundamentally shifted how work in agriculture, forestry, and fishing, is done changing exposures but not always improving worker safety and health, particularly for immigrant workers who are often still employed in labor intensive jobs. Automation and processing on board fishing vessels, particularly those of the large industrialized fisheries of Alaska and Scandinavia, are associated with very different work conditions and divisions of labor from many of the smaller scale fishing in the southeastern US. Immigrant workers in logging are frequently tasked with chain saw work like

felling and de-limbing; by contrast, those working in pine straw harvesting and bailing use few machines because much of this work continues to be done by hand [Shaffer and Milburn, 1999]. In some cases, technological change and changes in the organization of work have increased productivity by increasing the speed and repetitiveness of job tasks and, thus, the risk of work-related musculoskeletal disorders (WMSDs). In the case of farmworkers involved in burley tobacco production, for instance,

> . . . young tobacco plants are ''set'' or planted in the field via a setter, a manned piece of planting equipment attached to the back of a tractor. Workers ride on the setter, placing the plants into rotating clamps as they move over the field, exposing the workers to pinching injuries on their hands and fingers, muscular strain, and repetitive movement joint injuries. Falls may occur when mounting the setter or as the equipment moves over rough or uneven terrain [Struttman and Reed, 2002, p. 851].

Employer or Organizational Factors

Employment relationship

Owners and operators in the AgFF Sector frequently provide temporary or limited term employment to workers. Limited term employment, sometimes referred to as contingent or just-in-time labor and other times referred to as ''precarious employment,'' creates unique risks and health threats that are not encountered by permanent employees [Quinlan et al., 2001]. Workers in contingent, temporary, and informal work arrangements generally have lower wages, fewer employment benefits, less stability in their work, lower amounts of control over how they perform their work, and receive less training than permanent employees [Hipple and Stewart, 1996; Kalleberg et al., 2000; Aronsson et al., 2002]. Differences in these aspects of work are translated into poorer occupational health through elevated levels of stress from employment insecurity and psychological job demands, fewer social resources such as income and health insurance for maintaining or protecting health, and greater exposure to occupational hazards and insufficient safety training [Quinlan et al., 2001; Aronsson et al., 2002; Virtanen et al., 2003; Phelan et al., 2004].

Operators in the AgFF Sector, particularly in seafood processing, forestry, and, to a lesser extent, agriculture, rely on the US temporary worker program to meet their need for temporary and low cost labor. The H2-A and H2-B temporary visa programs, created by the Immigration and Nationality Act (§1101(a)(15)(h)(ii)(a) and (b)) are the fundamental system under which non-professional foreign workers are permitted to enter the United States for temporary employment. Under the H2-A program, which is exclusive to agricultural work, employers are required to offer the adverse effect wage rate, which is set by regulation, and they must provide free housing for those not reasonably able to return home each day, transportation from and back to the country of origin, and guaranteed employment for 75% of the period specified in the work contract (§20 C.F.R. 655.102(b)(1)–(6)). The more general H2-B program, through which non-agricultural employers and operators, such as in forestry and seafood processing, may request temporary foreign labor, overlaps with the H2-A program except employers are not required to provide free housing or guarantee workers a certain amount of hours (§20 C.F.R. 655.22). Thus, H2-B temporary workers often make the choice to come to the US sometimes based on false promises of work from recruiters in their home countries. Like the H2-A temporary worker program, H2-B temporary workers are tied to a single employer. Under both temporary worker programs, workers are allowed to work only for the employer who petitioned the Department of Labor for his/her services and, in most situations, are unable to have accompanying family members. These visiting workers are typically anxious to work and make money while away from home and family, and they do not want idle periods waiting for work [Griffith, 2007].

Although the vast majority of farmworkers in the US are believed to be undocumented, the presence of H2-A workers varies by crop and region of the country. For example, estimates from one sample of southeastern US farmworkers indicated that over half (52%) were performing farmwork under the H2-A program [Arcury et al., 2009]. Historically, forest workers have made up about 7% of the total annual H2-B admissions to the US and the majority of these have worked as tree planters in the Southeast. The H2-B forestry workforce, on average, makes up about 12.7% of the total forestry workforce in the US. However, in some southeastern states, the H2-B forestry workforce is upwards of 50% of the total forestry workforce, and in Mississippi, it is 100% of the forestry workforce. The number of H2-B visas certified for work in Mississippi exceeds the total number of forest workers based on forestry workforce data from the Bureau of Labor Statistics. Estimates of the number and proportion of H2-B temporary workers employed in the fishing or aquaculture are not available.

The ability of the US temporary worker program to effectively protect the health and safety of workers is suspect. Muntaner et al. [2010] argue that limited labor regulation accompanied with few protections for worker health and safety likely contributes to the exploitation of workers, especially migrant workers [Benach et al., 2010a,

2011]. In like fashion, the Southern Poverty Law Center (SPLC), a worker advocacy organization, is highly critical of the US temporary worker program, contending that it enables exploitation of workers. The SPLC cites examples of legal documents being held by the employer to prevent departure, a practice not discouraged by local law enforcement [Griffith, 2007; SPLC, 2007], and they contend that US industry recruiters sometimes charge workers fees for recruiter and travel costs, even taking deeds on homes as collateral on loans [SPLC, 2007]. Employers have been reported to blacklist workers, and the risk of blacklisting discourages workers from complaining or reporting work-related concerns. Discriminatory and gendered hiring practices and payments have been reported in the fishing sector: allegations have been made that women are hired in the picking/processing of crab, whereas men are hired for the more lucrative oyster processing.

Management and supervision

The crew system plays a key role in shaping the structure of day-to-day work and risk across the AgFF Sector. Nevertheless, there is little recognition of the importance of the institution of crew leaders or work supervisors outside of newspaper accounts [Rothenberg, 1998; Riley and Johns, 2002; Mayer et al., 2010]. The crew system is hierarchical with workers dependent on the crew leader for many services. In Florida citrus harvesting, for example, the crew leader may provide housing and loans as well as access to groceries and health clinics for workers. Because of the piece rate system, workers are obligated to work fast and not complain because the crew leader's income depends on members working as quickly as possible [Zabin, 1997; Rothenberg, 1998; Monaghan et al., 2011a]. There are often dense social and economic ties between crew leaders and members who are often from the same sending village in Mexico or other country of origin [Rothenberg, 1998]. Crew leaders are rarely rewarded for emphasizing safety and reporting injuries, and evidence suggests the safety climate created by crew leaders is associated with poorer occupational health outcomes in farmworkers [Arcury et al., 2012a]. Crew leaders typically have few tools or supplies of appropriate personal protective equipment (PPE), such as safety glasses, but research shows that supervisors can have an impact on the safety behavior of workers [Mayer et al., 2010].

The crew system is found throughout the AgFF Sector, although its manifestations vary. Crews in pine straw harvesting are similar to those used in agriculture. The crew leader or labor contractor is frequently an independent contractor who serves as an intermediary between workers and pine straw dealers/land owners [Casanova, 2007]. Crew leaders find harvesters through social networks locally and abroad, and, in some cases, double as ''coyotes'' to supply labor directly from abroad [Casanova, 2007]. Just as in agriculture, pine straw harvesters are dependent on the forest crew leader for housing, transportation, etc. A crew structure is also common in commercial fishing. Crew members working on others' boats may be at increased risk of injury when they are unable to adapt the boat to their personal needs [Kucera et al., 2009]; this situation is likely widespread among immigrant fishery workers. Other research has found that task rotation may not be beneficial for crew members of a boat [Torner et al., 1988] and that increasing crew size in small crabbing operations in North Carolina decreased exposure to biomechanical shoulder stress for the captain but did not have the same effect for crew members [Kucera et al., 2010]. The importance of the ability to control work and the rewards of that work is clearly illustrated by Levinson's [2002] description of winter drop-netters off the North Carolina coast. In this dangerous off-shore winter fishery, work is often limited by winter weather, making it important to be productive while the weather holds. Drop-netters work in groups self-described as ''tribes,'' where three or four boats from the same larger fleet of boats leave and return to the same dock areas at the same times. While the ''tribe'' approach can serve a protective function in the event of mechanical problems, it also creates the potential for greater loss if winter storms rapidly approach or if safety shortcuts are made to facilitate more rapid work. While this description is limited to fishing, similar issues arise in agriculture and forestry when long-periods of rain or threats of early frost compress available time for production.

By the bucket, bale, or catch: piece rate compensation

Immigrant workers in the AgFF Sector are often paid by the piece, but there is substantial variability within the industry [Carroll et al., 2005]. National Agricultural Workers Survey (NAWS) estimates indicate that, on average, approximately 16% of farmworkers are paid by the piece, but nearly one-third of workers in fruits and nuts reported being paid by the bucket compared to less than 1% of those in horticulture. In the eastern region of the country nearly one-in-five (19%) agricultural workers are piece workers. Workers in forestry are also frequently paid by the piece. Tree planters, many of whom are H2-B workers are paid by the tree and the going rate in 2002 was roughly 2.5 cents per tree planted [McDaniel and Casanova, 2005]. Similarly, in pine straw harvesting, a major commodity in Georgia and the Carolinas, workers are typically paid by the bale although they can earn an additional sum for loading bales onto trailers [Casanova, 2007]. In fisheries, crewmembers' wages are frequently based on a share of the catch [Watterson et al., 2008]. Piece-rate

compensation encourages workers to focus more on speed and production than avoiding risks and personal safety [Johansson et al., 2010]. Wage theft has been reported by agricultural workers in the southeastern US [Robinson et al., 2011], but the distribution and prevalence of this experience across the AgFF Sector is relatively unknown.

Job-Specific or Task-Level Factors

Many jobs in the AgFF Sector take place in rural and remote physical locations that can be far removed from towns, hospitals, and communities with services and adequate housing stocks and where health and safety inspectors are housed. Workers are often mobile, moving from work site to work site adding to surveillance and enforcement issues and enhancing the health and safety risks associated with transportation in these sectors [Frank et al., Report 4; Hoerster et al., 2011]. Immigrants working on fishing boats may be some distance from shore and may cross state and national borders (into international waters) while on board complicating jurisdictional issues related to health and safety.

Farmworkers have been documented to have little control over their work arrangements including what tasks are preformed and how [Grzywacz et al., 2008], and despite the absence of similar research in forestry and fishing, there is little reason to believe that immigrant workers in these subsectors differ from their counterparts in agriculture. Windle et al. [2008] conceptualized the complex variety of direct and indirect factors that can influence health and safety in fishing. A number of these factors reflect structural components of the actual work tasks [Jensen, 1996; Lipscomb et al., 2004], crew size, and work distribution [Lipscomb et al., 2004; Kucera and Lipscomb, 2010] that influence their ability to control their work and the work rewards of work on which they can or cannot rely. There is a long history of gender-based divisions of labor in farm work, particularly on family farms [Haugen and Brandth, 1994; Coldwell, 2009], but apart from NAWS estimates indicating that approximately 20% of farmworkers nationally are female [Carroll et al., 2005], there has been no research describing the stratification of occupations within the modern industrial agricultural complex within which most immigrant farmworkers find themselves. The division of labor in fishing has historically been gendered, with men largely filling the roles of captain, mate, and crew in boats on the water, while women are more involved in work on shore from handling and processing catch, to net/gear maintenance, keeping books, etc. Masculinity is an important factor that mediates the occupational health of fishermen [Power, 2008].

Dominant occupational stressors that are characteristic of AgFF employment are psychological demands arising from production minimums, monotony, and repetitive tasks. In tree planting, for example, H2-B temporary workers must achieve a minimum of 2,500 trees planted per day within a particular time frame (usually 2 weeks) in order to keep their job [McDaniel and Casanova, 2003b; Sarathy and Casanova, 2008]. Across the AgFF Sector, it is not uncommon for workers to spend an entire workday performing a single task repeatedly. However, it is also important to acknowledge potential heterogeneity in the experience of these demands. As Grzywacz et al. [2008] outlined:

> Farmwork is repetitive, highly time dependent, heavily prescribed and shaped by temporal location within the agricultural season. However, while highly routinized during specific periods of the agricultural season, there is substantial variety in the tasks that are performed across the season; tasks necessary during planting are very different from those required during harvest. Likewise, there is an ebb and flow in the intensity of the work, with substantial pressure during planting and harvesting and less time pressure during the growing season. Thus, farmwork is an occupation that is inherently demanding and provides workers with little control, yet the cyclical nature of the occupation as well as other factors like focal crop, region of the country, and recent weather contribute to substantial heterogeneity in workers experiences (p. 82).

Finally, situational or contextual factors are intimately connected to the safety and health of immigrant workers in the AgFF Sector. The itinerant lifestyle imposed on immigrant farm, forestry, and fishing workers cannot be separated from the work they perform. H2-B temporary workers in forestry spend an average of 10 months out of each year in the US [McDaniel and Casanova, 2003a]. Because the work visa does not allow family members to accompany the worker, workers are physically separated from family and community for the better part of each year. Likewise, separation from family is common among farmworkers [Ward, 2010], and it creates emotional hardships that have been linked with poor mental health [Grzywacz et al., 2006]. Research in this field indicates that although the work is seasonal or temporary, the same workers return year after year thus leading to a ''culture'' of migration [Massey et al., 1987; McDaniel and Casanova, 2003b] that may mitigate negative effects [Grey and Woodrick, 2002].

Many hardships accompany the itinerant nature of immigrants' work in the AgFF Sector. Housing conditions are frequently poor [Vallejos et al., 2009; Arcury et al., 2012b]. Empirical reports document substantial crowding and frequent housing violations [Gentry et al., 2007] that

contribute to increased risk for infectious disease and stress. Indeed, aspects related to poor housing, including crowding, are dominant features of the Migrant Farmworker Stress Inventory [Hovey and Seligman, 2005]. Factors that aggravate housing challenges for AgFF workers include the small affordable housing stock in rural areas and high levels of mobility in some occupations such as tree planting that may require living in temporary housing or long commutes. For immigrant fishermen, their housing may be on the boat thus blurring the boundary between housing and worksite and opening up new OHS risks such as the risk of suffocation, explosion, and the vessel sinking or being damaged in a storm while tied to the wharf.

Immigrant AgFF workers are vulnerable to racism and discrimination in their daily work lives, particularly in the Southeast, which has a long history of institutional racism. Evidence suggests that immigrants in the AgFF Sector may receive more unpleasant and physically dangerous job assignments relative to their non-immigrant counterparts [Marín et al., 2009]. Immigrant workers confront significant challenges in gaining access to high quality, affordable, and coherent health care [Arcury and Quandt, 2007; Hoerster et al., 2011]. Because providers frequently lack formalized training in the illnesses and injuries common in the AgFF Sector and migration creates barriers to completing effective treatments [Frank et al., Report 4], quality of care may be lacking as well. Consistent access to food is a challenge; a substantial proportion of farmworkers and farmworker families are documented food insecure [Quandt et al., 2004; Weigle et al., 2007; Hill et al., 2011]. These issues have direct and indirect implications for the health of immigrant workers in the AgFF Sector.

ORGANIZATION OF WORK RESEARCH AGENDA FOR AgFF

The body of work focused on the organization of work and its role in OHS in the AgFF Sector in the Southeast is fragmented and underdeveloped, particularly in the fishing industries. Little is known about the organization of work and the place of immigrant workers in many subsections of the agricultural and forestry industries; very little research has been done on fishing [Watterson et al., 2008], and none has been done on the relationship between the role of immigrant workers, the organization of their work, and the OHS hazards they confront. No research has looked at the place of immigrant workers in aquaculture and their OHS; indeed, very little research has been done on OHS issues for any group of workers in aquaculture [Watterson et al., 2008; Moreau and Neis, 2009]. Furthermore, the research that does exist is spread across multiple literatures thereby providing little cross-fertilization of ideas.

Figure 3 provides a framework for thinking about the organization of work research relevant to the AgFF Sector, and it provides a device for identifying existing gaps. First, like the more general model articulated by NIOSH, our model views the organization of work as having a nested structure wherein job-specific factors are presumed to serve an intervening role between organization-level factors and occupational safety. Likewise, organizational factors (and subsequent job-specific factors) are presumed to serve an intervening role between external factors and OHS. Readers are cautioned to avoid the tendency toward reductionism, either on the micro-level (we need to change how jobs are designed at the task level) or the macro-level

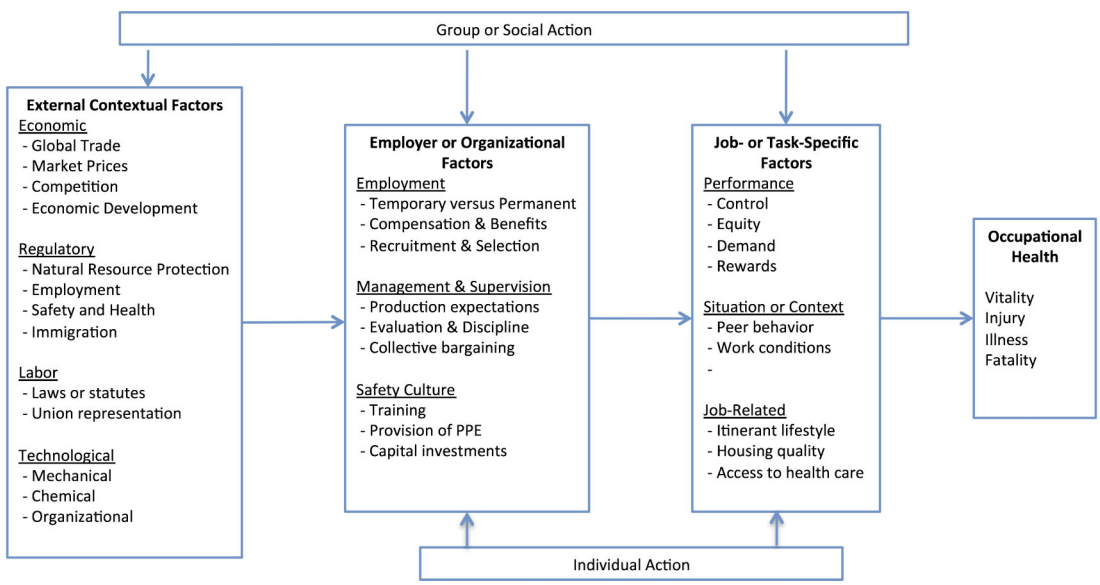

FIGURE 3. Conceptual framework for guiding organization of AgFF work research focused on occupational health.

(changes to temporary workers programs and greater penetration of organized labor are needed to improve the occupational health of immigrant workers). Such a tendency is overly simplistic and unlikely to generate positive change. Readers are also encouraged to note that occupational health is viewed as a multi-dimensional concept wherein ''health'' represents both positive (e.g., vitality and engagement) as well as negative outcomes (e.g., illness, disease). Finally, readers are encouraged to notice the acknowledgement that both individual and social action can modify the shape and power of the organization of work and its influence on health outcomes. An altruistic employer or crew chief can make decisions that fundamentally benefit or harm his crew, despite the broader environment.

There are several key areas for future organization of work research in the AgFF Sector. Basic research is needed that describes the organization of work within and across the AgFF Sector. Organization of work research would emphasize clear descriptions of key concepts identified in Figure 3 for agriculture, forestry and fishing respectively. Although some research has characterized the level of control and demand confronted by immigrants in agriculture [Grzywacz et al., 2008] and among fisheries workers [Kucera and McDonald, 2010], the generalizability of this research is difficult to realistically assess. Likewise, descriptive studies of organization-level factors relevant to work, such as reliance on piece-rate compensation systems or alternative strategies for labor contracting, are needed within each subsector. An important issue relevant to occupational health disparities is a comparison between native and immigrant workers in various work organization attributes. If deleterious organization of work attributes are disproportionately shouldered by immigrant relative to native workers, then it becomes a pressing leverage point for building health equity.

Comparable descriptive research is also needed across the AgFF Sector. In the absence of data, the conclusions of this paper rest in part on the assumption that immigrant workers confront similar organization of work issues regardless of whether they find themselves in agriculture, forestry, or fishing. Organization of work attributes could be measured in agricultural workers (H2-A visa holders) and forestry and fishing workers (H2-B visa holders) to determine whether key work organization factors like use of piece-rate compensation systems, availability of protections by organized labor, number of moves per person-month of labor, or perceived control over work vary by subsector. Such a study design would also be invaluable for determining whether protections built into the H2-A system, such as provision of housing or travel expenses and a guarantee of a certain number of hours (and potential earnings) have implications for occupational health.

Research focused explicitly on the health-related implications of the organization of work in the AgFF Sector is sorely needed. Cohort studies are needed to document the short- and long-term occupational health outcomes associated with organization of work factors. Short-term studies might focus on proximal organization of work determinants of worker safety behaviors. Grzywacz et al. [2011], for example, argue that worker autonomy and psychological demands pertaining to production expectations contribute to elevated pesticide exposure because workers are less able to adhere to practices advocated by the Worker Protection Standards. Comparable studies should be fielded in forestry and fishing. Intervention studies are needed to determine the putative effects of organization of work attributes on worker health outcomes. Long-term cohort studies are needed to evaluate the role that organization of work factors play in the etiology of chronic disease. Recognizing that organization of work factors are frequently studied in relation to cardiovascular diseases [Peter and Siegrist, 2000], recent evidence indicating that high rates of hypertension are more common among recent cohorts of Mexican Americans relative to previous cohorts [Al Ghatrif et al., 2011] raises questions about the extent to which differential exposure to organization of work factors plays a role in the apparently growing cardiovascular disease burden among Latinos.

Researchers need to recognize that the utility of traditional cohort study designs with repeated panels observed at 1- or 5-year intervals (or longer) for understanding the health of immigrant workers in the AgFF Sector is limited because of labor turnover, labor mobility and vicissitudes associated with the timing, duration, and intensity of work organization-related exposures for these workers [Grzywacz et al., 2008]. Researchers will need to develop alternative study designs to capture potential within- and across-season variation in work organization attributes, recognizing that some work organization attributes are relatively enduring (e.g., protections offered by temporary work visas), whereas others may wax and wane across the study period (e.g., work intensity). Characteristics of the study population, such as their marginalized status, residential and geographic mobility, language preference, and literacy also pose challenges to traditional epidemiologic methods, and they require creative alternatives for sample design, data collection, and measurement [Arcury et al., 2006; Monaghan et al., 2011b].

Intervention studies are needed to determine the putative effects of organization of work attributes on worker health outcomes. Research is needed focusing on the influence of different ownership, crew, and employment structures on worker health and safety. Although the AgFF Sector has heavy reliance on a hierarchically organized crew structure, there is substantial variation in how this is

implemented. Variation in work conditions, organizational structure, and exposures could provide natural experiments within which to study occupational injury and illness. Intervention studies focused on immigrant workers' crew leaders could be fielded to determine whether they are effective agents for changing the safety behaviors and common practices of their crews.

Analyses are needed to evaluate the repercussions of various policies affecting AgFF workers, including their immediate and long-term health outcomes. Concrete analyses are needed to determine the health consequence of exemptions to the Fair Labor Standards Act for agriculture as well as segments of forestry and fishing [Flocks, 2012]. Evaluation of the human costs of regulations designed for conservation and management of natural resources is needed. Likewise, analyses focused on the health and safety implications of laws related to the right to unionize and the protections of local markets from international competition are needed as they likely contribute added injury and illness risk for workers in the AgFF Sector [Durrenberger, 1993; Windle et al., 2008].

Finally research on alternative methods for studying organization of work among AgFF workers is needed. Because of the nature of the work and its organization, traditional approaches using survey tools such as the well-known Job Content Questionnaire [Karasek et al., 1998] may not be practical or relevant. Not only are such instruments potentially challenging for immigrant workers [Grzywacz et al., 2009], they do not capture the intricacies of macro-level policy implications for work organization. Alternative strategies for sampling, recruiting, and following immigrant workers in the AgFF Sector are needed. The use of site-based sampling has been effectively used in studies of farmworkers [e.g., Arcury et al., 2009] as well as immigrant workers in other sectors [Quandt et al., 2006], but the value of this approach for more highly mobile workers (e.g., tree planters) and those in remote areas remains unknown. Finally, statistical issues revolving around the inherent clustering of exposures among workers within given sectors remain to be systematically addressed, although it has been addressed in some work [Preisser et al., 2003].

SUMMARY AND CONCLUSION

Although organization of work research is developing in the general occupational health literature, research focused exclusively on the AgFF Sector and immigrant workers in particular within the Sector is sparse [Watterson et al., 2008]. Nevertheless, there is evidence suggesting work organization likely plays a substantial role in the elevated rates of injury, illness, and fatality experienced in the AgFF Sector. Researchers are encouraged to build on the conceptual framework and research recommendations provided here to work towards a better understanding of the organization of work in the AgFF Sector and to harness this understanding to better protect the health of this vulnerable worker population.

REFERENCES

Ahonen EQ, Porthe V, Vazquez ML, Garcia Am, Lopez-Jacob MJ, Ruiz-Frutos C, Ronda-Perez E, Benach J, Benavides FG, ITSAL Project Collaborators. 2009. A qualitative study about immigrant workers' perceptions of their working conditions in Spain. J Epidemiol Community Health 63(11):936–942.

Ahonen EQ, López-Jacob MJ, Vázquez ML, Porthé V, Gil-González D, García AM, Ruiz-Frutos C, Benach J, Benavides FG, ITSAL Project. 2010. Invisible work, unseen hazards: The health of women immigrant household service workers in Spain. Am J Ind Med 53: 405–416.

Al Ghatrif M, Kyo YF, Al Snih S, Raji MA, Ray LA, Markides KS. 2011. Trends in hypertension prevalence, awareness, treatment and control in older Mexican Americans, 1993–2005. Ann Epidemiol 21: 15–25.

Arcury TA, Quandt SA. 2007. Delivery of health services to migrant and seasonal farmworkers. Annu Rev Public Health 28:345–363.

Arcury TA, Quandt SA, Barr DB, Hoppin JA, McCauley L, Grzywacz JG, Robson MG. 2006. Farmworker exposure to pesticides: Methodological issues for the collection of comparable data. Environ Health Perspect 114:923–928.

Arcury TA, Grzywacz JG, Chen H, Vallejos QM, Galván L, Whalley LE, Isom S, Barr DB, Quandt SA. 2009. Variation across the agricultural season in organophosphorus pesticide urinary metabolite levels for Latino farmworkers in eastern North Carolina: Project design and descriptive results. Am J Ind Med 52:539–550.

Arcury TA, Grzywacz JG, Talton JW, Chen H, Vallejos QM, Galván L, Barr DB, Quandt SA. 2010. Repeated pesticide exposure among North Carolina migrant and seasonal farmworkers. Am J Ind Med 53:802–813.

Arcury TA, O'Hara H, Grzywacz JG, Isom S, Chen H, Quandt SA. 2012a. Work safety climate, musculoskeletal discomfort, working while injured, and depression among migrant farmworkers in North Carolina. Am J Public Health 102(Suppl 2):S272–S278.

Arcury TA, Weir MM, Summers P, Chen H, Bailey M, Wiggins MF, Bischoff WE, Quandt SA. 2012b. Safety, security, hygiene and privacy in migrant farmworker housing. New Solut 22:153–173.

Aronsson G, Gustafsson K, Dallner M. 2002. Work environment and health in different types of temporary jobs. Eur J Work Organ Psychol 11:151–175.

Bambra C. 2011. Work, worklessness and the political economy of health inequalities. J Epidemiol Community Health 65:746–750.

Benach J, Muntaner C. 2007. Precarious employment and health: Developing a research agenda. J Epidemiol Community Health 61: 276–277.

Benach J, Muntaner C, Chung H, Benavides FG. 2010a. Immigration, employment relations, and health: Developing a research agenda. Am J Ind Med 53:338–343.

Benach J, Muntaner C, Solar O, Santana V, Quinlan M. 2010b. Conclusions and recommendations for the study of employment relations and health inequalities. Int J Health Serv 40:315–322.

Benach J, Muntaner C, Delclos C, Menéndez M, Ronquillo C. 2011. Migration and ''low-skilled'' workers in destination countries. PLoS

Med Jun 8(6):e1001043. DOI: 10.1371/journal.pmed.1001043. Epub2011 Jun 7.

Carroll D, Samardick RM, Bernard S, Gabbard S, Hernandez T. 2005. Findings from the National Agricultural Workers Survey (NAWS) 2001–2002: A demographic and employment profile of United States farm workers. Washington, DC: US Department of Labor.

Casanova V. 2007. Three essays on the pine straw industry in a Georgia community. Unpublished doctoral dissertation, Auburn University, Auburn AL. http://etd.auburn.edu/etd/bitstream/handle/10415/131/Casanova_Vanessa_8.pdf?sequence=1 Accessed June 26, 2011.

Casanova V, McDaniel J. 2006. No sobra y no falta: Recruitment networks and guest workers in southeastern U.S. forest industries. Urban Anthropol Stud Cult Syst World Econ Dev 34:45–84.

Coldwell I. 2009. Masculinities in the rural and the agricultural: A literature review. Sociol Ruralis 50:171–197.

Commercial Fishing Industry Regulations. 1991. 46 CFR 28.

Commercial, Fishing Vessel Safety Act. 1988. Public Law 100-424.

Cornelius W, Martin P. 1993. The uncertain connection: Free trade and rural Mexican migration to the United States. Int Migr Rev 27(3):484–512.

Crosson S. 2007. A social and economic analysis of commercial fisheries in North Carolina: Albemarle and Pamlico Sounds. Morehead City, NC: Division of Marine Fisheries, NC Department of Report Environment and Natural Resources.

Dolan A, Taylor HM, Neis B, Eyles J, Ommer R, Schneider DC, Montevecchi W. 2005. Restructuring and health in Canadian coastal communities: A social-ecological framework of restructuring and health. Ecohealth 2:1–14.

Durrenberger EP. 1993. It's all politics: South Alabama's seafood industry. Urbana and Chicago: University of Illinois Press.

Fernandez-Kelly P, Massey DS. 2007. Border for whom? The role of NAFTA in Mexico-U.S. migration. Ann Am Acad Pol Soc Sci 610:98.

Flocks J. 2012. The Environmental and social injustice of farmworker pesticide exposure. Georgia J Poverty Law Policy 19:255–282.

Frank AL, Liebman AK, Ryder B, Weir M, Arcury TA. Report 4. Health care access and health care workforce for immigrant workers in the agriculture, forestry and fishing sector in the southeastern US. Am J Ind Med (in preparation).

Garrity-Blake BJ, Nash B. 2007. An inventory of NC fish houses. NC Sea Grant Report. http://www.ncseagrant.org/home/about-ncsg/news-events?id=1277&task=showarticle Accessed March 15, 2013.

Gentry AL, Grzywacz JG, Quandt SA, Davis SW, Arcury TA. 2007. Housing quality among North Carolina farmworker families. J Agric Saf Health 13:323–337.

Gereffi G. 1994. The organisation of buyer-driven global commodity chains: How US retailers shape overseas production networks. In: Gereffi G, Korzeniewicz M, editors. Commodity chains and global capitalism. Westport: Greenwood Press.

Grey MA, Woodrick AC. 2002. Unofficial sister cities: Meatpacking labor migration between Villachuato, Mexico and Marshalltown, Iowa. Hum Organ 61:364–376.

Griffith D. 2006. American guestworkers: Jamaicans and Mexicans in the U.S. labor market. University Park, PA: The Pennsylvania State University Press.

Griffith D. 2007. Guestworkers, enganchadores, and changing labor relations in U.S. rural communities. J Lat-Lat Am Stud 2:74–86.

Grzywacz JG, Quandt SA, Early J, Tapia J, Graham CN, Arcury TA. 2006. Leaving family for work: Ambivalence and mental health among Mexican migrant farmworker men. J Immigr Health 8:85–97.

Grzywacz JG, Quandt SA, Arcury TA. 2008. Immigrant farmworkers' health-related quality of life: An application of the job demands-control model. J Agric Saf Health 14:79–92.

Grzywacz JG, Alterman T, Muntaner C, Gabbard S, Nakamoto J, Carroll DJ. 2009. Measuring job characteristics and mental health among Latino farmworkers: Results from cognitive testing. J Immigr Minor Health 11:131–138.

Grzywacz JG, Quandt SA, Arcury TA. 2011. Job stress and pesticide exposure among immigrant Latino farmworkers. In: Burke R, Clarke S, Cooper C, editors. Occupational health and safety: Psychological and behavioral challenges. Aldershot, UK: Gower.

Hanrahan CE. 2010. CRS [Congressional Research Service] issue statement on agricultural trade and development. Congressional Research Service publication # IS40253. http://www.nationalaglawcenter.org/assets/crs/IS40253.pdf Accessed June 27, 2011.

Haugen MS, Brandth B. 1994. Gender differences in modern agriculture: The case of female farmers in Norway. Gend Soc 8:206–229.

Hill BG, Moloney AG, Mize T, Himelick T, Guest JL. 2011. Prevalence and predictors of migrant farmworkers in Georgia. Am J Public Health 101:831–833.

Hipple S, Stewart J. 1996. Earnings and benefits of contingent and noncontingent workers. Mon Labor Rev 119:22–30.

Hoerster KD, Mayer JA, Gabbard S, Kronick RG, Roesch SC, Malcarne VL, Zuniga ML. 2011. Impact of individual-, environmental-, and policy-level factors on health care utilization among US farmworkers. Am J Public Health 101:685–692.

Hovey JD, Seligman LD. 2005. The mental health of agricultural workers. In: Lessenger JE, editor. Agricultural medicine: A practical guide. New York: Springer, pp. 282–299.

Jensen OC. 1996. Work related injuries in Danish fishermen. Occup Med 46:414–420.

Johansson B, Rask K, Stenberg M. 2010. Piece rates and their effects on health and safety—A literature review. Appl Ergon 41:607–614.

Kalleberg A, Reskin BF, Hudson K. 2000. ''Bad'' jobs in America: Standard and nonstandard employment relations and job quality in the United States. Am Sociol Rev 65:256–278.

Kaplan IM, Kite-Powell HL. 2000. Safety at sea and fisheries management: Fishermen's attitudes and the need for co-mangement. Mar Policy 24:493–497.

Karasek R, Brisson C, Kawakami N, Amick B. 1998. The job content questionnaire (JCQ): An instrument for internationally comparative assessments of psychosocial job characteristics. J Occup Health Psycol 4:322–355.

Kochhar R. 2008. Latino labor report, 2008: Construction reverses job growth for Latinos. Pew Hispanic Center.

Kompier M, Ybema JF, Janssen J, Taris T. 2009. Employment contracts: Cross-sectional and longitudinal relations with quality of working life, health and well-being. J Occup Health 51:193–203.

Kucera KL, Lipscomb HJ. 2010. Shoulder stress in small-scale commercial crab-pot fishing. J Agromedicine 15:394–404.

Kucera KL, McDonald MA. 2010. Occupational stressors identified by small-scale, independent commercial crab pot fishermen. Saf Sci 48:672–679.

Kucera KL, Loomis D, Lipscomb HJ, Marshall SW, Mirka GA, Daniels JL. 2009. Ergonomic risk factors for low back pain in NC

crab pot and gill net commercial fishermen. Am J Ind Med 52:311–321.

Kucera KL, Loomis D, Lipscomb HJ, Marshall SW. 2010. Prospective study of incident injuries among southeastern US commercial fishermen. Occup Environ Med 67:829–836.

Landsbergis PA, Grzywacz JG, LaMontagne AD. 2012. Work organization, job insecurity, and occupational health disparities. Am J Ind Med DOI: 10.1002/ajim.22126 [Epub ahead of print].

Levinson JP. Dropnet tribes: Making a day's work in North Carolina's winter fishery. Chapel Hill, University of NC, Chapel Hill, 2002—Dissertation.

Lipscomb HJ, Loomis D, McDonald MA, Kucera K, Marshall S, Li L. 2004. Musculoskeletal symptoms among commercial fishers in North Carolina. Appl Ergon 35:417–426.

Lipscomb HJ, Loomis D, McDonald MA, Argue RA, Wing S. 2006. A conceptual model of work and health disparities in the United States. Int J Health Serv 36:25–50.

Marín AJ, Grzywacz JG, Arcury TA, Carrillo L, Coates ML, Quandt SA. 2009. Evidence of organizational injustice in poultry processing plants: Possible effects on occupational health and safety among Latino workers in North Carolina. Am J Ind Med 52:37–48.

Massey DS, Durand J. 2002. Beyond smoke and mirrors: Mexican immigration in an age of economic integration. New York: Russell Sage Foundation.

Massey D, Alarcon R, Durand J, Gonzalez H. 1987. Return to Aztlan: The social process of international migration from western Mexico. Berkeley, CA: University of California Press.

Mayer B, Flocks J, Monaghan P. 2010. The role of employers in promoting pesticide safety behavior among Florida farmworkers. Am J Ind Med 53:814–824.

McDaniel J, Casanova V. 2003a. Guest worker programs: Overview of the H2-B program. For Landowner 63:5–6.

McDaniel J, Casanova V. 2003b. Pines in lines: Tree planting, H2-B guest workers and rural poverty in Alabama. South Rural Sociol 19(1):73–96.

McDaniel J, Casanova V. 2005. Forest management and the H2-B guest worker program in the southeastern US: An assessment of contractors and their crews. J For 103(3):114–119.

McDonald MA, Loomis D, Kucera KL, Lipscomb HJ. 2004. Use of qualitative methods to map job tasks and exposures to occupational hazards for commercial fishermen. Am J Ind Med 46:23–31.

Monaghan P, Bryant C, McDermott R, Forst L, Luque J, Contreras R. 2011a. Adoption of safety eyewear among citrus harvesters in rural Florida. J Immigr Minor Health 14:460–466.

Monaghan P, Forst L, Tovar-Aguilar J, Bryant C, Israel G, Galindo-Gonzalez S, Thompson Z, Zhu Y, McDermott R. 2011b. Preventing eye injuries among citrus harvesters: The community health worker model. Am J Public Health 101:2269–2274.

Moreau DTR, Neis B. 2009. Occupational health and safety hazards in Atlantic Canadian aquaculture: Laying the groundwork for prevention. Mar Policy 33:401–411.

Muntaner C, Chung H, Solar O, Santana V, Castedo A, Benach J, EMCONET Network. 2010. A macro-level model of empoloyment relations and helath inequalities. Int J Health Serv 40:215–221.

NIOSH. 2002. Recommendations to the U.S. Department of Labor for Changes to Hazardous Orders—May 3, 2002. Morgantown, WV: U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health.

Oxfam. 2004. Like machines in the fields: Workers without rights in American agriculture. http://www.oxfamamerica.org/files/like-machines-in-the-fields.pdf Accessed June 27, 2011.

Peter R, Siegrist J. 2000. Psychosocial work environment and the risk of coronary heart disease. Int Arch Occup Environ Health 73:S41–S45.

Phelan JC, Link B, Diez-Roux A, Kawachi I, Levin B. 2004. Fundamental causes of social inequalities in mortality: A test of a theory. J Health Soc Behav 45:265–285.

Porthe V, Ahonen AE, Vazquez ML, Pope C, Agudelo AA, Garcia AM, Benavides AM, Benach J, ITSAL project Collaborators. 2010. Extending a model of precarious employment: A qualitative study of immigrant workers in Spain. Am J Ind Med 53:417–424.

Power NG. 2008. Occupational risks, safety, and masculinity: Newfoundland fish harvesters' experience and understandings of fishery risks. Health Risk Soc 10:565–583.

Preisser JS, Arcury TA, Quandt SA. 2003. Detecting patterns of occupational illness clustering with alternating logistic regressions applied to longitudinal data. Am J Epi 158:495–501.

Quandt SA, Arcury TA, Early J, Tapia J, Davis JD. 2004. Household food security among migrant and seasonal Latino farmworkers in North Carolina. Public Health Rep 119:568–576.

Quandt SA, Grzywacz JG, Marín A, Carrillo L, Coates ML, Burke B, Arcury TA. 2006. Illness and injuries reported by Latino poultry workers in western North Carolina. Am J Ind Med 49:343–351.

Quandt SA, Kucera KL, Haynes C, Klein BG, Langley R, Agnew M, Levin JL, Howard T, Nussbaum MA. Report 3. Occupational health outcomes for workers in the agriculture, forestry and fishing sector: Implications for immigrant workers in the southeastern US. Am J Ind Med (in preparation).

Quinlan M, Mayhew C, Bohle P. 2001. The global expansion of precarious employment, work disorganization, and consequences for occupational health: A review of recent research. Int J Health Serv 31:335–414.

Ratha D, Mohapatr S, Xu Z. 2008. Migration and Development Brief 8. Migration and Remittance Team Development Prospects Group, The World Bank.

Riley N, Johns D. 2002. Florida's farmworkers in the twenty-first century. Gainesville: University of Florida Press.

Robinson E, Nguyen HT, Isom S, Quandt SA, Grzywacz JG, Arcury TA. 2011. Wages, wage violations, and pesticide safety experienced by migrant farmworkers in North Carolina. New Solut 21:251–268.

Rothenberg D. 1998. With these hands: The hidden world of migrant farmworkers today. New York: Harcourt Brace.

Runyan J. 2000. Summary of federal laws and regulations affecting agricultural employers, 2000. Food and Rural Economics Division, Economic Research Service, US Department of Agriculture. Agricultural Handbook No. 719. http://www.ers.usda.gov/publications/ah719/ah719.pdf Accessed June 27, 2011.

Sarathy B, Casanova V. 2008. Guest workers or unauthorized immigrants? The case of forest workers in the United States. Policy Sci 41:95–114.

Shaffer RM, Milburn JS. 1999. Injuries on feller-buncher/grapple skidder logging operation in the southeastern United States. For Prod J 49:24–26.

Siegrist J, Dragano N, Wahrendorf M. 2009. Psychosocial stress at work and health of older workers: A comparative European study. University of Duesseldorf, Unpublished Report.

Sinclair P, Bailey C, Dubois M. 2003. Engineer and a dog: Systemic changes in Alabama's pulp and paper industry. South Rural Sociol 19:70–93.

SPLC. 2007. Close to slavery: Guestworker programs in the United States. Southern Poverty Law Center, Montgomery, Alabama http://www.splc.org

Struttman TW, Reed BS. 2002. Injuries to tobacco farmers in Kentucky. South Med J 95:850–856.

Stull DD. 2000. Tobacco barns and chicken houses: Agricultural transformation in western Kentucky. Hum Organ 59:151–161.

Thorpe A, Bennett E. 2004. Market-driven international fish supply chains: The case of Nile perch from Africa's Lake Victoria. Int Food Agribusiness Manag Rev 7(4):40–57.

Torner M, Blide G, Eriksson H, Kadefors R, Karlsson R, Petersen I. 1988. Workload and ergonomics measures in Swedish professional fishing. Appl Ergon 19:202–212.

Vallejos QM, Quandt SA, Arcury TA. 2009. The condition of farmworker housing in the eastern United States. In: Arcury TA, Quandt SA, editors. Latino farmworkers in the eastern United States. New York: Springer.

Villarejo D. 2003. The health of U.S. hired farm workers. Annu Rev Public Health 24:175–193.

Virtanen P, Liukkonen V, Vahtera J, Kivimäki M, Koskenvuo M. 2003. Health inequalities in the workforce: The labour market core–periphery structure. Int J Epidemiol 32:1015–1021.

Ward LS. 2010. Farmworkers at risk: The costs of family separation. J Immigr Minor Health 12:672–677.

Watterson A, Little D, Young JA, Boyd K, Azim E, Murray F. 2008. Towards integration of environmental and health impact assessments for wild capture fishing and farmed fish with particular reference to public health and occupational health dimensions. Int J Environ Res Public Health 5:258–277.

Weigle MM, Armijos RX, Hall YP, Ramirez Y, Orozco R. 2007. The household food insecurity and health outcomes of U.S.-Mexico border migrant and seasonal farmworkers. J Immigr Minor Health 9:157–169.

Windle MJS, Neis B, Bornstein S, Binkley M, Navarro P. 2008. Fishing occupational health and safety: A comparison of regulatory regimes and safety outcomes in six countries. Mar Policy 32:701–710.

Woods M. 2005. Rural geography. London: Sage.

Zabin C. 1997. U. S. Mexico economic integration: Labor relations and the organization of work in California and Baja California agriculture. Econ Geogr 73:337–355.