



## The Current State of Agricultural Health Research and Practice: Critical Review

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## **INTRODUCTION**

Agriculture is centered in rural areas and includes the activities of farming (growing crops), ranching (raising animals), fishing (harvesting fish), and forestry (harvesting timber).<sup>1,2</sup> The scope of agricultural industry activities and agricultural support activities extends across a variety of workplaces including ranches, dairies, green houses, crop lands, nurseries, orchards, hatcheries, boats, and natural habitats.<sup>2</sup> Although the agricultural industry employs slightly less than one percent of all workers, this industry has among the highest fatal and non-fatal injury rates of all industries.<sup>3,4</sup> In 2011, the fatal injury rate for the U.S. agriculture industry was 24.4/100,000 full time equivalent workers (FTE) and the non-fatal work-related injury or illness rate for the U.S. agriculture industry was 5.5/100 FTE.<sup>3,4</sup>

Agricultural workers are exposed to a variety of hazards including environmental conditions; chemicals from pesticides, fertilizers, and cleaners; ergonomic hazards such as repetitive movements, heavy lifting, and awkward postures; animals; and mechanical equipment. The health and safety concerns in the agricultural industry vary by industry sub-sector and by occupation within each sub-sector.

The purpose of this report is to provide an overview of the present state of agricultural health research for health care policy makers and providers. The report is intended to serve as a resource for health care providers and policy makers to identify priority areas for future research and for improved health care delivery among agriculture populations. Prevention and treatment strategies initiated at the community, workplace, and clinical levels to serve agricultural workers are also outlined. This document serves as a Policy Brief to a more in-depth full report on this topic that may be accessed through the Rural Gateway

## **METHODOLOGY**

Agriculture health recommendations and emerging research issues identified by NIOSH and the NORA Agricultural, Forestry, and Fishing Sector Council were compiled to review emerging issues in agricultural populations. They were combined with supplemental literature to summarize the current state of agricultural health research by industry subsector.

## **FINDINGS**

NIOSH and NORA priorities in the area of agricultural health include:

### ***National Institute for Occupational Safety and Health (NIOSH): Emerging Agricultural Health Issues<sup>5</sup>***

- Development and implementation of science and technology in agricultural processes (i.e. global positioning system-controlled tractors and the use of genetics in animal reproduction);
- Modifications and innovations to existing technology and agricultural methods (i.e. roll-over protective structures installed on tractors manufactured before 1985) as well as replacement technologies (i.e. synthetic rope instead of cable, radio controlled chokers, video monitoring, robotic functions, autonomous systems in timber harvesting);
- Adopting new technologies, including biotechnologies which may result in improved occupational health and safety benefits and reduced risk factors (i.e. pest-resistant bioengineered crops to decrease pesticide use);
- Emerging threats (i.e. avian flu);
- Surveillance systems for safety and health research in forestry and logging; and
- Evaluations, revisions, and recommendations of safe fishery management techniques.

### **National Occupational Research Agenda (NORA): Development of a National Agriculture, Forestry, and Fishing Agenda Goal<sup>6</sup>**

- 1) Improve surveillance of the nature, extent, and economic burden of occupational illness, injuries, and fatalities; occupational hazards; and worker populations at risk for adverse health outcomes.
- 2) Reduce deleterious health and safety outcomes in vulnerable worker populations with increased work place exposures or susceptibilities. These populations include those defined by age (under 18 and over 65 years old), gender, limited English proficiency, migration, SES, ethnicity, culture, disability status, and worker documentation status.
- 3) Move proven health and safety strategies into workplaces through the development of partnerships and collaborative efforts to disseminate interventions and promote best practices.
- 4) Reduce the number, rate, and severity of traumatic injuries and deaths involving hazards of production agriculture and support activities.
- 5) Improve the health and well-being of agricultural workers by reducing the occupational causes or contributing factors to acute and chronic illness and disease including MSDs, psychological stresses, zoonotic diseases, and respiratory hazards.
- 6) Reduce the number, rate, and severity of traumatic injuries and deaths involving hazards of forestry.
- 7) Improve the health and well-being of forestry workers by reducing occupational causes or contributing factors to acute and chronic illness and disease including MSDs, exposures to toxic materials, drug and alcohol use, and availability of protective clothing.
- 8) Reduce the number, rate, and severity of traumatic injuries and deaths involving hazards of commercial fishing.
- 9) Improve the health of commercial fishermen by reducing occupational causes or contributing factors to illness and disease including MSDs.

### **Priority Populations for Agricultural Health Research**

**People with disabilities:** Workers with physical or cognitive disabilities have an elevated risk of occupational injury due to a decreased ability to respond to workplace situations, including emergency situations, and perform job tasks. Approximately 20 percent of farm or ranch workers have a disability that restricts work performance, such as MSDs, hearing impairment, cardiovascular diseases, or respiratory illnesses.<sup>7</sup> Persons with disabilities in the agricultural setting may also include workers with amputations, functional disability, or those participating in work rehabilitation after MSDs or other types of injuries.<sup>8</sup>

**Ageing workers:** A trend toward increasing age of principal farm operators is prominent among farm workers. The 2007 Census of Agriculture reported a rise in the average age of U.S. farm operators from 55.3 in 2002 to 57.1 in 2007, and the number of farm operators age 75 and older increased by 20 percent.<sup>7</sup> Farmers continue to work later into life due to economic implications and may concurrently rely on off-farm occupational income as their primary source of income.<sup>1</sup> Ageing workers across agricultural sub-sectors are at increased risk of occupational injury and illness due to vision changes, hearing loss, loss of balance, symptoms and secondary effects from existing health conditions, and medication side-effects.<sup>9</sup> In 2001 and 2004, agriculture production workers age 55 and older had similar non-fatal injury rates compared to workers ages 20-54, but the injuries were more severe in older workers including fractures, sprains/strains, and increased restricted work days.<sup>10</sup> From 1992-2004, the fatality rate for farm workers ages 55 and older (45.8/100,000 workers) was 1.8 times that of the overall agriculture fatality rate (25.4/100,000 workers).<sup>10</sup> In 2003, farmers over age 75 had a high fatality rate of 57/100,000 FTE and were two times as likely to die while farming compared to younger farmers.<sup>9</sup>

**Children:** Children living on or near family farms become involved in agricultural employment at a young age.<sup>1</sup> In 2009, an estimated 1.03 million youth under the age of 20 resided on farms and approximately 519,000 of these youth residents worked on the family farm. In addition, 230,000 workers under age 20 were hired to work on farms in 2009.<sup>11</sup> Agriculture-related injuries among those less than 20 years of age have declined from 13.5 per 1,000 farms in 2001 to 7.2 per 1,000 farms in 2009.<sup>12</sup> Youth ages 16 and above may be employed in any occupation on a farm, but there are restrictions on the type of work those under age 16 may perform. However, no laws or standards apply to youth working on a family owned or operated farms and youth on small fishing vessels that do not require contract protections.<sup>13</sup>

Young workers may perform tasks inappropriate for their skill level and physical and mental development due to economic needs of the family.<sup>13</sup> Fatal injuries to youth on farms from 1995-2000 most frequently involved machinery (25 percent), motor vehicles (17 percent), and drowning (16 percent).<sup>14</sup> The most common source of non-fatal injuries among youth in 2009 was transportation events.<sup>14</sup> Children typically experience muscle strains in the upper extremities, shoulders, back, and neck from agricultural work.<sup>8</sup> While some states have school-directed programs or safety camps to teach youth about injury prevention, injuries among children on farms are common. These educational lessons are successful in achieving short term improvements in knowledge and behavior change.<sup>15</sup>

**Foreign-Born & Migrant Workers:** The National Agriculture Workers Survey (NAWS) reported 72 percent of all farm workers were foreign-born in 2007-2009, and the majority of the foreign-born workers were from Mexico.<sup>16</sup> Foreign-born workers in the agriculture industry are employed in occupations such as dairy, livestock, and crop production as well as in forestry jobs.<sup>17</sup> Migrant workers are farm workers who relocate to accommodate employment opportunities that fluctuate by season. There is a decreasing trend of migrant workers employed in the agriculture industry from approximately 53 percent (1998-2000) to 25 percent (2007-2009).<sup>18</sup> The most commonly reported injuries among foreign-born and migrant agricultural workers are MSDs, hearing loss, eye injuries, skin disease, mental health issues, heat-related injuries, pesticide exposure, and green tobacco sickness. Injuries and illness in the migrant worker population also result from alcohol use, poor oral health, and infectious disease due to lifestyle factors.<sup>17</sup>

Migrant workers are at an increased risk of poor health status attributed to increased poverty rates, mobility of work, and hazardous living conditions including substandard housing.<sup>19</sup> Migrant workers sometimes lack sufficient access to health services due in part to their transient work. The Affordable Care Act does not cover illegal immigrants and includes provisions for reduced payments to hospitals that treat a large share of uninsured patients including illegal immigrants.<sup>20</sup> The highly mobile nature of the work makes it difficult to develop a social network and connect with primary health care services.<sup>19</sup> 85 percent of adult migrant and seasonal farm workers were uninsured in 2000, which is substantially greater than the 37 percent of national low-income adults who were uninsured.<sup>19</sup> In 2000, approximately 90 percent of children in migrant farm worker families were uninsured compared to 22 percent of U.S. low-income children.<sup>19</sup> Receiving Medicaid coverage is difficult because coverage is dependent on immigration status, number of dependent children, asset tests, and state residency requirements that are often unmet by transient migrant workers.<sup>19</sup> The cost implications to the health care system of providing services to uninsured migrant populations are unknown and are an important area of future research. However, foreign-born and migrant workers also face language, cultural, and psychosocial barriers to accessing health care services from the U.S. medical system that need to be addressed.<sup>17,21</sup>

### Health and Safety Research Priorities by Types of Agricultural Activity

A summary of major health and safety issues identified by our literature search is provided in the following table, according to type of agricultural activity.

Agricultural Sub-sector	Summary of Major Health Issues
Farming	<ul style="list-style-type: none"> <li>-Transportation and machinery-related injuries</li> <li>-MSDs from repetitive movements, unusual postures, or overexertion-Exposure to agricultural chemicals (pesticides, solvents, cleaners, and nitrogen based fertilizers)</li> <li>-Respiratory effects including bronchitis, farmers hypersensitivity pneumonitis, organic dust toxic syndrome, occupational asthma, mucus membrane inflammation syndrome, and sinusitis</li> <li>-Mental health issues</li> </ul>
Ranching	<ul style="list-style-type: none"> <li>-MSDs from automation of work practices, repetitious work tasks, performing tasks in awkward postures, and high muscle loads</li> <li>-Animal-related injuries</li> <li>-Contamination of water and air from animal waste producing respiratory irritants</li> <li>-Particulate matter, gas, agrochemical, and pesticide exposures associated with mucous membrane irritation, bronchitis, asthma, asthma like syndrome, and COPD</li> <li>-Zoonotic Diseases: Brucellosis, leptospirosis, tuberculosis, avian or swine influenza, or cryptosporidiosis</li> <li>-Mental health issues</li> </ul>
Fishing Workers	<ul style="list-style-type: none"> <li>-Exposure to physical, chemical, environmental, and biological hazards</li> <li>-Injuries from fishing vessel loss and man overboard</li> <li>-Machinery-related injuries</li> <li>-Falls on deck</li> <li>-MSDs from performing repetitive movements, operating machines, and working for long periods of time</li> <li>-Fatigue, sprains and strains, and exposure to excessive noise, toxic chemicals, and UV radiation.</li> <li>-Zoonotic diseases</li> <li>-Mental health issues</li> </ul>
Forestry	<ul style="list-style-type: none"> <li>-Muscle strain, cumulative trauma, and MSDs</li> <li>-Sedentary and repetitive work postures among machine operators</li> <li>-Exposure to toxic materials from pesticides, insect repellent, herbicides, dust, smoke, and engine emissions</li> <li>-Hazardous climate exposures such as high UV exposure, elevated wind speeds, and extreme weather conditions and temperatures</li> <li>-Mental health issues-Machinery-related injuries including struck-by injuries</li> </ul>

## PRIORITY AREAS FOR IMPROVED HEALTH CARE DELIVERY

### The Clinical Health Care Setting

There are a variety of primary care practices serving agricultural workers in rural areas including private physician practices, Rural Health Clinics (RHC), and Health Resources and Services Administration (HRSA)-funded Health Centers. The rural health care infrastructure differs from urban and suburban areas in regard to the limited number of services provided and shortage of health care workers.<sup>22</sup> Rural residents are less likely to receive specialized care and post-hospital home care compared to non-rural residents.<sup>22</sup> Emergency medical service response and transport times are greater in rural areas compared to urban areas.<sup>22</sup> According to 2013 data, there were 8,541 Health Professional Shortage Areas in rural areas, compared to

5,746 in urban areas, across primary care, dentists, and mental health providers.<sup>23</sup> Health care coverage is also lacking in rural areas as fewer residents have employer-provided health care and Medicaid benefits.<sup>24</sup>

HRSA-funded Health Centers provide primary health care services to medically underserved populations and some receive funding for special populations including migrant farm workers. In 2012, there were 159 federally funded Migrant Health Centers, which operated around 700 satellite service sites.<sup>25</sup> In 2011, it was estimated that HRSA-funded Health Centers served 25 percent of migrant workers in the U.S., or 862,808 migrant and seasonal farm workers and their family members.<sup>26</sup> Non-HRSA funded clinics that serve migrant populations may be reimbursed by Medicare and Medicaid for migrant and seasonal farm workers depending on the clinic's reimbursement status. Many clinics serving agricultural workers rely on other funding sources and offsets including tax revenues, donations, grants, Medicaid, Medicare, and other government revenue for added support, but clinic resources and funds may be limited.<sup>19</sup>

## **The Practitioner**

### ***Conducting Health Screenings:***

Practitioners can identify risk factors and early signs of work-related injuries and illnesses. Preventive screenings include asking workers about dust exposure in their workplace, conducting lung function tests to monitor respiratory health, and performing hearing assessments on workers exposed to excessive and loud noises.<sup>15</sup> Regular skin checks among pesticide applicators and workers with dermal exposures increase early detection of skin cancer. Other recommended screenings among agriculture workers include regular prostate screenings, bowel health assessments, and blood monitoring for detection of lymphatic cancers.<sup>27</sup> Providers may identify risks for transportation-related injuries and other injuries, especially in older workers, by checking patient medication use, neurology, and mobility.<sup>9</sup>

Agricultural workers and rural residents have a high prevalence of mental health symptoms and are at an increased risk for suicide.<sup>15,24</sup> Mental health issues are increased in agricultural workers as a result of work-related stress including the physical environment and economic uncertainties and difficulties.<sup>15,24</sup> Mental health and depression screenings help identify mental health symptoms, including exhaustion, fatigue, and decreased concentration, which increase injury risks among those in agriculture work environments. Stress-related to the workplace and lifestyle factors (financial problems, social isolation, and drug and alcohol abuse) are additional risk factors for mental health issues.<sup>1,9,15</sup> However, it may be difficult for residents of rural areas to seek help for mental health issues because rural areas lack mental health services compared to urban areas.<sup>24</sup>

### ***Implementing Effective Prevention Strategies:***

Partnerships between clinicians and community organizations can be an effective method to develop and implement injury prevention activities. Community organizations and health care providers working together to incorporate interventions and prevention strategies into daily job activities improves worker safety and health.<sup>6</sup> However, before committing time and resources to prevention programs, care should be taken to select effective prevention initiatives. A Cochrane review of educational strategies to prevent injuries among agricultural workers found little evidence supporting solely educational interventions for injury reduction.<sup>28</sup> Pooled results showed educational interventions aimed at reducing injury among adult and child agricultural workers were not effective, although moderate evidence of effectiveness was shown for improved farm safety knowledge and behaviors.<sup>15</sup> Educational interventions for children, such as school lessons and farm safety camps, have improved short term safety knowledge and beliefs.<sup>14</sup> Short term improvements in knowledge, attitudes, and behaviors have been observed in evaluations of adult educational interventions.<sup>15</sup> Educational interventions as a component of a multifaceted intervention have a better place than educational programs alone.<sup>15,28</sup>

Engineering controls are often associated with a high implementation cost. However, cost is not the only barrier to implementing effective engineering controls because financial incentives applying engineering controls may only have short-term effects. Financial incentives to retrofit roll-over protection equipment on older tractors had a short-term decrease on injury level, but no long-term effect.<sup>28</sup> Financial incentives such as insurance premium discounts for participants in interventions decreased injury claims directly after the intervention but were not effective over time.<sup>15</sup> Additional research is needed to examine whether financial incentives may lead to a long-term reduction in injury.

#### ***Increasing Foreign-born and Migrant Worker Health Care Utilization:***

Foreign-born and migrant workers may not access health care services for agricultural injury prevention because they experience significant language, literacy, and cultural barriers that decrease access to and quality of health care.<sup>21,29</sup> Practitioners should be aware that cultural beliefs of immigrant workers and prior experiences affect their receptiveness to health and safety initiatives.<sup>17</sup> Foreign-born agricultural workers may defer medical care for illnesses and prevent or self-treat conditions with traditional or home remedies.<sup>17</sup> Sometimes workers may acquire culturally-based, lay definitions of illnesses. For example, a study of migrant and seasonal workers in North Carolina reported the workers believed green tobacco sickness was the result of exposure to pesticides or heat rather than the result of nicotine absorption.<sup>30</sup>

Practitioners should be aware of the language and literacy preferences of patients. For example, the use of printed materials for training and providing safety information may be useless for a quarter of Mexican workers who speak pre-Columbian indigenous languages and lack Spanish or English literacy skills.<sup>17</sup> Dissemination of health and safety information to non-English speaking populations should be done using effective and appropriate methods.<sup>31</sup>

#### ***Continuing education needs:***

Practitioners can attempt to anticipate the types of agricultural injuries and illnesses they will encounter in a clinical setting that can be expected to result from the workforce demographics, farm types, and occupations that are unique to their geographic location. Knowledge of such trends helps designate the most appropriate prevention and treatment activities for workers in that location. Training for providers to identify and treat health problems associated with agricultural work should be made available because of primary care physicians may underestimate the risks of agriculture work.<sup>32</sup> Ideally, time would be allotted for continuing education opportunities on agricultural health topics.<sup>21</sup>

## **CONCLUSIONS**

Advancements in technology improve agricultural production, but these advancements may introduce corresponding hazards to workers. Continued research is needed to develop new technologies that eliminate work-place hazards. Foreign-born and migrant worker populations, and other vulnerable worker populations face cultural, social, and economic barriers to health care, and research is needed to reduce these disparities. Further evaluation of injury prevention strategies will inform practitioners and health care workers about the most effective methods to educate patients at the local level. Research on risk factors and treatment strategies to identify and monitor acute and chronic illnesses as well as zoonotic and emerging diseases is also a priority area.

Priority areas for improved health care delivery to agricultural populations must continue to address the insurance, cost, and access barriers to health care. Health care models that involve collaboration of agencies and resources can be developed and disseminated to help clinics increase the value of their resources. Evaluation and feasibility studies of health care preventive screenings must be continued as injury and illness prevention will improve overall health status of workers. Practitioners and health care workers should strive to stay informed about the work trends and agricultural-related issues in their area to improve patient treatment.

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