

Agricultural Health & Safety Among Racial and Ethnic Minorities: Current Research and Perspectives

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The publication of *Agriculture at Risk: A Report to the Nation* in 1989 was the result of an organized effort by a coalition of concerned health and safety professionals to raise awareness among legislators and the public about the high rate of occupational injury and illness in agriculture. This document outlined research and prevention goals for agricultural health and safety, and gave rise to ten NIOSH-sponsored agricultural health and safety research centers around the country. Before that time, OSHA and a handful of other federal agencies had attempted to take action in three areas of agriculture: agricultural injury prevention, pesticide management and migrant farmworker health, but with mixed results (M. Myers, 1992). The publication of *Agriculture At Risk: A Report to the Nation* represented the first national, coordinated effort to address occupational safety in agriculture.

When this effort began, the focal point was production agriculture as a whole. The main message was that agriculture is one of the most dangerous industries in America, and is the only one that federal and state government was taking almost no action to protect. The bulk of the data presented related to white farm owners and their families, and had little to say about other races, ethnicities or occupations within agriculture.

While minority research in agricultural health and safety is limited, national data on agricultural fatality by race suggests that black workers are at higher risk for occupational fatality than whites (Hard et al., 1999; Kraus, Lightstone, & McArthur, 1998; J. Myers & Hard, 1995). However, when stratified by race and occupation within agriculture, fatality patterns are less clear. J. Myers and colleagues find white farmers to be at substantially higher risk (1995), while later work by the same NIOSH group presents data indicating excess risk among black farmers (Hard et al., 1999).

Data from occupational research in several other industries also suggest that minorities are at increased risk of occupational injury and illness (Loomis & Richardson, 1998; Wright, 1992; Robinson, 1989). While currently there are no definitive answers, there is enough data suggestive of increased occupational risk among minority workers to warrant further study.

In 1996 NIOSH published its National Occupational Research Agenda (NORA), and included as one of its priority research areas, "special populations at risk," defined as, "workers with specific biologic, social, and/or economic characteristics who are more likely to have increased risks of work-related diseases and injuries." In particular, the document named children, women, the elderly and minority workers as special populations. This was a milestone, since it officially named minority research as a priority area for future funding.

1990 appears to have been a turning point in the publication of research related to minorities in agriculture. From 1987 through 1990, a total of thirteen articles were published, whereas in the

four years following, the rate more than doubled to 41 published articles. That trend continues, with roughly eight articles published each year.

In addition, data from the NIOSH-supported agricultural health and safety centers show steady increases in center activity devoted to minority occupational health. In a survey, the Centers were asked to estimate the number of studies and prevention programs ongoing in 1990 (or the year the center was established if after 1990) and again in 2000. The most frequent response for the baseline year was 1-2 projects in research and also 1-2 projects in prevention. By 2000, the most common response was 3-5 projects for both. Similarly, the most common comment received by the survey was that minority research and prevention has risen in importance among the Center's priorities. At the same time, most respondents commented on the inherent difficulty of carrying out research in this area. This comment was typical:

A major challenge is the temporary nature of employment either due to migration, or due to the workers actually settling in an area to do seasonal crop work during planting and harvesting, while at other times working in non-agricultural jobs. An equally major challenge in studying, or serving minority workers is that they are difficult to access due what seems to be a perception of adverse consequences from divulging information, or from just being observed (Kennedy, 2001).

However, five years after NORA, published health and safety research on minorities in agriculture is still scarce compared to the quantity of data that exists on white farm populations. If each racial or ethnic minority group in agriculture is considered separately, then the imbalance in the quantity of available research with respect to white farm owners is even more extreme. The research that does exist concentrates on a few populations in a few locations, such as Hispanic migrant and seasonal farmworkers in the West and Southeast, and African-American farmers in the South. Certainly more research on all aspects of minority agricultural health and safety are needed, especially among groups as yet unstudied.

In considering current and future research and prevention, it is important to look at more than just the quantity of studies, and the groups represented, but also at what questions the research seeks to answer, and how data are collected. Ultimately, the manner in which research is conceptualized, conducted, and interpreted in minority occupational health and safety will determine whether these efforts actually result in improved health and safety of minority workers.

Overview

Table I shows the quantity and type of studies published on various minority worker populations in agriculture. A second table (Table II) was created to summarize the unpublished outreach and education activities undertaken by the NIOSH-supported Agricultural Health and Safety Research Centers in each region. Table II is not intended to represent all education and outreach efforts being undertaken for minority agricultural workers, but simply to provide examples of current activities, organized by group, from around the country.

In reviewing Table I, some generalizations about agricultural health and safety research on

minority populations can be made. First, the bulk of the research concentrates on Hispanic migrant and seasonal farmworkers in California and in the Southeast, with the Hispanic farmworkers in the Northeast a distant third. Speaking very generally, research in these three leading regions is similar in terms of study question type and methods. All three look at injury, communicable disease, environmental exposures and social factors. In addition, Hispanic farmworker research in both California and the Southeast includes general health assessments. In California, we also find evaluations of ergonomic interventions.

In terms of findings, the table shows several elevated prevalence rates for Hispanics, African-Americans, and Caribbeans in communicable disease (Ciesielski, Seed, Ortiz, & Metts, 1992; Ciesielski, Seed, Esposito, & Hunter, 1991; Ciesielski, Handzel, & Sobsey, 1991; Hibbs, Yeager, & Cochran, 1989; Jacobson, Mercer, Miller, & Simpson, 1987). In terms of fatal injury, the data are inconclusive. Some data show white farm owners at highest risk for death (J. Meyers & Hard, 1995), whereas other research suggests that African-American and Hispanic farmers and farmworkers have higher fatal injury risk than white farmers (Hard et al., 1999; Stallones, 1999). In addition, several common health problems are identified for many of the racial/ethnic populations, but they are not in rates, which lend themselves to comparison with the general population. There are also a wide variety of qualitative descriptive findings presented throughout the research.

Because of the diversity of the outcomes considered by each study, even within the groupings of race/ethnicity, occupation, and region, their results cannot be combined to paint a clear picture of the overall occupational health of the populations within any of these strata. This may simply be a function of the field being relatively young.

The following discussion of published studies will focus on how effectively researchers have addressed each of four key areas: a) the definition of the study population; b) definition of the "occupationally healthy" worker; c) measures of occupational health; and d) identification of possible causal factors.

a) Definition of the Study Population

In any research, careful consideration must be given to how the study population is to be defined. Traditionally, researchers looking at minorities in all fields have tended to group minorities into broad categories such as "African-American" or "Hispanic," without any thought to whether these labels actually constitute a group in any meaningful way. Unless one is to argue that the tint of a worker's skin or his eye color is causally related to his risk of occupational injury or illness, other factors than these must be considered in the design of studies aimed at establishing causal relationships between risk factors and morbidity. Certainly, the tasks the worker is undertaking will play a large role in risk. So will cultural and social factors associated with ethnic or racial group membership, but only if that group actually functions as a group or is viewed as a distinct group in society.

In addition, the geographic location of a group is an important and often overlooked factor, since the political and historical influences on minority occupational safety will certainly vary in different regions of the country. In reviewing and presenting the existing literature, the authors

grouped published research along the three dimensions mentioned above: race/ethnicity, job type, and geographic location. While this is not intended as a hard and fast rule of group definition, each group should be defined following some explicit rationale. Clear and defensible definitions of study populations are particularly important in minority research, since minority health research has at various times in the past been appropriated for racist purposes in an attempt to show white superiority (Krieger, 1987).

In the case of minority farm owners, research tends to focus on specific groups using the race/ethnicity, occupation, and location definition advocated in this review. Arcury (1995) describes African-American farmers in detail, looking at, for example, geography, farm size, commodity, and history of farm ownership. Describing the study population in detail may be easier to do with some farm populations than others, since not all workers are permanent, legal residents, with distinct racial identities, as this population is.

For example, in studies looking at migrant and or seasonal farmworkers, definitions are often incomplete or extremely broad. This becomes problematic when attempting to interpret results. Researchers need to state precisely who is represented in the results, and what work task, cultural, political or social conditions may be associated with the findings.

The community studies by Griffith (1995a) are very detailed and descriptive, but they define groups by geography (city) mainly, and then make inferences about migrant and seasonal workers, under the assumption that they make up a large proportion of the population. The authors attempt to determine racial/ethnic percentages of their study populations, but do not present results stratified along racial/ethnic lines.

Many studies (Hard et al., 1999; Arcury & Quandt, 1998b; Crandall, 1997; J. Myers & Hard, 1995) do not specify exactly what is meant by the term, "farm worker". It is not clear whether this group includes temporary harvest labor, family members or full-time, paid employees. These are very distinct groups which should be identified.

One important aspect of group definition relates to not only naming the occupation of the group within agriculture, but in identifying as closely as possible the actual job tasks undertaken, since they are the fundamental sources of injury and illness risk. Isaacs, (1995) gives a very informative listing of major job tasks of migrant and seasonal farmworkers by commodity. Ergonomic studies (Meyers, 1999; Miles, 1996) contain highly detailed descriptions of work task. Hopefully, subsequent ergonomic research will use this detailed information to correlate certain occupational injuries or illnesses with certain commodities and tasks. This type of task description would also be helpful in other types of studies.

Several studies look at migrant and seasonal farmworkers as an occupational group without selecting one ethnicity/race as the main population of interest (Garcia, 1996; Earle-Richardson, 1998; Chi, 1991a-d; Jones, 1991; McDermott, 1990). This may be the result of the research interest being mainly on all workers doing a certain type of work, (such as "migrant farmworker", or "grape worker" in the case of Samet (1992) and Gamsky, Schenker, McCurdy, & Samuels (1992)), or with the idea of making cross-group comparisons.

The choice may be made to simply group by job category, discounting race/ethnicity as a major factor in occupational health, which may or may not be appropriate. It may be best used as a first exploratory step to determine if any health effects may be present. If indicated, this can then be followed later by more detailed analysis by group. One might certainly argue that in some cases race/ethnicity does not define the group nor its occupational risk.

While it is legitimate to collect data on several different identified ethnic/racial groups with the idea of making comparisons between them, there are some risks in undertaking multiple group research. Some studies employing this methodology lacked adequate statistical power due to limited sample size within certain ethnic strata (Ford, 2000).

While comparative data is an important aspect of meaningful research, limiting the comparison groups to one or two, and/or oversampling the main group of focus may be necessary in the face of financial and logistical constraints. In addition, there may be other benefits to studying one group extensively. For example, when researchers acquire an in-depth knowledge of the cultural history and sociological factors related to a particular group, they are better able to conduct research and interpret the findings related to that group. This is typically best accomplished by the assembly of a multidisciplinary team.

In reviewing the agricultural health and safety literature, it was found that most studies addressed one of two broad categories of workers: a) minority farm owner-operators and b) migrant and seasonal farmworkers. It is likely that more occupational categories exist (such as farm manager, full-time employee, or crew chief), but as yet these do not appear in the research literature to any great extent. Certainly other worker types exist (e.g., Mexican dairy workers, chicken processing workers, and year-round orchard workers). Further research on these groups is needed. In sum, much of the current minority health and safety research in agriculture could benefit from a more complete and precise definition of the study population. The reviewers advocate the use of a study population definition based on race/ethnicity, occupation, and geographic location. This will allow for more meaningful analyses and interpretation of study results.

b) Defining the "Occupationally Healthy" Worker

The next important step is to define what occupational health actually means for a given population under study. The identification and prioritization of attributes of a healthy worker is important because it does two things. First it identifies the priority areas for research, and second, it provides some kind of yardstick by which to measure study results.

For example, consider the Mexican migrant farmworker who picks ground crops in Southern California, perhaps travels north to Washington for the apple harvest, and then goes back to Mexico at the end of the harvest season. How does one conceptualize this individual at his optimum occupational health? Would occupational health dictate that he be disease and injury-free, or just not beyond a certain level or frequency? Must fields be free of pesticides, or is the use of protective gear adequate? Similar questions must be answered with regard to behavioral risk factors such as those for chronic disease and poor mental health.

One must also consider social and legal factors which may affect the migrant's overall well-being. For example, does the worker have his own car to travel, and all the legal documentation

he needs to safely and easily migrate? Does he have long-term relationships with employers, for job security? Depending on one's point of view, some or all are important indicators of occupational health.

Moreover, one must consider how the definition of occupational health relates to the individual's health status on entering the occupation: Should a worker with initially poor health get better, or just not get worse? Some might even take the position that good health is totally incompatible with stoop labor. The authors do not advocate for one definition over another, however, it seems clear that one cannot effectively research problems in occupational health and safety, without first defining occupational health. The issue of definition takes on special importance in the case of minorities, since minority workers (particularly immigrants) frequently undertake unpleasant and difficult work, and because many minority workers enter the workforce in poor health.

This broad issue of what constitutes good occupational health and safety must be carefully applied to each individual research question that is asked. Unfortunately, this was not found to be the case among the articles reviewed. Rather, this definition must be deduced from the research question. For example, Arcury (1995) makes a connection between farmers' views of work-related hazards and injury risk. We then must deduce that his definition of the occupationally healthy worker includes the belief that threats of injury on the farm are high. In other injury studies, it can be inferred that the injury-free worker is the occupational health gold standard (Ford, 2000; Lyman, 1999; Ciesielski, Hall, & Sweeney, 1991). Perhaps many published researchers have considered this question in developing their research, but it would clarify the purpose and meaning of the study if it were discussed explicitly in the results.

If one is comfortable inferring definitions of good occupational health from research questions, one sees a wide variety of definitions in the published minority agricultural health and safety literature: being disease-free (Jones, 1991), having social support (Schoonover Smith, 1987), taking precautions against pesticide exposure (Arcury, 1998), getting cancer screening (Lantz, 1994), and even having the ability to promote one's own health (Kerr, 1990).

One problem that these widely varying definitions illustrate is that individual studies focus on one problem without placing it in the context of overall occupational health for the study population. This fragmented view is evident when looking at the research as a whole.

c) Measures of Occupational Health

Once some kind of "gold-standard" has been constructed, measures of good occupational health can be easily identified. While many of the studies reported traditional measures of morbidity and mortality, such as incidence and prevalence, some other indicators were encountered, which demonstrate varying definitions of good occupational health among researchers. Some examples are: worker awareness of danger in agriculture, existence of physical hazards, presence of safety programs, farmer behavior, such as alcohol use and fatigue, seroprevalence of various infectious diseases, degrees of emotional support, prevalence of violence, subject's ability to promote one's own health, willingness to have medical tests, degree of fear of cancer, and the belief in survivability of cancer. It is also worth noting that the majority of these measures relate to individual behavior, rather than environmental, social or legal determinants of health.

Clearly the wide divergence in occupational health measurements springs from the different conceptualizations of good occupational health. With greater consistency among researchers addressing a.) and b.), there would be greater consistency among occupational health measures, and more opportunity for comparison between studies.

d) Identification of Possible Causal Factors

Before any measurements are taken and analyzed, a wide variety of possible causal factors must be considered. Among them are: the physical and social work environment, the political context of the job, cultural factors, and measurements, if available, on white or other minority groups doing these same jobs.

Much of the research seems to focus on identifying and quantifying poor outcomes rather than considering the reasons why. Again, this may simply be an indicator of a young field of study. Research by Griffith (1995a), while not strictly occupational health-related, has been included in this review as an example of the sociological approach which could provide the needed contextual data to assist in interpreting the meaning of current minority research. A number of complex social and economic phenomena are described and explained in this work.

One example of how this more sociological approach of Griffith (1995a) could benefit current health and safety research is his finding that men traveling alone are increasing throughout the migrant workforce. This finding is not in itself an occupational health outcome, however, the fact that increasing numbers of males are working alone in the migrant and seasonal workforce is directly related to farmworker health and safety. As he explains, the forces that are creating this phenomenon also reinforce the entrenched powerlessness that is associated with poor working conditions and poor health outcomes:

... the separation of productive [farmworkers] from reproductive labor [non-working families and dependents] is so extreme that the costs of reproducing and maintaining workers during youth and old age are borne in separate geographical regions and often separate political entities. ...[this] model undermines worker's attempts at assimilation and the power assimilation brings. (p. 280)

If U.S. laws and labor dynamics force men to travel without families, and never settle near their place of employment, then they will forever be disconnected from American society, and will not receive the benefits of social services, preventive health care, or labor union membership, which are all things that might lead to better health. It is this kind of contextual information that allows for more informed interpretation of health outcome data.

In looking at minorities at risk for occupational injury and illness in agriculture, two common but distinct scenarios appear. In the first, dangerous (or undesirable) jobs are filled by minority workers, and in the second, minorities and whites fill the same jobs, but something about being a minority increases the risk (Frumkin, Walker, & Friedman-Jimenez, 1999; Loomis & Richardson, 1998). It is important to make this distinction when thinking about the causes of poor occupational health outcomes among minorities.

Migrant and seasonal farmworkers are an example of the first scenario. Demographic shifts over the last two decades have resulted in this temporary labor force becoming almost entirely minority. However, unlike other sectors, it may be that it is the strenuousness, unpleasantness and low status of manual farm labor (versus farm management or ownership) that is relegating it to minority and immigrant work, rather than an inherent increased risk of fatality. At least one study has found the risk of occupational fatality to be higher among white farm owners than among minority farm workers (J. Myers et al., 1995).

An example of greater risks experienced by minorities holding the same jobs as whites is that of minority owned and operated farms. Some data suggests that black farm owners have higher injury and fatality rates than white or Hispanic owners. More research is needed to determine what social factors may account for these differences.

Many of the studies reviewed find that the study populations have elevated rates of some adverse health outcomes, but they do not address the question of what aspects of group membership may account for these differences. While one might argue that that this question can legitimately be left for subsequent research, it is recommend that hypotheses be put forward, even speculative ones, as to what may be causing poorer outcomes for a particular group. As in any field of science, these theories are critical to designing coherent research.

For example, the one study of Native Americans and farm fatality (Crandall, 1997) concludes that Native Americans have higher farm fatality rates than whites. But it is not evident to the reader whether all Native Americans have the same elevated risk, or whether different tribes might differ, or on the other hand whether Native Americans as a whole might be part of some larger group of workers who all experience higher risk. If we had some theories as to what puts these Native Americans in New Mexico at risk, it might be easier to interpret these results.

Another illustration of how the definition of a study population may be influenced by theories of causation is Stiles' (1999) study of culture and driver knowledge. In the introduction, she focuses on the driving behavior of Mexican migrant workers, citing excess motor vehicle crashes among Hispanics and also the assertion made by California law enforcement that driver performance among Mexican migrant workers is poor. This is believed to be due in to a lack of familiarity among this group with California traffic laws, particularly those related to the use of seatbelts and child safety seats. Clearly, this definition of study population is driven by the tentative assessment of what is causing the high rate of motor vehicle crashes.

Published literature reviews, policy papers, and commentary Despite the fact that published research is scarce, there does exist a large number of policy and commentary papers on different aspects of minority agriculture and safety; 17 papers on migrant and seasonal farmworkers alone were located. Seven literature reviews on migrant and seasonal farmworkers were also identified. One that this large number of policy articles and literature reviews may be the result of a growing interest in the poor working conditions of migrant and seasonal farmworkers coupled with frustration over the difficulty of conducting research on this group.

Conclusion and Recommendations

Over the last ten years the quantity and diversity of research in minority agriculture and health has expanded. However, the volume of research that provides incidence or prevalence data has not grown as steadily, possibly due to the difficulty inherent in enumerating and studying these often invisible and mobile populations.

First, more clarity with respect what group is being studied would strengthen minority research. This can be achieved through more detailed and careful definitions of the study population in the research. The authors suggest a definition of study population based on three factors: ethnicity/race, work task (or job) and geographic location. Similarly, the research would be more useful if studies regularly included detailed descriptions of subject's work tasks. Research leading to a job task classification system that can be used in all of agricultural safety and health research is also needed.

In addition to defining the study population and the work they do more completely, minority occupational research in agriculture would benefit greatly from a clearer definition of the occupationally healthy minority worker. Although it is a subjective construct, it is needed for research and prevention to have any direction toward healthier workers. This definition should also include some process of prioritizing issues of concern. The current literature contains a wide variety of topics, which may or may not reflect the most pressing health issues of the populations.

The existing research appears to center around a few groups - many groups are not represented at all. Similarly, there is anecdotal evidence that other job categories of minority agricultural workers exist that may be at high risk for occupational injury and illness. These categories (e.g., Mexican dairy workers, chicken processing workers, and year-round orchard worker) should be more clearly identified and considered for further study.

To move from documenting poor health outcomes to understanding why, there is a need for a multi-disciplinary approach to research. Quantitative and qualitative methods should be combined in order to have prevalence data and descriptive data together. The body of literature could benefit from more sociological research into what social factors may be contributing to poor outcomes and why. More basic demographic research on minority populations would be useful.

Much of the research and discussion in policy papers consider minority groups nation wide without any consideration of region. Caution must be used when generalizing findings outside of the region and group of study, certainly until researchers have a better understanding of the most important contextual factors in determining occupational health and safety among minority populations.

On a more methodological note, communication and collaboration within the agricultural health and safety community could be improved by developing a better system for cataloguing published and unpublished agricultural research and prevention activities. Currently, there is no one repository of agricultural health and safety research, let alone a source dedicated to such research for minorities. There are only a few journals dedicated to health and safety issues in agriculture. The remainder of the published research is spread throughout journals of occupational health, public health, industrial hygiene, industrial medicine, epidemiology,

education, sociology and anthropology, requiring researchers to search a large number of literature databases. Furthermore, a great deal of relevant information tends to be in government reports or academic holdings and do not appear in commercial databases.

Research and prevention in the area of agricultural health and safety and minorities has grown significantly over the last ten years. With the support of NORA and the advocacy of committed researchers and safety specialists, a wide range of questions are now being asked relating not only to injury and disease, but also to issues of equity, minority representation and perceived well-being of the workers themselves. This represents a maturing of the field, and brings us to a point where new, more challenging questions must be addressed, such as what constitutes a minority group, and how we define occupational health. The authors recognize the enormous challenges presented by the recommendations presented above for all researchers in the field. However, we believe these steps are necessary if minority workers in agriculture are to realize the benefits of this research with improvements the quality of their own lives.

Methodological Note: The authors are part of the Northeast Center for Agricultural and Occupational Health, one of 10 centers around the country funded by NIOSH to study and promote occupational health and safety in agriculture. Consequently, our perspective on the state of agricultural health and safety is heavily influenced by the work of this center and the other nine centers. Due to the accessibility of data from these centers, their work is discussed whereas the work of many other institutions with whom the Northeast Center is not affiliated is not. The authors are certain that many unpublished activities are occurring around the country worthy of mention, however, the agricultural health and safety centers as a group span the country and are featured here only as an example of activities undertaken by a variety of local, state and federally-supported institutions.

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Table I. Summary of topics, methods and selected findings of agricultural health and safety research by ethnic/racial minority group (Groupings formed by worker type, race/ethnicity and region)			
	Research topics	Methods used	Results (selected findings): refer to studies for complete results
Migrant or seasonal farmworkers			

<p>Hispanic, Southeast published studies: 15</p>	<p>A. injury fatality rates (vs. farmers) occupational injury B. communicable disease intestinal parasites, risk factors, prevalence of PPD positivity, active TB, Risk factors: active TB incidence sero-prevalence of 3 parasitic diseases C. environmental exposures green tobacco sickness incidence pesticide exposure risks, morbidity pesticide knowledge and beliefs extent of pesticide safety training water quality D. overall health health status E. social factors economic and social conditions affecting quality of life</p>	<p>(5) survey (4) interview (2) PPD (2) focus group (1) water testing (1) screenings (1) clinical measures (1) cholinesterase testing (1) chest x-rays (1) blood test & history</p>	<p>A. 80% of injuries: broken bones, sprains or cuts A. 16 per 100K worker-year farm workers vs. 38 for farm owners A. 65% of seriously injured did not receive prompt care A. employers covered medical expenses for 38% (5/13) of injured workers B. 31% TB +, 52% BCG, 20% BCG and TB+ B. 33% TB positivity in Hispanics (lower than African-Americans and Haitians); active disease .47% B. 41% had GTS in one year; most no precautions; 9% sought medical treatment; 7% lost work time B. cysticercosis: 10%; T .cruzi: 2%; plasmodia: 4.4%, one active Malaria B. study population: 53% Hispanic; 5% HIV+, 44% TST+, 8% syphilis +, 47% no condom use C. 1/3 ever received pesticides training/information; 25.6 % received training this year C. 50 % reported being sprayed by pesticides, working in field with obvious chemical smell. C. camp water: 44%+ total coliforms, 26%+ fecal coliforms; rates increased in a second year C. cholinesterase levels significantly lower among farmworkers (30.28 vs. 32.3 U/g hemoglobin) C. workers concerned with acute exposure; little knowledge of long term effects C. farmers unaware farmworkers are exposed because they do not mix or apply the pesticide C. farmworkers do not recognize the skin as a site of chemical absorption C. few knew routes of exposure or use protective measures D. common medical problems: dental, musculoskeletal, muscle spasms, skin rashes, hypertension D. common symptoms: headaches, difficulty seeing, body pains, chest pains/discomfort, joint stiffness E. employers have preferences for certain ethnic groups as workers E. extreme poverty; largely Hispanic; growing proportion of "single" males E. majority single, male, 25-44 years, < 6years education, rent E. services subsidize farm labor-allowing wages to stay low E. workers tend to press for changes only after attaining security, stability, respect E. farm workers who use contractors tend not to speak English or own cars</p>
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<p>Hispanic, West (California) published studies: 14</p>	<p>A. injury injury causes commodity-specific farm injuries driving behaviors/ knowledge</p> <p>B. communicable disease tuberculin reactivity</p> <p>C. environmental exposures dermatitis prevalence, risk factors smoking status, pulmonary function prevalence of respiratory symptoms meaning of decreased FVC in grape workers</p>	<p>(6) survey (6) interview (5) direct observation (1) focus group (1) TST w/ X-ray (1) medical surveillance (1) spirometry (2) injury reports (1) safety walk through (1) first aid records (2) ergo risk screening</p>	<p>A. 18.5% injuries compensated by worker's compensation A. 20% associate injury w/ farm work, equipment and transportation. A. 4.5% of workers had injury in previous year A. 70% received safety training for task prior to injury A. 75% w/ children <4 yrs say use safety seats - 34% observed using safety seats A. 86% say always belted -37% observed using belts A. causes of fatalities: (1) MVA involving tractors, (2) farmmachinery / tractor episodes A. common injuries: finger wound, back strains, sprains, contusions, fractures, open wounds A. common injury causes: overexertion, cutting/piercing objects, tools A. injury prevalence: 24% lower back, 19% upper back, and 18% wrist A. injury rate: 28.7 per 100 B. 16.6% Tuberculin reactivity, high reactivity among foreign-born C. 15% reported headaches on the job C. current smoking, age, F sex, working \geq 8 months/yr in AG associated with respiratory symptoms C. no demonstrated causal relationship between grape work and lower FVC C. skin disease may be causally associated with exposures and lack of protective equipment.</p>
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	Research topics	Methods used	Results (selected findings)
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<p>Hispanic, West (California), continued</p>	<p>D. overall health overall health status E. social factors economic, social conditions affecting quality of life F. intervention evaluation evaluation of intervention reducing the grape harvest load evaluating ladder modifications on safety and acceptance impact of specifically developed handles for plant containers in reducing musculoskeletal disorder H. ergonomic exposures priority musculoskeletal concerns engineering interventions</p>		<p>D. underutilization, poor access to preventive care D. 1/3 dental problems, 40% report musculoskeletal > 1 week, 20% report itchy eyes E. shortage of skilled supervisors E. community has developed informal networks to accommodate the farm labor E. dependence keeps them in the migrant labor workforce E. services which make workers able to work (like transportation) also make them dependent F. musculoskeletal disease lowered by reducing the load carried by workers to 50 pounds F. new design may cause decrease in productivity due to heaviness F. some resistance to using ladders, although acknowledge safety benefits F. average lifting index was reduced from 2.27 to 1.20 for 1-gallon containers and 5.20 to 3.26 for 5 gallon containers; reduced forward flexion from 64.46% to 43.95% with 1-gallon and 22.00% to 11.15% with 5 gallon containers F. overall the program was successful - helped to break down barriers between this target group and health care H. ergonomic concerns—slips and falls (field work); lifting/carrying (Shipping); repetitive hand tasks (propagation/canning). H. musculoskeletal disease from OSHA 200 log and First aid reports—highest number in back injury followed by other upper extremities. Suggested engineering strategies are lightweight handles for lifting and carrying cans; handles for cans mounted on hand trucks; raised working platforms in canning offloading area; hydraulic tilting trailers; powered clippers and cutters</p>
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Hispanic, Northeast published studies: 9	<p>A. injury methods for future injury research</p> <p>B. communicable disease</p> <p>PPD prevalence</p> <p>C. environmental exposures</p> <p>severity of pesticide exposure</p> <p>E. social factors</p> <p>social/political working environment related to injury</p> <p>drinking, farm and camp life</p> <p>economic characteristics</p> <p>economic returns from physical, mental health investments</p> <p>poverty</p> <p>economic, social conditions</p> <p>affecting quality of life</p>	<p>(7) interview</p> <p>(4) survey</p> <p>(2) focus groups</p> <p>(1) record review</p> <p>(1) PPD</p> <p>(1) pesticide application</p> <p>(1) occupational/medical</p> <p>(1) history</p> <p>(1) cholinesterase levels</p> <p>(1) direct observation</p>	<p>A. farmworkers more willing to participate if researchers are known</p> <p>A. interest and support among growers toward research</p> <p>A. opposition to interviewing farmworkers regarding work injury</p> <p>B. 27% PPD positivity</p> <p>C. depressed cholinesterase levels during field work; might indicate pesticide exposure</p> <p>E. 94% received housing and/or utilities</p> <p>E. average = 3.83. of 13 possible fringe benefits received by migrants</p> <p>E. common benefits: 60% end of season cash bonus, 50% loans and credits; 36% discounted rates on commodities; 30% transportation allowance; 27% worker's comp, 21% health insurance</p> <p>E. drinking related to learned social behaviors and culture</p> <p>E. economy very connected to Florida labor conditions</p> <p>E. legal and social agencies have improved working conditions</p> <p>E. mean income substantially below poverty level.</p> <p>E. mental well-being predictive of earnings</p> <p>E. New Jersey nurseries: contract worker use on the increase, multi-tiered labor force</p> <p>more incentives for workers than other commodities; ineffective on local force</p> <p>E. pressures of reliability of workforce vs. flexibility</p> <p>E. regular/ occasional drinkers: Puerto Ricans 90%, Mexicans 67%</p>
African-American, Northeast published studies: 5	<p>B. communicable disease</p> <p>TB</p> <p>D. overall health</p> <p>subjective well being</p> <p>E. social factors</p> <p>housing conditions</p> <p>medical utilization</p> <p>economic characteristics</p>	<p>(5) interview</p> <p>(1) PPD</p>	<p>B. 46% PPD pos</p> <p>D. subjective well-being score 78.38, general pop 80.34</p> <p>E. housing conditions are substandard in 25% home community and 70% at camps</p> <p>E. delay in Medical care—57% immigrants-lack of time</p> <p>E. 25% of all workers expressed fear of or disbelief in medical profession</p> <p>E. 64% visited doctor when faced with bothersome condition</p> <p>E. 31% have used ER; 38% used a clinic; 27% admitted no knowledge of migrant clinics</p> <p>E. health capital investments increase earning potential</p>

	Research topics	Methods used	Results (selected findings)
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Hispanic, Midwest published studies: 6	C. environmental exposures respiratory disease prevalence D. overall health health promoting behaviors E. social factors extent of health care, financial assistance needs met economic and social conditions affecting quality of life G. chronic disease cancer knowledge, attitudes	(3) survey (2) focus group (2) interview (1) clinical exam	D. health promoting behaviors valued D. several prevalent medical problems E. increasingly, lone male migrants from Mexico fill jobs E. insurance costs have driven employers out of providing transportation E. lack of work and increasing cost of housing in Texas E. low income E. poor preventive medical care utilization E. relatively stable migrant labor force; migrant families dwindling E. social services provided to workers facilitates their continuing in low wage jobs G. poor cancer knowledge
African-American, Southeast published studies: 7	A. injury impact of injury B. communicable disease HIV prevalence, risk factors E. social factors social support	(2) interview (3) survey (1) clinic reports (1) ER reports (1) HIV screen (1) syphilis test	A. (study population 24% US born black) 80% of injuries: broken bones, sprains or cuts; A. 65% seriously injured did not receive prompt care B. 13% HIV positive B. 16% syphilis reactive B. 46% never use a condom E. 80% turn to crew leader for help E. assistance deemed most helpful: 45% financial; 19% health care; 16% someone to talk to privately; 8% transportation E. employers covered medical expenses for 38% (5/13) of injured workers,
Hispanic, Northwest, (Washington-Oregon) published studies: 2	E. social factors mental/psychosocial issues G. chronic disease use of breast, cervical cancer screening	(1) survey (1) observations of community health promoters	E. 97% Mexican born E. problems: (1) child abuse and neglect, (2) domestic violence (3) adolescent emotional difficulties, (4) substance abuse, (5) mental and somatic disorders, (6) stress-related physical disorders G. underutilization of pap smear, mammography and BSE
Caribbean, Northeast published studies: 1	B. communicable disease TB	(1) interview (1) PPD	B. 83% positivity
Native American, New Mexico published studies: 1	A. injury occupational injury deaths	(1) medical examiner data review	A. Study population: 6.6% American Indian. Had highest farm injury death rate followed by whites and Hispanics. Leading causes of death were tractor use, alcohol, farm animal, electrocution
Hispanic, Colorado published studies: 1	A. injury risk of fatal head injury	(1) death certificates review	A. skull fracture / intra-cranial injury relative risk: 2.5

Haitian, Southeast published studies: 1	B. communicable disease TB	(1) PPD testing	B.76% PPD positivity
Haitian, Mid-Atlantic published studies: 1	B. communicable disease TB	(1) interview (1) BCG scar check (1) PPD	B.55% PPD positivity (vs. 37% positive total population)
Hispanic, Southwest (Texas) published studies: 2	D. overall health health patterns E. social factors economic and social conditions affecting quality of life	(1) survey, (2) interview, (2) direct observation, (1) focus group discussions (1) state health record review	D.1/3 adults positive for TB; UTI common problem among females; children: dental caries and head lice E. patriarchal system contributes to problems with access to health care and social services E. reduction in migrant labor needs E. increasingly difficult to have a full itinerary of jobs E. more workers travel alone E. this group being replaced by new immigrants E. workers becoming more reliant on social services

	Research topics	Methods used	Results (selected findings)
Farm owner-operators			
African-American, Southeast published studies: 5	A. injury injury determinants injury risk perceptions previous farm injury prevalence injury types E. social Factors demographic characteristics G. chronic Disease prostate cancer mortality rates	(3) survey (1) Interview (1) focus groups	A. realistic perceptions of farm injury A. both higher and lower injury incidence G. increase prostate cancer mortality
Hispanic, Colorado published studies: 1	A. injury risk of fatal head injury	(1) death certificate review	A.for skull fracture / intra-cranial injury risk: 1.70
Research using a nationwide study population			
Migrant and seasonal farmworkers			

<p>Hispanic migrant farmworkers published studies: 9</p>	<p>C. environmental exposures pesticide-related skin disease D. overall health occupational health status of farm workers overall health status of farmworkers who use migrant health clinics E. social factors economic and social conditions affecting quality of life F. intervention evaluation change in personal empowerment in camp health aides (CHA) evaluation of peer health education model for expectant mothers</p>	<p>(4) interview (3) survey (1) direct observation (1) focus group/structured (1) review of BLS statistics and worker's compensation data (1) review of (NAMCS) data (1) personal observations (1) life histories</p>	<p>C. eight active ingredients or mixtures accounted for 51.5% of the skin disease cases. Exposure to naturally occurring plants like poison oak and ivy do not appear to account for the distribution of pesticide associated skin disease among agricultural workers D. 43.9% of farmworkers visiting the clinics had more than one morbidity D. like to see better housing. 67.4 % rarely or never knew which pesticides were used; 57.3% never or rarely knew of field re-entry signs being posted D. most common diagnosis was diabetes mellitus, followed by health of an infant or child D. of the top twenty diagnosis in migrant health clinics, only eight were represented in the NAMCS D. worst health probs: 11.8% pesticide related probs; 10.9% musculoskeletal probs; 10.8% heart probs E. ability to work without legal status, existence of support networks keep new immigrants coming E. direct relationships between good housing and reliable work force (in the North) , but employers are reluctant to make the investment E. farmworkers try to maximize stability in their lives through informal networks E. many workers stay in farm work for many years, as they are kept marginal in American society. E. oversupply of workers E. there are limits to how many workers an informal network can support result is labor contractors E. trends toward unaccompanied Latino males E. under-employment hastens the flight of more productive workers from farm work F. 24 subjects exhibited increase in personal empowerment</p>
<p>Farm owners and farm workers</p>			
<p>Hispanic published studies: 2</p>	<p>A. injury agricultural fatalities</p>	<p>NTOF fatalities in Ag industry, excluding fishing sectors and forestry NTOF and CFOI data</p>	<p>A. workers other than black or white had the lowest fatality rate A. young Hispanic workers had an elevated fatality rate. Farm tractor leading cause for both female and male. Although CFOI and NTOF systems showed different values, they did reveal the same trends.</p>
<p>African-American published studies: 2</p>	<p>A. injury agricultural fatalities</p>	<p>NTOF fatalities in Ag industry, excluding fishing sectors and forestry NTOF and CFOI data</p>	<p>A. blacks had the highest fatality A. black workers, especially black farmers identified as having high fatality risks by race. Farm tractor leading cause for both female and male. Although the two systems showed different values, they did reveal the same trends</p>

Table II. Selected Unpublished Agricultural Health & Safety Research and Promotion Activities by Region	
Activity Title	Objective
Kentucky, the Carolinas, and the Southeast	
The Migrant Network Coalition in Kentucky	a.) heighten awareness about services available to migrant farm workers, avoid duplication of services, determine what additional services are needed, and provide assistance in identifying funding sources for new services
South Carolina Replication of a Community Partnership for Agricultural Safety and Health in a Minority Population	a.) implement a community-based agricultural health and safety program in a minority population, using the model developed by the Kentucky Partnership for Farm Family Safety and Health; b.) Empower a historically black college, South Carolina State University, to increase emphasis on agricultural health and safety
The Medical Spanish for Health Professionals Project	provide physicians with a working knowledge of health-related Spanish vocabulary
The Kentucky Farmworker Health Program	provide outpatient medical care from a primary care physician, basic dental care, and assist with transportation to and from the doctor or pharmacy. Other services include Spanish translation services, health education, and preventive health care services
Kentucky Partnerships to Empower Farm Women to Reduce Hazards to Family Health and Safety	prevent agricultural illnesses, injuries, and fatalities and to promote health and safety in the rural population by mobilizing farm families and their communities through education and raising awareness
Latino Farmworker Musculoskeletal Discomfort and Relief Seeking Behavior	examine work-related musculoskeletal discomfort and how it relates to relief seeking behavior among Latino farm workers employed in North Carolina field crop production
Student Incentive Awards Migrant/Transit Project: Toward More Accessible Health Care	use field research and GIS analysis to integrate rural health and rural transportation literatures by examining the Kentucky Migrant Health Program
Wisconsin and the Midwest	
Development of a Model to Assess and Communicate Farmworker Occupational Health Risks	describe potential occupational health risks involved with tasks by type of production. Work is also being done on gathering demographic information on migrant farmworkers, geographic location, crops, and tasks performed in this region.
Migrant Farmworker Youth Activities	generate specific recommendations for research, education, and programs addressing the occupational health and safety needs of migrant or seasonal farmworker adolescents (12 - 17 years) who are engaged in activities related to agriculture
Colorado and High Plains	

Collaborative Projects	facilitate Spanish Translation of North Dakota's health and safety curriculum ("Always be Careful") targeting youth, into Spanish
Evaluation of Dust and Endotoxin in the Total Dust and Thoracic Mass Obtained from Corn Storage and Processing Facilities in Colorado	look at thoracic particulate mass in corn dust and total thoracic particulate mass in corn dust
Health and Safety Consultation	identify hazards in feed mills
Health and Safety Training	deliver health and safety training presentations based on client requests, according to the Worker Protection Standard
Migrant Farm Worker Safety and Health	work with Americorps students and Ag Sciences about co-sponsoring Environmental Protection Agency Worker Protection Standard training
1998 Migrant Worker Health Evaluations	a.) assist workers in obtaining EPA certification under the Worker Protection Standard; b.) conduct training with the Migrant Head Start Program; c.) visit migrant residence camps to identify hazards; d.) obtain potable water samples to evaluate the safety of the drinking water source
TB among migrant farmworkers in Northeastern Colorado	a.) work in collaboration with the Salud Migrant Health Clinic to determine the prevalence of positive TB tests among the migrant farm workers in northeastern Colorado; b.) provide counseling and appropriate follow-up treatment for participants who test positive
Washington, Oregon, and the Northwest	
A Hazard Evaluation in the Apple Warehouse Industry	a.) identify health and safety and ergonomic hazards in the Washington apple warehouse industry. Expected exposures of interest include: noise, carbon monoxide, risk factors for musculoskeletal disorders, pesticides and temperature (cold); b.) document self-reported health effects occurring among packing house workers; c.) identify existing controls for reducing worker injury and illness to the industry
Cholinesterase Monitoring of Pesticide Applicators in Washington State	a.) evaluate the accuracy of cholinesterase determinations performed on the EQM Testmate Kit under field conditions as compared to a reference laboratory; b.) to examine whether a field-based kit provides advantages in promptness of worker removal
Identification of Injury Problem Areas	a.) employ various regional data sources to identify agricultural-related injury problem areas; b.) estimate the 1 yr cumulative incidence of work-related injury in 1999 among adult Hispanic farm workers; c.) determine the distribution of work-related injuries among adult Hispanic farmworkers by injury type, cause of injury and other injury characteristics; d.) determine the potential risks factors for injuries among Hispanic farm workers
Occupational Skin Disorders in Northwest Farming, Fishing, and Forestry	develop interventions to control the major causes of farming workplace dermatitis
Perception of Risk among Female Workers in the Fruit Packing Industry: A Biocultural Approach	investigate workers' perception of health and safety hazards, as well as socioeconomic and demographic constraints in work opportunities

Prevention of Agricultural Injuries that result from Ladder Falls	collaborate with WA Dept of Labor and Industries to evaluate its eye and ladder accident prevention program
Injuries and Awareness of Worker Compensation Options among Farm Workers in the Yakima Valley, WA	study injury experience and awareness of worker compensation options among Hispanic farm workers in Yakima Valley, WA
Neurological Effects of Organophosphorus Insecticides in Farmworkers	determine whether farm workers exhibit neurological changes following one season of exposure to low levels of organophosphorus insecticides, and whether these changes are persistent
Florida and the Deep South	
Development of an Agricultural Injury Surveillance System	develop an agricultural injury surveillance system to detect the incidence of agricultural injuries and related deaths among farm workers and their families
Heat Stress Management Among Migrant and Seasonal Farmworkers	a.) characterize heat stress exposures among migrant and seasonal farm workers; b.) characterize the workplace and cultural constraints in managing farm worker heat stress exposures; c.) develop a prototype heat stress management approach.
Translation of Materials and Programs That Are Used in Education and Intervention Into Spanish	translate safety materials into Spanish, and provide on-site training in Spanish.
Project Safe: A Farm Safety Program for Florida Minority Farmers	Phase I: a community-based assessment of the occupational injury prevention knowledge and behavior of African-American farm women. Phase II: develop culturally sensitive intervention strategies to increase minority farmers' knowledge of occupational risks and injury prevention
Health Effects of Pesticides on Farm Workers in Southern Dade County	determine whether minorities, by race, are more susceptible to pesticide health effects than non-minorities (white, non-Hispanic) and to evaluate methods for the reduction in the use of pesticides in South Florida. The GIS (Geographic Information System) is used to analyze relationships
Texas, Arkansas, New Mexico, and the Southwest	
Addressing Agricultural Safety Needs in the Arkansas Delta	identify the cause and severity of injuries and fatalities and existing hazards for agricultural workers in this seven county region
Agricultural Injuries Among Navajo Farm Families	develop culturally sensitive, locally determined model interventions to reduce fatalities and injuries among Navajo farm families
Analysis of Regional NAWS Data	analyze the health and work history for the states of Texas, Arkansas, Louisiana, New Mexico, and Oklahoma and to produce a profile with recommendations for further investigation
Migrant Farmworker Health and Safety Needs	publication of results of farmworker perception of safety and health risks survey. Expanded distribution of Farmworker News, a bilingual newspaper devoted to occupational health and safety issues. Development of research track at the Midwest Migrant Stream forum to facilitate communication, research strategies and collaboration among and between research academicians, migrant farmworker advocates, and health care providers

Health and Injury Surveillance Project	determine the risks and issues that face African-American farmers (owners and laborers) in the Arkansas Delta region that may be addressed with interventions
Promoting Farmworker Health and Safety Research	1) provide farm workers with injury prevention information in a culturally appropriate format and language;2) enhance awareness and resources to improve the quality of research related to occupational health and safety for farm workers
	identification of Migrant and Seasonal farmworkers in a four county region in the West Texas Panhandle
California, Arizona, and the West	
Agricultural Surveillance	establish and maintain a statewide agricultural respiratory disease surveillance system, in order to: a.) identify selected cases for potential investigation and development of prevention recommendations; b.) develop and implement broad-based interventions to address the principle causes of agricultural respiratory diseases; c.) disseminate findings
Bridging the Language, Cultural, and Educational Barriers that Impede the Delivery of Health and Safety Information and Training to Agricultural Workers	investigate, develop, and evaluate effective ways to bridge language, cultural, and educational barriers that impede the delivery of safety training and hazard awareness information to agricultural workers and their employers
Assessment of Agricultural Injuries and Illnesses in the Gila River Indian Community	a.) investigate injuries and illnesses on GRIC farms; b.) describe trends, year of occurrence, age of affected individual, gender, ethnicity, level of worker protection training, job classification and the injury or illness; c.) develop a planning and evaluation commission to study the data, including trends, frequency and types of injuries and illnesses, identify available resources, rank and prioritize the hazards and develop a strategic plan to address these concerns;d.) disseminate information concerning farming hazards on the GRIC
Estimating the True Incidence of Pesticide Illness in California	assemble and integrate information from multiple sources about the frequency and circumstances of health effects related to pesticide exposure. In addition to descriptive information, data abstracted from these sources will be linked and used to develop a log-linear model capable of estimating the numbers of cases that escape detection
Measuring Occupational Injuries and Illness Among California's Hired Farm Workers	conduct a comparative assessment of three independent recent unpublished data sets: (NAWS) interviews (1998-2000), CIRS (CAWHS)(1999-2000), and (WCIRB) summary reports (1995-1997), to examine trends in occupational injuries and illnesses among California's hired farm workers
Extending Pesticide Use Best Practices Information to Ethnic Minority, Limited Resource Specialty Crop Growers	extend culturally appropriate pesticide management and safety information to targeted cultural minority, small scale, specialty crop producers
Behavior Related to Organophosphate Exposure in Children of Migrant Farmworkers	determine the risk of adverse neurologic or neurobehavioral effects of parental agricultural organophosphate exposure comparing children of farmworkers and non farmworkers

Pulmonary Fibrosis and Mineral Content of Lung Tissues from Deceased California Farmworkers	examine the relationship between mineral dust exposure in the farming industry and histopathological changes occurring in the lungs of the California farmworker. The study is also designed to show the importance of airway branching patterns in the deposition, retention, and histopathology associated with mineral dusts in the lung
Detoxifying Pesticide Protective Clothing for Farmworkers	develop a technology that can convert regular clothing into nontoxic, comfortable clothing that will detoxify common pesticides; and to explore detoxification mechanisms of halamine structures on fabric surfaces
Monitoring Fieldworker Infections by Sampling at Their Residence: The 1997 federal Food Safety Initiative.	monitor infections rather than illness. If the risks found are perceived as significant, investigators plan to look further at the manure itself in a later study, with a view to quantifying the risk as a function of the way in which manure has been handled and applied
Study of Pregnancy Outcome	Investigate adverse reproductive outcomes and their association with agricultural work as well as with other risk factors
New York and Pennsylvania	
Study of Ergonomic Strain Among Apple Migrant Farmworkers	analyze the ergonomic factors that contribute to upper body strain among apple harvest workers in New York and Pennsylvania apple orchards
Study of Occupational Injury and Illness in Migrant Farmworkers	a.) identify types and frequency of occupational injuries and illnesses experienced by migrant and seasonal farm workers in New York and Pennsylvania who use federally funded migrant health centers. b.) evaluate the relative importance of different injury illness risks experienced by this population, and target prevention efforts accordingly
Safety Training for Apple Orchard Workers	develop orchard safety curriculum and train orchard owners and managers in establishing on the job orchard worker safety program. Will be expanded to other commodities in the near future
Enumerating Migrant and Seasonal Farmworkers in the Northeast	estimate workers and worker hours at risk for injury as part of the multi-state migrant and seasonal farmworker study

Table III. Key Feature of Research in Minority Agricultural Health And Safety
<p>A. Group definition Race/ethnicity and language Definition of work (identify tasks) Geographic location Other unique features of the combination of race/ethnicity, task, geographic location</p>
<p>B. Occupational health definition (gold standard) Identification of “given” or unchangeable features Characteristics of health</p>
<p>C. Occupational health measures Clinical indicators Self-reported indicators Group level indicators</p>

D. Identification of possible causal factors

Physical work environment
Social work environment
Political context
Cultural factors
Comparison with white or other minority groups doing the same jobs

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