Health and Safety Hazards in Northwest Agriculture: Setting an Occupational Research Agenda

Richard A. Fenske, PhD, MPH,* Adrienne Hidy, MA, Sharon L. Morris, BA, Marcy J. Harrington, BS, and Matthew C. Keifer, MD, MPH

Background *Agriculture is among the most hazardous occupations in the United States. Research can provide new insights about disease and injury and serve as the foundation for occupational health and safety policies. The determination of research priorities can be problematic. Public participation approaches offer opportunities to identify and integrate various perspectives.*

Methods *The agenda process was modeled on the NIOSH National Occupational Research Agenda. Center staff contacted representatives of producer groups, labor, health care, academia, and public agencies to participate in telephone interviews and a daylong workshop.*

Results *Twelve research priorities were identified: musculoskeletal disorders; respiratory disease; skin disease; traumatic injuries; chemical exposures; special populations at risk; social and economic foundations of workplace safety; risk communication barriers; diagnostic approaches; hazard control technology; intervention effectiveness; and surveillance research methods.*

Conclusions *The agenda process engaged stakeholders in priority setting. The resulting document is a useful guide for occupational safety and health in agriculture.* Am. J. Ind. Med. Suppl. 2:62–67, 2002. *© 2002 Wiley-Liss, Inc.*

KEY WORDS: health and safety hazards; Northwest agriculture; occupational research agenda

INTRODUCTION

The Northwest, specifically Idaho, Oregon, and Washington, is one of the most productive and diverse agricultural regions in the United States. The region's farmers, farm workers, and their families contribute significantly to the local and national economies. Yet planting, management, and harvesting of crops place these groups at risk for a variety of health and safety hazards. Washington state workers' compensation claims data indicate that agricultural workers are at greater risk of fatal and nonfatal injury, systemic poisoning, and dermatitis than are nonagricultural workers [WADES, 1991]. In Idaho and Oregon, job-related fatalities occur in farming at higher rates than most other occupations [ID, 1999; ORDCBS, 1999].

Scientific research can provide new insights into the etiology of disease and injury, and can serve as the foundation for innovative occupational health and safety policies. However, the determination of research priorities can be problematic. An analysis of health and safety hazards in farming at the federal, state, and local levels is

Department of Environmental Health, Pacific Northwest Agricultural Safety and Health Center, School of Public Health and Community Medicine, University of Washington, Seattle, Washington

Contract grant sponsor: National Institute for Occupational Safety and Health; Contract grant number: U07/CCU012926-03; Contract grant sponsor: Washington State Medical Aid and Accident Funds (administered through the UW Department of Environmental Health).

*Correspondence to: Richard A. Fenske, Department of Environmental Health, Box 357234, University of Washington, Seattle, WA 98195. E-mail: rfenske@u.washington.edu

Accepted 3 March 2002
DOI 10.1002/ajim.10081. Published online in Wiley InterScience (www.interscience.wiley.com)

complicated by the diversity of tasks, worker populations, and geographical aspects inherent to each region. In the Northwest, for example, wheat growing is highly mechanized, while cultivation and harvesting of such crops as tree fruit, berries, hops, grapes, and forest products are labor intensive, requiring migrant and seasonal workers [Wahlers, 1998]. The picture becomes even more complex when children participate in work activities, as they often do in farming [Heyer et al., 1992; Matter, 1998].

Public participation approaches offer an opportunity to identify interested parties, often referred to as ''stakeholders,'' and to integrate their perspectives into the priority setting process [Greene, 1988; Lawrence, 1989; Pearsons, 1990; Cousins and Earl, 1992]. Such an approach has been formalized at the federal level through the Federal Advisory Committee Act, and has been used to assist such agencies as the Department of Energy in its decision making [NRC, 1994; Boiko et al., 1996].

One recent example of a stakeholder process is the National Occupational Research Agenda (NORA) process developed by the National Institute for Occupational Safety and Health [NIOSH, 1996; Rosenstock et al., 1998]. The NORA process involved broad stakeholder input, and has led to significant new research funding in the identified priority areas. Emphasis was placed on the seriousness of the hazards faced by workers, and the probability that research could make a difference in reducing occupational injury and illness. The priority setting process described in this paper is modeled on NIOSH's National Occupational Research Agenda efforts.

METHODS

The agenda process initiated by Pacific Northwest Agricultural Safety and Health Center (PNASH) was designed to elicit the perspectives of producers, labor representatives, health care professionals, academicians, and public agency officials. Each of these groups had a stake in health and safety research, and was able to contribute to the broad discussion of priorities for Northwest farming. We hoped to find common ground among these groups in the identification of significant hazards for which new research could make a difference at a regional level.

The Center staff drew on its existing database to contact individuals within these groups, and then used a snowball technique to identify additional participants for a structured interview. Initial plans included the use of focus groups across the region, but this approach could not be supported with available resources. Individuals in the database were sent a descriptive cover letter, a response form to indicate their interest in participating in a telephone interview, a fact sheet about the Center, and a self-addressed stamped envelope. The response form also requested names and contact information for other key people and organizations that could play a role in this process.

A telephone script with eight questions was developed and PNASH staff members were assigned one or two constituent groups to interview. The questionnaire asked the respondents 1) what they thought were the most important health and safety hazards faced by those who work in the region's agricultural industry, 2) which of those hazards were the most serious in terms of number of people exposed and seriousness of risk, 3) what research would be useful to reduce those risks, 4) what kinds of training and other interventions would be useful to reduce the risks, and 5) what resources they found useful for agricultural health and safety information. The respondents were also asked to recommend others to interview by telephone and suggestions of representatives for a priority setting workshop (Farm Summit). Lastly, the respondents were asked to provide any other comments or suggestions regarding priorities for agricultural health and safety research for the region.

Between October 1997 and December 1997, Center staff mailed 240 introductory letters and received a total of 151 responses. Thirty-six respondents declined to be interviewed. The majority of those who refused either passed the information to a more appropriate individual, or were no longer with the organization. The accumulation of names and organizations was reviewed on a regular basis. In an effort to obtain adequate representation from all constituent groups, Center staff called nonrespondents and targeted the groups with the lowest representation, such as health care and labor. Nearly all individuals who indicated a willingness to participate were interviewed by Center staff. Those who were receptive but not interviewed either were no longer with the organization, or could not be reached by the Center deadline for telephone interview completion. A total of 116 interviews were completed between November 1997 and February 1998.

In preparation for the Farm Summit workshop, Center staff reviewed the names of people who had been recommended to attend the Summit during the interview process. Some additional names were suggested by Center staff. The primary criterion for invitation to the Farm Summit was adequate representation for each of the key constituent groups. Six individuals were selected from each constituent group. Those categories that had less than six representatives, such as health care and owner operators, were identified for more intensive Center staff contact. Thirty-eight persons were invited to the Farm Summit, and 30 attended—8 academicians, 9 public agency officials, 2 labor representatives, 4 producers, 3 child health and safety advocates (who were also farm owners), 1 health care professional, and 3 private consultants. Twenty-one of the attendees had completed the telephone interview.

In addition to helping establish the attendee roster, the telephone interviews influenced the content and structure of

the Farm Summit. Prior to the workshop, responses to each question were tallied and grouped by themes and constituents. This information was provided to attendees in advance of the workshop, together with a description of the Center, executive reports from Washington and Oregon state pesticide reporting organizations, the NIOSH NORA document, and a description of NIOSH agricultural-related research projects.

Guided by professional facilitators, the morning session consisted of small groups defined by constituencies (producer, labor, health care, public agency, and academic institution). These groups generated a list of the priority safety and health problems in the region's farming. All attendees reconvened to report the most significant problems selected by their group. As groups presented their topics, facilitators displayed the flip chart paper for group viewing and modified the growing list to eliminate duplication or to combine similar topics. In all, 21 topics were identified through this process, and were displayed to workshop members by the facilitators. Everyone was then given the opportunity to vote for particular topics. Each participant was provided with five colored stickers and asked to place a sticker next to the most significant agricultural safety and health priorities. The nine safety and health problems that received the most support were selected for further discussion. In the afternoon session, constituency-mixed groups met to propose solutions and research opportunities for each of the nine priority topics. Results were then shared with all participants for final discussion, and comments recorded on flip charts.

RESULTS

After a review of the information gathered from the telephone interviews and Farm Summit, Center staff returned to the NIOSH NORA document as a tool to help organize the results. The main NIOSH NORA categories, Disease and Injury, Work Environment and Workforce, and Research Tools and Approaches, were retained and subcategories selected and modified to reflect the concerns unique to northwest agriculture as determined by participants (Table I).

TABLE I. Priority Research Areas for the Occupational Research Agenda for Northwest Farming

Category	Priority research areas
Disease and injury	Musculoskeletal disorders
	Respiratory disease
	Skin disease
	Traumatic injuries
Work environment and workforce	Chemical exposures
	Special populations at risk
	Social and economic foundations of workplace safety
	Risk communication barriers
Research tools and approaches	Diagnostic approaches
	Hazard control technology
	Intervention effectiveness
	Surveillance research methods

Areas are organized according to categories defined in the NIOSH National Occupational Research Agenda.

Musculoskeletal Disorders

Work-related musculoskeletal disorders of the upper extremities and the low back are common and costly [Andersson et al., 1995; Silverstein and Kalat, 1998]. The causes for such disorders are complex. The prevalence of back injuries among agricultural workers appears high in the region [ORDCBS, 1998; Roggenburg, 1999]. Tasks that may contribute to these disorders include heavy lifting, carrying, forward bending, kneeling, and excessively fast-paced work. New research efforts are needed to characterize exposure, understand basic pathophysiologic mechanisms, and assure that these work-related disorders are successfully prevented and treated.

Respiratory Disease

Asthma deaths increased from 1980 to 1989 in Washington state [Roberts et al., 1996], and asthma is also considered a significant problem in Oregon [Ertle and London, 1998]. Asthma and bronchitis have been carefully studied in only a few agricultural occupations, such as animal confinement workers. Grain farmers have been found to be at increased risk for broncho-spastic disease. Some pesticides have been linked to asthma, as have molds and airborne organic dusts from plant decomposition and microbial sources. Participants expressed specific concern for pulmonary problems, work-related asthma, and allergies, and suggested that exposure to silica, dust, diesel exhaust, and particulates and chemicals resulting from field burning were important causes of respiratory disease in the region.

Skin Disease

Agriculture has the highest rate of occupational dermatitis among the major industrial sectors. The highest rate of skin disorders seen within Washington state agriculture is in the fruit and tree nut industry with a rate of 2.7 claims per 1,000 FTE years. The majority of workers filing claims had the occupational title of Farm Worker [Sama et al., 1998]. Participants identified skin disease, specifically dermatitis, as a significant health and safety hazard in the region's

farming industry. Causes of skin disease include exposure to the sun and poison oak.

Traumatic Injuries

Traumatic injuries in the region's farming industry were the most frequently identified hazards in telephone interviews, and were a top priority issue for each constituency group at the Farm Summit. A major cause of death within agriculture is machine-related incidents; nonfatal injuries are also common, and can result in lost work time and expensive medical treatment. In both Washington and Oregon workers in farming filed a substantial portion of total workers' compensation claims related to traumatic injuries [ORDCBS, 1998; Wahlers, 1998]. Between 1979 and 1997, in Idaho, the most frequent cause for fatalities among agricultural workers was due to machinery. Tractors (47%), general machinery (12%), and trucks (10%) were the primary contributors. Tractors were also a leading cause of fatal incidents among children under 18. Additional fatalities were associated with livestock, primarily horses, and irrigation [Karsky, 1999].

Chemical Exposures

Agricultural chemical exposure is common on most farms in the Northwest, affecting producers and farm workers alike. Most concerns have focused on pesticides, but exposure to fertilizers and air contaminants, such as carbon monoxide and diesel exhaust, may carry health risks as well. Chemical exposure among children living on or near farms is also a public health concern. Periodic illness outbreaks, such as the acute poisoning of pesticide applicators by phosdrin, incidents related to pesticide drift, and carbon monoxide poisoning inside packing houses, maintain the public's attention on farming as a hazardous industry. Research is needed to better characterize exposure pathways, estimate acute and chronic health risks, understand the effects of mixed chemical exposures, and design effective interventions to reduce potentially harmful exposures. Improved worker training and risk communication are also needed.

Special Populations at Risk

Many types of people participate in Northwest farming. Occupational hazards are distributed differentially across populations, and some of these are underserved, such as migrant and seasonal workers, and children of agricultural families. Loss of employment, and lack of access to health care are risk factors of special importance for the farm worker population. Minors under the age of 15 employed on farms in Washington state were overrepresented in the number of claims filed by all minors [Heyer et al., 1992]. In Oregon, between 1986 and 1995, agriculture ranked third, following the retail and the service industries, in accepted disabling claims for workers aged 17 and under [Matter, 1998]. Current surveillance mechanisms for certain injuries are inadequate, as children working on family farms and as short-term laborers may not be covered under workers' compensation. Research is needed to define the nature and magnitude of risks for well-defined subgroups within the worker population, and to develop appropriate intervention and communication strategies.

Social and Economic Foundations of Workplace Health and Safety

Health protection in the workplace normally assumes the provision of basic public health services, such as sound nutrition, clean water, adequate and safe housing, and access to health care. For many farm workers, however, the existence of these basic services cannot be taken for granted. Workplace health and safety issues in farming are inextricably linked to broader social and economic factors. Lack of sanitary facilities, poor prenatal care, lack of day-care facilities, and alcohol and drug use can all adversely affect health. Among farm operators, economic uncertainty and long working hours can produce stress. Stress[Q1] has long been considered a ''fact of life'' in farming communities, but has more recently been recognized as an important risk factor for injuries and chronic diseases. New research has helped define the various components of farm stress, allowing the design of interventions. Further efforts in this area are likely to improve the quality of life for farmers and reduce the risks of injury and illness.

Risk Communication Barriers

Many occupational and environmental health problems are characterized by substantial scientific uncertainty. Under these circumstances, effective risk communication is particularly difficult. Some of the barriers to risk communication in Northwest farming include a lack of interest in health and safety issues among farmers and workers, and tension between producers and employees. Public and private interest groups, government agencies, health-care providers, and the media are all sources of health risk information, but messages are often fragmented or conflicting. Effective risk communication is an important part of risk management, and without it even the most detailed and exhaustive risk assessments have little impact on public policy. Linguistic, cultural, and educational differences present special challenges to effective risk communication in the region.

Hazard Control Technology

A variety of engineering, administrative, and worker protection techniques can be used to manage health and

safety hazards. These may include redesign of equipment, training modifications, or new types of personal protective equipment. Important concerns in Northwest farming include tractor rollover protection, mitigation of pesticide drift and applicator exposure, chemical product substitution, and improved techniques for livestock management. Some participants felt that emphasis on wage-based labor rather than piecework could prevent many serious injuries. Opportunities for research include bioengineering, machinery design and proper maintenance, livestock management, and proper use of personal protective equipment.

Diagnostic Approaches

Proper diagnosis of work-related illness and injury in agriculture can be difficult for the clinician. Many patients present nonspecific symptoms, and disease may be the result of preexisting conditions as well as recent exposure. Workers who have arrived recently in the Northwest may not have medical records for the clinician to review. Also, it is not always possible for a diagnosis to be informed by a detailed understanding of work processes and workplace conditions. All of these factors make accurate diagnosis extremely challenging. Participants recommended further advancement in methods to identify agricultural-related occupational illnesses. Health care providers also need to be better informed and motivated to learn diagnostic methods specific to agricultural work. Specific areas for improved diagnostic approaches were identified as heat stress, pesticide exposure, and dermatitis.

Intervention Effectiveness

Changes are often introduced into agricultural production with the intent of preventing or reducing illness and injury, but the effectiveness of these changes is not normally monitored. Evaluation of interventions is a relatively new area of research in occupational health and safety. Such investigations can be expensive, and may seem unnecessary, particularly in cases where the intervention is relatively straightforward. In other cases, however, there may be several intervention options, and their relative impact is an open question. Participants frequently questioned the effectiveness of enforcement agencies, and suggested improvements in communication and technical assistance. They also recommended assessing the effectiveness of agricultural equipment, prescribed procedures, and recommended changes in worker behavior.

Surveillance Research Methods

Public health surveillance is central to the process of disease prevention. Modern disease prevention and health promotion programs are based on meaningful data systems. Surveillance systems in farming need to be updated and expanded, and new methodologies for data collection and evaluation need to be developed. Repeated surveys using common definitions of illness or injury can lead to an understanding of trends in communities or worker groups. Data from such a surveillance system can be used to identify unusual patterns of disease, or can serve to evaluate the effectiveness of interventions. Few surveillance systems exist for illness and injury related to agricultural production. New methods are needed to address the unique characteristics of rural populations and agricultural workers.

DISCUSSION

This project encountered a number of challenges that limited results and conclusions. A primary limitation was the incomplete identification and recruitment of constituent representation from throughout Washington, Oregon, and Idaho. Center staff made multiple efforts to contact hard-to-reach groups, such as health care workers, agricultural owners and operators, and labor, but their representation in the telephone interviews and Farm Summit was nonetheless inadequate. Reasons for the limited participation may have been lack of familiarity with the Center, limited resources restricting more in-depth one-on-one contacts, and the busy schedules of these groups throughout the year.

The challenges associated with quantifying data gathered in the telephone interviews and the Farm Summit was another limitation to this study. The telephone interviews consisted of open-ended questions that were reviewed and tallied. The Farm Summit workshop results were the product of an informal voting process, and participants had an opportunity to review the results of the telephone interviews prior to the meeting. In addition, most of the workshop participants had also participated in the telephone interview. Thus, their views may have been emphasized more strongly than those who participated in only one aspect of the priority setting process. Finally, the agenda process did not ultimately produce a true prioritization of individual health and safety research topics. We were not able to assign a numerical rank to the twelve research priorities, but consider all topics would benefit by new research.

CONCLUSIONS

The Occupational Research Agenda for Northwest Farming has been a successful process for gathering and categorizing the health and safety concerns of a broad regional constituency. It will direct research and education activities of the PNASH, and should prove valuable for other investigators in the region. This process was applied recently to Northwest forestry safety, and has provided a useful direction for activities in this industry as well.

ACKNOWLEDGMENTS

Special thanks to all those who participated in telephone interviews and the workshop, and to Amy Hagopian, Peter House, and Norm Herdrich for their contributions to this effort.

REFERENCES

Andersson GBJ, Fine LJ, Silverstein BA. 1995. Musculoskeletal disorders. In: Levy B, Wegman D, editors. Occupational health. Boston: Little: Brown and Co., p 455–489.

Boiko PE, Morrill RL, Flynn J, Faustman EM, van Belle G, Omenn GS. 1996. Who holds the stakes? A case study of stakeholder identification at two nuclear weapons production sites. Risk Anal 16: 237–249.

Cousins JB, Earl LM. 1992. The case for participatory evaluation. Educ Eval Pol Anal 14:397–418.

Ertle AR, London MR. 1998. Insights into asthma prevalence in Oregon. J Asthma 35:281–289.

Greene JG. 1988. Stakeholder participation and utilization in program evaluation. Eval Rev 12:91–96.

Heyer N, Franklin G, Rivara FP, Parker P, Haug JA. 1992. Occupational injuries among minors doing farm work in Washington State: 1986–1989. Am J Public Health 82:557–560.

ID. 1999. Idaho census of fatal occupational injuries: 1997 http:www.state.id.us/iic/supplement.pdf [Cited 28 June 1999].

Karsky T. 1999. Agricultural Safety and Health Statistics. http://www.uidaho.edu/bae/agsafety/stats.htm [Cited, 29 June 1999].

Lawrence JE. 1989. Engaging recipients in development evaluation: the ''stakeholder approach.'' Educ Rev 13:243–256.

Matter A. 1998. Oregon industrial report on 1986–1995 compensable claims and fatalities for workers aged 17 and under. Salem, OR: Oregon Department of Consumer and Business Services.

NIOSH. 1996. National occupational research agenda. Washington, DC: National Institute for Occupational Safety and Health.

NRC. 1994. Building consensus through risk assessment and management of the USDOE environmental remediation program. Washington DC: National Academy Press.

ORDCBS. 1998. Oregon workers' compensation claim characteristics, calendar year 1996. Salem, OR: Oregon Department of Consumer and Business Services.

ORDCBS. 1999. Census of fatal and occupational injuries, Oregon, 1997. Salem, OR: Oregon Department of Consumer and Business Services.

Pearsons GA. 1990. Defining the public interest: citizen participation in metropolitan and state policy making. National Civic Review: Making Citizen Democracy Work 79:105–117.

Roberts C, Mayer JD, Henderson WR. 1996. Asthma deaths in Washington State 1980–1989: geographic and demographic distributions. Ann Allergy Asthma Immunol 76:20–26.

Roggenburg L. 1999. Characteristics of work injuries and illnesses for 1997: agriculture, forestry and fishing. Salem, OR: Oregon State Department of Consumer and Business Services.

Rosenstock L, Olenec C, Wagner G. 1998. The National Occupational Research Agenda: a model of broad stakeholder input into priority setting. Am J Public Health 88:353–356.

Sama S, Bushley A, Cohen M, Cotey M, Park B, Kaufman J. 1998. Work-related skin disorders in Washington State, 1993–1997. Olympia, WA: Washington State Department of Labor and Industries.

Silverstein B, Kalat J. 1998. Work-related disorders of the back and upper extremity in Washington State, 1989–1996. Technical Report 40-1-1997. Olympia, WA: Department of Labor and Industries.

WADES. 1991. Agriculture, forestry, and fishing employment in Washington State. Olympia, WA: Washington State Department of Employment Security.

Wahlers R. 1998. Agricultural workforce in Washington state 1997. Olympia, WA: Washington State Employment Security.