



PACIFIC NORTHWEST AGRICULTURAL SAFETY AND HEALTH CENTER

Promoting Safe and Sustainable Agricultural Workplaces and Communities

Serving Region X (Alaska, Idaho, Oregon, Washington), Located at the University of Washington

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The regional Ag Centers are:

“an invaluable component of the AFF Program.... The regional nature of the centers allows research to be focused, targeted and relevant to worker populations.”

National Academy of Sciences



“We need to know how the different work habits will affect musculoskeletal risks. They're [PNASH] working with us in trying to get ahead of the curve. We'd like to get the right design now rather than years down the road.”

- Washington state orchardist

The PNASH Center conducts research and promotes best health and safety practices for Northwest producers and workers in farming, fishing and forestry. Our goal is to prevent or reduce injury and illness for producers, workers, and their families. We support productivity, jobs, and sustainable rural communities.

One of ten regional NIOSH Centers for Research and Prevention, PNASH is housed at the UW School of Public Health and works in a consortium of multiple disciplines, institutions and community partners throughout the Northwest. Our faculty, staff, and students bring expertise in medicine, nursing, industrial hygiene, epidemiology, engineering, and education. In our last five years, 23 graduate students received their degrees or practicums in conjunction with PNASH projects.

WHY FOCUS ON FARMING, FISHING, AND FORESTRY?

The burden of agricultural occupational injuries in the United States has been estimated to exceed \$4 billion in direct and indirect costs.

The agricultural industries consistently rank among the most dangerous jobs with fatality rates 7-8 times that of the all-industry average. U.S. commercial fishing fatality rates exceed national averages for all occupations by 60 times. Logging fatality rates exceed the national average by 20 times.

Farming is a unique workplace in that families live on site. Every year 100 children are killed on the farm. There have been great safety improvements in reducing children's injuries from 29,277 in 2001 to 15,876 in 2009. These successes show the real value of our prevention programs and the need to extend our reach.

A challenge for agriculture and our region is its dynamic workforce, and for some sectors such as logging, a high turnover in employees. Compared to other industries ag workers are to a greater extent male, younger (14-21), older (65+) and Hispanic. These demographics drive safety information needs.

In the Northwest:

- In 2010 alone, 42 people in our region lost their lives while working in agriculture: 5 in Alaska, 9 in Idaho, 7 in Oregon, and 21 in Washington.
- 2008 farm injuries cost Washington (WA) state more than \$18 million.
- Also in WA, ag is ranked third in both highest time loss from work and in injury costs - \$.53 per day per FTE worker.
- In Oregon, ag is ranked fourth for average claims costs. The average costs per claims are: \$56,650 farming, \$34,375 on-shore fishing, and \$60,795 forestry.

In addition to injuries and fatalities, farm, forest and fishing workers are also at high risk for illnesses such as lung diseases, hearing loss, skin diseases and certain cancers associated with chemical use and prolonged sun exposure.

PNASH CURRENT WORK & FUTURE DIRECTIONS

New labor and injury-saving production technologies. PNASH and our partners are working on new safety devices and initiatives to automate tasks. Traumatic and musculoskeletal injuries reduce productivity and are costly to business and families.

Workforce development and safety education. We respond to changing demographics of workers, addressing the needs of new workforces (e.g., Hmong refugee farmers).



Reducing Pesticide Handler Exposures

A Model Research and Practice Initiative in Washington State

THE CHALLENGE

Farmers and farmworkers alike voice concerns about exposure to OP pesticides, and for good reason. The consequences can be severe. A relatively minor difference in dose can produce symptoms as mild as a headache or become life-threatening. Plus, evidence suggests that some pesticides, such as OPs, may have long-term health effects on adults and children. Research has linked pesticide exposure to increased risk for male infertility, Parkinson's disease, certain types of cancers. A mother's exposure can result in birth defects, lower birth rates and birth weights, and miscarriages.

In particular, pesticide handlers have the greatest potential for exposure because their work brings them in close contact with pesticides.

In 1992, the US Environmental Protection Agency (EPA) estimated that 10,000 – 20,000 physician-diagnosed pesticide poisonings occur each year among hired farmworkers. The same year, the Worker Protection Standard was revised and expanded in an attempt to reduce these poisonings. However, a recent study in California from 1997 to 2000 found that no worker safety laws were violated in 38% of pesticide poisoning cases, calling into question whether standards are adequately protective. According to a review of pesticide poisonings from 2003-2008 by the Washington State Department of Health, pesticide drift is the leading cause of overexposure for bystanders and agricultural workers in Washington state.



Safety is the "work of changing minds. And it is not done overnight."
– Project Participant

In February 2004, the Washington State Department of Labor & Industries implemented a cholinesterase monitoring rule, which requires agricultural employers to provide a blood test to workers who handle certain pesticides 30 hours or more within a 30 day period. The goal is to identify a worker affected by pesticide exposure—even before symptoms occur—using the worker's own cholinesterase levels as a baseline.

While worker safety laws exist, they may not be adequately protective. The sources of pesticide exposure are varied, and when exposed to similar levels, different people react to the chemical in different ways.

RESPONSE & RESULTS

PNASH investigators seek to understand and reduce pesticide exposures in Washington state's Yakima Valley, one of the most agriculturally productive areas in the country.

To support and evaluate the cholinesterase monitoring rule, PNASH conducted research, trained community-based medical personnel doing the monitoring, improved the laboratory assay's validity and reliability, and interpreted monitoring results.

Cholinesterase Monitoring

Cholinesterase is an enzyme in the body that acts as the nervous system's "off switch." Many pesticides act by disrupting the function of this type of enzyme in insects (and in people), so the nervous system works overtime causing neuro-muscular detriment. Workers whose cholinesterase levels are low could become sick if they continue to be exposed. Monitoring workers' cholinesterase levels can provide an early warning of overexposure, so steps can be taken to prevent further harm.

Identifying risk factors for exposure

PNASH researchers discovered that workers' behavioral practices, such as the availability and use of protective equipment, can dramatically impact their exposure levels. Results of a five-year study led by PNASH identified the following risk factors for pesticide overexposure that lead to cholinesterase inhibition: cleaning spray equipment, mixing/loading pesticides, and not using a locker to store PPE. Protective factors included: wearing a full-face respirator and wearing chemical-resistant footwear. These findings were used in support of workplace-based solutions to reduce exposures.



Pesticide safety training and education tools

↪ Fluorescent Tracers were first used in research to assess pesticide contamination routes and dermal exposures. Now, the Fluorescent Tracer (FT) technique has grown into an effective tool for hands-on pesticide safety training. The dramatic visualization of the FT shows workers where contamination occurs and helps them to evaluate their day-to-day practices and personal protective equipment.

↪ To address risk factors that lead to pesticide exposure, PNASH, in partnership with farmers, educators, and researchers in Washington state, collected 24 solutions and ideas identified on farms and developed a guide called *Practical Solutions for Pesticide Safety*. The effort included 25 farms, 95 participants and hundreds surveyed.

**A splash shield designed and constructed by the Expert Working Group
– a team of growers, applicators and safety professionals**

Cutting-edge studies to measure exposure and genetic risk

↪ The oxime reactivation assay, developed by scientists at PNASH and the Centers for Disease Control (CDC), improved the cholinesterase laboratory test. It helps diagnose acute poisoning with OP pesticides and guide treatment when a person comes into an emergency clinic with pesticide poisoning symptoms. The assay increases accuracy in a diagnosis and detects the specific pesticide that caused the exposure.

Researchers also developed a process for tandem mass spectrometry (HPLC/MS/MS) of protein adducts in the blood of exposed workers. The HPLC/MS/MS method can detect exposures to OP pesticides at low levels more reliably than using the original cholinesterase activity assay.



↪ Personal susceptibility to the harmful effects of certain pesticides may lie in our genetics. Paraoxonase 1 (PON1) is an enzyme in our bodies that plays an important role in breaking down certain OP pesticides into less toxic forms. Research suggests that PON1 levels and how efficiently the enzyme can detoxify reagents may be based on an individual's genotype, the genetic identity of an individual—somewhat like an architect's blueprint for a house.

PNASH researchers compared levels of PON1 and PON1 genotypes to the results of the cholinesterase monitoring of pesticide handlers. The scientists found there were differences in the level of serum cholinesterase inhibition by PON1 genotype, suggesting that some pesticide handlers were better able to metabolize OP pesticides than others, and also that people with high PON1 activity had less cholinesterase inhibition than those with low PON1 activity.

Health care provider education

Protecting workers from the negative effects of pesticides is truly in the hands of frontline primary care providers. Currently, half of US states require that physicians report occupational pesticide-related illness and injury and other states can voluntarily participate in national surveillance through the Centers for Disease Control. PNASH has educated physicians, mid-level practitioners, and *promotores* (community health workers) on recognizing and treating illness from pesticide exposure by developing guidelines, training and outreach materials.

Interagency partnerships

In the last five years, Washington state has become a model for how multiple players contribute to improving pesticide safety. There is a strong network of farmworker and community clinics and exceptional pesticide education programs, including hands-on training for pesticide handlers and supervisors. In addition, a working group of staff from PNASH and the Washington State Departments of Health, Agriculture, and Labor & Industries reviewed surveillance and compliance data and research to better understand the problem of pesticide poisoning in the Northwest region. The group explored how and why they are being exposed and what can be done to reduce overexposures.

IMPACT

PNASH's multidisciplinary, collaborative approach to addressing the problems of pesticide poisoning has helped demonstrably reduce the risks of pesticide exposure faced by agricultural workers in the Northwest.

↳ Data from the state-wide cholinesterase monitoring program shows a marked decline in pesticide applicator exposures since the program began in 2004. The program's early cases mobilized PNASH, multiple agencies, nonprofits and the industry to address exposures. The current low rate of cases is evidence for the success of education efforts, a reduction in the use of azinphosmethyl (due to EPA phase out of this pesticide), and employers' limiting handler exposures.

↳ Isolation and identification of protein adducts for OP pesticides at low levels to develop an assay more reliable than using the existing cholinesterase activity assays.

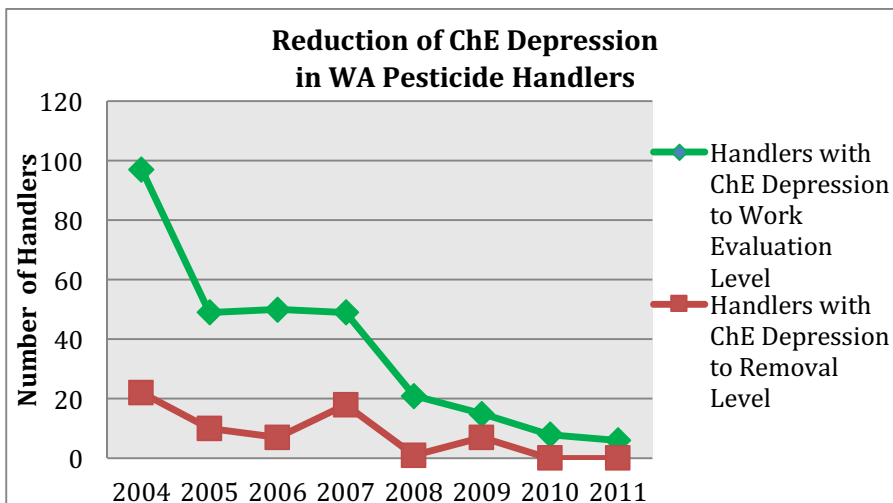
↳ Identification of genetic susceptibility (PON1 status) in farmworkers exposed to organophosphate (OP) pesticides. This is the first time that a study of a working population has demonstrated the validity of the assumptions behind PON1's effect on pesticide overexposure susceptibility.

↳ Research to Practice delivery on the long-term effects of pesticide exposure on human health. This educational program was delivered to over 800 pesticide applicators throughout the Northwest.

↳ Development and distribution of targeted pesticide safety educational materials and tools for educators, growers and health care providers (See Products).

↳ The Fluorescent Tracer (FT) training was an early PNASH product and has now been employed in safety and integrated pest management programs throughout the United States and in other countries (Cambodia, Vietnam, Ecuador, Guyana). The Washington State Department of Agriculture's hands-on training program uses FT, training approximately 200 pesticide handlers each year. There is monthly demand for this PNASH training program, with regular FT Kit purchases and online viewing of the video and website.

↳ Washington state is recognized as a model for pesticide safety, with PNASH investigators and partners serving and leading national and international initiatives, including: The NIOSH National Personal Protective Laboratory; US EPA work on human exposure study ethics, agent orange, and medical education surveillance; Fogarty International Scholar Training in SE Asia, International Society for Exposure Sciences.



The impact of the FT tool is immediate and striking. Observed one pesticide safety professional: "This is one of the most powerful training tools that I have encountered, because the message is clear and it is shocking."

This body of work responds to the National Academies of Sciences recommendations: Improve Stakeholder Engagement and Partnership; Implement Integrative and Interdisciplinary Approaches; Enhance Awareness of National Policy.

PRODUCTS

Practical Solutions for Pesticide Safety → http://depts.washington.edu/pnash/practical_solutions

The Practical Solutions for Pesticide Safety guide is a collection of 24 solutions and ideas identified on farms and developed in partnership with farmers, educators and researchers in Washington state. (English/Spanish)

Fluorescent Tracer Training - Hands on Learning for Pesticides

Website → http://depts.washington.edu/pnash/fluorescent_tracer

Video → <http://www.youtube.com/user/PNASHCenter>

Pesticide safety trainers find the fluorescent tracer (FT) to be a powerful tool for mimicking pesticide contamination and helping workers self-evaluate their practices and protective equipment. Available are the FT kit, manual and video. (English/Spanish)



Pesticide Worker Education Packet →

http://depts.washington.edu/pnash/pesticides_health

Originally packaged and delivered to Northwest Promotes, this packet is available online with make-your-own instructions.

Organophosphate Pesticides & Child Health: A Primer for Health Care Providers

→ <http://depts.washington.edu/opchild/index.html>

This course presents the current scientific evidence regarding health risks for children exposed to organophosphate pesticides.

Pesticide Health Effects Medical Education Database → <http://www.pesticidemededucation.com>

This online toolbox provides instructors and students with case-based trainings covering modern day environmental health hazards, exposure scenarios, signs and symptoms, and directives for treatment.



Cholinesterase Test Kit

We have shown the Test-mate™ kit to be an effective, cost-efficient test that can provide rapid results for workers – important if they are shown to have a ChE depression.

RESEARCH PUBLICATIONS

Hofmann JN, Keifer MC, De Roos AJ, Fenske RA, Furlong CE, van Belle G, Checkoway H. Occupational determinants of serum cholinesterase inhibition among organophosphate-exposed agricultural pesticide handlers in Washington State. *Occup Environ Med.* 2010 Jun;67(6):375-86.

Hofmann JN, Keifer MC, Furlong CE, De Roos AJ, Farin FM, Fenske RA, van Belle G, Checkoway H. Serum cholinesterase inhibition in relation to paraoxonase-1(PON1) status among organophosphate-exposed agricultural pesticide handlers. *Environ Health Perspect* 2009;117(9):1402—1408.

Keifer M, Gasperini F, Robson M. Pesticides and Other Chemicals: Minimizing worker exposures. *Journal of Agromedicine*, 2010: 15:264-274.



Community–Industry-Partnerships

Local Collaboration to Address Local Needs

THE CHALLENGE

Fatality rates in agriculture, fishing, and forestry are nearly 10 times that of other industries, averaging more than 25 deaths per 100,000 workers each year. Our Northwest agricultural industries and community stakeholders value the sustainability of their health, livelihood, and environment. Cutting the risk of workplace injuries, illness and fatalities benefits businesses by reducing costs. And most important: it saves lives and prevents permanent disabilities.

Washington agriculture, and in particular the Yakima Valley, is a highly productive area, ranking near the top in the nation. It produces more apples, mint, winter pears, and hops than other counties. Consider that Washington state's apple

production is valued at over \$1.7 billion dollars. Dairy farming in Washington is also intensive, and Yakima County is one of the largest dairy-producing counties in the nation, with 72 dairies and 95,000 cows; it produced 2.1 billion lbs. of milk in 2009. The Yakima Valley has a highly productive industry, but holds the challenges of industrialized agriculture—a large and sometimes seasonal workforce, scarce water supply, and stewardship of the land and communities.

PNASH investigators have worked in the Yakima Valley and surrounding Central Washington for the last 20 years and have fostered partnerships to address the priority needs of these industries and communities. In the last five years, PNASH has extended our collaborative approach to other populations at risk in the Northwest including the Hood River Valley in Oregon, Weiser, Idaho and the Olympic Peninsula, Washington. (See Impacts.)

RESPONSE & RESULTS

Science linked with meaningful community participation can produce effective solutions to the environmental and workplace health concerns of agricultural communities. When specific community or work-related issues emerge, PNASH directly engages or partners with stakeholders. Here are two model successes.

"People in the workplace are the experts."

This is the philosophy of the PNASH Center. This successful method to

workplace safety is seen throughout PNASH projects. A model example is PNASH's recent collaborative project that developed Practical Solutions for Pesticide Safety, a guide with simple strategies that have been shown to be effective through on-farm research and practice. Direct community involvement was a key element of the project; with the participation of workplace experts (experts in the day-to-day aspects of production). PNASH engaged innovative workers, educators, employers, and safety and health professionals in Washington state's tree fruit industry. Throughout this effort, the project was guided by the "Expert Working Group." In all, 25 farms and 1200 individuals contributed to identifying solutions to reduce pesticide handlers' exposures .



Yakima County is the number one producer of treefruit in the U.S.



Community-Based Participator Research (CBPR) Characteristic of CBPR is the active involvement of the research team, study participants, and their advocates. The needs of the community are not only collectively recognized, but the aims of the research include interventions designed to address those needs and improve the health of the population.

EI Proyecto Bienestar (or, Well Being Project) is a long standing community health intervention effort guided by a Yakima Valley community advisory board and a partnership of: PNASH; Northwest Communities Education Center/Radio KDNA; Heritage University; Yakima Valley Farm Workers Clinic. This project initiated through a NIOSH grant in 2003 has sustained and grown. Our current Proyecto Bienestar projects include:

Aggravating Factors of Asthma in a Rural Environment (NIH&CDC 2009-2013) This community-based project characterizes ambient triggers of asthma in the rural setting by following 50 asthmatic children - mapping and evaluating their asthma episodes, and comparing these to measured contaminants in the air.

ConneX Program and UW Summer Extension Course (HRSA/Yakima Valley Farm Workers Clinic 2011-2013)

Since 2003, PNASH has led a summer environmental education course in Yakima, WA with university credit for ConneX program students. ConneX is an education outreach program at the Yakima Valley Farm Workers Clinic with the aim to create a competitive pool of young people from disadvantaged backgrounds to enter health professions. PNASH faculty, partners and graduate students lead the curricula and organize a field survey or sampling activity. The community surveys from 2004 through 2010 helped our partnership understand the environmental and occupational health concerns, and evaluate the effectiveness of our educational interventions.



IMPACT

PNASH Center initiatives have developed into lasting partnerships; ongoing training and education programs; and self-sustaining community research and intervention efforts throughout the Northwest. These partnerships ensure the relevancy of our work and have greatly extended the reach and transfer of research findings into practical application.

- EI Proyecto Bienestar (or, Well Being Project). Four core partners and a 13 member Community Advisory Board in the Yakima Valley informs PNASH projects.
- ConneX Program and UW Summer Extension Course. 40 disadvantaged undergraduate students were trained in environmental health by PNASH in the ConneX Program between 2006 and 2011.
- Hood River Community Advisory and Family Cohort. Over 300 agricultural families participate in a research and education program, guided by an advisory board of growers, parents, health care providers and researchers.
- Washington Governor's Ag Safety and Health Conference and Advisory Board. A lasting inter-agency and industry collaboration since 2004.
- Washington Community Health Workers Network. Began in 2004, PNASH was a founding partner and continues to support annual promotores education.
- Promotora Program for Forest Workers, OR. A new forest service workers intervention effort supported by PNASH.
- Partnership for Hispanic Health, ID. Serving on the Core since 2005 providing CBPR, medical and evaluation expertise.
- Expert Working Group to Minimize Pesticide Applicator Exposure. Advisory group of growers, pesticide handlers and safety educators. Meeting included education with recertification credits.
- Collaboration on Pesticide Exposure Reduction. Washington State Departments of Health, Agriculture, and Labor & Industries to better understand and address the problem of pesticide poisoning in the Northwest region.

PNASH's partnership accomplishments are best demonstrated by the formal endorsement and support from leaders and organizations in farming, fishing and forestry. In our competitive renewal application we had 89 letters of support.

This body of work responds to the National Academies of Sciences recommendations: Identify and Track AFF Populations at Risk, Improve Stakeholder Engagement and Partnership; Implement Integrative and Interdisciplinary Approaches; Enhance Awareness of National Policy.





Storytelling to Teach

Life-Changing Ag Injury Stories

WEBSITE

http://depts.washington.edu/pnash/audio_library

THE CHALLENGE

In 2010 alone, 42 people in the Northwest lost their lives while working in agriculture. In 2008, farm injuries cost Washington state more than \$18 million. Consider the uncounted costs to a family when there is an injury or, worse, long-term disability. We know that safety precautions can often be disregarded. But what if someone you know is involved in an incident that results in serious illness or injury? Chances are, the message hits home.

RESPONSE

Our lives are a grand collection of stories, and the telling of stories endures as one of the best means to pass on wisdom and know-how. PNASH used the power of storytelling in a project called *Reality Tales* to translate health and safety research and education for farm producers and workers. It used three approaches to develop stories: 1) a radio call-in storytelling contest, 2) the national oral history StoryCorps project to capture and record owner operator stories, and 3) Spanish-language novellas (soap operas) to personalize for workers the risks of ag illnesses and injuries – the message being “it too can happen to you if one takes safety for granted.”



Survival Story – Saved by Roll Bar

Project excerpt: “I remember the look on both of their {mom and dad’s} faces – at first being scared for us and then finding out that we were OK. It hit home how important safety is.... How much our parents loved us.... Life is short.”

- Chris Furrer (age 16), Dairy in Monroe, Washington



The Chavira Family – a Radio Novela for Farmworker Health

RESULTS

Here are some of the inspiring stories we’ve heard and shared:

- Isabela breaks down in tears, describing how she can never work again after falling from a ladder while trying to pick one last piece of fruit.
- Russell found his farmer brother 10 days after an ATV overturn, crushed by the vehicle, and then describes his own rollover one year later.
- Diana, a mother who lost her arm to a combine, urges listeners: “Don’t wear jewelry when you are working around farm equipment.”
- Wade, reflecting on a neck fracture caused by falling hay bales, observes: “Sometimes we get in a hurry and don’t think about what we’re doing and that’s when we get into trouble.”

Other issues include: vehicle roll overs; falls from ladders, machinery, and structures; children and machinery; animal handling; heat-related illness; asthma; pesticide exposure; water quality; and workplace abuse.

IMPACT

- Tens of thousands of regional workers and growers have been reached through radio play, call-in sessions, and webcasts. These have been shared widely through our partners, growers, and in both Hispanic and English radio.
- PNASH introduced agricultural health and safety stories to the national Story Corp Project, which have been aired around the nation and are now preserved in the National Archives.

This project responds to the Nat’l Academies of Sciences recommendation: Conduct Research on Knowledge Diffusion.

PRODUCTS

Audio Library - Listen and Learn! Life Changing Ag Injury Stories (English and Spanish)

- http://depts.washington.edu/pnash/audio_library



Health Communication and Literacy

Culturally Responsive Delivery of Science and Solutions

THE CHALLENGE

PNASH is committed to effectively communicating research findings and addressing the real needs in the workplace. In rural agriculture, employers, health care providers, extension and field advisors are the frontline educators as well as trusted sources of information. So, PNASH researchers work closely with these key intermediary educators to provide health information and safety solutions to workers.

For example, heat-related illness (HRI) emerged as a serious issue for farming. It affects employee productivity and annually leads to agricultural worker injuries and deaths (B LS 2010). HRI comes from prolonged exposure to heat, which can cause dehydration and lead to diminished concentration and strength, and increase accidents. HRI can also be fatal. In Washington state, HRI caused the deaths of three workers in the past three years, and was the reason behind 580 workers' compensation claims between 1995 and 2007. Yet HRI is entirely preventable.

In order to better protect workers, the Washington State Department of Labor & Industries filed a new permanent workplace rule (effective July 5, 2008), which requires training about heat stress or heat-related illness to "be provided to employees and supervisors, in a language the employee or supervisor understands, prior to outdoor work."

Employers and safety educators strive to adequately equip and communicate information about health and safety to workers, but the changing demographic of who makes up the workforce creates new challenges. According to the National Agricultural Worker Survey, 68% of foreign-born Hispanics working in the United States have six or less years of education, and when asked if they speak English, less than 10% answered "some" or "well."

In addition, Spanish is not the universal language for all Hispanic workers—there are over 60 indigenous languages in Mexico alone. In Western Washington, nearly 23% of farmworkers identified themselves as Indigenous Mexican, according to the Washington State Farmworker Housing Trust's report published in July 2008.

These numbers barely scratch the surface, but do speak to the diversity of audience that safety trainers must reach within the agricultural industries, and the difficulty in developing effective methods and educational materials.

RESPONSE & RESULTS

In conjunction with public health agencies and employers, PNASH researchers seek solutions to work with, train, and protect an underserved, linguistically and culturally diverse population from occupational hazards.

Community-Based Participatory Research

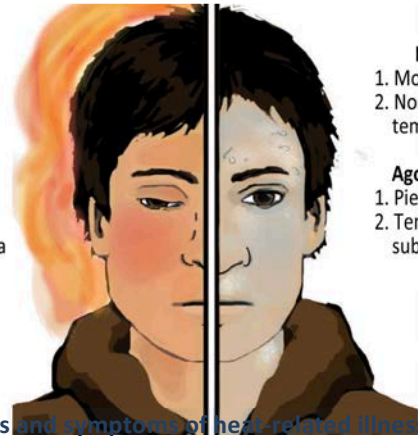
Using community-based participatory research (CBPR) and with the help of *promotores*, we work with underserved populations to better understand and overcome barriers such as language and cultural differences.

Heat Stroke

1. Dry, hot skin
2. Very High body temperature
3. Confusion

Ataque de Calor

1. Piel seca, caliente
2. Temperatura muy alta del cuerpo
3. Confusión



Heat Exhaustion

1. Moist, clammy skin
2. Normal or subnormal temperature

Agotamiento de Calor

1. Piel mojada, húmeda
2. Temperatura normal o subnormal

Signs and symptoms of heat-related illness

Promotores are community health workers or peer educators who are key to reaching and building trust between underserved populations and the health care system. While *promotores* often do not have a medical education, they are hired locally and trained for specific health programs and often serve as the best means of delivering those messages. Many are then inspired to pursue healthcare careers.

For example, the forest service workers—the “workers in the woods” of the Northwest Olympic peninsula—earn a living gathering salal and cutting blocks from salvage cedar stumps. An estimated 55–65% of these workers are Indigenous Guatemalan and Indigenous Mexican, as reflected in initial results of a CBPR project that included interaction with local workers. There are at least four different indigenous languages frequently spoken within this worker community. Current training programs and safety warnings and labels do not take these linguistic differences into account, much less the associated cultural and unique challenges. PNASH led a partnership project that addressed worker and ecological sustainability issues and provided safety education.

Culturally Relevant and Accessible Materials

In order to more effectively communicate and train workers, PNASH develops materials that span culture, language, and education-level differences by using images, graphics, and audio. Our products are field-tested with the target audience and developed by personnel with bicultural expertise.

This cultural competence in our communications is important to both our research methods and our communication of risks and solutions. Much of our research takes place in the field and our surveys and study methods are designed for the language and culture of our study participants.

Partnerships

PNASH works with bilingual and bicultural personnel and partners. Our success in producing effective materials and training methods is due to community and industry partnerships. These partners bring in cultural expertise or we hire staff from within the communities and industries where we are working. PNASH also partners with local health care providers and agencies.

For example, in assessing public health impacts associated with climate change, researchers found mortality rates linked to increased temperatures and worsening air quality. Relatively short but intense heat waves over the last 30 years have been responsible for hundreds of deaths in the United States and Canada and thousands of deaths in Europe. Projections suggest these events will become more frequent, more intense, and longer lasting in the 21st century, and PNASH researchers have computed the probable number of heat events that will occur in our region and have identified populations at risk. Currently, PNASH scientists are working with regional health departments to prepare for the future impacts of climate change and its impacts on workers and citizens, and to develop strategies for how communities might reduce health risks associated with climate change.



Audio/Visual touchscreen questionnaire



PNASH educational exhibit

Dissemination of results through existing and trusted sources
A PNASH grower survey found that the most popular sources of information are trade journals and industry-specific educational events and recertification classes. These preferred venues were similar for both English and Spanish speakers. However, Spanish speakers had greater preference for radio, TV and videos, while English speakers tended to use internet sources. These findings and our years of experience have influenced how PNASH tailors program communications and dissemination; we work with trusted partners in each industry including promotores, health care providers, trade media and industry safety educators and employers.

IMPACT

PNASH works locally to develop culturally appropriate educational information for Hispanic workers. We provide education and share materials to over 2,000 individuals annually including promotores, health care providers, employers, workers, and safety professionals.

➔ Heat illness research and education. PNASH developed and shared culturally appropriate educational information for Hispanic workers. During the 2005 summer that resulted in the death of a local farmworker, we were able to alert our healthcare providers and provide them with guidance on the most efficacious means to lower body core temperature to prevent death from heat stroke. This work has led to new research direction - to determine the risk factors for HRI and investigate cultural beliefs and practices related to hydration and HRI in adult outdoor crop workers.

➔ Improving journalism to English and Spanish agricultural communities. Through a journalist workshop, we developed a cadre of local news and trade journalists with an understanding of environmental, occupational and children's health issues. This resulted in improved articles and also launched the Nurse Murph column in the Western-Farmer Stockman and Good Health articles in the Good Fruit Grower magazine.

➔ Articles and life-changing ag injury stories. PNASH's popular 'Nurse Murf' column on ag health and safety has been published in two large grower magazines and Spanish language news, reaching ~41,000 producers and 60,000 workers in the region. In addition, PNASH has been successfully using the power of storytelling to teach and inspire safe practices. These have been shared widely through our partners, growers, and in both Hispanic and English radio.

➔ Linking ground-level relevance to national communication efforts. PNASH connects national initiatives to the real needs of Northwest agricultural workers. For example, we have assisted NIOSH in developing and audience testing a Spanish brochure on farm noise and hearing loss, and the National Personal Protective Technology Laboratory with pesticide handler stakeholder feedback and participation. With the US EPA we advise on pesticide label improvements and health care provider education.

This body of work responds to the National Academies of Sciences recommendation: Conduct Research on Knowledge Diffusion Processes; Implement Integrative and Interdisciplinary Approaches; Enhance Awareness of National Policy.

PRODUCTS

Nurse Murf/Enfermera Elena ➔

http://depts.washington.edu/pnash/nurse_murf

Nurse Murf is a syndicated column by Helen Murphy-Robinson sharing current medical and safety information for those that work in farming. (English/Spanish)

Heat Illness ➔ http://depts.washington.edu/pnash/heat_illness

A website providing critical education information for employers, trainers and promotores to share with workers (English/Spanish)

Pesticides & Health ➔ http://depts.washington.edu/pnash/pesticides_health
Educational information, online courses and training tools.

Audio Library - Listen and Learn! - Audio Biblioteca - ¡Escuche y Aprenda!

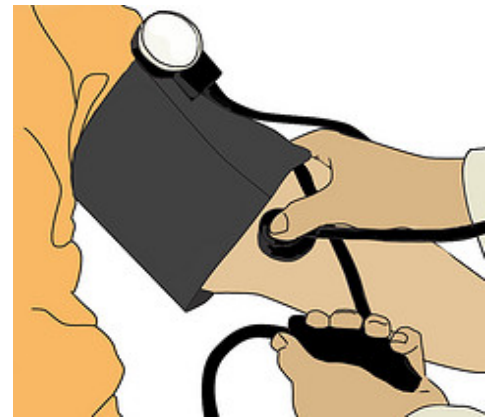
➔ http://depts.washington.edu/pnash/audio_library

AG StoryCorps® - Life changing agriculture injury stories from farmers.

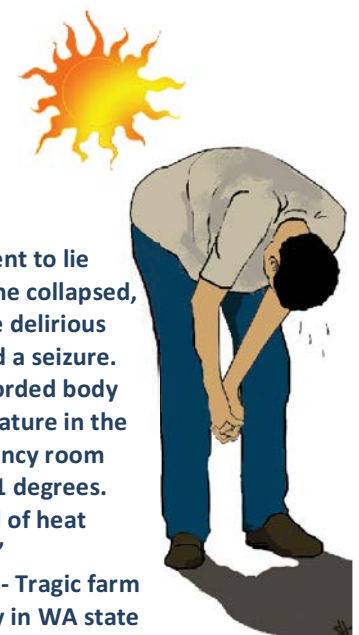
The Chavira Family - Listen as they cope with issues such as asthma, pesticide exposure, water quality, and workplace abuse common among immigrant farmworker families. (English/Spanish)

Ladder Injuries - Real workers discuss stories about falls from ladders, the injuries they suffered, and the consequences faced by themselves and their families. (English/Spanish)

Heat Illnesses - Four short radio dramas on how to recognize, treat, and prevent Heat Illness. (English/Spanish)



Realistic and iconic illustrations aid communications on questionnaires, returning results, and educational materials.



“He went to lie down, he collapsed, became delirious and had a seizure. His recorded body temperature in the emergency room was 111 degrees. He died of heat stroke.”

- Tragic farm fatality in WA state



Commercial Fishing Safety

Survival Solutions for Those Working at Sea

THE CHALLENGE

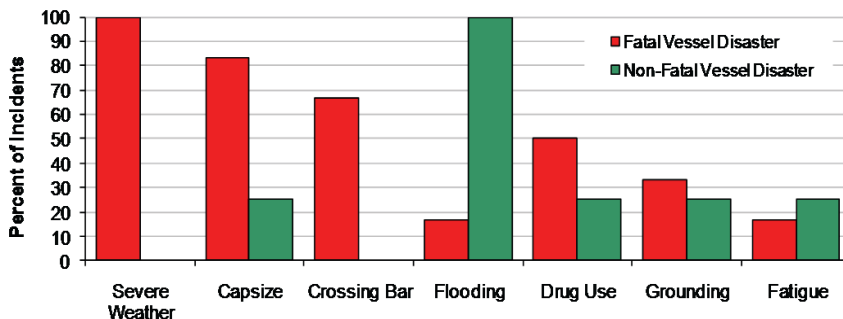
The Discovery Channel's show, *Deadliest Catch*, depicts the often harrowing job of Alaskan king crab fishing in the Bering Sea. Commercial fishing in general and all along the West Coast is no less deadly.

There are many 16- to 20-hour days, weather can change on a dime, and swells in places such as the Bering Sea or across a river bar—where the river meets the open ocean—can capsize even large vessels before the captain or his crew has time to pull on a life vest or survival suit.

The West Coast Dungeness crab fishery represents one of the most dangerous work environments in the United States; the fatality rate is higher than the Bering Sea crab fishery.



From 2003–2009, 14 deaths were recorded. None of the victims was wearing a personal flotation device (PFD), and most of the fatalities (79 percent) resulted from capsized vessels while crossing river bars or when fishing near shore.



Compared to the rest of the West Coast, fatal vessel disasters in Oregon are more likely to involve capsizing and crossing hazardous bars.

Thanks in part to safety training and vessel stability checks, deaths resulting from vessel sinkings have decreased, but those from falls overboard remain high, totaling 155 nationwide from 2000 to 2009. Again, none of these fishermen were wearing a personal flotation device (PFD).

The good news is injury prevention programs can work – showcased by the fatality rate of commercial fishers in Alaska dropping by 42% since 1990.

This decline in deaths was the result of a variety of collaborative safety programs and was called out as one of the *“Ten Great Public Health Achievements - U.S., 2001-2010”* (MMWR, 2011).

RESPONSE & RESULTS

PNASH is working with the NIOSH Alaska Field Station and other partners to address priority needs, such as evaluating survival drill instruction and field testing and promoting personal flotation devices (PFDs) to reduce drownings at sea.

PNASH's research project on PFD use was launched quickly in response to partner concerns and NIOSH findings that fishermen fatalities were from falling overboard overboard, often minutes from rescue, and none of the fishermen killed were wearing a PFD. So to improve safety and to better understand the views and experiences of the Dungeness crab fishermen, PNASH researchers surveyed commercial crab fishermen in Oregon on their practices and asked them to field-test

five different PFDs. The PNASH research team identified PFD use, safety training and on-board safety drills, and a better understanding of vessel stability as key to reducing fatality and injury rates. Surveys showed that almost 70 percent did not regularly practice on-board safety drills, and nearly half of crew members had not received safety training.

PNASH's work with the nonprofit Alaska Marine Safety Education Association (AMSEA) evaluated how often fishers need to take refresher trainings. AMSEA conducted safety trainings, and conducted pre-, post-, and follow-up surveys to assess how well training information was retained among professional fishermen. Study results indicated that substantial deterioration of safety skills occurred at the one month and three month intervals, and identified key reasons why more frequent trainings were not being conducted within the fleet. This study recommended, through an ongoing Coast Guard rulemaking process, to add requirements for iterative (ideally monthly) training requirements for refresher training for Drill Conductors.

IMPACT

PNASH research has informed legislation requiring increases in the frequency of safety training for fishermen, and has vetted and identified the best and most user friendly personal flotation devices on the market.

- Refresher Training for Commercial Fishermen. Findings from a PNASH-funded study on refresher survival drill instruction have been incorporated into US Coast Guard regulations on training frequency, designed to reduce drowning deaths at sea.
- **Personal Floatation Devices for Crab Fishers.** PNASH's PFD project was launched quickly in response to concerns. This fishery now has identified what PFDs work for them and the industry and Coast Guard continue to promote the use of these life savers.
- Development of a Surveillance Strategy to Guide Injury Prevention Efforts in the Washington Commercial Fishing Industry. A newly funded project that answers to the need for information on nonfatal fishing injuries; in order to identify areas where interventions are most needed to prevent injuries. The aims of this 1-year pilot project are to develop methods for: 1) characterizing nonfatal fishing injuries in WA using existing data sources; and 2) effectively disseminating this information to key fishing stakeholders.

This body of work responds to the National Academies of Sciences recommendations: Improve Stakeholder Engagement and Partnership; Implement Integrative and Interdisciplinary Approaches; Enhance Awareness of National Policy.

RESEARCH PUBLICATIONS

Field Research and Consultation Group and Center for Research on Occupational & Environmental Toxicology. Oregon Crab Fishing Safety Assessment. University of Washington, December 2011.

"People want to be safe, but they want equipment that's relevant and practical to their work situation."

- PNASH Fishing Safety Partner



Dungeness crab fisherman evaluate personal floatation devices (PFDs) in a PNASH partnership project



Logging and Forest Service Workers

Changing Workforces and Technologies

THE CHALLENGE

The iconic Northwest image of a lumberjack swinging his axe amid towering conifers has not reflected reality for over a century. Technology now has made mechanized logging the norm, except on the steepest slopes. And more and more operators are coming to the realization that the workforce today does not reflect the logging workforce they have known for most of their professional lives. The demographics within the logging and forestry labor forces are changing swiftly, and safety and health efforts must change with it or workers will pay the price in injuries or their lives.

Logging fatality rates already exceed the national average by 20 times. Research rates logging among the most exertive work.

Injury and death rates in logging and related industries have often been cyclical. For example, injuries among Oregon loggers increased 77% after the 1980–1981 recession as companies quickly rebuilt their work forces.

Data in Oregon, Washington, and Idaho show that loggers who are least 45-years-old represent around 50% of the workforce, a percentage that is growing. Other states and countries show similar trends.

Latino immigrant workers are increasingly finding employment as laborers in Pacific Northwest forests in logging and represent that majority of forest service workers.

Forest services (specialty forest product harvesting, nurseries, and management, among others) are an expanding industry, growing with the need to more actively manage our forests, such as to reduce fuel loads to prevent forest fire.

The forestry services industry also has a high rate of injuries and illness. From 2003 to 2008, there was an average of 8.86 injuries and illnesses per 100 workers in Oregon compared to an average of 5.3 per 100 workers for all of private industry. Common injuries include broken bones, open wounds, severe poison oak rashes, and dehydration. Although not as high as the fatality rate for loggers, the fatality rate among forest workers is still higher than the rate for all industries.

RESPONSE & RESULTS

PNASH has been working with industry to make logging less hazardous, especially for older loggers who may be more at risk for injury.

For example, ergonomics may be improved by replacing steel wire with synthetic rope, which has one-ninth of the weight. In a small study of older workers (over 45) compared to young workers, older workers were found to have higher maximum heart rates on selected tasks. Overall for all ages of participants, synthetic rope was much easier to handle than the steel wire rope, and participants reported that they were able to traverse the terrain more easily with the synthetic rope.

Other PNASH projects have addressed health and safety issues in the harvesting of specialty forest products, such as cedar and greenery used in floral arrangements. One study



Cedar block harvester in Olympic Peninsula working deep in the woods harvesting old cedar stumps – one of the many varied jobs categorized as forest service work



Synthetic rope in logging workload intervention study

documented the working conditions of cedar block cutters on the Olympic Peninsula through field observations and key informant interviews with workers.

A second study, *The Sustainable Harvest Project*, brought together a variety of stakeholders from the Forks, Washington area, including harvesters, local city and tribal nation representatives, and public and private landowners to address concerns regarding the sustainability of the workforce and the ecology of salal (a harvested floral green).

This group prepared a harvester-led, culturally and linguistically appropriate training to introduce harvesters (especially newer ones) to key concepts and skills. Out of the project came a new training resource – a DVD with information on worker rights, ecological conservation of the salal resource and the forest in general, basic health and safety of harvesters and a new video on how to access community health services (actors were local harvesters).



Salal harvesters in Washington state – greens for floral arrangements are in high-demand

The Alliance of Forest Workers and Harvesters, the Berkeley Labor Center at the University of California, and Lomakatsi Restoration Project is developing a program specifically designed to educate forestry services workers about safety on the job and available health care services.

With a small grant from PNASH, this partnership piloted a job health and safety *promotora* program for these workers. Alliance staff recruited and trained *promotores* to staff the program as well as to collaborate in developing and conducting a sample survey among forest services workers.

Contacting workers through snowball sampling, the *promotoras* administered the questionnaire to 150 workers, representing a response rate of 75%. Principal findings show that injury rates among forest workers are much higher than rates reported by the Bureau of Labor Statistics, and that forest workers and employers fail to report on-the-job injuries at rates consistent with other studies. The forest workers surveyed reported specific concerns about safety training and working conditions. The needs raised by workers will help this partnership in developing a *promotora* program.

IMPACT

Worker populations that were largely unacknowledged and unaddressed by safety materials, requirements, and regulations are receiving support in the form of user specific trainings, education, and engineering solutions to make their jobs safer.

➔ Synthetic rope is now in use in the logging industry, but its wider use has been hampered by its cost and perceived durability. These factors are offset by the reduced workload on older workers and the time savings for the tasks.

➔ **Logging Safety Education.** PNASH is working with contract logging partners to improve safety education and address the challenges of the logging workforce. Current efforts include convening a Future of the Forestry Workforce conference and development of Logging Masters program.

➔ Promotora Program in formative development for Oregon Hispanic forest service workers to reduce on-the-job injuries and illnesses.



Oregon Promotores at work

This body of work responds to the National Academies of Sciences recommendations: Identify and Track AFF Populations at Risk; Improve Stakeholder Engagement and Partnership; Implement Integrative and Interdisciplinary Approaches.

PRODUCTS

Northwest Forest Worker Safety Review (2002 – Present) ➔ http://depts.washington.edu/pnash/forestsafety_news
Forest Worker Health and Safety (Spanish DVD)