

# Pacific Northwest Agricultural Safety and Health Center



2010 December

## ANNUAL REPORT

CDC/NIOSH Cooperative Agreement #2 U50 OH07544-09  
September 30, 2009 – September 29, 2010

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**Pacific Northwest Agricultural Safety and Health Center  
Annual Report to NIOSH  
CONTRACT 2 U50 OH07544-09  
Fiscal Year 2009/2010**

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**Peer-Reviewed Publications**

Hofmann-JN, Keifer-MC, Checkoway-H, De Roos-AJ, Farin-FM, Fenske-RA, Richter-RJ, van Belle-G, Furlong-CE. Biomarkers of sensitivity and exposure in Washington state pesticide handlers. *Adv Exp Med Biology* 2010; 660: 19-27. PMID: 20221867, NIHMS193802.

Hofmann-JN, Checkoway-H, Borges-O, Servin-F, Fenske-RA, Keifer-MC. Development of a computer-based survey instrument for Organophosphate and N-methyl-carbamate exposure assessment among agricultural pesticide handlers. *Ann. Occup. Hyg.* epub April 2010; Vol 54, No 6: 640-50. PMID: 20413416, PMC2918489.

Rohlman-DS, McCauley-L. Toxicity of Anticholinesterase Pesticides in Neonates and Children. T Satoh & R Gupta (Eds.) *Pesticides: Metabolism, Neurotoxicity and Epidemiology.* New York, John Wiley & Sons, Inc. 2010.

## I. EXECUTIVE SUMMARY

The Pacific Northwest Agricultural Safety and Health (PNASH) Center, established in 1996, serves Alaska, Idaho, Oregon, and Washington with a goal of reducing occupational disease and injury among agricultural operators, workers, and their families. In recognition of the importance of all agricultural industries to the Northwest, our scope of work includes farming, fishing, and forestry industries. The PNASH Center's emphasis is on injury and illness prevention and health promotion, especially among populations not well represented in current research, including hired laborers, migrant/seasonal workers and children. Our approach is to:

- Work in partnership with employers, workers, agencies and other research and service organizations
- Develop innovative research and intervention programs that focus on problem solving
- Take solutions to the workplace through training, outreach, and participatory research

In recognition that the agricultural worker and community are the foundation of a strong agricultural industry, PNASH's theme is "Safe and Sustainable Agricultural Workplaces and Communities."

The 2009 Fiscal Year (FY), the fourth year of our NIOSH awarded five-year program, saw marked progress across all eleven Center projects. This year shaped the final project activities in preparation for concluding our current 5-year cycle and launching the next five-year cycle. Two new projects were funded through our regional Small Grant/Pilot Project Program. In addition, PNASH was awarded a supplement to two projects, Minimizing Pesticide Exposure and Reality Tales. These supplemental activities began in late in Year 4 and were able to support student summer field experiences in addition to expanding these projects' aims

The faculty, staff, and students of the PNASH Center are pleased to have completed a productive 2009 FY. . We invite you to review our accomplishments and results of all our projects and look forward to seeing these projects' results and impacts in the coming year.

## CENTER ACCOMPLISHMENTS FOR 2009

### 1. Res 1: Risk Factors for Cholinesterase Depression among Pesticide Handlers

To date, a total of 265 agricultural pesticide handlers have been enrolled in this study. During the past year, 48 handlers participated in the study, with a total of 50 visits (i.e., occasions when participating handlers completed the survey and/or provided a blood sample for PON1 testing). Self-reported information about potential sources of pesticide exposure was collected for a total of 50 participant visits during the 2010 spray season. Descriptive analyses of survey data from 154 study participants during the 2006-2007 spray seasons have been performed, and there is an ongoing analysis of the 2006-2010 data that will be completed by the end of 2010.

PON1 status is hypothesized to be a biological marker of susceptibility to some organophosphate pesticides including chlorpyrifos. A total of 48 blood specimens for PON1 testing were collected from participating handlers during the 2010 spray season. Blood specimens from 163 participants during the 2006-2007 spray seasons have been tested for PON1 status and genotype. Analyses of ChE inhibition in relation to self-reported exposures based on data collected during the 2006 through 2010 spray seasons are currently underway. An analysis of exposures in relation PON1 status is pending.

The Committee on Pesticide Exposure Reduction (COPER) was also founded in this past year. COPER brought together representatives from the three state agencies with responsibilities related to occupational exposure to agricultural pesticides (WA State Department of Agriculture, WA State Department of Health, WA State Department of Labor and Industries). The PNASH Center was the fourth partner in COPER and the facilitator for the group.

Publications:

Hofmann-JN, Keifer-MC, Checkoway-H, De Roos-AJ, Farin-FM, Fenske-RA, Richter-RJ, van Belle-G, Furlong-CE. Biomarkers of sensitivity and exposure in Washington state pesticide handlers. *Adv Exp Med Biology* 2010; 660: 19-27. PMID: 20221867, NIHMS193802.

Hofmann-JN, Checkoway-H, Borges-O, Servin-F, Fenske-RA, Keifer-MC. Development of a computer-based survey instrument for Organophosphosphate and N-methyl-carbamate exposure assessment among agricultural pesticide handlers. *Ann. Occup. Hyg.* epub April 2010; Vol 54, No 6: 640-50. PMID: 20413416, PMC2918489.

## **2. Res 2: Neurobehavioral Assessment of Pesticide Exposure in Children**

The neurobehavioral study is conducted from September to January, ongoing since 2008. The 3rd wave of recruitment and testing began in September 2010. Currently 245 families have completed home interviews and neurobehavioral testing. Dust samples were collected from homes where carpet was available (N=254). These samples are being analyzed at the University of Washington laboratory. Families tested in winter of 2009 have been contacted and asked to complete questionnaires assessing pesticide exposure in the past year and to collect a second dust sample from their home. A total of 82 of these families have completed the second year interview and neurobehavioral test session.

For both recruitment and pesticide safety training purposes, a computer-based training was developed (Safe Workplace, Safe Home/Sitio de Trabajo Seguro, Hogar Seguro). This training was administered to 470 adults at the Hood River County Fair during 2010. Pre- and post-test knowledge was assessed as well as demographic information.

Publication:

Rohlman-DS, McCauley-L. Toxicity of Anticholinesterase Pesticides in Neonates and Children. T Satoh & R Gupta (Eds.) *Pesticides: Metabolism, Neurotoxicity and Epidemiology*. New York, John Wiley & Sons, Inc. 2010.

## **3. Res 3: Enhancements to ChE Monitoring: Oxime Reactivation and OP-ChE Adducts**

This analytical method was further expanded by acquiring additional, custom-synthesized analytical standards that were used to improve the accuracy and precision of the method. Expanding upon pilot studies carried out in Year 3, human blood was treated in vitro with CPO. Adduct levels and ChE activity with and without oxime reactivation by PAM were measured. Our results showed that CPO inhibition of human butyrylcholinesterase is rapid, occurring within minutes, and that aging of the adduct is complete within 12 to 24 hours. Analysis of the adduct levels determined by LC/MS/MS is in progress.

We have also adapted the reactivation assay for use with the Test-mate cholinesterase activity kit. During 2010 the Test-mate kit will be taken to the field clinic and used to measure ChE activity before and after PAM reactivation in samples collected from pesticide handlers in Washington State. Samples that exhibit cholinesterase depression will subsequently be analyzed for OP-ChE adducts.

## **4. Prev 1: Interventions to Minimize Worker and Family Pesticide Exposures**

In Year 4, 32 practical solutions were identified by worksite walk-through evaluations and personal interviews with the farm managers and pesticide handlers. All solutions were innovations developed on the farm. Twenty practical solutions have been evaluated by 29 pesticide safety educators and orchard managers (in English and Spanish). In addition, solutions have been evaluated by Hispanic pesticide handler audiences using an audience response system. The project has also validated a quantitative method for using fluorescent tracers to evaluate application technologies. Other accomplishments included a field study that looked at the comparison between two spray volumes and having a cab on a tractor or not. A splash shield was designed to minimize pesticides splashed to the face during the mixing process. An evaluation of PPE and application equipment decontamination methods was piloted in a lab setting.

This year, communication activities focused on the development of summary sheets for each practical solution identified and on presentations to Hispanic audiences used to evaluate the uniqueness and practicality of potential solutions. Summary sheets were audience-tested through the Expert Working Group (EWG) and a battery of external reviewers of farm managers and pesticide safety educators. These solutions sheets are used internally for the project and will serve as the basis for the final document of recommended practical solutions.

#### **5. Edu 2: Reality Tales: Storytelling to Translate Agricultural Health and Safety Research**

Field-testing was accomplished with the ladder and StoryCorps narratives (ATV). During this period eight Story Corps narratives were edited down to three minutes for placement in communication channels. These narratives include the following injuries: a manure pit entrapment, a harrow rollover, a combine amputation, a fatal encounter with a bull, a cervical spine fracture from a hay bale blow, a ladder fall, two ATV rollovers (one of which was fatal and the other a near miss ATV accident), a child finger-burn from a hay baler, and a tractor with ROPS rollover incident. Additionally, four comic dramas demonstrating the risk factors, signs and symptoms, and treatment of 5 heat illnesses were aired on two Spanish-language stations covering the northwest and central east regions of the state where there are concentrations of farmworkers. Both stations aired the novelas on a rotating basis, at least three times per day.

In addition, during this project period, two local radio station story contests were promoted in two areas of the state (northwest and central east regions) in order to recruit storytellers. Unlike the previously popular ladder injury contest, no calls came in at either radio station. Station personnel speculated that the reasons farmworkers did not participate were busy work schedules, lack of familiarity with heat-related illnesses, embarrassment because such illnesses are viewed as a lapse of personal responsibility, or fear of reprisal from employers.

#### **6. Pilot 7: Responding to Uncertain Results in Research: A Pilot Study of Pesticide Handlers' Responses to PON1 Status**

This small project used interviews to understand the perspective of Hispanic pesticide handler research participants on receiving their individual genetic results, even when these results lack clinical significance. In general, workers were very aware that the pesticides they handled were potentially harmful substances, aware of PPE, and highly interested in actions to protect their health. If there were results that would indicate increased risk of harms from exposure; participants indicated they were very interested in knowing those results as well. However, many participants did not have a clear understanding of what the information that they were receiving meant. In order to respond to this uncertainty on a community level, the project team decided to take a step back to the basics. These results initiated the production of a video to improve the informed consent process in 2009. In addition, the results also motivated a new system for coordinating with the clinic to facilitate returning ChE results to pesticide handlers directly, rather than only to the employers, as was previously the practice at the CWOM clinic. This systems change was in direct response to the needs and interests articulated during the key informant interviews.

#### **7. New PNASH Funded Small Grants/Pilot Projects**

##### **Pilot 11: Occupational Safety and Health of Forest Workers**

Awarded to the Alliance of Forest Workers and Harvesters, this group will conduct a small community-based participatory research project aiming to document occupational injuries and illnesses and related medical treatment among immigrant, Spanish-speaking forest workers in southern Oregon. This project will inform the development of a pilot job health and safety promotora program for these workers that is funded through another NIOSH/CDC award.

##### **Pilot 12: Oregon Crab Fishing Safety Survey**

In a collaborative effort between the University of Washington and Oregon Health Sciences University, this project surveys Oregon commercial crab fisherman on their safety views and practices and fieldtests personal floatation devices.

## **TOTAL CENTER BUDGET**

09/10 Original Budget: \$1,387,207 TC  
08/09 Unobligated Balance Carryforward: \$325,493 TC  
09/10 Administrative Supplement: \$250,000 TC  
**Total 09/10 Budget: \$1,962,700 TC**  
**Total 09/10 Committed Cost Sharing: \$156,000 TC**  
**Total 09/10 Program Income: \$1,802 TC**

Actual Federal Award Expenditures: \$1,424,768 TC  
Actual Cost Sharing Expenditures: \$134,583 TC (cost share met proportional to federal expenditures)  
Estimated In-kind Support Value: \$50,000 TC  
Outside Funding: \$218,600 TC

## **CENTER PROJECTS**

Administrative, Planning and Outreach Core  
Research 1: Risk Factors for Cholinesterase Depression among Pesticide Handlers  
Research 2: Neurobehavioral Assessment of Pesticide Exposure in Children  
Research 3: Enhancements to Cholinesterase Monitoring: Oxime Reactivation & OP-ChE Adducts  
Research 4 Pilot: Assessment of Job-related Exposures for Diarrheal Illness in Farmworker Families  
Prevention1: Interventions to Minimize Worker and Family Pesticide Exposures  
Education 1: Introducing a Cholinesterase Test Kit into Clinical Practice  
Education 2: Reality Tales: Storytelling to Translate Agricultural Health and Safety Research  
Pilot 7: Responding to Uncertain Results in Research: A pilot study of pesticide handlers responses to PON1 status  
Pilot 8: Investigation of the Apparent Discrepancy between Observed Cholinesterase Depression among Pesticide Handlers in Washington and Regulatory Estimates of Exposure  
Pilot 9: FFA Community Mobilization for Safe Agricultural ATVs and Tractor ROPS  
Pilot 10: Reducing Workloads for Older Loggers in Physically Demanding Logging Tasks with Synthetic Rope

### **Ongoing Projects: 7**

#### **Projects completed this fiscal year: 3**

Research 4 Pilot: Assessment of Job-related Exposures for Diarrheal Illness in Farmworker Families  
Pilot 7: Responding to Uncertain Results in Research: A Pilot Study of Pesticide Handlers' Responses to PON1 status  
Pilot 8: Investigation of the Apparent Discrepancy between Observed Cholinesterase Depression among Pesticide Handlers in Washington and Regulatory Estimates of Exposure

#### **Projects dropped/discontinued in this fiscal year: 1**

Pilot 9: FFA Community Mobilization for Safe Agricultural ATVs and Tractor ROPS

### **New Projects.**

#### **New Pilot/Feasibility Projects: 2**

Pilot 11: Occupational Safety and Health of Forest Workers  
Pilot 12: Oregon Crab Fishing Safety Survey

## **CENTER INVESTIGATORS**

Scientific Investigators: 21  
Program Support Staff: 8

**REGIONAL ACTIVITIES:** AK, CA, ID, OR, WA, and some that span USA

## CENTER PRODUCTS

### Presentations

- 10/10/2009 - Oregon Logging Safety Conference  
John Garland. Synthetic Rope and Ergonomic Benefits
- 11/4/2009 - APHA 2009, Philadelphia, PN.  
Matthew Keifer. Implementation of a Portable Cholinesterase Monitoring Kit in A Clinical Setting: A Normalization Process Approach.
- 11/10/2009 - American Public Health Association, Philadelphia PA.  
Diane Rohlman. Development of an Icon-Based Questionnaire for Measuring Life Exposure to Pesticides in Children
- 11/10/2009 - Annual Meeting of the ISES, Minneapolis, MN.  
John Kissel. Comparison Of Dosimetry-Based Exposure Predictions And Biomonitoring Results In Chlorpyrifos Handler Studies From PHED.
- 1/18/2009 – PNASH Expert Working Group, Yakima, WA.  
Pip Ewg Presented Management Alternatives to the Organophosphates For Control Of Codling Moth (Cydia Pomonella) By Michael Bush, Phd, Extension Educator.
- 12/7/2009 - Washington Horticulture Conference, Yakima, WA.  
Maria Tchong. Soluciones y Practicas Creativas Para El Uso Sefuo De Pesticidas.
- 1/5/2010 - WSDA Pasco Real Agricultural Show, Pasco, WA.  
Coby Jansen. A State Cholinesterase Monitoring Program: Analysis of Consultation Data.
- 1/10/2010 - GS Long Meeting, Pasco, WA.  
Pablo Palmandez. Soluciones y Practicas Creativas Para El Uso Sefuo De Pesticidas.
- 1/10/2010 - Washington Logging Safety Conference, WA.  
John Garland. Synthetic Rope and Ergonomic Benefits.
- 1/27/2010 - ASHCA, Dallas/Fort Worth, TX.  
Richard Fenske, Jennifer Krenz, and Kit Galvin. Poster Presentation: Practical Solutions for Minimizing Agricultural Worker and Family Exposure To Pesticides.
- 1/28/2010 - ASHCA Annual Meeting, Dallas/Fort Worth, TX.  
Matthew Keifer. Poster Presentation: Workplace Factors That Influence Serum Cholinesterase Inhibition Among Organophosphate Exposed Pesticide Handlers In WA State.
- 2/1/2010 - 68th Annual Meeting of the Oregon Academy of Science, Portland, OR.  
Diane Rohlman. Asthma and Pesticide Exposure in Children.
- 2/2/2010 - 68th Annual Meeting of the Oregon Academy of Science, Portland, OR.  
Diane Rohlman. Neurobehavioral Performance and Home Environment.
- 2/2/2010 - 68th Annual Meeting of the Oregon Academy of Science, Portland, OR.  
Diane Rohlman. Pesticide Risk Perception among Residents of an Agricultural Region In Oregon
- 2/12/2010 - Western Migrant Stream Forum, Seattle, WA.  
Using Data To Identify And Address Causes of Pesticide Over-Exposure In Washington State Agricultural Employees. 2/12/2010 - 19th Annual Western Migrant Stream Forum, Seattle, WA.
- 4/14/2010 - National Action Summit For Latino Worker Health And Safety.  
Coby Jansen. Poster Presentation. Using Data to Identify And Address Causes Of Pesticide Over-Exposure In Wa State Agricultural Employees.
- 4/20/2010 - PNASH Research Review, Granger, WA.  
Pablo Palmandez. Interventions to Minimize Agricultural Worker And Family Pesticide Exposure.
- 5/19/2010 - UW Student Research Day, Seattle, Wa.  
Rad Cunningham. 2010 Preliminary Results of the Analysis of The 2006-2010 Data was presented to students and staff.
- 5/21/2010 – PNASH Expert Working Group Meeting, Yakima, WA.  
Noise Exposure at Work Presentation to EWG.

- 6/15/2010 - 26th International Neurotoxicology Conference, Portland, OR.  
Diane Rohlman. Neurobehavioral Evaluation of Children Living In an Agricultural Community.
- 8/10/2010 - Center for Research on Occupational and Environmental Toxicology Summer Student Research Forum, Portland, OR.  
Diane Rohlman. Pesticide Exposure Estimates Based on Carpet Dust Samples from the Homes of Agricultural and Non-Agricultural Workers.
- 12/15/2010 - UW DEOHS Advisory Meeting, Seattle, WA.  
Richard Fenske. Interventions to Minimize Agricultural Worker and Family Pesticide Exposure.

#### Publications

##### Article Published, Professional (Juried Publication)

- Rohlman DS, Lucchini R, Anger WK, Bellinger DC, Van Thriel C  
Neurobehavioral Testing in Human Risk Assessment  
Neurotoxicology; Vol. 29.
- Hofmann-JN, Keifer-MC, Checkoway-H, De Roos-AJ, Farin-FM, Fenske-RA, Richter-RJ, Van Belle-G, Furlong-CC.  
Biomarkers of Sensitivity and Exposure in Washington State Pesticide Handlers  
Adv Exp Med Biology 2010;
- Hofmann-JN, Checkoway-H, Borges-O, Servin-F, Fenske-RA, Keifer-MC  
Development of a Computer-Based Survey Instrument for Organophosphate and N-Methyl-Carbamate Exposure Assessment Among Agricultural Pesticide Handlers  
Ann. Occup. Hyg. Epub April 2010; Vol 54, No 6: 640-50. PMID: 20413416, PMC2918489.
- Keifer-M, Gasperini-F, Robson-M  
Pesticides and Other Chemicals: Minimizing Worker Exposures  
Journal of Agromedicine July 2010; 15(3):264-74.

##### Article Published, Feature (Trade Publication)

- Garland-J  
New Yarders... Old Yarders  
Loggers World; Spring 2010.
- Rohlman-D  
Survey of Residents of a Northwest Orchard Community Shows High Levels of Perceived Pesticide Risk and Lack of Pesticide Training  
Migrant Clinicians Network Streamline 2010;16.
- Rohlman-D  
Neurobehavioral Effects of Pesticide Exposure In Children  
Migrant Clinicians Network Streamline 2010;16.
- Jansen-C  
Healthcare Providers' Role in Strengthening Regulations and Preventing Pesticide-Related Illness in Farm Workers  
Streamline Newsletter March/April 2010; Vol 16, Issue 2.
- Jansen-C  
Inter-Agency Collaboration in Wa State To Prevent Pesticide Exposures  
Agconnections Newsletter Spring 2010; Vol 5, No 1.
- Hohn-E. Rohlman-D  
Survey of Residents of Northwest Orchard Community Shows High Levels of Perceived Pesticide Risk and Lack Of Training  
Mcn Streamline July/Aug 2010; Vol 16, Iss 4.
- Jansen-C  
Healthcare Providers' Role in Preventing Pesticide Related Illness  
Mcn Streamline March/April 2010; Vol. 16, Iss 2.

#### Fact Sheet

- Galvin-K  
30 Two-Page Practical Solution Summary/Instruction Sheets

#### Book

- Rohlman-DS, Mccauley-L  
Toxicity of Anticholinesterase Pesticides In Neonates And Children.  
T Satoh & R Gupta (Eds.) Pesticides: Metabolism, Neurotoxicity And Epidemiology. New York, John Wiley & Sons, Inc. 2010.

#### Education / Training / Outreach

- Training: Zillah School District FFA Leadership Tractor and ATV

#### Thesis or Dissertation

- Minimizing Pesticide Handler Pesticide Exposure: Practical Solutions Fresh from The Orchard
- Moving from Evidence to Collaboration and Action: Identifying And Addressing Causes of Pesticide Exposure among WA State Agricultural Workers

#### Website or Webpage Established

- PNASH Center Website - Updated with Featured Resources
- Fluorescent Tracer: An Educational Tool for Pesticide Safety Educators

#### Newsletter

- Northwest Forest Worker Safety Review - Issue 9

#### CD-ROM/Audio

- Una Visita a La Clinica. Que Son Cholinesterasa y PON1? (A Visit to the Clinic. What Is Cholinesterase and PON1?)
- Ag Injury Stories Told By Survivors Or Relatives - Three Minute Segments
- Four Radio Novelas on Heat-Related Illness
- Four Radio Novelas on Pesticide Exposure, Air Pollution/Asthma, Water Pollution, and Workplace Abuse
- Radio Novelas, La Familia Chavira Aprendiendo Sobre La Genética

#### Evaluation Instrument / Tool

- SOP: Incorporating Oxime-Mediated Reactivation Of Butyrylcholinesterase into The Test-Mate Cholinesterase Activity Kit.
- Safe Workplace, Safe Home/Sitio De Trabajo Seguro, Hogar Seguro: Computer-Based Training on Pesticide Safety at Work and Home

#### Poster

- PNASH Center Display Poster
- Using Data To Identify and Address Causes Of Pesticide Over-Exposure in Wa State Agricultural Employees
- Pesticide Exposure Estimates Based on Carpet Dust Samples from the Homes of Agricultural and Non-Agricultural Workers
- Practical Solutions for Minimizing Agricultural Worker And Family Exposure to Pesticides
- Fresh From the Orchard: Practical Solutions For Preventing Pesticide Exposure

#### Powerpoint Presentation (For Distribution)

- Soluciones Y Practicas Creativas Para El Uso Seguro De Pesticidas
- Data summarizing COPER and risk factors data.

#### Other

- 1/9/2010 - UW/UBC Public Health Symposium  
Fluorescent Tracer display and video at the UW/UBC Public Health Symposium.

- 3/3/2010 - 6th Annual Washington Governor's Ag Safety Day, Yakima, WA.  
Organized and staffed the Health Fair at the WA Ag Safety Day for the 4th year. This event included hands-on learning through participation and games.
- 4/9/2010 - UW Paws-on-Science, Seattle, WA  
FT Tracer booth and demonstrations conducted at UW Paws-on-Science event for grade 6-12 students at Seattle Center.
- 7/10/2010 - WSDA Health Fair  
PNASH lead educational games on heat illness at a regional health fair organized by the WSDA farmworker education program.
- 7/28/2010 - WSU Field Day, Wenatchee, WA.  
WSU Field Day Demonstrations of Pesticide Exposure Interventions.

#### Conferences

- 2/12/2010 - 2/12/2010: 19th Western Migrant Stream Forum  
Research Reception with 20 posters and rapid presentations.

#### Other Products

##### Year-End Report to NIOSH

- 2008-2009 PNASH Center Annual Report

## II. ADMINISTRATION, PLANNING, AND OUTREACH

### PROJECT TITLE

Administrative, Planning, and Outreach Core

### PROJECT OFFICERS(s)

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### HOST ORGANIZATION

University of Washington  
Environmental and Occupational Health Sciences  
Box 357234  
Seattle, WA 98195

### PROJECT DESCRIPTION

The Administrative, Planning, and Outreach Core provides the administrative infrastructure for the entire Center program and assists in the implementation of individual project objectives. The core ensures that project activities are well coordinated within the Center, are of high scientific quality, and responsive to stakeholder needs. The components of this core include:

- Management.
- Pilot Project Program.
- Internal and External Advisory Committees.
- NIOSH Agricultural Center Collaboration.
- Agricultural Community Outreach and Education Program.

### PROJECT START AND END

Start: 9/30/2006      End: 9/29/2011

### PROJECT BUDGET

- 1 Actual Project Expenditures: \$
- 2 Estimated In-kind Support Value: \$
- 3 Outside Funding: \$

### PROJECT AIMS

- 1 Management – **Ongoing**
- 2 Pilot Project Program – **Ongoing**
- 3 Internal and External Advisory Committees – **Ongoing**
- 4 NIOSH Agricultural Center Collaboration – **Ongoing**
- 5 Agricultural Community Outreach and Education Program – **Ongoing**

### NORA GOALS AND ACTION STEPS ADDRESSED

The Administrative, Planning, and Outreach Core supports all NORA goals, and specifically in FY2009 addressed:

**Intermediate Goal 2.1** – Define and identify "vulnerable workers" in each sector- agriculture, forestry, and fishing

**Intermediate Goal 2.2** Identify the deleterious health and safety outcomes of vulnerable workers in each sector- agriculture, forestry, and fishing.

**Intermediate Goal 2.4** - Use innovative and proven communication, education, training, and marketing techniques to tailor workplace safety and health programs to be responsive to the unique needs of vulnerable workers.

**Intermediate Goal 3.1** - Form collaborative efforts with key stakeholders to:

- 1) biennially assess current and emerging major occupational health and safety concerns and solutions;
- and 2) prioritize interventions for implementation.

**Intermediate Goal 3.3** - Use innovative and proven communication, education, and social marketing techniques to influence knowledge, attitudes, and practices of agricultural workers, loggers, and commercial fishermen.

## PROJECT ACCOMPLISHMENTS and CHALLENGES

Planning and development activities:

- 19th Western Migrant Stream Forum, February 11-13, 2010, Seattle, WA. Planning, project presentations, and PNASH-hosted Research Reception with 20 posters and rapid presentations. Selected posters were published as articles in the MCN Streamline newsletter in the 2010 year.
- Research Review and Advisory Board Meeting, April 20, 2010, Zillah, WA. A two-day meeting with advisors, stakeholders, and Center investigators to: 1) present PNASH's project progress, preliminary results, and new directions; 2) advise project investigators in their final stages of work; and 3) generate ideas for the PNASH Center's future work in our 2011-2016 cycle. Website: [http://depts.washington.edu/pnash/research\\_review10.php](http://depts.washington.edu/pnash/research_review10.php)
- Strategic planning for 2011-2016 cycle including: 1) identification of regional needs from data review and advisory inputs; 2) call for ideas to regional investigators; 3) survey of farmworker clinic medical directors; and 4) program-to-program planning meetings with the Washington State Department of Health, Washington State Department of Agriculture, Washington State Department of Labor and Industries, Migrant Clinician's Network, AK NIOSH Office, Coast Guard.

## PROJECT PRODUCTS

Publications

Article published, professional (juried publication)

- Keifer-M, Gasperini-F, Robson-M  
Pesticides and Other Chemicals: Minimizing Worker Exposures  
Journal of Agromedicine July 2010; 15(3):264-74..

Article published, feature (trade publication)

- Hohn-E. Rohlman-D  
Survey of Residents of Northwest Orchard Community Shows High Levels of Perceived Pesticide Risk and Lack Of Training
- Jansen-C  
Inter-Agency Collaboration in Wa State To Prevent Pesticide Exposures  
Agconnections Newsletter Spring 2010; Vol 5, No 1.

Education / Training / Outreach

Website or webpage established

- PNASH Center Website - Updated with featured resources

Newsletter

- Inter-Agency Collaboration in WA State to prevent pesticide exposures
- Northwest Forest Worker Safety Review - Issue 9

#### CD-ROM

- Four Radio Novelas on Pesticide Exposure, Air Pollution/Asthma, Water Pollution, and Workplace Abuse

#### Poster

- PNASH Center Display Poster

#### Conferences

- 2/12/2010 - 2/12/2010: 19th Western Migrant Stream Forum  
Research Reception with 20 posters and rapid presentations.

#### Other

- 3/3/2010 - 6th Annual Washington Governor's Ag Safety Day  
Organized and staffed the Health Fair at the Washington Ag Safety Day for the 4th year. This event included hands-on learning through participation and games.
- 7/10/2010 - WSDA Health Fair  
PNASH lead educational games on heat illness at a regional health fair organized by the Washington State Department of Agriculture's Farmworker Education Program.

#### Other Products

##### Year-End Report to NIOSH

- *2008-2009 PNASH Center Annual Report*

#### **STATES PROJECT WAS ACTIVE IN**

ID, OR, WA, and some that span USA

#### **COLLABORATION**

All other NIOSH Ag Centers  
Centers for Disease Control  
Heritage University  
Migrant Clinician's Network  
National Institute of Occupational Safety and Health  
Northwest Community Education Center  
Northwest Community Education Center/Radio KDNA  
Northwest Regional Primary Care Association  
Oregon Health and Sciences University  
US Environmental Protection Agency  
UW Department of Environmental and Occupational Health Sciences  
UW Department of Occupational Nursing  
UW Dept of Health Services/ Public Health Practice  
UW Pediatric Environmental Specialty Unit  
UW School of Public Health and Community Medicine  
Washington State Department of Agriculture  
Washington State Department of Health  
Washington State Department of Labor and Industries  
Washington State Farm Bureau  
Washington State University  
Yakima Valley Community College  
Yakima Valley Farm Workers Clinic

#### **External Advisory Committee members:**

Deborah Carter, Northwest Horticultural Council  
Jim Doornick, Doornink Fruit Ranch  
Leda Garside, Tuality Healthcare's ¡Salud! Services

Barbara Lee, Director, National Children's Center for Rural and Agricultural Health and Safety  
(resigned during this period)  
Karen Lewis, Extension Educator, Washington State University  
Carol McCormick, Outreach Coordinator, Columbia Valley Community Health  
Betty Ann Cohen, Physician, Yakima Health Management Associates  
Eric Zakarison, Grower, Zacharison Partnership  
Victor Jensen, Owner, Golden Glen Creamery

### III. CENTER PROJECTS

#### PROJECT TITLE

Res1: Risk Factors for Cholinesterase Depression among Pesticide Handlers

#### PROJECT OFFICERS(s)

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#### HOST ORGANIZATION

University of Washington  
Environmental and Occupational Health Sciences  
Box 357234  
Seattle, WA 98195

#### PROJECT DESCRIPTION

In 2004, the Washington State Department of Labor and Industries (WADL&I), under mandate from the Washington State Supreme Court, initiated a new cholinesterase (ChE) monitoring program for agricultural workers who handle toxicity class I or II organophosphate (OP) or N-methyl-carbamate (CB) pesticides. The ChE enzyme, which plays an essential role in the regulation of neural signaling, is inhibited by OP and CB pesticides. Washington is only the second state in the Union to establish a ChE monitoring program; California has required ChE monitoring since 1974. In contrast to the California monitoring program, the Washington program benefits from a single laboratory provider, a central data repository (WADL&I), provision of the vast majority (>80%) of ChE tests by three main clinics, and an inspection team that reviews work practices and conditions at workplaces where ChE depressions occur. Although these investigations have revealed several potential risk factors, none of these factors have been confirmed through a comparison against work practices and conditions among a reference group of handlers who did not have depressed ChE activity. These characteristics of the newly established ChE monitoring program offer researchers an unprecedented opportunity to investigate determinants of overexposure to OP and CB pesticides. In the proposed study, we will seek to identify and characterize risk factors for ChE depression among handlers participating in the Washington State ChE monitoring program. Approximately 1,200 handlers will be recruited over a 5-year period in collaboration with the three main occupational medicine clinics in agricultural regions of Washington State. A participant's risk of ChE depression will be evaluated with respect to workplace, behavioral, and genetic characteristics (paraoxonase or PON1 status). Exposure information will be obtained using a computer-based survey instrument with audio-recorded questions and icon-based responses that are displayed on the touch screen Tablet PC. We will collect exposure data before ChE activity status is determined. Reported exposures will be validated through worksite visits for a subset of study participants. Blood specimens will be collected and analyzed for determination of PON1 status for each study participant. Epidemiologic studies are needed to verify animal-based findings that PON1 status correlates with susceptibility to certain OPs. The results of this study will improve our understanding of potential routes and mechanisms of pesticide overexposure, and will help to prevent such exposures among pesticide handlers. The effectiveness of educational materials developed in response to identify risk factors will be evaluated in terms of their impact on the prevalence of ChE depression and the prevalence of reported risk factors among participating handlers.

#### PROJECT START AND END

Start: 9/30/2006      End: 9/29/2011

## PROJECT BUDGET

1. Actual Project Expenditures: \$ 279,650.73
2. Estimated In-kind Support Value: None
3. Outside Funding: None

## PROJECT AIMS

- 1 Enroll 50% of Washington State pesticide handlers who undergo repeat ChE testing in an ongoing cross-sectional study. – **Ongoing**
  - To date, a total of 265 agricultural pesticide handlers have been enrolled in this study. During the past year, 48 handlers participated in the study, with a total of 50 visits (i.e., occasions when participating handlers completed the survey and/or provided a blood sample for PON1 testing). Enrollment has been somewhat lower than expected due to an overall decrease in the number of workers participating in the ChE monitoring program, possibly due to work reorganization or reduced use of organophosphate and carbamate insecticides.
- 2 Collect information about likely key risk factors for pesticide over-exposure from participating handlers. – **Ongoing**
  - Self-reported information about potential sources of pesticide exposure was collected for a total of 50 participant visits during the 2010 spray season. Descriptive analyses of survey data from 154 study participants during the 2006-2007 spray seasons have been performed, and there is an ongoing analysis of the 2006-2010 data that will be completed by the end of 2010.
- 3 Characterize PON1 status in blood specimens from each participant. – **Ongoing**
  - PON1 status is hypothesized to be a biological marker of susceptibility to some organophosphate pesticides including chlorpyrifos. A total of 48 blood specimens for PON1 testing were collected from participating handlers during the 2010 spray season. These blood specimens are analyzed by Dr. Clement Furlong and colleagues to determine PON1 status based on the two-substrate assay, as well as plasma PON1 activity levels. Genotyping assays for the C-108T polymorphism in the PON1 promoter region and the Q192R polymorphism in the PON1 coding region will also be performed. Blood specimens from 163 participants during the 2006-2007 spray seasons have been tested for PON1 status and genotype. This test will be repeated for samples collected during the 2008-2010 spray seasons.
- 4 Determine which risk factors are associated with ChE inhibition, including workplace conditions, behavioral factors, and PON1 status. – **Ongoing**
  - Analyses of ChE inhibition in relation to self-reported exposures based on data collected during the 2006-2010 spray seasons are currently underway. An analysis of exposures in relation to PON1 status is pending.
- 5 Evaluate the impact of educating workers and growers about risk factors for ChE depression. – **Future**
  - The results from the analysis of the 2006 and 2007 data have been shared with the Washington State Department of Agriculture, published in the academic journal *Environmental and Occupational Medicine*, and summarized in an article published in *Good Fruit Grower*, a magazine well read by Washington State orchardists. Similar use will be made of the results of the 2006-2010 data.

## NORA GOALS AND ACTION STEPS ADDRESSED

**Intermediate goal 1.3** - Ensure that occupational illness, injury, and fatality surveillance data for the AgFF sector are readily available to workers, employers, intramural and extramural research scientists, and the public in a timely manner.

**Intermediate goal 2.3** - Improve data collection and existing databases to provide information on safety and health disparities among vulnerable workers.

**Action step 2.3.3** - Establish data-sharing mechanisms among universities, government agencies, and community-based and non-governmental organizations.

**Intermediate goal 2.4** - Use innovative and proven communication, education, training, and marketing techniques to tailor workplace safety and health programs to be responsive to the unique needs of vulnerable workers.

**Action step 2.4.5** - Facilitate implementation of effective health and safety interventions tailored to address risk factors associated with vulnerability, through partnerships with industry leaders in AgFF.

**Intermediate goal 5.3** - Reduce acute and chronic illness associated with exposure to pesticides and other agrochemicals.

**Action step 5.3.1** - Improve the organization of existing information. Based on an evaluation of findings, develop and implement biological monitoring guidelines, e.g. ChE testing.

**Action step 5.3.3** - Test and evaluate interventions that lead to implementation of best practices and behavioral change related to protection from chemical exposures.

## **PROJECT ACCOMPLISHMENTS and CHALLENGES**

- A major accomplishment of this project this year was the development and work of the Committee on Pesticide Exposure Reduction (COPER). COPER brought together representatives from the three state agencies with responsibilities related to occupational exposure to agricultural pesticides (WA State Department of Agriculture, WA State Department of Health, WA State Department of Labor and Industries). The PNASH Center out of UW was the fourth partner in this collaboration. This effort was led by Coby Jansen, a research assistant who did her master's capstone work on this project, and Helen Murphy-Robinson, PNASH Center Director of Outreach and Education.
- As reported previously, we continue to under recruit participants from what we had originally estimated. This has been the key challenge in this project for the past three years.

## **PROJECT PRODUCTS**

### Presentations

- 1/5/2010 - WSDA Pasco Real Agricultural Show, Pasco, WA.  
Coby Jansen. A State Cholinesterase Monitoring Program: Analysis of Consultation Data.
- 1/28/2010 - ASHCA Annual Meeting, Dallas/Fort Worth, TX.  
Matthew Keifer. Poster Presentation: Workplace Factors That Influence Serum Cholinesterase Inhibition Among Organophosphate Exposed Pesticide Handlers In WA State.
- 2/12/2010 - Western Migrant Stream Forum, Seattle, WA.  
Using Data To Identify And Address Causes of Pesticide Over-Exposure In Washington State Agricultural Employees. 2/12/2010 - 19th Annual Western Migrant Stream Forum, Seattle, WA.
- 4/14/2010 - National Action Summit For Latino Worker Health And Safety.  
Coby Jansen. Poster Presentation. Using Data to Identify And Address Causes Of Pesticide Over-Exposure In WA State Agricultural Employees.
- 5/19/2010 - UW Student Research Day, Seattle, Wa.  
Rad Cunningham. 2010 Preliminary Results of the Analysis of The 2006-2010 Data was presented to students and staff.

### Publications

Article published, professional (juried publication)

- Hofmann-JN, Keifer-MC, Checkoway-H, De Roos-AJ, Farin-FM, Fenske-RA, Richter-RJ, Van Belle-G, Furlong-CC.  
Biomarkers of Sensitivity and Exposure in Washington State Pesticide Handlers  
Adv Exp Med Biology 2010;

- Hofmann-JN, Checkoway-H, Borges-O, Servin-F, Fenske-RA, Keifer-MC  
Development of a Computer-Based Survey Instrument for Organophosphate and N-Methyl-Carbamate Exposure Assessment Among Agricultural Pesticide Handlers  
Ann. Occup. Hyg. Epub April 2010; Vol 54, No 6: 640-50. PMID: 20413416, PMC2918489.  
Article published, feature (trade publication)
- Jansen-C  
Healthcare Providers' Role in Strengthening Regulations and Preventing Pesticide-Related Illness in Farm Workers  
Streamline Newsletter March/April 2010; Vol 16, Issue 2.
- Jansen-C  
Inter-Agency Collaboration in Wa State To Prevent Pesticide Exposures  
Agconnections Newsletter Spring 2010; Vol 5, No 1.

#### Education / Training / Outreach

##### Thesis or dissertation

- Moving from Evidence to Collaboration and Action: Identifying And Addressing Causes of Pesticide Exposure among WA State Agricultural Workers

##### CD-ROM

- Una Visita a La Clinica. Que Son Cholinesterasa y PON1? (A Visit to the Clinic. What Is Cholinesterase and PON1?)

##### Poster

- Using Data To Identify and Address Causes Of Pesticide Over-Exposure in Wa State Agricultural Employees

##### PowerPoint Presentation (for distribution)

- Data summarizing COPER and risk factors data

## **STATES PROJECT WAS ACTIVE IN**

WA and National- US

## **COLLABORATION**

Central Washington Occupational Medicine

Department of Entomology and Environmental Toxicology, Washington State University

Farmworker Education Program, Washington State Department of Agriculture

Lourdes Clinic

Pesticide Incident Reporting and Tracking Panel, Washington State Department of Health

Scientific Advisory Committee, Washington State Cholinesterase Monitoring Program

UW Department of Medical Genetics

UW Department of Epidemiology

WA Department of Labor and Industries

WorkCare, PLLC

Yakima Worker Care and Sunnyside Worker Care

## PROJECT TITLE

Res2: Neurobehavioral Assessment of Pesticide Exposure in Children

## PROJECT OFFICERS(s)

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## HOST ORGANIZATION

Oregon Health & Science University  
CROET  
3181 SW Sam Jackson Park Road  
Portland, OR 97239

## PROJECT DESCRIPTION

The goal of the proposed study is to extend our previous work to identify possible health effects from chronic exposure to organophosphate pesticides in school-age children (5-12 years) and determine if performance is correlated with current home pesticide exposure or with an estimate of lifetime measure of exposure. We propose a 5-year plan of research that will: 1) establish an optimal exposure measurement protocol; 2) recruit a cohort of 150 exposed and 150 non-exposed control children; 3) compare neurobehavioral performance of children of applicators to children of controls in a cross-sectional study, and relate neurobehavioral performance of all children to estimates of (potential) home dust exposure and estimates of lifetime exposure; 4) repeat the same measurements in a second year to obtain longitudinal data that will characterize developmental progress and relate that progress to exposure estimates; 5) develop one-page English/Spanish brochures for the various communities to describe research outcomes and their implications for school, work, home, and clinical diagnosis.

## PROJECT START AND END

Start: 1/10/2006      End: 9/29/2011

## PROJECT BUDGET

1. Actual Project Expenditures: \$206,167.37
2. Estimated In-kind Support Value: None
3. Outside Funding: None

## PROJECT AIMS

- 1 Establish a sampling protocol to characterize Organophosphate (OP) exposures in urine metabolites in children over a spraying season. Obtain self-reports of pesticide use by applicators and family members using an icon-based interview approach to develop an estimate of lifetime pesticide exposures in the children tested. – **Partially Met**
  - The CDC has agreed to analyze the urine samples and we are waiting for results.
  - Methods to assess lifetime pesticide exposure using the Life History Calendar were presented at the American Public Health Association Meeting in November 2009.
- 2 Recruit a cohort of 150 school-age children, whose parents are active OP pesticide mixer-loader applicators, and an age- and gender-matched control group (N=150); and implement procedures for maintaining contact with the sample over two application seasons. – **Met**
  - Recruitment materials have been developed and used by our community research assistant to present

- the project and recruit families to participate in the Neurobehavioral Study (Aim 3). The project has been presented at over 15 different community events during the past year (e.g., ESL classes, street fairs and festivals, churches, school open houses, soccer tournaments, and job fairs).
- Data from the Recruitment Study (N=510) conducted at the Hood River County Fair in July 2009 was presented at two meetings and an article written for the Migrant Clinicians Network Streamline newsletter. The goal of this study was to recruit families for the Neurobehavioral Study and also to identify common knowledge and beliefs about pesticides to use in the development of communications from the study (Aim 5).
  - During the 2010 Hood River County Fair a training study was conducted to recruit families and to evaluate pesticide knowledge before and after training. Four hundred and seventy adults completed computer-based pesticide safety training (Aim 5).
- 3 Conduct a cross-sectional study of neurobehavioral performance in children (age 5-12) of pesticide mixer-loader-applicators, compared to same-age control children, and relate performance of all children to home dust exposures. – **Ongoing**
- The Neurobehavioral Study is conducted from September to January beginning in 2008. The 3rd wave of recruitment and testing began in September 2010. Currently 245 families have completed home interviews and neurobehavioral testing.
  - Dust samples were collected from homes where carpet was available (N=254). These samples are being analyzed at the University of Washington Laboratory.
  - An additional research assistant was hired to assist with data collection during the neurobehavioral testing and we have added an additional part-time research assistant for the ongoing testing.
- 4 Examine neurobehavioral performance of the same 300 children in the following (second) year to determine if home pesticide exposures affect neurodevelopment. – **Ongoing**
- Families tested in Fall/Winter of 2009 have been contacted and asked to complete questionnaires assessing pesticide exposure in the past year and to collect a second dust sample from their home.
  - A total of 82 families have completed the second year interview and neurobehavioral test session.
- 5 Develop a series of communications to the orchard worker, orchard owner, school and medical communities in Hood River that describe the research outcomes and targeted implications. – **Ongoing**
- A computer-based training was developed in Spanish and English to provide training on pesticide safety in the workplace and at home (Safe Workplace, Safe Home/Sitio de Trabajo Seguro, Hogar Seguro). This was administered to 470 adults at the County Fair during 2010. Pre- and post-test knowledge was assessed as well as demographic information.
  - An advisory board meeting was held in March 2010 to provide a study update for the project and solicit feedback about initial data analysis and future plans.
  - A project website is in development to provide families with their results of pesticides found in their dust samples and information about reducing pesticides in the home.

## **NORA GOALS AND ACTION STEPS ADDRESSED**

**Strategic Goal 1 - Surveillance -** Improve surveillance within the Agriculture, Forestry, and Fishing Sector to describe: the nature, extent, and economic burden of occupational illnesses, injuries, and fatalities; occupational hazards; and worker populations at risk for adverse health outcomes.

**Strategic Goal 2 - Vulnerable Workers -** Reduce deleterious health and safety outcomes in workers more susceptible to injury or illness due to circumstances limiting options for safeguarding their own safety and health.

**Strategic Goal 3 - Outreach, Communications, and Partnerships -** Move proven health and safety strategies into agricultural, forestry, and fishing workplaces through the development of partnerships and collaborative efforts.

**Strategic Goal 5 - Agriculture Health - Improve the health and well being of agricultural workers by reducing occupational causes or contributing factors to acute and chronic illness and disease.**

### **PROJECT ACCOMPLISHMENTS and CHALLENGES**

- 245 families have participated in the Neurobehavioral Study (including home interviews, neurobehavioral testing, and home dust sample collection)
- 82 families returned for follow-up neurobehavioral testing
- Pesticide safety training was developed and 470 participants completed the training
- Due to the demographics of our population we were unable to locate 150 families with a parent that actively mixes, applies, or loads pesticides. We broadened our Agricultural Group to include families with a parent working in agriculture as an orchard worker (harvester or field worker) or in the packing plant.

### **PROJECT PRODUCTS**

#### Presentations

- 11/10/2009 - American Public Health Association, Philadelphia PA.  
Diane Rohlman. Development of an Icon-Based Questionnaire for Measuring Life Exposure to Pesticides in Children
- 2/1/2010 - 68th Annual Meeting of the Oregon Academy of Science, Portland, OR.  
Diane Rohlman. Asthma and Pesticide Exposure in Children.
- 2/2/2010 - 68th Annual Meeting of the Oregon Academy of Science, Portland, OR.  
Diane Rohlman. Neurobehavioral Performance and Home Environment.
- 2/2/2010 - 68th Annual Meeting of the Oregon Academy of Science, Portland, OR.  
Diane Rohlman. Pesticide Risk Perception among Residents of an Agricultural Region In Oregon
- 2/12/2010 - Western Migrant Stream Forum, Seattle, WA.  
Using Data To Identify And Address Causes of Pesticide Over-Exposure In Washington State Agricultural Employees. 2/12/2010 - 19th Annual Western Migrant Stream Forum, Seattle, WA
- 6/15/2010 - 26th International Neurotoxicology Conference, Portland, OR.  
Diane Rohlman. Neurobehavioral Evaluation of Children Living In an Agricultural Community.
- 8/10/2010 - Center for Research on Occupational and Environmental Toxicology Summer Student Research Forum, Portland, OR.  
Diane Rohlman. Pesticide Exposure Estimates Based on Carpet Dust Samples from the Homes of Agricultural and Non-Agricultural Workers.

#### Publications

Article published, professional (juried publication)

- Rohlman DS, Lucchini R, Anger WK, Bellinger DC, Van Thriel C  
Neurobehavioral Testing in Human Risk Assessment  
Neurotoxicology; Vol. 29.

Article published, feature (trade publication)

- Rohlman-D  
Survey of Residents of a Northwest Orchard Community Shows High Levels of Perceived Pesticide Risk and Lack of Pesticide Training  
Migrant Clinicians Network Streamline 2010;16.
- Rohlman-D  
Neurobehavioral Effects of Pesticide Exposure In Children  
Migrant Clinicians Network Streamline 2010;16.

#### Book

- Rohlman-DS, Mccauley-L  
Toxicity of Anticholinesterase Pesticides In Neonates And Children.  
T Satoh & R Gupta (Eds.) Pesticides: Metabolism, Neurotoxicity And Epidemiology. New York, John Wiley & Sons, Inc. 2010.

#### Education / Training / Outreach

##### Evaluation instrument / tool

- Safe Workplace, Safe Home/Sitio De Trabajo Seguro, Hogar Seguro: Computer-Based Training on Pesticide Safety at Work and Home

##### Poster

- Pesticide Exposure Estimates Based on Carpet Dust Samples from the Homes of Agricultural and Non-Agricultural Workers

#### **STATES PROJECT WAS ACTIVE IN**

OR, WA, and National- US

#### **COLLABORATION**

Hood River community members

Members from the Oregon growers and shippers organizations

Members of the Oregon State University Agriculture Extension Office

## PROJECT TITLE

Res3: Enhancements to Cholinesterase Monitoring: Oxime Reactivation & OP-ChE Adducts

## PROJECT OFFICERS(s)

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## HOST ORGANIZATION

University of Washington  
Environmental and Occupational Health Sciences  
Box 357234  
Seattle, WA 98195

## PROJECT DESCRIPTION

The overall goal of this proposal is to improve the specificity, sensitivity, and reliability of cholinesterase monitoring, thereby providing a tool to detect and reduce overexposure of agricultural workers to cholinesterase (ChE)-inhibiting pesticides.

## PROJECT START AND END

Start: 1/10/2006      End: 9/29/2011

## PROJECT BUDGET

1. Actual Project Expenditures: \$ 140,536.85
2. Estimated In-kind Support Value: \$ None
3. Outside Funding: \$ None

## PROJECT AIMS

- 1a Develop/validate a sensitive, accurate, and robust analytical procedure based on HPLC/MS/MS for the measurement of OP-adducts to plasma ChE (butyryl ChE, BuChE). – **Met**
  - The analytical method was further expanded by acquiring additional, custom-synthesized analytical standards to improve the accuracy and precision of the method.
- 1b Evaluate the potential of oxime reactivation followed by measurement of ChE activity for confirmation of depressed ChE activity. – **Met**
- 2 Evaluate the relationships between OP-adduct levels, reactivatability of ChE, and ChE activity in vitro, in vivo in rats, and in humans exposed to OP pesticides. – **Ongoing/revised**
  - Although the LC/MS/Ms assay is effective for measuring OP-ChE adducts in human samples, to date we have been unsuccessful in detecting OP-ChE adducts in rat plasma. This is likely because BuChE concentrations are at least 20-fold lower in rat plasma compared to human plasma. Therefore, we have decided to refocus this aim specifically on the human in vitro and in vivo experiments.
  - Expanding upon pilot studies carried out in Year 3, human blood was treated in vitro with CPO. Adduct levels, and ChE activity with and without oxime reactivation by PAM, were measured. Our results showed that CPO inhibition of human butyrylcholinesterase is rapid, occurring within minutes, and aging of the adduct is complete within 12 to 24 hours. Analysis of the adduct levels determined by LC/MS/MS is in progress.

- 3 Research to practice: Incorporate the assays developed in Aim 1 with the practice of OP pesticide exposure monitoring in Washington State. – **Ongoing**
- We have adapted the reactivation assay for use with the Test-mate cholinesterase activity kit. In the current year, the Test-mate kit will be taken to the field clinic and used to measure ChE activity before and after PAM reactivation in samples collected from pesticide handlers in Washington State. Samples that exhibit cholinesterase depression will subsequently be analyzed for OP-ChE adducts.

#### **NORA GOALS AND ACTION STEPS ADDRESSED**

**Intermediate Goal 5.3** - Reduce acute and chronic illnesses associated with exposure to pesticides and other agrochemicals.

**Action Step 5.3.4** - Develop and improve methods for assessment of exposures to agrochemicals, including interactions of multiple chemicals found in the workplace.

#### **PROJECT ACCOMPLISHMENTS and CHALLENGES**

- Accomplishments for the past year include improvements to the HPLC/MS/MS method for analyzing cholinesterase adducts. Additional standards were synthesized and added to the method to expand the number of adducts monitored and to improve quantification.
- Human plasma samples, treated in vitro with chlorpyrifos oxon, were analyzed for reaction rates of cholinesterase inhibition and adduct aging. Cholinesterase activity was measured with and without oxime treatment. Samples were also prepared and analyzed by HPLC/MS/MS for comparison of cholinesterase activity inhibition and adduct levels.
- A procedure was developed incorporating oxime-mediated reactivation of butyrylcholinesterase into the Test-mate cholinesterase activity kit.
- The primary, ongoing challenge is to develop an analytical procedure with sufficient sensitivity to measure cholinesterase OP adducts in rat plasma. More sensitive instruments are present at the University of Washington, but potential collaboration with key research groups has been delayed.
- Another continuing challenge has been obtaining analytical standards of OP adduct peptides from collaborators. Shifting priorities and turnover of several key individuals at the CDC have prevented us from acquiring additional adduct standards that would improve quantitative aspects of the HPLC/MS/MS method.

#### **PROJECT PRODUCTS**

Evaluation instrument / tool

- SOP: Incorporating Oxime-Mediated Reactivation Of Butyrylcholinesterase into The Test-Mate Cholinesterase Activity Kit.

#### **STATES PROJECT WAS ACTIVE IN**

OR and WA

#### **COLLABORATION**

Organic Analytical Toxicology Branch, National Center for Environmental Health, CDC

## **PROJECT TITLE**

Res4 Pilot: Assessment of Job-related Exposures for Diarrheal Illness in Farmworker Families

## **PROJECT OFFICERS(s)**

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## **HOST ORGANIZATION**

University of Washington  
Environmental and Occupational Health Sciences  
Box 357234  
Seattle, WA 98195

## **PROJECT DESCRIPTION**

It is hypothesized that occupational and environmental exposure pathways from livestock operations, in particular cattle operations, pose a significant risk of exposure to zoonotic bacterial contamination (e.g. *Campylobacter* spp., *Salmonella* spp., *E.coli* O157:H7) for farmworkers and their families. In addition to on-the-job workplace exposures of livestock handlers, livestock-handling farmworkers may unwittingly expose themselves and their families through transportation of job-related bacterial contamination to the household. Additionally, farmworkers may reside in close proximity to livestock operations, which results in environmental contamination of their homes by a variety of pathways (e.g. through bioaerosol or well water contamination). The primary objective of the proposed project is to assess job-related exposures for farmworkers and their families to three common zoonotic bacterial pathogens: *Salmonella* spp., *Campylobacter* spp., and *E.coli* O157:H7. The specific aims of the proposed project are: 1) adaptation, development, and/or validation of methods for sampling of bacteria on surfaces (e.g. vehicle and household carpets, worker apparel, and other workplace, vehicle and household surfaces); 2) assessment of fomite surfaces, bioaerosol, and water as workplace exposure pathways; 3) assessment of the paraoccupational (or take-home) exposure pathway for three zoonotic pathogens (*Salmonella* spp., *Campylobacter* spp., and *E.coli* O157:H7); and 4) assessment of residential proximity to job-related livestock operations as an exposure pathway. This study will specifically address NIOSH priorities for a special occupation at risk (farmworkers) as identified in the National Occupational Research Agenda (NORA). Additionally, this study will develop or adapt novel methods for occupational-related sampling for pathogenic microorganisms.

## **PROJECT START AND END**

Start: 1/10/2006      End: 9/29/2010

## **PROJECT BUDGET**

1. Actual Project Expenditures: \$ None
2. Estimated In-kind Support Value: \$ None
3. Outside Funding: \$10,000

### **PROJECT AIMS**

- 1 Adaptation, development, and/or validation of methods for sampling of bacteria on surfaces (e.g. vehicle and household carpets, worker apparel, and other workplace, vehicle and household surfaces) – **Met**
- 2 Assessment of fomite surfaces, bioaerosol, and water as workplace exposure pathways – **Partially Met**
- 3 Assessment of the para-occupational (or take-home) exposure pathway for three zoonotic pathogens (Salmonella spp., Campylobacter spp., and E. coli O157:H7) – **Partially Met**
- 4 Assessment of residential proximity to job-related livestock operations as an exposure pathway. – **Other**

See Appendix for final report.

### **NORA GOALS AND ACTION STEPS ADDRESSED**

Intermediate Goal 5.4 - Reduce illness and disease due to environmental and infectious exposures in agriculture such as ultraviolet radiation, heat, and zoonosis.

### **PROJECT ACCOMPLISHMENTS and CHALLENGES**

See Appendix for final report.

### **PROJECT PRODUCTS**

Previously reported.

See Appendix for final reports/draft manuscripts.

### **STATES PROJECT WAS ACTIVE IN**

WA

### **COLLABORATION**

Microbial-Vac Systems, Inc.  
Environmental Sciences Program, Heritage University

## PROJECT TITLE

Prev1: Interventions to Minimize Worker and Family Pesticide Exposures

## PROJECT OFFICERS(s)

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## HOST ORGANIZATION

University of Washington  
Environmental and Occupational Health Sciences  
Box 357234  
Seattle, WA 98195

## PROJECT DESCRIPTION

The overall objective of this five-year project is to identify and test practical interventions that reduce pesticide exposures of agricultural workers and their families, and to disseminate these “best practices” into agricultural workplaces and workers’ homes in the Northwest and around the nation. We define interventions very broadly to include changes in product use and innovations in application equipment, as well as changes in specific work practices. We will work closely with producers, workers, and our regional land-grant institutions to develop cost-effective interventions that are acceptable to both employers and employees. Specific aims are as follows:

1. Convene an Expert Working Group (EWG) to define intervention strategies appropriate to the Northwest tree fruit industry
2. Conduct worksite intervention studies of pesticide applicator exposure
3. Implement and evaluate a novel pesticide applicator safety training program
4. Translate best practices into a document for a national audience

## PROJECT START AND END

Start: 1/10/2006      End: 9/29/2011

## PROJECT BUDGET

- 1 Actual Project Expenditures: \$ 354,190.26
- 2 Estimated In-kind Support Value: \$20,000
- 3 Outside Funding: \$ None

## PROJECT AIMS

- 1 Convene an (EWG) to define intervention strategies appropriate to the Northwest tree fruit industry.  
– **Ongoing**
  - Three EWG meetings were held in FY09/10. For some meetings, invited speakers came and EWG members received pesticide recertification credits. Educational sessions for FY/09/10 included: “Management Alternatives to the Organophosphates for Control of Codling Moth (*Cydia pomonella*)”, by Michael Bush, PhD, Extension Educator and “Noise Exposure at Work”, by Kit Galvin, MS, CIH.
  - The EWG evaluation is currently taking place. Both project staff and EWG participants are interviewed by an outside party. This data will be used for the proposed model for using EWGs for informing Agricultural Health and Safety Research.

- A review of the current peer literature on interventions to minimize has been conducted. The second phase of the review is now ongoing.
- 2 Conduct worksite intervention studies of pesticide applicator exposure. – **Ongoing**
- The quantitative method for using fluorescent tracers to evaluate application technologies was validated.
  - A field study looked at the comparison of two spray volumes; using or not having a cab on a tractor.
  - A splash shield was designed to minimize spray splashed to the face during mixing. The initial evaluation took place and the redesign was developed.
  - Thirty-two practical solutions were identified by worksite walk-through evaluations and personal interviews with the farm managers and pesticide handlers. All solutions were innovations developed on the farm. Twenty practical solutions have been evaluated by 29 pesticide safety educators and orchard managers (in English and Spanish). An additional 655 solutions have been evaluated by Hispanic audiences using an audience response system.
  - An evaluation of PPE and application equipment decontamination methods was piloted in a lab setting.
- 3 Implement and evaluate a novel pesticide applicator safety training program. – **Ongoing**
- C-train is a novel safety training based on behavioral education principles, that uses a computer software program containing system user instruction screens, which allows the trainee to navigate the program and answer multiple-choice questions. The C-train was presented to the EWG members for evaluation by providing feedback. The objectives of the evaluation session were to provide the EWG with background information on C-train, give members an opportunity to use the C-train training, and obtain feedback from the group regarding their experience with C-train. The C-train was presented during one of the EWG meetings, and once completed group members were asked to fill out an evaluation form. The evaluation contains seven questions, four of which are responding to statements on a Likert scale (from strongly disagree to strongly agree). The remaining three questions were open-ended, regarding whether they dislike/like the training and if they incorporate C-train training into their orchard's safety training. All of the participants indicated that they liked the training because of its active engagement and because C-train is self-paced. In addition, the participating group members believed that the topics were well explained. The main disadvantage was the cost of software and the additional cost of the computer hardware. Participants thought a larger orchard would find C-train beneficial after the initial costs, however smaller orchards would find the training too costly. Overall, the EWG believed that C-train is a good tool for providing training to orchard workers especially if the cost can be reduced.
- 4 Translate best practices into a document for a national audience. – **Ongoing**
- In Year 4, communication activities focused on the development of summary sheets for each practical solution identified and presentations to Hispanic audiences to evaluate uniqueness and practicality of potential solutions. Each summary sheet is bilingual (English and Spanish) and developed for a lay-audience. Summary sheets include information on solution description and image, tips and recommendations, previous practice, idea source, problem addressed, cost, meeting of regulations, steps to set up, and feedback from farmer/applicator users. Summary sheets were audience tested through the EWG and a battery of external reviewers of farm managers and pesticide safety educators. These summary sheets are used internally for the project and will serve as the basis for the final document of recommended practical solutions.
  - The development and dissemination plan for the final product is completed and we have 5 secured presentation slots in upcoming industry and pesticide education events in the Northwest. In addition, this project's effort coordinated with the Collaboration on Pesticide Exposure Reduction (COPER) to identify which of this project's practical solutions addressed issues identified in the group review of their data sets. COPER is a group facilitated by PNASH and composed of multiple agencies that share information and are working together to understand root causes of pesticide exposures and

solutions. The major outcome of this collaboration is coordination between service/education groups, refinement of understanding of project results and communication, and a greater capacity and reach in the dissemination of our shared results (see page 16 for more information on COPER).

- Due to the extent of the project's development of locally-identified solutions and the need to evaluate these solutions, we are revising project engagement from the national level to the local level. A local body of advisors and select national advisors are reviewing project results and products.

## **NORA GOALS AND ACTION STEPS ADDRESSED**

**Intermediate Goal 2.4** - Use innovative and proven communication, education, training, and marketing techniques to tailor workplace safety and health programs to be responsive to the unique needs of vulnerable workers.

**Action Step 2.4.2** – Determine effectiveness of existing interventions and educational materials that are tailored to address unique factors associated with vulnerability.

**Intermediate Goal 3.1** - Form collaborative efforts with key stakeholders to: 1) biennially assess current and emerging major occupational health and safety concerns and solutions; and 2) prioritize interventions for implementation.

**Action Step 3.1.2** – With partners, prioritize interventions for implementation in the agriculture, forestry and fishing industries.

**Intermediate Goal 3.2** - Identify practical and proven occupational safety and health interventions, then encourage new studies to meet needs where proven strategies do not exist.

**Action Step 3.2.1** – Determine best methods to influence the behaviors of agricultural workers, loggers and commercial fishermen. Methods should account for social, economic, cultural, and other factors affecting the adoption of best practices among workers and employers. Assessments of barriers, motivators and ideal strategies should be undertaken by NIOSH Agricultural Research Centers, USDA, Cooperative Extension services, universities and other partners with expertise to conduct relevant, valid studies.

**Action Step 3.2.2** – Document and report proven interventions. Determine how and where a list and description of proven strategies should be maintained for easy access by stakeholders in the AgFF industries. The NIOSH Agricultural Research Centers should participate in this process to identify strategies of national as well as regional relevance.

**Action Step 3.2.3** - Identify gaps in health and safety best practices and methods. Encourage and facilitate studies and programs to meet industry needs for improved safety, including engineering, information technology, and policy approaches.

**Intermediate Goal 3.3** - Use innovative and proven communication, education, and social marketing techniques to influence knowledge, attitudes and practices of agricultural workers, loggers, and commercial fishermen.

**Action Step 3.3.2** – Increase awareness and promote expanded application of best practices, materials, technologies, and policies via partners such as producer organizations, health and safety practitioners, regulatory personnel, vocational teachers, extension agents, insurers, clinicians, and others in positions to influence adoption of best practices.

**Intermediate Goal 4.5** - Reduce the number, rate, and severity of non-fatal injuries (OSHA recordable type) and the number and rate of fatalities in production agriculture and support activities not covered in 4.1, 4.2, 4.3 and 4.4 by 25% by 2018.

**Action Step 4.5.4** - Work with the NIOSH Agricultural Research Centers, Cooperative Extension safety specialists, Farm Bureau safety leaders, and others to identify effective, research-based intervention programs for non-fatal work-related injury for application at national, state, county and community levels.

**Action Step 4.5.5** - Work with ASHCA, the National Institute for Farm Safety (NIFS), NIOSH Agricultural Research Centers, Cooperative Extension safety specialists, Farm Bureau safety leaders, producer organizations, and others to promote and implement safety education, intervention programs, and recommended guidelines/policies for non-fatal work-related injury (refer to Strategic Goal 3).

**Action Step 4.5.7** – Identify best options for protecting non-workers from hazards in and around production agriculture and support activities.

## **PROJECT ACCOMPLISHMENTS and CHALLENGES**

- One of the most successful aspects of this project has been the EWG. The EWG has provided an in-depth look at safety measures for airblast pesticide applications – identifying those that work well and those that need improvement. Established at the end of 2007, a total of 17 individuals with experience in agriculture from Ellensburg to Prescott, WA, have participated as members of the group, including pesticide handlers, growers, orchard managers, pesticide safety educators, and industrial hygienists. The maximum number of members at one time has been 11, with 4 members involved with the group since the beginning. We would like to extend our appreciation to all of them for their tremendous support in this pesticide safety research project.
- Our major effort this past year has been searching for Pesticide Practical Solutions developed by farmers and pesticide handlers in agricultural production in Washington State.
  - A total of 32 practical solutions were found in orchards/ranches operations in the state.
  - Each worksite participated in in-depth interviews on the use of solutions and how practical and cost effective the safety measure has been.
  - Each solution has been summarized in a two-page English/Spanish sheet with photos and details on steps to set up the solution.
  - Practical solutions have been reviewed by external evaluators (farm managers, pesticide safety educators and pesticide applicators). This evaluation is ongoing with the identification of new solutions.

## **PROJECT PRODUCTS**

### Presentations

- 1/18/2009 – PNASH Expert Working Group, Yakima, WA.  
Pip Ewg Presented Management Alternatives to the Organophosphates For Control Of Codling Moth (Cydia Pomonella) By Michael Bush, Phd, Extension Educator.
- 12/7/2009 - Washington Horticulture Conference, Yakima, WA.  
Maria Tchong. Soluciones y Practicas Creativas Para El Uso Sefuo De Pesticidas.
- 1/10/2010 - GS Long Meeting, Pasco, WA.  
Pablo Palmandez. Soluciones y Practicas Creativas Para El Uso Sefuo De Pesticidas.
- 1/27/2010 - ASHCA, Dallas/Fort Worth, TX.  
Richard Fenske, Jennifer Krenz, and Kit Galvin. Poster Presentation: Practical Solutions for Minimizing Agricultural Worker and Family Exposure To Pesticides.
- 4/20/2010 - PNASH Research Review, Granger, WA.  
Pablo Palmandez. Interventions to Minimize Agricultural Worker And Family Pesticide Exposure.
- 5/21/2010 – PNASH Expert Working Group Meeting, Yakima, WA.  
Noise Exposure at Work Presentation to EWG.
- 12/15/2010 - UW DEOHS Advisory Meeting, Seattle, WA.  
Richard Fenske. Interventions to Minimize Agricultural Worker and Family Pesticide Exposure.

### Publications

### Fact Sheet

- Galvin-K  
30 Two-Page Practical Solution Summary/Instruction Sheets

#### Education / Training / Outreach

##### Thesis or dissertation

- Minimizing Pesticide Handler Pesticide Exposure: Practical Solutions Fresh from The Orchard Poster
- Practical Solutions for Minimizing Agricultural Worker And Family Exposure to Pesticides
- Fresh From the Orchard: Practical Solutions For Preventing Pesticide Exposure

##### PowerPoint Presentation (for distribution)

- Soluciones Y Practicas Creativas Para El Uso Sefuo De Pesticidas

##### Other

- 7/28/2010 - WSU Field Day, Wenatchee, WA.  
WSU Field Day Demonstrations of Pesticide Exposure Interventions.

#### **STATES PROJECT WAS ACTIVE IN**

OR, WA, and National- US

#### **COLLABORATION**

95 agricultural handlers, supervisors, producers and educators

- 12 of the 95 agricultural handlers, supervisors, producers and educators, are part of the EWG
- 25 companies that have contributed to the 'Practical Solutions'

NIOSH

US EPA

Washington State University, Cooperative Extension

## **PROJECT TITLE**

Edu1: Introducing a Cholinesterase Test Kit into Clinical Practice

## **PROJECT OFFICERS(s)**

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## **HOST ORGANIZATION**

University of Washington  
Environmental and Occupational Health Sciences  
Box 357234  
Seattle, WA 98195

## **PROJECT DESCRIPTION**

This project will work to enhance and simplify worker monitoring for pesticide overexposure by introducing a portable testing kit, the Test-mate ChE test system into an existing, state-wide cholinesterase monitoring program. Washington State OSHA (known as WISHA) mandates the monitoring of cholinesterase for certain agricultural workers. Over 2200 baseline and 900 follow-up tests were done last year. The measurement of cholinesterase by clinics in Washington presently depends on sending samples across the state to a central lab. This Test-mate system employs the Ellman methodology (same as the laboratory) and a battery-powered, portable, light emitting, diode-based photoanalyzer that measures the activity of both plasma and erythrocyte cholinesterase, using only 10 microliters of blood. The blood sample can be obtained from a finger stick sample or venipuncture. The kit has been used in countries around the globe, has been reported upon in many studies in the published literature, and has shown good performance when compared to laboratory-based systems. Easy to apply in a clinician's office, the introduction of Test-mate to clinics, for both large and small programs, will be facilitated by developing several "use models" based on the way the clinic conducts testing. Once developed, these use models will be used to disseminate the technology to other clinics in the area. Data gathering throughout the study period will assess the usability of the kit, the effectiveness of training, as well as the accuracy of Test-mate against the gold standard laboratory. The use of the Test-mate will also permit evaluation of new cholinesterase depression verification techniques developed by the Agricultural Center (Simpson Project). Monitoring workers for overexposure to pesticides is a labor and resource intensive process. This translation project will take a proven methodology, reconfirm its value, and introduce it into the cholinesterase testing process aiming to reduce the work and cost, as well as improve the quality of information and response time of the cholinesterase monitoring process.

## **PROJECT START AND END**

Start: 1/10/2006      End: 9/29/2011

## **PROJECT BUDGET**

- 1 Actual Project Expenditures: \$ 279,650.73
- 2 Estimated In-kind Support Value: None
- 3 Outside Funding: None

## PROJECT AIMS

- 1 To work with a single clinic in Washington State to design a "use model" for onsite ChE testing using the Test-mate ChE system. – **MET**
  - Our relationship with Central Washington Occupational Medicine Clinic has continued to be productive this year as we began to collect samples for trial analysis on the test kit.
  - Graduate student Stefani Penn has drafted a use model and blood collection protocol for review with CWOM clinic staff.
- 2 To identify clinic-specific issues that interfere with use of the Test-mate system and adapt the "use model" to resolve these issues. – **MET**
  - Barriers to Test-mate uptake in the CWOM clinical setting have been identified through former graduate student Randy Treadwell's thesis work. We have been able to ameliorate some of the small barriers. For example, the research team has been able to provide the clinic with freezer space for maintaining blood samples. Space was identified early on in the study as a limiting factor for the use of the Test-mate system.
- 3 To expand participation from three to five clinics with smaller ChE monitoring programs and adapt the use model for dissemination to other clinical providers. – **REVISED**
  - We have approached several clinics in eastern Washington about incorporating the ChE test-kit into their ChE monitoring activities. However, the clinics expressed limited enthusiasm to do so. The smaller clinics generally use 3rd party, off-site contract laboratories to perform their biochemical analyses, so incorporating ChE testing into their on-site operations did not fit well with clinics' current operating model. Furthermore, the decreasing frequency and low incidence of ChE depressions in Washington State over the past two years does not provide an ideal setting to evaluate the suitability of the Test-mate ChE system and reactivation assay. Therefore we propose to work with colleagues in Nicaragua to evaluate the Test-mate ChE system & reactivation assay in a population of workers who experience a higher frequency of ChE depression (and more severe depression) compared to agricultural workers in Washington State.
- 4 To determine the potential for Test-mate to augment or replace laboratory-based cholinesterase testing based on the performance of Test-mate in the clinic setting, as well as the cost of incorporating the Test-mate into the monitoring system. – **ONGOING**
  - Reactivation of ChE activity following incubation of ChE with an oxime improves the specificity of ChE measurements as indicators of overexposure to ChE-inhibiting pesticides (see project R3, Specific Aim 1b).
  - The research team has been working in the laboratory to refine the protocol for reactivation of cholinesterase activity in human plasma. After doing a number of experiments to determine the most efficient incubation time and temperature for reactivation with plasma butyrylcholinesterase, the team is working to create a protocol for reactivation of human erythrocyte acetylcholinesterase.
  - Additional experiments will be performed in the coming months to determine the most efficient incubation time and temperature for erythrocyte enzyme reactivation.
  - This season, samples will be tested on the Test-mate system and compared against lab results.
- 5 To introduce to clinics two new methods for ChE inhibition verification. – **FUTURE**
  - This aim will be addressed in year five of the center. The two new methods for ChE inhibition verification are oxime-mediated reactivation of ChE activity and measurement of OP-ChE adducts.
  - During the Spring 2011 spray season the Test-mate ChE system & reactivation assay will be implemented in the CWOM clinic. Any samples that exhibit ChE depression will be sent to the University of Washington Laboratory for verification testing using the OP-ChE adduct method.
  - Educational materials describing the two new methods for ChE inhibition verification and their potential benefits will be prepared and distributed by the PNASH outreach core.
  - Documentation describing the use model developed for the Test-mate ChE system and reactivation assay will also be distributed.

## **NORA GOALS AND ACTION STEPS ADDRESSED**

**Intermediate Goal 5.3** - Reduce acute and chronic illnesses associated with exposure to pesticides and other agrochemicals.

**Action Step 5.3.4** - Develop and improve methods for assessment of exposures to agrochemicals, including interactions of multiple chemicals found in the workplace.

**Action Step 5.3.5** - Improve utilization of the NIOSH Agricultural Research Centers, ERCs, and other partners to address regional work and environmental hazards that causes unique illness and disease conditions that can be rectified in the future by research and program interventions.

## **PROJECT ACCOMPLISHMENTS and CHALLENGES**

- We successfully established a blood draw protocol and trained CWOM staff accordingly this past season, enabling us to overcome two identified barriers for use: time and environmental restraints.
- Implementation of the reactivation assay for butyrylcholinesterase, using the Test-mate system.
- Developed draft use model using frozen baseline methodology to implement Test-mate ChE system & reactivation assay in a clinic setting
- While positive for farm worker health, one challenge to this study has been the low level of ChE depressions throughout the state and therefore the limited number of small clinics that provide cholinesterase monitoring services. As the number of ChE depressions has been decreasing each year, we did not anticipate this at the beginning of the grant cycle.

## **PROJECT PRODUCTS**

None in FY 2009.

## **STATES PROJECT WAS ACTIVE IN**

WA

## **COLLABORATION**

Central Washington Occupational Medicine (CWOM)

## **PROJECT TITLE**

Edu2: Reality Tales: Storytelling to Translate Agricultural Health and Safety Research

## **PROJECT OFFICERS(s)**

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## **HOST ORGANIZATION**

University of Washington  
Environmental and Occupational Health Sciences  
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## **PROJECT DESCRIPTION**

The goal of this project is to use the ancient oral tradition of storytelling as a novel, educational communication strategy to translate health and safety research and education for agriculture producers and workers in order to reduce the instance of two critical issues: ladder injuries and heat stress. The project will develop and reproduce 'reality tales' told by workers or workers' relatives who have either directly or indirectly experienced these health problems. These tales then will be placed within three communication channels: facilitated Community Health Worker (CHW) educational sessions in farmworker camps, local call-in radio talk shows, and a magazine favored by agricultural producers. The educational rationale is that storytelling, as opposed to instructions or data, is more relevant, memorable, and persuasive-- thus better engaging audience members to effect personal behavior change. Year 1 will define the take-home educational messages and issues to be communicated (behavioral, technical and social) through the storytelling methodology by a review of current research findings and prevailing educational interventions for ladder injuries and heat stress. Also in Year 1, the project will determine which communication channels are the most influential and best means to connect with the stakeholder agricultural producers and workers. In Year 2, the project will gather agriculture workers who have directly or indirectly experienced heat-related illnesses, ladder injuries, or near miss ladder accidents to form 'story groups'. The project will engage these groups to recount, discuss, document, and evaluate their stories for model educational narratives. During Year 3, the project will develop pilot storytelling narratives and field-test them in three cycles with members of the target audiences. Year 4 will place the storytelling narratives in three communication channels: 1) face-to-face, CHW led educational sessions in farmworker camps; 2) local call-in radio talk shows and; 3) as articles in a grower magazine. In the fifth year, the project will evaluate the use of narratives in these three channels as well as document the project through a user's manual, presentations, and publications. In addition, we will produce and disseminate storytelling narratives for others to use locally and nationally.

## **PROJECT START AND END**

Start: 1/10/2006      End: 9/29/2011

## **PROJECT BUDGET**

- 1 Actual Project Expenditures: \$ 85,336.19
- 2 Estimated In-kind Support Value: \$
- 3 Outside Funding: \$

## PROJECT AIMS

- 1 Define the key take-home educational messages to be communicated (behavioral, technical, and social) through the storytelling methodology by a review of current research findings and prevailing educational materials aimed at preventing ladder injuries and heat stress. – **Met**
- 2 Determine the most effective means to reach agricultural producers and workers by identifying their preferred communication channels. – **Met**
- 3 Gather agriculture workers who have directly or indirectly experienced heat-related illnesses, ladder injuries, or near-miss ladder accidents to form “story groups.” – **Met (revised)**
  - During this reporting period two local radio station story contests were promoted in two areas of the state (northwest and central east regions) in order to recruit storytellers. Unlike the previously popular ladder injury contest, no calls came in at either radio station. Station personnel speculated that the reasons farmworkers did not participate were busy work schedules, lack of familiarity with heat-related illnesses, embarrassment because such illnesses are viewed as a lapse of personal responsibility, or fear of reprisal from employers.
- 4 Engage these worker story groups to recount, discuss, document, and evaluate their stories for model educational narratives. – **Met**
  - This aim was met with regard to ladder injuries for our Hispanic community and through StoryCorps recordings with our Anglo farmers.
- 5 Develop pilot storytelling narratives and field-test them in three cycles with members of the target audiences. – **Met (Revised)**
  - Field-testing was accomplished with the ladder and StoryCorps narratives (ATV) but as no workers called in with heat-related illness stories, we were unable to produce or field-test their stories. During this reporting period, eight Story Corps narratives were edited down to three minutes for placement in communication channels. These narratives include the following injuries: a manure pit entrapment, a harrow rollover, a combine amputation, a fatal encounter with a bull, a cervical spine fracture from a hay bale blow, a ladder fall, two ATV rollovers one of which was fatal and the other a near miss ATV accident, a child finger-burn from a hay baler, and a tractor with ROPS rollover incident.
- 6 Place the storytelling narratives in three communication channels; 1) face-to-face CHW led educational sessions in farmworker camps, 2) local radio call-in talk shows, and 3) a popular growers’ magazine. – **Ongoing**
  - During this reporting period, four comic dramas demonstrating the risk factors, signs and symptoms, and treatment of five heat illnesses were aired on two Spanish-language stations covering the northwest and east central regions of the state where there are concentrations of farmworkers. Both stations aired the novelas on a rotating basis at least three times per day.
- 7 Evaluate the use of the storytelling narratives in all three communication channels. – **Ongoing**
  - A community survey was conducted in the Yakima area, within the radio range of Radio KDNA a month after the novelas were aired. Of those self-identified radio listeners (51), 63% reported that they heard the heat-related illness stories.
- 8 Document the project through a user’s manual, presentations, and publications; produce and disseminate storytelling narratives. – **Future**

## **NORA GOALS AND ACTION STEPS ADDRESSED**

**Intermediate Goal 3.3** - Use innovative and proven communication, education, and social marketing techniques to influence knowledge, attitudes and practices of agricultural workers, loggers and commercial fishermen.

**Intermediate Goal 3.4** - Use innovative educational techniques and certification programs to improve the safety practices of agricultural workers, loggers and commercial fishermen.

**Intermediate Goal 4.1** - Reduce the number of fatalities due to overturns of tractors in agriculture by 50%, through the use of Rollover Protective Structures or similar technologies, by 2018.

**Intermediate Goal 4.2** - Reduce the number and rate of fatalities in production agriculture and support activities due to runovers by agricultural field and farmstead machinery by 50% by 2018.

**Intermediate Goal 4.3** - Reduce the number and rate of fatalities in production agriculture and support activities involving agricultural field and farmstead equipment, not covered in 4.1 and 4.2 by 25% by 2018.

**Intermediate Goal 4.4** - Reduce the number, rate, and severity of non-fatal injuries in production agriculture and support activities involving agricultural field and farmstead equipment by 25% by 2018.

**Intermediate Goal 5.1** - Reduce the incidence and prevalence of musculoskeletal disorders (MSD) associated with work practices and production agriculture.

## **PROJECT ACCOMPLISHMENTS and CHALLENGES**

- We produced and aired four radio novelas in Spanish that dramatize the risk factors, signs and symptoms, and first aid treatment of five heat-related illnesses on two Spanish-language radio stations serving the northwest and central regions of Washington State, where farmworkers are concentrated.
- Eight StoryCorps recordings of farmers recounting to family members life-changing, farm-related injuries that had a significant impact on how they view farm health and safety were edited into three-minute spots. Narratives included a manure pit entrapment, a harrow rollover, a combine amputation, a fatality from a bull, a cervical spine fracture from a hay bale blow, a ladder fall, two ATV rollovers (one of which was fatal and the other a near-miss ATV accident), a child finger-burn from a hay baler, and a tractor with ROPS rollover incident.
- We were unable to capture worker stories on heat-related illness, perhaps due to lack of familiarity with heat-related illnesses, embarrassment because such illnesses are viewed as a lapse of personal responsibility, or fear of reprisal from employers. Another reason may be related to the time of year (July) that the novelas were aired (during the busy agriculture season) which coincided with the time of year when workers most need this information to recognize, prevent and seek, or provide emergency first aid to co-workers.

## **PROJECT PRODUCTS**

Education / Training / Outreach

CD-ROM

- Ag Injury Stories Told By Survivors Or Relatives - Three Minute Segments
- Four Radio Novelas on Heat-Related Illness

## **STATES PROJECT WAS ACTIVE IN**

WA

**COLLABORATION**

Columbia Valley Community Clinic  
Heritage University  
Radio KDNA  
Radio KSVR  
Regional Grower  
StoryCorps  
Washington State Labor and Industries  
Washington State University Co-op Extension

#### IV. SMALL/PILOT PROJECTS

##### PROJECT TITLE

Pilot 7: Responding to Uncertain Results in Research: A Pilot Study of Pesticide Handlers' Responses to PON1 status

##### PROJECT OFFICERS(s)

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##### HOST ORGANIZATION

University of Washington  
Environmental and Occupational Health Sciences  
Box 357234  
Seattle, WA 98195

##### PROJECT DESCRIPTION

This small grant project aims to understand how pesticide handlers understand early results from a study that could have health implications for them individually. Our project builds on an existing study that provided pesticide handlers with individual results regarding their paraoxonase (PON1) status, their cholinesterase (ChE) levels, and their risk behavior as determined through a survey. We conducted 1-on-1 interviews with a targeted subset of participants who have requested and received information about their PON1 status in 2008. These interviews explored what motivates participants to request results, even when those results are of unknown clinical significance. We also examined the impact of different types of information on risk perception and risk behavior. In addition, we explored participant interest in receiving research results generally, to understand how participants may use results to make decisions, and to identify alternative strategies for communicating results. Advocates of genetic research have hypothesized that genetic information will help promote healthy behaviors in individuals. Current research about the impact of genetic information on risk perception and risk behaviors is quite limited, particularly in a pesticide handler population. Returning results is also seen as a practice that enhances trust between participants and researchers. Yet, if there is a mismatch between participants and researcher explanatory models of susceptibility, we may unintentionally do more harm than good. We have a strong, interdisciplinary team that brings expertise in community engagement, outreach and education, ethics research, epidemiology, and environmental health research to this project. This project will lead to insights for PNASH investigators about returning results and dissemination strategies with a priority population, and will provide preliminary data for future research projects about dissemination of individual research results and risk perceptions. Specifically, this project addresses three NORA priority areas: Risk Communication (primary), Special Populations at Risk (secondary), and Chemical Exposures (secondary).

##### PROJECT START AND END DATES

Start: 9/30/2008      End: 9/329/2010

##### PROJECT BUDGET

- 1 Actual Project Expenditures: \$ 970.31
- 2 Estimated In-kind Support Value: \$ None
- 3 Outside Funding: \$ None

## PROJECT AIMS

- 1 Explore worker motivations behind requesting personal PON1 test results. –**Met**
  - This aim was complicated by the time of year of our interview rollout. We began interviewing in late November, and recruitment was low. We hypothesize that holidays and season led to many men being unavailable at this time. The specific research questions we have to answer with the interviews were also revised due to reasons outlined below.
  - Through the discussions we did have with pesticide handlers, it was clear that most men did not understand PON1 and had limited recall of the letter the UW team sent them with their results. Therefore, we revised our aims to exploring less about the impact of the UW team's letter and more about interests and need to know results generally. That said, a key finding from our small group of informants was that they could not recall either PON1 or the letter with the results themselves. This finding led the team to reconsider their approach to communicating with participants about the PON1 component of the study.
  
- 2 Describe how workers used or interpreted their results in the absence of known scientific significance or clinical importance. – **Met**
  - As described above, worker recall of the specific results was limited. Because of this, workers were very interested and invested in their ChE results and were very aware of the role those findings played in their risk status. When it came up during the interview, PON1 was presumed to be another such marker of exposure. New insights were gained during the 2010 activities in the restructure of our pilot grant, as described in #6 below.
  
- 3 Examine the impact of different information (PON1 status, ChE levels, or risk survey information) on participant understanding of risk. – **Met**
  - The findings also initiated the production of a video to improve the informed consent process in 2009, and also motivated a new system for coordinating with the CWOM clinic to facilitate returning ChE results to pesticide handlers directly, rather than only to the employers, as was previously the practice at the clinic. This systems change was in direct response to needs and interests articulated during the key informant interviews.
  - In general, workers were very aware that the pesticides they handled were potentially harmful substances, aware of PPE, and highly interested in actions to protect their health. In general, if there were results that would indicate increased risk of harms from exposure, they were very interested in knowing those.
  
- 4 Test and modify conclusions from informant interviews. – **Met**
  - After gathering that the pesticide handlers interviewed really did not have a basic understanding of what genetics is, which limited their ability to comprehend their PON1 results, the research team decided to take another approach. See Aim 6 below.
  
- 5 Explore worker attitudes toward workplace genetic testing generally. – **Met**
  - See Aim 1 above.
  - In addition, our expanded approach of the video and radionovela, produced in Summer 2010, will explore these attitudes further. Interviews were conducted with key informants around the health clinic and key stakeholders from the Community Advisory Board for the parent project that provided insights to create the radionovela on the topic of genetic risk and workplace genetic testing. This is described in greater detail in #6 below.

- 6 Outline alternative approaches to returning results or communicating with participants about project progress in future projects. – **Met**
- Even with the small interview sample, the findings impacted how the parent study team returned results to participants in 2009 (via phone rather than letter). It was also made clear that we needed to do a better job of providing a basic overview to participants about genetics.
  - As gathered from the initial round of key informant interviews, many participants really did not have a clear understanding of what the information meant that they were receiving. Thinking this is likely the case for other participants in the Risk Factors Study that have received their PON1 and ChE results, and in order to respond to this uncertainty on a community level, the project team decided to take a step back to the basics. Having successfully developed and aired Spanish language radio dramas (radionovelas) on the local Spanish-language public radio station in the Yakima Valley, Radio KDNA, we decided to script a novela to convey some basic information about genetics and the importance of genetics research. Radio has been identified as one of the preferred methods of communication for farmworkers in the Yakima Valley, so this method seemed like a great tool for disseminating information.  
To determine what information to include in the novella and with what storyline to approach it, as well as gather more information from community members and health professionals on their opinions of returning uncertain genetic results, we conducted two focus group-style group conversations. The first was with Community Advisory Board members from El Proyecto Bienestar. Matt Keifer facilitated this conversation, and Rogelio Rangel, undergraduate summer student, led an activity called ‘Your Money or Your Life’. Items discussed in this focus group included questions about people’s general knowledge of genetics, what level of vocabulary should be used in the novela, and what we could expect people to understand through a radio format.
  - CAB members and the novela writer helped brainstorm ideas for how to convey basic information about genetics in a radionovela and came up with some general ideas, which were later fleshed out in the script. There was agreement that starting off by talking about PON1 was too obscure and that in order to prevent listener confusion, the novela should use language that is as basic as possible.

See Appendix for final report.

## **NORA GOALS AND ACTION STEPS ADDRESSED**

**Intermediate Goal 2.4** - Use innovative and proven communication, education, training, and marketing techniques to tailor workplace safety and health programs to be responsive to the unique needs of vulnerable workers.

**Action Step 2.4.3** – Facilitate the development and evaluation of high quality and appropriate materials where gaps exist.

**Intermediate Goal 3.2** - Identify practical and proven occupational safety and health interventions, then encourage new studies to meet needs where proven strategies do not exist.

**Action Step 3.2.3** - Identify gaps in health and safety best practices and methods. Encourage and facilitate studies and programs to meet industry needs for improved safety, including engineering, information technology, and policy approaches.

**Intermediate Goal 3.3** - Use innovative and proven communication, education, and social marketing techniques to influence knowledge, attitudes and practices of agricultural workers, loggers and commercial fishermen.

## **PROJECT ACCOMPLISHMENTS and CHALLENGES**

- This project was successful in gathering opinions from farmworkers that have already, and will continue to, impact the way researchers interact with this population.
- We were able to go beyond our original scope and develop a public education piece for the general community that covers a basic overview of genetics, the importance of genetic research for public

health, and researcher responsibilities.

- As mentioned in Aim 1, the research team had a difficult time recruiting participants for interviews. In addition, most participants did not clearly remember having received their PON1 results nor did they understand what the information in the letter was saying.

See Appendix for final report.

## **PROJECT PRODUCTS**

Other Products

- Fifteen minute Spanish language radio drama, *La Familia Chavira aprendiendo sobre la genética*.

## **STATES PROJECT WAS ACTIVE IN**

WA

## **COLLABORATION**

Central Washington Occupational Medicine

El Proyecto Beinestar, Community Advisory Board

Northwest Community Education Center/Radio KDNA

Center for Ecogenetics and Environmental Health (Dave Eaton, PI, NIEHS-funded)

## **PROJECT TITLE**

Pilot 8: Investigation of the Apparent Discrepancy between Observed Cholinesterase Depression among Pesticide Handlers in Washington and Regulatory Estimates of Exposure.

## **PROJECT OFFICERS(s)**

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## **HOST ORGANIZATION**

University of Washington  
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## **PROJECT DESCRIPTION**

Blood cholinesterase (ChE) monitoring among pesticide handlers in Washington State in 2004-2007 reveals greater than, 20% plasma ChE depression in an average of 15% of workers tested each year. These data present a unique opportunity to examine assumptions employed by regulatory agencies in conducting risk assessment of pesticide use. The project proposed here entails population-based prediction of ChE depression that would be expected based on default assumptions used in the regulatory decision-making framework and comparison of those predictions with observed outcomes in Washington. This analysis will target early season use of chlorpyrifos. In the event that observed ChE depression passes a threshold, follow-up investigations are conducted that include a survey of handler practices that might lead to unusual exposure. Estimation of exposures that might be expected as a result of selected handler behaviors that are not assumed in the standard risk assessment process is also proposed. Pesticide handler exposure assumptions are based in large part on limited studies conducted by pesticide registrants (manufacturers) and submitted the Pesticide Handlers Exposure Database (PHED) maintained by US EPA and Health Canada. In some cases those studies entail both collection of exposure measurements and of biomonitoring data, presenting a second opportunity for comparison of predicted and observed exposures. The second part of the proposed project would involve application of PHED data from studies involving chlorpyrifos to this task. The proposed project is entirely consistent with PNASH's long-standing efforts to understand workplace exposures to pesticides to inform intervention to reduce illness. It is similarly consistent with the Occupational Research Agenda For Northwest Farming's Chemical Exposure Priority Research Area and with the National Occupational Research Agenda goal 5.3 dealing with prevention of agrochemical related illness.

## **PROJECT START AND END**

Start: 9/30/2008      End: 9/29/2009

## **PROJECT BUDGET**

- 1 Actual Project Expenditures: \$ 0
- 2 Estimated In-kind Support Value: \$ 0
- 3 Outside Funding: \$ 5,000

## PROJECT AIMS

- 1 Generate a probabilistic prediction (cumulative population distribution) of plasma cholinesterase (ChE) depression among professional handlers of chlorpyrifos in the agricultural sector in Washington State and compare it to observations made under the auspices of the Washington State Department of Labor and Industries (WADL&I) cholinesterase monitoring program. – **Partially Met**
  - Data from the WADL&I ChE monitoring program including follow-up investigation reports were obtained and compiled. Descriptions of exposure conditions were judged insufficient to warrant probabilistic prediction of ChE depression in Washington State handlers. Aim 1 was then revised to encompass examination of the conservatism of default regulatory assumptions regarding handler exposure to and toxicity of chlorpyrifos.
- 2 Generate estimates of chlorpyrifos doses likely to result from failure to practice appropriate personal hygiene or properly employ PPE, to determine the extent to which such failures might explain observed plasma ChE depression in Washington State handlers. – **Met**
  - Narrative reports from required post-hoc ChE depression investigations were collected and examined for purposes of identification of common behaviors associated with ChE depression.
  - ChE depression was found to be associated with mixing/loading, spray equipment cleaning, use of half- rather than full-face respirators, failure to wear chemically resistant footwear, and lack of access to a PPE locker. Skin areas exposed due to various types of PPE-related failures (removal of gloves, use of non-resistant footwear, etc.) are potentially sufficient to permit chlorpyrifos exposures that could explain associated ChE deficits, depending upon duration of misuse. However, some apparent failure modes may reflect multiple types of failure (e.g., half-face respirators may be more prone to dislodgement allowing increased respiratory exposure, as well as increased dermal exposure, compared to full-face respirators).
- 3 Reexamine the ratio of chlorpyrifos doses predicted from dosimetry to those estimated from biomonitoring in the 13 Pesticide Handlers Exposure Database (PHED) chlorpyrifos studies for which both types of data are available. – **Met**
  - All 13 PHED studies involving handler exposure to chlorpyrifos were obtained. Data from those studies were entered into an Excel database and subjected to additional analyses. The studies encompass 165 volunteers classified as mixer/loaders, applicators, cleanup workers, or scouts. Estimates of exposure based on dosimetry were compared to estimates of exposure based on observed biomarker excretion.

See Appendix for final report.

## NORA GOALS AND ACTION STEPS ADDRESSED

**Intermediate Goal 5.3** - Reduce acute and chronic illnesses associated with exposure to pesticides and other agrochemicals.

**Action Step 5.3.1** – Improve the organization of existing information. Based on an evaluation of findings, develop and implement biological monitoring guidelines, e.g., cholinesterase testing.

**Action Step 5.3.3** - Test and evaluate interventions that lead to implementation of best practices and behavioral change related to protection from chemical exposures.

## PROJECT ACCOMPLISHMENTS and CHALLENGES

- Data from the WADL&I ChE monitoring program, including follow-up investigation reports, were obtained and compiled. Descriptions of exposure conditions were judged insufficient to warrant probabilistic prediction of ChE depression in Washington State handlers. Aim 1 was then revised to encompass examination of the conservatism of default regulatory assumptions regarding handler exposure to and toxicity of chlorpyrifos.

- The studies encompass 165 volunteers classified as mixer/loaders, applicators, cleanup workers, or scouts. Estimates of exposure based on dosimetry were compared to estimates of exposure based on observed biomarker excretion.

See Appendix for final report.

## **PROJECT PRODUCTS**

### Presentations

- 11/10/2009 - Annual Meeting of the ISES, Minneapolis, MN.  
John Kissel. Comparison Of Dosimetry-Based Exposure Predictions And Biomonitoring Results In Chlorpyrifos Handler Studies From PHED.

## **STATES PROJECT WAS ACTIVE IN**

National - U.S.

## **COLLABORATION**

Washington State Department of Labor and Industries

## **PROJECT TITLE**

Pilot 9: FFA Community Mobilization for Safe Agricultural ATVs and Tractor ROPS Use

## **PROJECT OFFICERS(s)**

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## **HOST ORGANIZATION**

University of Washington  
Environmental and Occupational Health Sciences  
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Seattle, WA 98195

## **PROJECT DESCRIPTION**

The goal of this pilot project is to test whether teams of Future Farmers of America (The National Organization of Agriculture Students) members can collect local data on ATV and tractors, present it back to their community for feedback, and use both to design an innovative local safety campaign. If successful, students will seek more funding to implement and evaluate the campaign as well as disseminate their experience to the wider agricultural community at AG Safety Day and the FFA membership regionally and nationally. Given the feasibility of this model, the intention is to apply for NIOSH funding to implement this project statewide as envisioned by Washington State FFA. We will train one chapter of FFA officers and committee members as master trainers to gather community data on the number and uses of ATV's in agricultural operations, the prevalence of tractors with rollover protective systems (ROPS) and seatbelts, the barriers to retrofitting, and the number of injuries and near misses with these vehicles over the last 5 years. After training a team of fellow students, the master trainers and students will gather, analyze, and summarize the data to present back to the participating farms. During this feedback session, teams will facilitate a community discussion on the best means to reduce injuries from tractors and ATV's. With their survey data as evidence and the ideas from the community, the FFA teams will propose a variety of safety campaigns for which they will vet and seek funding. This project addresses a critical issue in agricultural safety and health and opens up a new field of work to PNASH ; working with youth as farm safety advocates and farm vehicle injuries. This project also explores an innovative training methodology– using research as an educational strategy. Specifically, it will explore the feasibility of a youth-to-youth and youth-to-farmer educational model, work towards instilling a culture of agriculture health and safety in future farmers by a learning-through-doing health educational process, introduce students to the discipline of occupational public health, and provide data on the prevalence of ROPS, seatbelts and ATV use and injuries from both in one sample community.

## **PROJECT START AND END**

Start: 9/30/2009      End: 9/29/2010

## **PROJECT BUDGET**

- 1 Actual Project Expenditures: \$ 16,421.60
- 2 Estimated In-kind Support Value: \$ 1,000
- 3 Outside Funding: None

## PROJECT AIMS

1. Conduct a farm based census survey on the prevalence of tractors with ROPS and seatbelts, barriers to retrofitting tractors with ROPS, the use of ATVs in agriculture, and the one and five year incidence of tractor and ATV injuries and near misses. – **Not Met**
2. Analyze and present the survey data back to the community of farmer respondent participants. – **Not Met**
3. Facilitate a community meeting in order to generate novel and effective ATV and tractor safety campaign ideas. – **Not Met**
4. Use the survey results and suggestions from the community to design innovative tractor and ATV safety campaign ideas. – **Not Met**
5. Select a safety campaign design for which to seek funding based on appropriate available resources, estimated effectiveness and implementation feasibility. – **Not Met**

## NORA GOALS AND ACTION STEPS ADDRESSED

**Intermediate Goal 4.1** - Reduce the number of fatalities due to overturns of tractors in agriculture by 50%, through the use of Roll-Over Protective Structures or similar technologies.

**Action Step 4.1.1** - Work to increase the number of older non-ROPS tractors retrofitted with ROPS and seat belts or replaced by ROPS and seatbelts equipped tractors.

**Action Step 4.1.2** - Bring awareness to the issue by conducting extensive outreach to production agriculture and get more tractor operators to use a tractor with ROPS and wear seat belts on ROPS-equipped tractors. Outreach materials could include pamphlets, posters, radio, and TV ads. Establish rebate programs to encompass the entire nation similar to recent efforts in New York and Virginia.

**Action Step 4.1.3** - Improve surveillance: include economics, intervention cost-effectiveness, epidemiology, behavior, and other human factors, as well as engineering and technology. Because ROPS are proven technology, more research should be done on determining barriers preventing farmers from retrofitting their tractors with ROPS, assessing which tractors are overturning, and identifying where fatalities are occurring.

**Action Step 4.1.4** - Partnership groups and coalitions, essential to preventing tractor-related injuries and deaths, should be formed in each region or state to influence adoption of proven interventions (e.g., engineering, incentives, and policies). Partners should include, among others, government agencies, employer associations, labor representatives, tractor manufacturers, family farm representatives, farm cooperatives, insurance companies, universities, and NIOSH Agricultural Research Centers.

## PROJECT ACCOMPLISHMENTS and CHALLENGES

- While FFA organizers and students remain excited and enthusiastic about the potential of this project, parents were too concerned about the personal and financial ramifications of their children conducting a survey of local workplace accidents, and could not sign-off on the project. Without parental consent and with apparent community concerns, the project could not move forward.
- Participating FFA students and staff gained experience in ATV and tractor safety and in planning a survey and PNASH researchers made some excellent contacts within the Washington State FFA.

## PROJECT PRODUCTS

Education / Training / Outreach

- Training: Zillah School District FFA Leadership Tractor and ATV

## STATES PROJECT WAS ACTIVE IN

WA

## COLLABORATION

Washington State Future Farmers of America

## PROJECT TITLE

Pilot 10: Reducing Workloads for Older Loggers in Physically Demanding Logging Tasks with Synthetic Rope

## PROJECT OFFICERS(s)

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## HOST ORGANIZATION

University of Washington  
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Box 357234  
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## PROJECT DESCRIPTION

Timber harvesting (logging) starts the production cycle for forest products and has been characterized as difficult, dangerous, and dirty. In the US, logging is among the top three most dangerous jobs and when all factors are considered, logging is likely the most dangerous job in the country. Earlier research characterizes logging workload, rating logging among the most exertive work. Data in Oregon, Washington, and Idaho show that loggers who are least 45-years-old represent ~50% of the workforce, a percentage that is growing. Other states and countries show similar trends. The current NIOSH Forestry Sector NORA goals emphasize the workload issue: Intermediate Goal 6.4- "Establish a Forestry Sector Partnership to outline research methodologies and to develop new technologies (e.g., synthetic rope, "smart" clothing) to reduce workloads and injury risks associated with logging and forest operations." The research also relates to Strategic Goal 2: "Reduce deleterious health and safety outcomes in workers more susceptible to injury or illness due to circumstances limiting options for safeguarding their own safety and health (*Older Workers*)." This project also ties to Forestry Health Intermediate Goal 7.1: "Develop and implement interventions to minimize the frequency and causes of work-related musculoskeletal diseases (MSDs) and other acute and chronic illnesses leading to premature disability." Synthetic rope weighs one ninth that of similar strength wire rope. Prior research has documented potential gains for younger forest workers, but older forest workers stand to gain the most from ergonomic improvements using synthetic rope. The project will assess the ergonomic and economic benefits of using synthetic rope to replace wire rope in standardized logging tasks for older workers (>age 40) compared to current practices and younger workers (prior research). The project will show next generation of forest operations researchers that heart rate measures can contribute to research on improvement efforts.

## PROJECT START AND END

Start: 9/30/2009      End: 9/29/2011

## PROJECT BUDGET

1. Actual Project Expenditures: \$ 42,189.02
2. Estimated In-kind Support Value: \$ None
3. Outside Funding: None

## PROJECT AIMS

- 1 Assess the ergonomic and economic benefits of using synthetic rope to replace wire rope in standardized logging tasks for older workers (>age 40) compared to current practices and younger workers. – **Ongoing**
- 2 Show next generation of forest operations and occupational/medical/ergonomic researchers that heart rate measures can contribute to research on      improvement efforts. – **Ongoing**

## **NORA GOALS AND ACTION STEPS ADDRESSED**

**Intermediate Goal 6.4-** Establish a Forestry Sector Partnership to outline research methodologies and to develop new technologies (e.g., synthetic rope, “smart” clothing) to reduce workloads and injury risks associated with logging and forest operations.

**Strategic Goal 2-** Reduce deleterious health and safety outcomes in workers more susceptible to injury or illness due to circumstances limiting options for safeguarding their own safety and health (older workers).

**Intermediate Goal 2.4 -** Use innovative and proven communication, education, training, and marketing techniques to tailor workplace safety and health programs to be responsive to the unique needs of vulnerable workers.

**Intermediate Goal 7.1-** Develop and implement interventions to minimize the frequency and causes of work-related Musculoskeletal Diseases (MSDs) and other acute and chronic illnesses leading to premature disability.

## **PROJECT ACCOMPLISHMENTS and CHALLENGES**

- Designed project to meet institutional and operational constraints
- Cleared institutional safeguards of human subjects protection and data security
- Contacted cooperating firms for data collection, but found recession left firms not actually operating
- Fire season limited contact for some firms who were not able to operate
- Used back-up data collection system when Garmin did not function properly
- Currently collecting field data in Oregon and Washington sites based on collaborator availability
- Expect good data from subjects
- Need to find firms willing to cooperate who are actually operating

## **PROJECT PRODUCTS**

### Presentations

- 10/10/2009 - Oregon Logging Safety Conference  
John Garland. Synthetic Rope and Ergonomic Benefits
- 1/10/2010 - Washington Logging Safety Conference, WA.  
John Garland. Synthetic Rope and Ergonomic Benefits.

### Publications

Article published, feature (trade publication)

- Garland-J  
New Yarders... Old Yarders  
Loggers World; Spring 2010.

## **STATES PROJECT WAS ACTIVE IN**

OR

## **COLLABORATION**

Associated Oregon Loggers and member firms  
Washington Contract Loggers and member firms