



Health and Safety in Western Agriculture

NEW PATHS

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POSTER PRESENTATIONS

Impact of Computer-based Pre-training on Learning in a Face-to-Face Supervisor Skills Workshop for Latino Agricultural Workers

Austin JA, Alvero AM, Fuchs MM, Patterson L, Anger KW, Western Michigan University, Queens College, Oregon Health & Science University

This study assessed the impact of computer-based training of supervisor skills in Latino agricultural workers with limited education. Ten participants were all born and educated in Mexico, and all spoke Spanish, the language of the training. Five participants completed computer-based supervisor skills training, and five completed computer-based hazard communication (Hazcom) training as a control condition. Following the computer-based training, a consultant experienced in behavior management conducted a two-day supervisory skills training workshop face-to-face. All participants were given a 20-question multiple-choice test on supervisor skills before and after the workshop. The Hazcom group participants reported receiving a mean of 8.2 years of education (range 5-9), and the participants completing supervisor skills training reported a mean of 6.4 years of education (range 5-8). Although the groups did not differ on knowledge scores before the face-to-face workshop, after the workshop the HazCom group had a mean test score of 51.2% (SD=8.7) while the Supervisor CBT group had a higher mean test score of 65.2% (SD=14.3). The difference was marginally significant by a t-test ($p = 0.052$), and the effect size was large ($d = 1.16$). The results suggest that computer-based training in supervisor skills can be effective in preparing participants with limited education to learn supervisor skills from a face-to-face workshop. Previous research demonstrated that computer-based training can teach basic work skills to immigrants with limited education, and this study extends that to complex work concepts.

Exposure to Ultrafine Particles During Allergic Sensitization Yields an Altered Lung Epithelial Structure

Carosino CM, Harkema JR, Last JA, Kenyon NJ, Pinkerton KE, University of California, Michigan State University

Particulate matter (PM) has been shown to exacerbate allergic airway diseases. In agricultural settings, exposure to high dust, high PM, air is a common occupational hazard. Recent studies demonstrate ambient ultrafine particles (UFP) may act as an adjuvant in Ovalbumin-induced allergic sensitization via the addition of small quantities of intranasally instilled UFPs with Ovalbumin (Ova). The objective of this study was to investigate the effect of ultrafine particles via inhalation and/or instillation during the sensitization phase of an allergic mouse model. Male eight-week-old Balb/c mice were sensitized with 10 μg Ova on days 2, 3, and 4, challenged with 40 mg/m^3 Ova for 1 hour on days 12 and 13, and sacrificed on day 14. Some animals additionally received collected UFP instilled with the Ova, inhalation exposure to UFP for 5 hours/day for days 1-5 following Ova instillation or both treatments combined. The UFPs are generated and collected on-site with an average concentration of 224.6 $\mu\text{g}/\text{m}^3$ and an average size of 53.5 ± 3.8 nm. Histology of the fixed lung revealed markedly increased mucin content in the animals sensitized with UFP and Ova than in animals primed with Ova alone. Previous studies have shown no increase in mucin content with UFP alone or in the challenge phase. This study indicates with the addition of UFP during the priming phase, an exacerbated allergic response results, and this could further explain some of the epidemiological trends we witness in asthmatic patients living and working in high PM areas such as in agricultural settings.

Funded by: NIEHS Graduate Training Grant

Pilot Study: Lower Yakima Valley Private Well Study and Proximity to Surrounding CAFOs

Castro V, Heritage University

The Yakima County of Washington state is predominantly irrigated farmland. The area includes multiple confined animal feeding operations (CAFOs), and much was orchard land where lead arsenate was used before DDT was introduced. Heavy metals and nitrate are likely to be found in water wells in areas of agriculture. There is little data on private drinking water wells in the Yakima Valley. Using Community Base Participation, ConneX (program that identifies young people living in the Yakima Valley who are interested in healthcare careers), NCEC/KDNA (a public radio station that share a variety of services to the isolated Spanish speaking community), and University of Washington recruited private well-water owners/renters at locations such as local grocery stores, community events, and through radio broadcasts to receive sterile water containers and return them to KDNA for free nitrate testing. ConneX students were trained in the use of Lamotte nitrate kits (testing range: 0-10ppm). Using a volunteer convenience sample pilot data on qualitative nitrate content, and approximate well location will be plotted on a broad map of the Yakima Valley. Results from pilot study will indicate if further research is necessary.

Collection Efficiency and Viability of Aerosolized E. coli with a Liquid Impinger Compared to Agar Impaction

Dunbar L, Gordor R, Novosselov I, Meschke JS, University of Washington

Aerosolized bacteria have been shown to cause respiratory inflammation and allergies with continuous exposure. The aerosolization of bacteria is a concern for workers in various agricultural processes, including dairy farms, grain elevators, and animal husbandry. A model organism for this type of exposure is *Escherichia coli* because of its persistence and commonality in many agricultural settings. This study examines the bioaerosol collection efficiency of the SKC BioSampler liquid impinger relative to an Anderson single-stage impactor and a reference filter method. Samples were collected in a sealed aerosol-generating chamber with a known volume and *E. coli* concentration. The collection efficiency was determined by comparing the culturable organisms in the BioSampler liquid and the Anderson impactor. Qualitative PCR techniques were applied to the BioSampler liquid to examine the potential loss of viability of organisms collected. The Anderson impactor had 10-fold greater collection efficiency for viable *E. coli* than the BioSampler. Current findings suggest that the BioSampler causes the destruction of the *E. coli* through the change in airflow at the sampler inlet. The Anderson impactor sampling appears to be more effective means of the aerosolized *E. coli* collection.

Pilot Pesticide Safety Radio Campaign Targeting Mixteco Farmworkers

Evans E, US EPA

EPA is part of a Bilateral Consortium on agricultural worker risk communication. The Consortium aims to protect the shared US-Mexico agricultural workforce through collaborative pesticide safety awareness campaigns. As part of this effort, the Consortium is conducting pesticide safety outreach among indigenous language-speaking farmworkers and is targeting a large Mixteco population of orchard workers in Washington State's Yakima Valley. Indigenous farmworkers are a rapidly growing population and need to understand the potential risks of working around pesticides. However, these workers may not understand the required pesticide safety training that is conducted either in English or Spanish. Mixteco is primarily oral, and the farmworker population is low-literacy, so it is important to conduct nontraditional outreach and utilize radio stations with a large farmworker audience for this pilot project. The pesticide safety messages will be broadcast this fall as Mixteco public service announcements. Hispanic Communications Network, the contractor, will work with Mixteco-speaking talents, identified by a farmworker outreach specialist, to deliver the pesticide safety messages to Washington state orchard farmworkers during apple harvesting season.

Organizations and participants on the Bilateral Consortium include:

Adelaida Martinez Chapa with COFEPRIS Mexico; Ofelio Borges with Washington State Department of Agriculture; Elizabeth Evans, Kevin Keaney, Michael Walsh, Carolyn Schroeder, Carol Parker, and Christine Fortuin with EPA; Julia F. Storm and Catherine LePrevost with North Carolina State University; Kay G. Harris and Sergio Morales with North Carolina Department of Ag Consumer Services; Sonia Cotto Febo with Florida Department of Agriculture and Consumer Services; Dick Herrett with the National Association of State Departments of Agriculture; and Cesar Asuaje with University of Florida.

Washington Community Health Workers/ Promotores Network

Gomez L, Washington Community Health Worker Network

Washington Community Health Worker Network (WCHWN) History: Reaching out to underserved populations, including farmworkers, is challenging and requires culturally sensitive methods and tools to engage with the population. In order to share the burden of this challenge and learn from each other, community health workers from community health centers and related agencies in Washington State sought a networking venue to communicate frequently, discuss best practices and resources, and receive training. In response to this need, Washington Association of Community & Migrant Health Centers (WACMHC) and Northwest Regional Primary Care Association (NWRPCA) are coordinating the Washington Community Health Worker Network. The network meets quarterly. Background of Community Health Workers: Since the 1950s, community health workers (CHWs) have been a key component in building trust with underserved populations like migrant farmworkers and connecting them to the health care system. Usually bilingual and bicultural CHWs live in and understand the communities in which they work. Although their functions vary, in general, CHWs provide health education and information, refer clients to health and social services, provide informal counseling and support, offer direct service such as first aid and health screening tests, and advocate for individual and community needs. Depending on where they work or volunteer, they may assume a variety of titles such as “promotores” or “promotoras,” “camp health aides,” “lay health workers,” “outreach workers,” “peer educators,” “community health representatives,” “colonia health workers,” “health navigators,” or “indigenous or village health workers.” They are effective because they incorporate information about health and the health care system into the community’s culture, language, and value system, thereby improving cultural competence in the healthcare system and breaking down many barriers to health care. Mission: The purpose of the network is to produce a confident, broadly trained workforce of community health workers that will increase access to health care and change the health behaviors within their communities, ultimately decreasing health disparities within the state.

Trees Kill: Key Factors in Logging Safety

Hammond T, Oregon Fatality Assessment and Control Evaluation

This poster was developed to focus on global health issues. Experience with state regulation and employer commitment to safety in logging activities in the Pacific Northwest may help others to improve safety and reduce injuries and death in logging operations. As logging intensifies in Asia, Africa, and South America, more workers are exposed to extreme hazards in unmanaged conditions. Principal elements of safety planning in logging involve (1) develop a safety culture that includes a commitment from management, training, and a safety and health program that includes regular safety meetings, (2) communication procedures that encourage worker input, knowledge of work signals, and procedures to check on isolated workers, (3) personal protective equipment, (4) first-aid training and supplies, plus particular attention to safe practices for extremely hazardous work related to (5) falling trees, and (6) cables and rigging. Each logging site must have a competent person to inspect all equipment prior to use and supervise safe work practices.

Agricultural and Work Characteristics among Children of Hispanic Farmworkers

Hennessy-Burt TE, Stoecklin-Marois MT, Schenker MB, University of California, Davis

Background: Agriculture is a hazardous industry, especially for young workers. Most research has focused on family farms and children of farm owners. Much less is known about children of farmworkers and the work they do. MICASA is a population-based study of California farmworkers, and one component collected data on 100 adolescents. Interviews assessed work history, acculturation, and health risk behaviors, such as smoking, alcohol and drug use. Of the 100 adolescents, 38% were female and 62% male. 55% were US-born, 38% Mexican-born, and 7% Salvadoran-born. In addition, 49% worked for pay during the last year. Among those who worked, babysitting (67.4%) and farm work (73.5%) were most frequently reported. The average age they started farm work was 14 years, and adolescents worked an average of 4.3 weeks during the previous year. Hoeing, picking, and packing/sorting were the most common tasks. In models adjusted for age and sex, low acculturated adolescents were significantly more likely than moderately acculturated to do farm work (OR: 6.04; 95% CI: 1.99-18.4). An El Salvadoran birth was also associated with increased odds of farm work, but results were not significant (OR:3.18; 95% CI:0.45-18.4). These results represent a first step in understanding the characteristics and risks of a unique and vulnerable population who work in farming.

Biomarkers of Sensitivity and Exposure in Washington State Pesticide Handlers

Hofmann JN, Stevens R, MacCoss M, Goodlett D, Sherl AC, Keifer MC, Checkoway H, Kim JH, Richter RJ, Suzuki SM, Farin FM, De Roos JD, Furlong CE, Departments of Epidemiology, Medicine - Division of Medical Genetics, Genome Sciences, Medicinal Chemistry, Department of Environmental and Occupational Health Sciences, and Anesthesiology, University of Washington, The Fred Hutchinson Cancer Research Center

Since 2004, the state of Washington has implemented a program for monitoring serum cholinesterase (BChE) activity in pesticide handlers who work in agriculture. Pesticide handlers in Washington State were recruited during the 2006 and 2007 spray seasons when they were seen by collaborating medical providers as part of the statewide ChE monitoring program. Blood samples were collected from 163 participants and tested for PON1Q192R functional phenotype, PON1 genotype and plasma levels of PON1 [arylesterase (AREase)]. Percent change in BChE activity from baseline levels was evaluated relative to PON1 status. Participants with low AREase activity experienced a significantly greater degree of BChE inhibition than participants with high AREase activity (mean BChE inhibition of -8.44% and -3.27%, respectively; $p=0.017$). Greater BChE inhibition was observed among PON1Q192 homozygous individuals relative to PON1R192 homozygous individuals (with a mean BChE inhibition of -8.08% and -3.80%, respectively); this difference was statistically significant after adjustment for AREase activity ($p=0.028$).

In addition to using BChE inhibition as a biomarker of exposure, we have been developing protocols for analyzing OP modified protein biomarkers of exposure. The approach involves the development of rapid protocols for extraction of the target biomarker protein from a sample, digesting with the appropriate enzyme and identifying the OP-modified peptide by mass spectrometry. We are expressing active biomarker proteins in an E. coli system to provide heavy isotope labeled standards to use in quantifying the degree of modification.

Upper Respiratory Tract Responses in Rodents Exposed to Nanoparticle Aerosols

Hopkins L, Pinkerton K, Western Center - University of California, Davis

Inhalation of fine and ultrafine (nanoscale) particles is observed in diverse agricultural settings and may be associated with diverse adverse health effects. To investigate respiratory effects, we measured mucin expression, leukocyte influx, and particle uptake in nasal epithelia of mice exposed to four aerosols: concentrated ambient particles (CAPs), ultrafine soot-Fe₃O₂ (SFe), quantum dots (QDs), or carbon nanotubes (CNTs).

Results: Mucin was significantly increased within nasal septal regions of SFe-exposed mice but not within other groups. Nasal leukocyte populations were unchanged, despite a significant increase in neutrophils recovered by bronchoalveolar lavage in SFe mice. Interestingly, localized iron-positive staining was observed in nasal epithelium nerve tracts of CNT-exposed animals but not SFe-exposed animals. Whether this indicates uptake of CNTs themselves or simply uptake of soluble CNT-associated iron is not yet known. QDs were not seen in nasal epithelia but were detected both in sectioned olfactory bulbs and enzyme-digested bulbs. QDs were observed predominantly within the glomerular layer, suggesting transport involved olfactory sensory neurons. These observations suggest inhaled fine and ultrafine particles of varying composition may exert effects in the respiratory tract, including the nose, that could give rise to effects leading to systemic dissemination.

Pilot Organophosphorus Pesticide Air Monitoring Project

Krenz J, Fenske RA, Yost MG, Galvin K, Tchong-French M, Palmández P, Negrete M, Fitzpatrick C, Tsai MY, Crampton R, University of Washington

In response to a request from the Washington State Legislature in April of 2007, the University of Washington's Department of Environmental Health and Occupational Health Sciences (DEOHS) designed and implemented a study to monitor airborne concentrations of organophosphorus (OP) pesticides in agricultural areas of Washington State. This pilot study took place in the spring and summer of 2008 and focused on two tree fruit growing regions in Washington. Air sampling stations were set up to determine OP pesticide concentrations and exposure potentials at various locations within the regions. The data is in the process of being analyzed. The results of this study will provide information regarding actual community exposures as well as providing a basis for estimating exposure levels in proximity to application sites.

Validation of Microbial Recovery from Surfaces by Various Sampling Methods

Lee JK, Rohlik C, Ray L, Meschke JS, University of Washington

Bacterially contaminated surfaces in livestock operations are potential sources of occupationally-acquired infections. Unfortunately, available methods for sampling of bacteria on surfaces are poorly characterized. Recovery efficiencies of various microorganisms from the metal and ceramic tile surfaces were determined by contact plates, swabs, and the Microbial-Vac (M-Vac). Various concentrations (between $\sim 10^4$ cfu and $\sim 10^6$ cfu of *Escherichia coli*, *Bacillus subtilis*, or *Staphylococcus aureus*) were applied to 100 cm², dried over 2 hours, and then collected by the various methods. Recovery from the tile surface was higher than that of the metal coupon. *S. aureus* was the most efficiently recovered organism. Contact plate recoveries were found to be consistent, regardless of pressure and time factors for both surfaces; with recoveries of 28% and 0.08% from the tile surface for *S. aureus* and *E. coli*, respectively. Swab recoveries were 27.3% and 0.12% for *S. aureus* and *E. coli* on the tile surface, respectively. The M-Vac recoveries were found to be the most extensive, based on follow-up sampling. M-Vac results also suggest that loss of bacterial viability on surfaces was significant, though not solely responsible for the poor recovery. Overall, this study showed the recovery efficiencies varied, depending on the microorganism and sampling method.

The Impact of Nicotine Exposure on Chlorpyrifos Pharmacokinetics: Implications for Drug/Chemical Mixtures

Lee S, Poet T, Busby A, Timchalk C, Pacific Northwest National Laboratory

Chlorpyrifos (CPF) is a widely used organophosphorus (OP) insecticide. The objective of this study was to evaluate the potential impact of tobacco (nicotine) exposure on CPF pharmacokinetics. The influence of repeated nicotine exposure on in vivo metabolism of CPF to its active and inactive metabolites, (CPF-oxon and 3,5,6-trichloro-2-pyridinol [TCP], respectively), were investigated. Male rats were dosed with 1.) 1 mg nicotine/kg/day (s.c.) + 5 mg CPF/kg/day (in corn oil, po) for 7 days; 2.) 1 mg nicotine/kg/day for 7 days + a single dose of 35 mg CPF/kg po; or 3.) saline-controls were given 5 or 35 mg/kg CPF only. All the animals were sacrificed at 1, 4, 8, 12 or 24 hr post-dosing (CPF). Following repeated 5 mg CPF/kg exposure, there was less inhibition of cholinesterase (ChE) in the brain of rats pretreated with nicotine ($\sim 71\%$ of naïve [no CPF, no nicotine]) over saline-controls ($\sim 42\%$ of naïve) and similar differences were seen in plasma. For both CPF exposures (single or repeated), blood TCP C_{max} and AUC were increased (~ 2 -fold) indicating the possible increase of CYP450-mediated metabolism of CPF to TCP, which is consistent with the previous in vitro data. The results of this study suggest that repeated nicotine exposure (i.e., from smoking) could alter metabolism of CPF.

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Safety Guidelines for Hired Adolescent Farmworkers

Miller ME, Fisher R, Lee, Mulhern B, Washington State Department of Labor and Industries, National Children's Center for Rural and Agricultural Health and Safety, Safety Consultant

With funding from the National Institute for Occupational Safety Health (NIOSH), a project team led by staff of the National Children's Center for Rural and Agricultural Health and Safety in Marshfield, Wisconsin initiated a project to develop and distribute user-friendly safety resources that highlight relevant regulations and enhance the ability to effectively assign tasks and supervise adolescent farmworkers. To date, the English and Spanish version resources address: 1.) characteristics of adolescent workers; 2.) working outdoors; 3.) harvesting tree fruit and climbing a ladder; 4.) basic tractor operations; 5.) working with large animals; 6.) working with utility vehicles; and 7.) hand harvesting fruit and vegetables. Depending on the agricultural operation, an employer would likely select three of the above topics for use.

Each colorful, illustrated poster addresses supervisor responsibilities for ensuring work conditions are appropriate and adequate for assessing their teen workers. Training and supervision tips, specific to teens and to each job, are provided. Each poster includes illustrations of three main hazards and three points to remember for quick reference. Finally, each poster includes pertinent federal regulations and referrals to obtain state-specific child labor regulations. By late 2008 these new guidelines will be widely available, distributed to agricultural employers through the internet, agricultural media, and producer organizations. This poster presentation will include samples of the guidelines and strategies to obtain feedback from supervisors of youth as well as pilot testing of the materials.

Causal Factors for Pesticide-Related Illnesses among Agricultural Workers

Morrissey B, Rodriguez T, Magaña M, Washington State Department of Health (WDOH), Pesticide Program: Illness Monitoring and Prevention.

In Washington State, pesticide-related illness are a reportable condition. WDOH, Pesticide Program investigates reported cases and summarizes the data to identify and target prevention activities. Currently, WDOH has a supplemental grant from NIOSH to better identify root causes for pesticide illness and injuries among agricultural workers. In a recent four-year period (2003-2006), DOH documented 242 cases of occupational illness or injury plausibly related to agricultural pesticide exposure. DOH has been tracking 16 different underlying factors that can lead to overexposure. The leading causal factors of these 242 pesticide exposures were 1.) lack of required personal protective gear and 2.) pesticide drift. Underlying factors identified for lack of eye personal protective equipment (PPE) were: 1.) not aware it was required, wearing sunglasses instead safety glasses or goggles, and 2.) employer didn't provide it. Gloves were another common source of missing PPE. Underlying factors were 1.) not aware they were required; 2.)wearing the wrong type; and 3.) employer didn't provide them. Respirators problems identified were 1.) wrong type of cartridge or cartridges left in too long and 2.) lack of fit-testing. This poster will present data on these causal factors and also suggest prevention messages and strategies for reducing incidents.

Educating Through Games

Murphy H, PNASH - University of Washington

At heart we're all just overgrown kids and still enjoy games. We also learn very effectively through games. This poster session will draw you in to play a variety of educational games used to reinforce and evaluate farmworker training. PNASH has been distributed through our Washington State Community Health Worker/Promotora Network. Two games on Worker Protection Standard (WPS) training include a bingo (lotería) game developed by University of California, Davis and a jeopardy game developed by Washington State University. The third game is a home grown PNASH product, computer-based Heat Jeopardy. Come test your knowledge on WPS and heat-related illnesses and learn in the process.

Interventions to Minimize Worker and Family Pesticide Exposure

Palmández P, Galvin K, Tchong-French M, Fenske R, PNASH - University of Washington

Research and review of current information about pesticide exposure and health effects show that there are opportunities to reduce handlers' pesticide exposure and transmission of pesticides off the worksite. There is growing evidence that some pesticides such as organophosphorous pesticides may have long-term health effects on adults and children.

This is the second year of a five-year research project, and we have carried out 33 interviews (13 in English and 20 in Spanish) with experts in pesticide safety. Interviewees were orchard managers, growers, agricultural safety managers, fieldmen, educators, safety professionals, and handlers. We have convened three Expert Working Group meetings intended to identify practical interventions for field testing, with the goal of developing a best practices document for a national audience.

Development of a Sensitive and Specific Exposure Biomarker Assay for Organophosphate Pesticides using HPLC and Tandem Mass Spectrometry

Paulsen M, Simpson C, DEOHS, University of Washington

The toxicological mechanism of organophosphate pesticides (OP) involves covalent binding of the pesticide to cholinesterase enzymes resulting in inactivation of the enzyme. The enzyme-OP molecule is referred to as an adduct. A method utilizing LC/MS/MS was developed for measuring these adducts in human plasma. For this development work, adducts were prepared in vitro by adding chlorpyrifos oxon and methyl paraoxon to human plasma. Samples reacted at room temperature for 30 minutes and then were processed using affinity chromatography to purify the cholinesterase enzyme. The purified enzyme was digested with pepsin, and a nonapeptide fragment containing the region of OP binding was isolated. The LC/MS/MS method developed allows sensitive measurement of the nonapeptide with mono- and dimethylphosphate

and mono- and diethylethylphosphate adducts as well as the unadducted nonapeptide. This method should ultimately provide a new tool to quantify human exposure to OPs and also provide information regarding the specific pesticide the individual was exposed to.

Pulmonary Response in Mice Following Exposure to Particulate Matter of the California San Joaquin Valley

Plummer LE, Recendez J, Ham W, Kleeman M, Pinkerton KE, Western Center - University of California, Davis.

Epidemiological studies indicate an association between heightened levels of ambient fine/ultrafine particulate matter (PM) and increased incidence of adverse pulmonary health effects and increased hospital admissions. Acute pulmonary inflammation and oxidative stress are associated with several pulmonary conditions that are linked to PM exposure. The exact component(s) of ambient PM responsible for the observed health effects has yet to be elucidated. For the present study, four field measurement and exposure studies were completed during summer and winter seasons in urban Fresno, California (500 East Shaw Avenue) and rural Westside, California. For each experiment, male C57/BL6 mice were exposed to concentrated fine/ultrafine ambient particles (CAPs) using a Versatile Aerosol Concentration Enhancement System (VACES) for 6 hr/day for 10 days. Indicators of acute inflammation, cell injury, and oxidative stress in the pulmonary system were measured in lung tissue and bronchoalveolar lavage (BAL) fluid. The establishment of key pulmonary changes provides a basis for correlation to total ambient PM mass and/or specific PM components. Cytokine and chemokine analysis of lung tissue homogenate has demonstrated differential expression of markers of inflammation between experiments with significant decreases in expression of IL-1 β , IL-6, IL-10, IFN- γ , and MCP-1 during the Fresno summer, and significant increases in TNF- α , IL-1 α , IL-1 β , IL-6, IL-12, GM-CSF, IFN- γ , MCP-1, MIP-1 α during the Westside winter experiment. No significant differences were observed following exposure during winter in Fresno or summer in Westside. BAL analysis showed statistically significant increases in neutrophil counts for the Westside summer and winter experiments, though no significant differences in the number of cells recruited to the lungs. Analysis of BAL for oxidative stress related enzyme heme oxygenase-1 and cell injury indicator lactate dehydrogenase showed no significant differences compared to controls. This analysis of the pulmonary effects in mice following CAPs exposure during summer and winter in urban and rural locations combined with PM characterization may give an indication of the key components of PM associated with health effects observed in this highly populated and agriculturally productive region of California, providing valuable information for future regulatory policy decisions.

PBPK/PD Modeling of Chlorpyrifos in Sensitive Populations: Implications for Biomonitoring of Exposure

Poet TS, Campbell JA, Busby AL, Timchalk C, Pacific Northwest National Laboratory

Trichloropyridinol (TCPy) is the major metabolite of chlorpyrifos (CPF) and is used as a biomarker for exposure. TCPy has also been detected as residues on food and in the environment. Therefore, to quantitatively utilize TCPy as a CPF biomarker requires a more detailed understanding of TCPy pharmacokinetics. Laboratory research has elucidated the different pharmacokinetic behavior of TCPy from a CPF dose or from direct exposure to TCPy, and physiologically based pharmacokinetic/pharmacodynamic (PBPK/PD) modeling was implemented to quantify and interpret exposures. The model was interrogated to estimate the effects of metabolic variability associated with pregnant women and children and equate those effects against urinary TCPy concentrations. The worst-case scenario modeled a child with a 90% deficit in PON1 activity (the fifth percentile in newborns). At a 3 $\mu\text{g}/\text{kg}$ dose, the maximal plasma cholinesterase (ChE) inhibition in these individuals was less than 4% (96.2% of control). In all adult simulations, differences in maximal plasma ChE inhibition were nominal at exposures up to 10 mg/kg. Regardless of exposure scenario, the urinary elimination of TCPy over the first 24 hr was unchanged, indicating that biomonitoring of urinary TCPy cannot be used to predict PON1, ChE, or P450 activities in individuals.

Partially supported by an inter-/intra-agency agreement (DE-AC05-76RL01830) from the Centers for Disease Control and Prevention (CDC) and CDC/NIOSH grant R01 OH008173-01.

Point-of-view Video Analysis of a Fallers Safety Training Program

Risचितelli G, Hammond T, Oregon Fatality Assessment and Control Evaluation,
Oregon Health & Sciences University

The poster will present information on our current PNASH-funded pilot project using video mini-cameras mounted on hardhats to observe fallers at work, cutting trees in the woods. The project is designed to evaluate the effectiveness of safety training for loggers. Participants include two novice fallers and two experienced fallers, each observed at two time periods, before and after exposure to a Fallers Logging Safety booklet. Point-of-view video observation provides a way to gain access to a remote, mobile, and dangerous work situation. The poster will illustrate key technical aspects of this path-breaking study, including the equipment selected and assembled for the project, examples of the resulting video images, details of the human subjects research protocol, and use of Transana video analysis software. Methods will be described for analyzing the video data, and results will be presented for the initial data collected.

Symptoms of Depression and Levels of Perceived Stress in Hispanic Farmworkers Who Smoke

Rodriguez EJ, Stoecklin-Marois MT, Hennessy-Burt TE, Schenker MB, University of California, Davis.

Rationale: Depression is associated with smoking among US Hispanics. We examined associations between depressive symptoms, psychosocial factors, and smoking in a sample of California farmworkers. Methods: MICASA is a population-based study of occupational exposures and health in 422 farmworker families. Participants included men and women, ages 18-55, of Mexican and Central American descent, residing in Mendota, California, and engaged in farm work for at least 45 days within the past year. Individuals were identified with MOS-defined depressive symptoms based on a screener cutpoint of 0.06. Results: 875 participants were interviewed; mean age 37.5 (SD±10.2). 66% were Mexican-born, 30% Central American-born, and 4% US-born. 11% of women and 7% of men reported depressive symptoms. Women reported higher average perceived stress scores than men: 6.3 (SD ± 3.4) and 4.3 (SD ± 3.0), respectively (p<0.0001). 13% of men and 5% of women were current smokers. In models adjusted for age, gender, marital status, and acculturation, depressive symptoms did not significantly predict current smoking (OR=1.35; 95%CI:0.71-2.56) or long-term smoking (OR=0.63;95%CI:0.20-1.99). Conclusions: We observed an association of stress and depressive symptoms with gender but not smoking. This suggests further investigation into the relationship between psychosocial factors and smoking and its temporality.

Characterization of Bioaerosols and Bacterial Surface Contamination at a Large Washington Dairy Operation

Rohlik C, Lee JK, Ray L, Meschke JS, PNASH - University of Washington

Cattle are a source of potentially pathogenic bacteria, including E. coli, Salmonella, and Campylobacter. These fecally shed bacteria may persist and be widely distributed in the CAFO environment. It is hypothesized that dairy farmworkers may be at a significant risk of infection by occupational exposure through several routes, including bioaerosols, and contaminated surfaces. The primary aim of this project is to detect, quantify, and characterize the microbiology of bioaerosols and contaminated surfaces in a large freestall dairy CAFO in eastern Washington. A secondary aim is to evaluate the efficiency and effectiveness between bioaerosol and surface sampling methods in the CAFO environment. We used the SKC Anderson 6-stage, the SKC Anderson single stage, and the SKC Biosampler at comparable volumetric flows to detect microorganisms in air. Swabs and RODAC plates with both general and selective media were used to sample various surfaces throughout the farm. E. coli and Salmonella have been identified using the SKC Anderson six-stage, SKC Anderson single stage, RODAC and the swab method. We have not been able to isolate E. coli and/or Salmonella with the SKC Biosampler.

Assessment of Pesticide Exposure in Children

Rohlman DS, Patterson L, Fuchs M, Huszar S, Center for Research on Occupational and Environmental Toxicology, Oregon Health & Science University

There is increasing concern that the use of pesticides in agriculture may be affecting farmworker communities, including children. Organophosphate (OP) pesticides are among those of greatest concern, due to their persistence once in the home and their established neurotoxic effects. Neurobehavioral tests have identified deficits in adult populations exposed to and

poisoned by OP pesticides on farms. However, little research has examined OP pesticide exposure in children. While the neurotoxic effects of acute exposure to OP pesticides are well established, chronic low-level exposure are not well studied in adults and very few studies provide evidence of neurobehavioral deficits in farmworker children compared to controls. Children of farmworkers are presumed to be exposed to pesticides throughout development, and this exposure may produce subtle health effects that would not be detected by clinical examinations nor recognized by parents. The current study has developed methods to assess neurobehavioral functioning in school-age children and a measure of lifetime exposure to pesticides. Children's exposure to pesticides from the parent's work or residence in an agricultural community was measured. Measures of OP exposure and neurobehavioral performance of school-age children exposed to pesticides will be described and presented.

The Migrant Adolescent Work-Life Study

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Little published data describe chronic disease indicators among migrant farmworker adolescents, a vulnerable working population. To address this gap, we are conducting a five-year (2006-2011) combined cross-sectional/cohort study to examine the prevalence of and risk factors for hypertension, overweight, hyperinsulemia, and back symptoms among students from two South Texas high schools. Along with physical examinations, we are administering a questionnaire soliciting information on work history, health risk behaviors, acculturation, and other factors. Among 628 sampled students, 508 participated (80.9%) after completing consent procedures. Of these, 257 were migrant education students and 251 were their non-migrant counterparts. Approximately, 96.9% of participants are Hispanic and 50.0% are male. Initial analyses of baseline data, comparing migrant and non-migrant students, show a prevalence of 26.7% vs. 26.4% for acanthosis nigricans (AN, a marker of hyperinsulemia); and 26.0% vs. 20.0% for high normal or high blood pressure (>90th percentile for age, height, and gender). The prevalence of AN was 24.6% for males and 28.4% for females. The prevalence of high normal or high blood pressure was 32.0% for males and 17.7% for females. These preliminary results suggest a compelling need for a comprehensive intervention to prevent significant chronic disease in this high-risk Hispanic adolescent population.

A Survey of Tractors and Rollover: Protective Structures in Washington State

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A survey of farms in Washington State was conducted in 2005 to determine tractor characteristics and the presence of rollover protective structures (ROPS) in a state with more inclusive rules on tractor retrofitting than federal regulations. A total of 544 valid surveys were completed from a proportional random sample across different types of farms. Responders indicated that 58% of tractors overall were equipped with ROPS, and 42% of the tractors without ROPS were exempt from the state rules. Seatbelts on tractors equipped with ROPS were reportedly used "sometimes" or more than 30% of the time, and 17% of these tractors had no seatbelt installed. Tractors used for row crop farming were significantly more likely to be equipped with ROPS than those used for tree, vine, or hops farming. Older tractors were used for fewer hours, were less likely to be ROPS-equipped, and were less likely to be operated while wearing a seatbelt. The results were consistent with a positive effect of the Washington State ROPS requirements, demonstrated by the increased percentage of ROPS-equipped pre-1976 tractors, as compared to other states, and by the difference between ROPS-equipped tractors in exempt and non-exempt types of farming. The results point to the need for prevention activities to increase seatbelt use on ROPS-equipped tractors and for further development of practical protection for tractors operating under overhead obstacles.

Pharmacokinetics of Chlorpyrifos Metabolites in Saliva

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Non-invasive techniques have been advocated as a novel means of biomonitoring for a variety of potential toxicants, including pesticides; and saliva has been suggested as an ideal body fluid. There is a critical need to evaluate pharmacokinetics of pesticides in saliva in order to relate potential saliva sensor measurements to whole body exposures. Within this project, we quantitatively evaluated in vivo pharmacokinetics of trichloropyridinol (TCPy), a metabolite of the insecticide chlorpyrifos (CPF), in saliva. Using microsurgical techniques, mean (\pm SD) salivary clearance rates of TCPy were determined to be 0.0049 ± 0.0056 and 0.0040 ± 0.0019 mL/min for rats receiving IV bolus doses of TCPy at 1 mg/kg and 10 mg/kg, respectively. Similar rates indicate a linear relationship of salivary TCPy clearance between dose groups. Data generated are being incorporated into an existing physiologically based pharmacokinetic and pharmacodynamic (PBPK/PD) model. This model can be coupled with sensor platforms and used to estimate both concentrations and pharmacodynamic effects of CPF and CPF metabolites in blood and target organs. It is envisioned that this approach will be used to monitor agricultural workers that are at risk from acute and chronic pesticide occupational exposure.

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Project to Assess Seats and Whole Body Vibration in Tractor Drivers

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The goal of this study will be to determine whether there were differences in Whole Body Vibration (WBV) exposures when operating a tractor with different types of seat technologies (mechanical, air-ride, and active suspension). Previous work in our lab on forklift drivers has shown that there is a significant difference between seat technologies in WBV attenuation. Twelve experienced forklift drivers drove the same unloaded forklift with a mechanical and air suspension seat over a standardized test route. When comparing seat types, there were significant differences in z-axis WBV exposures, with the air suspension seat consistently yielding lower WBV exposures. In addition, there were differences between seats in how they attenuated WBV exposures based on the driver's weight. In the mechanical suspension seat, WBV exposures were weight dependent, with WBV exposure significantly decreasing as driver weight increased. With the air suspension seat, the same weight-dependent trend was not present. Using a portable PDA-based WBV data acquisition system, we intend to collect WBV exposures in a group of tractor drivers to determine whether seat technologies affect WBV exposures in a similar fashion as demonstrated in our forklift study.

Assessment of Chlorpyrifos Exposure in Agricultural Workers During Airblast Applications

Tchong-French M, Galvin K, Kibogy J, Fenske R, PNASH - University of Washington

Organophosphorus (OP) pesticides are commonly used in the tree fruit industry in Washington State. Chlorpyrifos is widely used as a dormant cover spray for controlling codling moth. The main goal of this study was to determine the pesticide exposure in agricultural workers during airblast applications and to verify the association between pesticide exposure levels and cholinesterase depression. Morning void urine samples from both pesticide handlers, who are the workers applying pesticides, and non-handlers were collected over a period of twenty-four days. The urine samples were measured for chlorpyrifos and its metabolites. Cholinesterase levels, baseline and follow-up, were obtained from the Washington State Cholinesterase Monitoring Program.

Results illustrated that the mean concentrations for the main chlorpyrifos metabolite, TCPy, for both handlers and non-handlers were significantly higher once pesticide application started in the orchard. No significant association was observed between the urinary metabolite levels and cholinesterase depression. The amount a pesticide handler applied was not a good predictor for his total exposure level. In conclusion, the urinary metabolite levels for the study subjects were significantly higher than the general population.

Introduction of a Portable Cholinesterase Monitoring Kit in a Clinical Setting Using a Normalization Process Approach

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Since 2004 Washington State has maintained a cholinesterase (ChE) monitoring program for farmworkers who are exposed to organophosphate (OP) and n-methyl-carbamate pesticides as part of their employment duties. This poster aims to highlight results from past studies involving the portable Test-Mate Cholinesterase Monitoring Kit (EQM Research, Inc., Cincinnati, OH) as well as research-to-practice goals for this academic year. Plans include an attempt to capture the perceptions of the current monitoring program in the Yakima Valley from those most involved with it: growers/employers, farmworkers, and healthcare staff at Central Washington Occupational Medicine, which handles the majority of ChE monitoring for the region. This perception data obtained through oral interviews will then be used as a surrogate to indicate any desire for change in the existing ChE monitoring program as it pertains to the Yakima Valley region of Washington State, which may or may not indicate utilization of a portable ChE monitoring kit. The success of a possible transition from research to practice for the Test-Mate kit will then be assessed by using the pre-established Normalization Process approach for clinical interventions, which is outlined in this poster. Ultimately, it is the goal of this project to assess how to introduce the Test-Mate Cholinesterase Monitoring Kit into clinical practice in a manner that best assures the success of initial and sustainable adoption.

Pesticide Exposure Assessment of Farmworker Families in Mendota, California

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An exposure study will be conducted to determine the relative contribution of dietary vs. non-dietary exposure pathways of the pesticides Permethrin and Imidacloprid in families of farmworkers living in Mendota, CA. From a random selection of 125 families, the mother and a child under the age of 5 will be enrolled. The primary data collection methods in this study will be collection of a urine sample, duplicate diet plate, and vacuum dust sample using a High Volume Small Surface Sampler (HVS3). In addition, a questionnaire will be conducted on pesticide use, considering both the types and frequency of applications in the home, and the frequency of cleaning in the home. Samples collected will be analyzed through the use of previously developed immunoassays; the sensitivity of which are currently being improved upon. A pilot study of two families is to take place in August 2008, with the main study taking place during the summer of 2009. The results from the study will be used to assess community needs and health risks as well as to develop priorities for culturally appropriate education and training programs and materials, which have the potential to benefit hired farmworkers and their families outside of Mendota.

Agricultural Work and Chronic Musculoskeletal Pain in Hispanic Farmworkers

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Agricultural work poses dangers to farmworkers in the US, and little information exists on risks for chronic musculoskeletal pain. We examined common work positions, such as kneeling, carrying heavy loads, and repetitive motion that may increase risk for chronic musculoskeletal pain.

MICASA is a population-based study of occupational exposures and health in farmworkers. Participants were Hispanic farmworkers, 18-55 years old, engaged in farm work, and residing in Mendota, CA. There were 435 men and 440 women. Mean age was 37.5 years. 66% were Mexican-born and 4% US-born. Chronic pain was defined as pain lasting 6 weeks or longer. 23.2% reported chronic back pain, 12.9% chronic knee pain, 11.1% chronic hip pain, 8.5% chronic neck pain, 6.9% chronic hand pain, and 6.3% chronic finger pain. After adjustment for age and gender, we observed a significant association for chronic knee pain with kneeling >10 hrs/week (OR=1.83, CI: 1.09-3.04). Chronic hip pain was associated with stooping/bending >16 hrs/week (OR=1.78, CI: 1.13-2.82). Work positions were not associated with back pain. Chronic musculoskeletal pain is common among farmworkers and is affected by common work positions. Further research is necessary to develop preventive interventions.