Appendix 2: Traumatic Injury Intramural and Extramural Projects

Extramural

More information is available for selected listed extramural projects. Follow the links to access additional detail on the goals, activities, outputs and outcomes of these studies.

Acute Back Injury

3380	System for Safe Patient Handling
3703	Predictors of Low-Back Injury and Disability in the U.S. Army
3746	A New Training Intervention to Prevent Back Injuries;
3749	Getting to Zero in Nursing Homes: Intervention Effectiveness
7708	Lift Aid Use in Reducing Injuries in Nursing Personnel
8375	Effectiveness of Patient Lift Equipment
VCE8875-03	Back Injury Interventions for Small Contractors

Emergency Responders

7960	Downed Fire Fighter Location System
03559FF	Leadership Intervention for Fire Service Personnel
03802D	Impact of Time and SCBA Tank Utiliz. on Injury Prev. in Fire Fighters;
04173R	SCBA Oximetry for Fire Fighter Physiologic Monitoring
07673R	Bioelectric Telemetry System for Fire Fighter Safety
07869 BT	Hazardous Substance Training for Emerg Responders

Machines

3612	ROPS Design and Testing for Agricultural Tractors;
8108	Audiovisual Method-ROPS Traumatic Injury Prevention
8542	National Agricultural Tractor Safety Initiative
08562R	A PC Based Virtual Reality Simulator for Forklift Safety Training
VEA8132	Prevention Effectiveness Analysis for Preventing Ag Tractor Roll-over Fatalities

Motor Vehicles

3419	Work-Related Motor Vehicle Crashes: Reducing the Burden
3804	Trucking Firm Characteristics, Driver Injury and Outcome
7699	Auditory Motion and Pedestrial-Motor Vehicle Collisions
217559	Effect of Active Speed Cntrls in Hwy Wk Zones

Workers in Alaska

4073	Occ Injuries Among Commercial Fishers

Workplace Violence

3407	Personal Safety for Social Services Providers
3412	Worksite Intervention to Reduce Wk-Related Assault Injury
3438	A Study of Risk Factors for Violence Among Nurses
3897	Homicide During Robbery: A Case Control Study
4037	Reducing Violence Against Nursing Home Caregivers
4051	Effects of OSHA Guidelines on Violence Prevention in Mental Health

7373	Wk-Related Assault: Impact of Trng & Policy
7374	Management Practices as a Factor in Workplace Violence
7754	Workplace Violence Risk in Home Hlth Wk Place
7816	Violence Against Teachers: Etiology & Consequences
7931	Risk for Violence in Long-Haul Truckers
7934	Evaluation of California Initiatives to Reduce Violence
7946	Organizational Factors Affecting Police Victimization
7947	Spokane Workplace Domestic Violence Initiative
7948	Evaluation of Workplace Violence Prevention Intervention
7953	Workplace Violence Nursing Health and Employment Outcomes
04051Prev	Eff of OSHA Guidelines on Violence Prev in Mental Hlth

Youth

3530	Safety of Youth Employment: A Nat'l Study of Parents & Teens
3786	On the Job Injury in South Texas Middle School Children
3796	Adolescent Toxic Exposures in the Workplace
3924	Children's Injuries on Kentucky Beef Cattle Farms
4205	Evaluation of NAGCAT Using Case Series of Injuries
4210	Using the ASHBMPManual as a Tool to Reduce Farm Hazards
4215	Adapting NAGCAT for Ethnic Communities: Aresearch Mode
4216	Teaching Kids Safety on the Farm: What Works
4220	Childhood Agricultural Safety and Health
4220	Evaluation of A School-Based Ag Health and Safety Curriculum
4222	Evaluating Teen Farmworker Education
4257	Evaluation of North American Guidelines for Children's Ag Tasks
4265	Childhood Ag Trauma Eval System
7298	The Youth Employment Training Pilot Program (Enhanced)
7301	Enhanced Surv of Occ Injuries to Youth
7534	Evaluation of Farm Safety 4 Just Kids Day Camps
7536	Effectiveness of Farm Safety Day Camps for Children
7744	Adolescent Farm Work, Fatigue, and Injuries in CO
7850	Evaluation of the NAGCAT Tractor Guidelines
7908	Effect of Work Permits in Protecting Youth Workers
8046	Removing the HOOA Family Farm Exemption: Impact on Injury
8058	Evaluation of Occupational Carrying Tasks for Farm Youth
8070	Adherence to the NAGCAT and Injury Risk Reduction
8126	Work Injury and Young People: A Prospective Survey
14357	Wisconsin Childhood Agricultural Safety and Health Intervention (513257)
14375	Etiology and Consequences of Injuries Among Children in Farm Households
16767	Childhood Injuries in Washington State Agriculture
514436	National Center for the Prevention of childhood Agricultural Injury
08107a	National Children's Center for Rural & Ag Health & Safety
VEA8067	Agriculture Child Labor

Title: **ROPS Design and Testing for Agricultural Tractors**

Submitted by Paul Ayers, University of Tennessee

1. Definition of the problem being addressed (e.g., number of workers affected; rates of injury, illness, or fatality; hazards)

Agriculture is considered one of the nation's most hazardous occupations with an estimated death rate of 21 per 100,000 workers in 1996 (National Safety Council, 1997). The National Safety Council estimated 800 agricultural work deaths in 1995. Also in 1995, the National Safety Council estimated 431 on-farm tractor-related deaths, of which 237 were due to tractor overturns. Although not all the tractor overturn fatalities are considered agricultural work deaths, it represents a considerable percentage. In fact, in 1994 agricultural work deaths were estimated at 890, while tractor overturns resulted in 188 on-farm fatalities. In these two years (1994 and 1995), the ratio of on-farm tractor overturn fatalities to agricultural work deaths rose from 20.6 percent to 29.6 percent.

In a review of the National Institute for Occupational Safety and Health (NIOSH) Fatality Assessment and Control Evaluation (FACE) program, 454 agricultural production fatalities were reported by the State FACE programs from 1990-1994 (Olenchock, 1997). Of these, 178 were tractor-related, with half resulting from tractor overturns. Here the ratio of tractor overturn fatalities to agricultural production fatalities is about 20 percent. A review of agricultural fatalities conducted by Myers and Snyder (1995) concluded, "tractor overturns (are) the leading cause of occupational traumatic death in the U.S. agricultural industry."

Tractor rollovers have been called an "occupational obscenity" by NIOSH (National Institute for Occupational Safety and Health) Director J. Donald Millar (NIOSH, 1993). NIOSH recommends National and community-based programs retrofit farm tractors with rollover protective structures (ROPS) and develop guidelines for the design of ROPS for tractors manufactured before 1971 (NIOSH, 1993).

2. Aims of the project (major objectives for the period of the work)

The overall objective of this project is to investigate and evaluate rollover protective structure (ROPS) designs for agricultural tractors in the United States to provide operator protection on tractors and in operating conditions not currently available. This objective includes both analysis of tractor ROPS inventory, and testing of ROPS designs and supporting structures.

3. Partners (participants in the project and the roles they served)

The author acknowledges the support of the National Institute for Occupational Safety and Health (NIOSH) safety engineers, Dr. John Etherton and Mr. James Harris for providing technical expertise. In addition, the author acknowledges the assistance of Doug Whitt, Laboratory Coordinator at the Agricultural Engineering Research Center (AERC) at Colorado State University (shop services), Dr. Juhua Liu (preparing and conducting field tests), and the following students: Sarah Legoza, Achai Broner, Chad Jackson, Nate Erickson, Jeremy

Pankonin, Luke Marriner, Travis Hertneky, Phillip Bacon, Ross Ballard, Ty Fickensher and Mike Olander (field test support).

4. Customers (intended users or beneficiaries of the results)

The customers of this research are primarily tractor and ROPS manufactures. These include Deere and Company, CNH, AGCO, Saf-T-Cab and Femco Mfg. The final beneficiary would be tractor operators involved in a tractor rollover with a certified ROPS.

5. Approach (tasks involved in conducting the project)

The specific tasks include:

1) Continued examination and inventory of agricultural tractor ROPS availability (specifically for older tractors) to determine the population of tractors for which ROPS are not available,

2) Prioritizing the agricultural tractor population for ROPS design feasibility based on population numbers and ROPS design and mounting feasibility,

3) Design, construction and testing of ROPS for the two highest prioritized pre-ROPS tractors (tractors not originally designed with the intent to mount a ROPS) in accordance with ASAE S519 (Rollover Protective Structures (ROPS) for Wheeled Agricultural Tractors, ISO Compatible). This includes conducting both lateral and longitudinal tests in static and field upset conditions,

4) Conducting a minimum of four axle housing strength tests for each pre-ROPS tractor to evaluate the torsional strength and design margins,

5) Conducting, in accordance with ASAE S519, lateral and longitudinal field upset tests on the NIOSH auto-ROPS (frame only) to evaluate elastic and plastic deformations and dynamic stresses,

6) Conducting, in accordance with ASAE S519, lateral and longitudinal field upset tests on the NIOSH auto-ROPS (frame and deployment sensor) to evaluate deployment timing. Video technology will be used to evaluate timing and operator protection. A field-upset test will also be conducted in a high-speed hillside roll condition,

7) Evaluating false deployment possibilities in lateral and longitudinal conditions at 45 degree slopes and high speed hill-side test conditions, and

8) Presenting pre-ROPS tractor ROPS and auto-ROPS design and test results to commercial ROPS manufacturer for commercial construction and follow-up field testing.

6. Results/Findings (preliminary or final observations and conclusions)

Analysis was conducted that indicates of the 70 most popular tractor models in the United State (Myers and Snyder, 1995), 50.4% were pre-ROPS tractors. Of these tractors, 73% are included in this ROPS

design study (includes previous R01 grant involving Ford and Farmall tractors). With the completion of this ROPS design research project, 89.6% of the Pre-ROPS tractors (in the top 70) will have a ROPS design.

ROPS can be successfully designed for the John Deere A and Allis Chalmers pre-ROPS tractors. These ROPS meet ASAE S519 (SAE J2194) standards. Axle housing tests conducted demonstrate the ability of the axle housings to attain the stresses produced during the static longitudinal tests without failure. Factors of safety of 1.6 were attained. The ROPS are able to withstand the forces produced during the field upset tests. The method of measuring ROPS dynamic deflection was developed by using a LVDT. Dynamic deflection occurred during about 0.155-0.2 seconds period. Body rotation velocity could be as high as 200-350 degrees/second when ROPS touched ground. The velocity of the deflection was 63 cm/s. The duration of tractor rollover is about 0.7 to1.0 seconds.

Maximum dynamic deflection is less than the static deflection at the required energy. Longitudinal static deflection is 22 cm and longitudinal dynamic deflection is 11 cm; lateral static deflection is 25 cm; lateral dynamic deflection is 12 cm. Dynamic deflection provides more effective information for development of engineering control strategies for deployable ROPS.

7. Outputs (reports, publications, products, methods, etc.)

Ayers, P. D., J. B. Conger, R. Comer and P. Trout. 2002. ROPS Design and Testing for Off-Road Utility Vehicles and Lawnmowers. Proceeding of the 2002 NIFS Conference, Ponte Vedra Beach, Florida, 24-27 June 2002.

Ayers, P. D. and J. Liu. 2001. ROPS design and testing for agricultural tractors. ASAE Paper No. 01-8034. ASAE, St. Joseph MI 49085.

Liu, J., P. D. Ayers, S. Legoza and A. Broner. 2000. Dynamic deflection of ROPS and prevention effectiveness evaluation. Proceedings of the NIFS Conference, Dubuque, IA.

Liu, J. and P. D. Ayers. 2000. ROPS design and dynamic deflection with prevention effectiveness evaluation. Proceedings of the NIFS Conference, Dubuque, IA.

Liu, J. and P. D. Ayers. 1999. Dynamic tractor stability index. Proceeding of the 1999 National Institute for Farm Safety Conference, Ocean City, Md.

Liu, J., P. D. Ayers and M. Vance. 1999. Off-road vehicle stability mapping integrating GPS/GIS and video technology. ASAE Paper No. 99-7047. ASAE, St. Joseph MI 49085.

Liu, J. and P. D. Ayers. 1999. Off-road vehicle rollover and field-testing of stability index. Journal of Agricultural Safety and Health 5(1): 59-71.

Liu, J. and P. D. Ayers. 1998. Applications of tractor stability index in development of control strategies for protective structures. Journal of Agricultural Safety and Health. Special Issue (1): 171-181.

8. Outcomes (how outputs have been used, e.g. change in behaviors, processes, technologies, guidelines, etc. that have made a difference in measurable endpoints related to exposures or health and safety indicators)

The findings of this study reveal the opportunity and approach for mounting ROPS on agricultural tractors. Tractor ROPS manufacturers can understand the opportunities and problems associated with mounting ROPS on pre-ROPS tractors (John Deere A and Allis Chalmers D17). This study also reveals the ROPS designs used to successfully mount ROPS to pre-ROPS tractors. The measurable endpoints include successful ROPS designs for pre-ROPS tractors, that may save lives of tractor operators involved in tractor rollovers.

Title: **Audiovisual Approach to Train WV Farmers on Prevention Effectiveness of ROPS in Reducing Traumatic Injury**

Definition of the Problem:
From 1997 through 2002, 37 tractor-related fatalities were identified in West Virginia. All but two of these involved males, and over one-third (13/37) were determined to be work-related (WR). The mean age at death was 58 with a range of 31 to 85 years. Thirty percent (11/37) of the victims were ≥65 years of age and 16% (6/37) were ≥75.

Tractor-related deaths occurred in 26 of West Virginia's 55 counties with nearly 80% (29/37) of the total in the north-central, northern and eastern panhandles regions of the state. Seventy-eight percent (29/37) of the incidents involved tractor overturns or rollovers, and 5% (2/37) involved power takeoffs. West Virginia's rugged terrain and generally mountainous environment increases the risk of rollovers and resulting injuries to tractor operators.

Field investigators for WV FACE conducted comprehensive investigations of 6 of the 13 WR deaths. None of the tractors were equipped with a rollover protective structure (ROPS) and seat belts. The average age of the tractors at the time of their respective crashes was 31 years (range 8 to 63 years). The type of farming specialty of the farmers killed on-the-job included beef cattle (4), general livestock (3), dairy (2), and crops (1). Four farmers were transporting round hay bales and four others were conducting mowing operations at the time of their deaths.

Aims of the Project:
The overall goal of the project was to use a locally developed video to inform West Virginia farmers about the risks associated with tractor rollovers and the effectiveness of ROPS in reducing traumatic injuries and determine whether the video influences change in tractor safety. Specific aims include:

1. Create a tractor safety video based on feedback gathered from farmer focus groups.

2. Distribute the video to West Virginia farmers.

3. Evaluate the video to determine changes in farmers' knowledge and actions concerning rollover risks, causal factors, and ROPS as a means of injury prevention.

Partners:
The Great Lakes Center for Agricultural Safety and Health (GLCASH) provided 2-year (10/03 – 9/05) funding for this project. The West Virginia Farm Bureau (WVFB) provided names and addresses of member farmers in WV. West Virginia University (WVU) Agricultural Extension agents helped conduct focus group meetings. The WVU Radio and Television Services (RTS) directed and filmed the video. The WV Fatality Assessment and Control Evaluation (FACE) Program provided background information and overall coordination of the project.

Customers:
The approximately 6,000 farmers in WV belonging to the WVFB during the period 2004-2005. Of these, the specific population-of-interest were farmers who operated tractors without ROPS.

Approach:
Key milestones of the project included:

1) October 2003 – January 2004: Select sites for multiple focus group meetings and identify farmers willing to participate through the WVFB and WVU County Agricultural Extension Agent network. Conduct focus group meetings.

2) February 2004 – April 2004: Work with the WVU RTS to develop an appropriate story line based on focus group feedback. With assistance from the WVFB and WVU County Agricultural Extension Agents, identify potential video participants.

3) May 2004 – August 2004: Film video in varying locales throughout West Virginia. Use farmer input to assist WVU RTS staff in editing video. Prepare project annual report to GLCASH.

4) September 2004 – November 2004: Distribute video to all farmers on the WVFB mailing list as well as to WVU County Agricultural Extension Agents.

5) December 2004 – September 2005: Develop, conduct pre-and post video mail surveys (Surveys 1 and 2) and follow-up telephone surveys (Surveys 3 and 4). Set up survey computerization system and appropriate data files. Enter survey data. Conduct quality assurance probes, as appropriate. Begin data analysis.

6) April 2005 – February 2006: Complete data entry and analysis. Prepare abstracts and manuscripts. Prepare project final report.

Results:

Survey 1 - mailed to 5,786 farmers belonging to the WV Farm Bureau – PRE VIDEO

2,203 surveys returned → 38.1% response rate

For the tractor most often operated by the respondent (N=2,203): 68% were equipped with ROPS and a seatbelt; 28% used their seat belt always or most of the time and 36% rarely or never used it.

For those tractors not equipped with ROPS and a seat belt (N=717): 74% had no plans to equip their tractors with ROPS; 24% were considering installing ROPS someday**;** 2% were taking action to install ROPS now.

If not installing ROPS and a seat belt, the most important reason why (N=574): 33% said ROPS was too expensive; 37% said ROPS was not available for their tractor model; and 30% said a rollover was unlikely.

For respondents without ROPS-equipped tractors, how often they would use a seat belt on any tractor that has a ROPS and seat belt (N=775); 32% would always use**;** 47% would sometimes use; and 21% would never use.

Survey 2 and Video - *"A Tractor Accident can Happen to Anyone"* mailed to 5,632 farmers* belonging to the WV Farm Bureau - POST VIDEO

**154 farmers/next of kin responding to Survey 1 indicated that they did not own a tractor, had retired or the farmer had died. These individuals were not sent a video or Survey 2.*

779 surveys returned after farmer viewed video → 13.8 % response rate

Did video increase awareness about risks associated with fatal tractor rollovers (N=748): 85% of respondents indicated yes.

Did video increase knowledge of ways to decrease risk of rollovers (N=750): 83% of respondents indicated yes.

Does the tractor you most often use have ROPS and a seal belt (N=736): 67% yes.

After viewing video, how often would respondents use a seat belt on any tractor that has a ROPS and seat belt (N=739): 45% would always use; 49% would sometimes use; and 6% would never use.

After viewing the video, opinion about installing ROPS and seat belt on their tractor that they use most often that does not have ROPS and a seat belt (N=286): 32% had no plans to equip their tractors with ROPS**;** 53% were considering installing ROPS someday**;**15% were taking action to install ROPS now.

If not installing ROPS and a seat belt, the most important reason why (N=125): 43% said ROPS was too expensive; 35% said ROPS was not available for their tractor model; and 22% said a rollover was unlikely.

Survey 3 - Telephone calls made to farmers who indicated during Survey 2 that they were considering or taking action to install ROPS and a seat belt and who provided their telephone numbers for future contact – POST VIDEO

107 of 244 farmers answered this question and provided their phone number

Multiple attempts to call 107 farmers → successful contact with 82 (77%)

Segments of video which were most important (N=55): Testimonials by farmer's widow/rollover survivor – 31%; Comments/instructions by narrator – 2%**;** Demonstrations – 25%**;** and Other – 42%.

Video shared with others (N=52) – 58% yes.

Shared video with: Family – 53%**;** Other farmers – 17%; and Others – 30%.

Contacted someone in past several months to install ROPS and seatbelt on tractor not so equipped (N=56) – Yes 50%

Have installed ROPS and seatbelt on most used tractor not equipped with ROPS and seat belt (N=23)– None

Reasons why ROPS and seat belt not installed (N=32): 19% too expensive**;** 12% not available for their tractor; and 69% other.

Survey 4 - Telephone calls made to farmers who indicated during Survey1 that they never wore their seat belts on the tractor they used most of the time that is equipped with ROPS and a seat belt and who provided a telephone number for future contact -- POST VIDEO

314 of 377 farmers answered this question and provided their telephone number

Multiple attempts to call 314 farmers → successful contact with 200 (64%)

Segments of video which were most important (N=63): Testimonials by farmer's widow/rollover survivor – 35%; Comments/instructions by narrator – 7%**;** Demonstrations – 25%**;** and Other – 33%.

Video shared with others (N=68) – 53% yes

Shared video with (N=36): Family – 64%**;** Other farmers – 3%**;** Dealers – 3%**;** and Others – 30%

How often do you use the seat belt on the tractor you indicted in an earlier survey that you used most often and was equipped with ROPS and seat belt (N=77): Always or most of the time – 10%; Sometimes – 19%**;** Rarely or never – 71%.

Outputs:

1. Two annual reports and final project report to GLCASH.

2. Video, "A Tractor Accident can Happen to Anyone." Separate versions prepared for WV and national release.

3. Poster presentation at 2002 annual meeting of the American College of Epidemiology. *Ann Epi* 2002; 12(7):510.

4. Poster presentation at the National Symposium on Agricultural Safety and Health, June 2004.

5. Poster and oral presentation at the GLCASH Symposium, September 2006.

6. Invited presentation at the WVU Institute for Occupational and Environmental Health Grand Rounds, October 24, 2006.

7. Invited lecture during WVU Department of Community Medicine course PUBH 704, November 2, 2006.

Outcomes:

1. Nearly 6,000 videos were distributed by the WV Farm Bureau in May 2005.

2. Twenty-one farmers who called the 1-800 number displayed on the video requested information on ROPS for their model tractor. ROPS was located for 18 of these. Forty-three other farmers, who had not originally received the video, were sent a video after learning of its existence from a statewide press release.

3. Several WV- and nationally-based corporations, organizations, governmental agencies including Dupont Corporation, the Veteran's Administration and Indiana State University were sent multiple copies of the video for internal training programs and inclusion in their lending libraries.

4. At the GLCASH's request, this video was adapted for national use and over 1,000 VHS and DVDs have been distributed in 33 states and 4 countries: 373 academics; 35 hospitals/health centers; 231 farm industry; 14 state and federal agencies; 85 safety organizations; and 6 insurance companies.

5. The video was highlighted in a GLCASH newsletter and in Gempler's Alert, June 2006 Volume 13(6).

Title: **A PC Based Virtual Reality Simulator for Forklift Safety Training**
Grant 1 R43 OH008562-01
PI: Kevin Chugh

1) Definition of the problem being addressed

The problem being addressed is forklift safety. There are over 1 million forklifts in operation in the United States and upwards of 6 million operators. Annually, there are 100-200 fatalities, and over 100,000 reported injuries (and perhaps countless unreported injuries as well).

2) Aims of the project

The aim of the project is to help reduce injury and fatality caused by improper forklift operation through superior training. Superior training can be achieved by replacing traditional hands off, passive technqiues, such as watching video tapes and completing workbooks, to an active hands-on technique, namely using a low cost virtual reality forklift safety trainer, being developed in this project.

3) Partners

This is a two phase SBIR project, and Phase I is complete, while Phase II is currently being reviewed for funding. In Phase I, the following partners were consulted:

Partner	Role
Erie Insurance	Review prototype, give feedback
Wal-mart	Review prototype, give feedback
Nissan Forklift	Review prototype, give feedback
Mitsubishi Caterpillar Forklift of America	Review prototype, give feedback

In Phase II, the following partners have committed to participate:

Partner	Role
Erie Insurance	Periodically provide feedback and guidance
Wal-mart	Periodically provide feedback and guidance
Nissan Forklift	Periodically provide feedback and guidance
Mitsubishi Caterpillar Forklift of America	Periodically provide feedback and guidance
Emedco	Will work to become distributor of product
High Peaks Ventures	Will consider financing commercialization
Niagara County Community College	Will run formal testing on forklift students with our simulator
Empire State Development Corporation	Will work to help with financing for commercialization

4) Customers

There are three target customers- forklift operators and small businesses who employ them, big businesses who have formal training programs and budgets, and forklift training schools.

5) Approach

The basic approach is to build 3D models of forklifts, cargo, warehouses, pedestrians, etc., then build the algorithms to model the physical interactions between these objects. A curriculum engine is then built and incorporated into the system so that the user can drive the forklift (using an actual PC game steering wheel) around a variety of environments.

6) Results/Findings

As this was a Phase I/feasibility project only, the results are largely annecdotal. We received unanimous support for the potential product in training forklift operators. Every company, operator, and insurance carrier we showed the product to was enthusiastic about the prospects, and confirmed that there is nothing like it on the market currently, and that there is tremendous potential to affect the safety of forklift operation with such hands on virtual reality based training.

7) Outputs

There is a working prototype, where a user can drive a forklift through a series of scenarios, as well as a video of such an interaction, available at http://www.tactustech.com/videos/forklift_tiny.wmv

8) Outcomes

Since this was a prototype development project only, the only outcomes are increased awareness of the potential for high fidelity, realistic training for forklift safety and enthusiasm for potential marketing opportunities with distributors, OEMs, and training facilities.

Title: **Work Site Intervention to Reduce Work Related Assault**

Submitted by: Corinne Peek-Asa, PhD
10/14/06

1. Definition of the problem being addressed (e.g., number of workers affected; rates of injury, illness, or fatality; hazards)

Crime and violence are the leading causes of occupational death in a number of retail and service businesses. In addition to affecting the health and well being of employees, these events affect customers and the business. Small business owners are at high risk for crime and violent events, and also have fewer resources to develop prevention programs.

2. Aims of the project (major objectives for the period of the work)

The major objective of this study was to determine the effectiveness of a community based, business-site educational intervention to reduce work-related assault injury in high risk business populations. The focus was on small retail establishments that included gas stations/convenience stores, restaurants, bars, motels, and grocery stores. Other objectives included identifying risk factors for workplace assaults, describing the incidence of workplace assaults in selected communities, and identifying specific environmental changes or groups of changes which decrease workplace violence.

The Workplace Violence Prevention Program had two sets of specific aims. The first were specified in the original grant, and the second in a competitive renewal. The original specific aims were:

1. Based on prior studies and existing state data, identify specific risk factors for work-related assaults in high risk businesses in two Southern California OSHA Regions.

2. Establish a comprehensive and on-going surveillance system to identify workplace assault incidence in these CalOSHA Regions from multiple reporting sources.

3. Develop, test, and introduce an educational intervention which addresses environmental, behavioral, and social risk factors for workplace assault.

4. Apply the educational intervention to selected businesses in the city of Los Angeles.

5. Measure the effectiveness of the intervention in reducing fatal and non-fatal assault injuries in the workplace by comparing differential work-place assault incidence by intervention status.

The second set of specific aims was developed based on trends identified during the first three years of the workplace violence project. These specific aims had two purposes. The first was to expand the original project to include additional information and to extend the follow-up period. The second purpose was to examine some emerging trends in workplace violence. These specific aims were:

1. Determine long-term compliance to the intervention program. Establish if intervention programs were upgraded, downgraded, or unchanged. Identify which program components were maintained long-term and which were not. Determine which business characteristics influence the level of compliance to the program.

2. Extend the follow-up period to determine if original program effectiveness is sustained beyond the initial three-month assessment. Determine the proportion of the expected decrease in workplace violence events attributable to the program by controlling for overall decreases in crime rates.

- Partners (participants in the project and the roles they served)

Project Personnel

Project Participant	Role on Project
Jess F. Kraus, MPH, PhD	Principal Investigator
Corinne Peek-Asa, MPH, PhD	Co-Principal Investigator
Carri Casteel, MPH, PhD	Project Director
Rosemary Erickson, PhD	Intervention Program Design
Lawrence Chu, MPH, PhD	Crime Data Supervisor
James Grayson, CPP	Safety Specialist
Phillip Smith, CPP	Safety Specialist
Dawn Gregory, CPP	Safety Specialist
Lisa Meneshian, MPH	Data Coordinator
Myduc Ta, MPH	Data Coordinator
William Kaufold, MPH	Field Data Collector
Caroline Lacsamana, MPH	Data Management Assistant

Interagency Collaborators

The Workplace Violence Prevention Project was a large undertaking that involved participation and input from a wide variety of professional backgrounds. We would like to acknowledge partners in other agencies that provided their time and resources to this project. Without their dedication we could never have completed this intervention project.

Cal/OSHA Consultation Services Program (WVPP Project Development)
John Howard
Bob Barish

Los Angeles Police Department
Chief Bernard Parks (signed final Memorandum of Understanding for access to crime reports)
Assistant Chief Jim McDonnell (established collaboration between UCLA and LAPD)

Records and Identification Division (Crime Report Abstraction)
Barbara Taylor
Jim Lee
Olivia Flores
Beverly Pippin

Information Technology Division (PACMIS Data)
Commanding Officer Troy Hart
D.C. Dasari

Crime Analysis Section (Memorandum of Understanding Approval)
Lieutenant Paul Geggie
Sergeant Dennis Ballas
Officer Arturo Gomez

Korean American Grocers Association (KAGRO) (Community Partner)
Yong Sun Kim, Chairman
Ellis Cha, President

KAGRO "Project Build-Up" Partners (Community Partners)
Twin Huynh, Customer Service Representative, Nabisco
Myn Min Kim, Customer Service Representative, Southern California Edison
Dan Holland, President, Mission Beverage Company
John S. Yoo, Community Outreach Director, Korean American Coalition

Corporate Partners
Jose Jacobo Orellana, Security and Safety Director, New Otani Hotel, Los Angeles
Pam Gray, California Loss Prevention Operations Manager, Whole Foods Market
John Ragsdale, Loss Prevention Manager, 7-11 Stores
John Christenson, Senior Loss Prevention Specialist, ARCO
Bert Blender, Owner, Grinder Restaurants
Gordon Rose, Vice President Operations, Acapulco Restaurants
Lisa Shavitz, Operations Director, Dominos Pizza
Ted McCaskey, Owner, Erewhon Natural Foods
Sergio Preciado, Public Relations Manager, King Taco
Larry Wright, Security Director, Mobil
Danny Glover, Safety Director, Motel 6
Mike Schlicte, Security Director, Shell
John Halvin, Security Director, Unocal
Keith Shiozaki, Senior Vice President, Yoshinoya Restaurants

Oxnard Police Department (WVPP Extension)
Commander Tom Chronister
Assistant Chief John Cronbach
Chief Art Lopez
Community Affairs Manager David Keith

Agency / Government Contacts (Consultants)
Mark Gleckman, American Society of Industrial Security
Special Agent William Rehder, Federal Bureau of Investigations (Takeover Robberies)

1. Customers (intended users or beneficiaries of the results)

Intended beneficiaries include retail and service businesses, law enforcement, security consultants such as ASIS, and community agencies that serve these businesses.

2. Approach (tasks involved in conducting the project)

INTERVENTION PROGRAM DEVELOPMENT AND COMPONENTS

The WVPP was developed to meet the individual needs of each business. The first step in developing the intervention plan for each business was a baseline security program assessment. This assessment identified and evaluated existing elements of a security program. Using this assessment, a specific set of action items were created for each store. The action items were specific recommendations on how to implement each element of the comprehensive security plan. Once the store's individual action plan was created, an individual consultation was conducted. This consultation was conducted by trained security professionals hired by the study. The individual consultation ensured that the business owner was introduced to all of the components of the safety program, that each action item was individually discussed, and that the owner had time to ask questions. The Security specialists were available to answer questions throughout the study period.

The WVPP focused on two types of workplace violence. The most prevalent type of violence in the eligible business types is related to robbery and similar criminal activity, and this type of violence is the primary focus of the prevention program. Because many of these businesses must work with potentially violent and intoxicated customers, a portion of the program also focused on recognizing and intervening early when a customer could become violent.

Crime Prevention Through Environmental Design (CPTED) was the basic model for the program. This model recognizes that much of the risk for crime can be modified through controlling the business environment. The focus was on controlling the environment prior to a crime taking place rather than on the individual criminal after the commission of an offense. The model emphasizes the integration of security and behavioral concepts into the normal and routine use of the environment, while treating labor- and hardware- intensive security devices as secondary.

The WVPP program was comprised of environmental controls including a comprehensive cash control program, ensuring good visibility into and outside of the business, maintaining good interior and exterior lighting, and limiting access and escape routes. The program also incorporates an employee training component which encourages safety awareness, how to respond to criminal activity to reduce the risk of violence, and how to present the business as a well-managed environment. These components constitute the "Basic Program" because they are appropriate for all businesses and emphasize procedures that can be implemented with relative ease and without significant cost. Although the "basic" robbery and violence prevention program is emphasized, safety and surveillance equipment (e.g., alarms, cameras) are

recommended to businesses at particularly high risk of violence. These components are deemed "Additional Recommendations" because they are more expensive and timely to implement and maintain and are secondary to the CPTED model.

Intervention program materials

Participating businesses received a wide range of informational and training materials. These were provided in the forms of interpersonal verbal communication, written materials, a video, and safety signage. Additional funding was secured from the California Occupational Safety and Health Administration to produce a WVPP video for employee training. This video was created in collaboration with the UCLA Department of Film and Television and was age-appropriate for the average small business staff worker. The video was named the "Best Prevention Video" at the World Injury Congress in New Delhi, India in 2000.

Each participating intervention business received:

- An individual Action Plan which detailed each specific recommendation for the business. The Action Plan was presented in the written form of a checklist with rationale for each action item following. Each element of the checklist was carefully reviewed in an on-site consultation with one of the study's Safety Specialists and the business owner.

- A management manual describing all intervention program components and the rational behind each specific component.

- An Equipment Guide that described all types of security equipment, their functions, and different types of products on the market with price ranges (such as different types of safes)

- Colorful brochures for employees on how to prevent robbery, what to do during and after a robbery, and how to detect and de-escalate potential violence.

- A prevention kit containing cash handling and educational materials which included a safety poster, placards for the door, cash registers and safes, and forms to document events.

- A violence prevention training video

- A certificate of participation

The program was prepared and presented in such a way that employees could be trained by the owner/manager and the recommendations easily enforced, which is especially beneficial in many of the businesses where employee turnover was high.

To improve language barriers between business operators and the security consultants, the management manual and a generalized Action Plan were translated into the following languages.

- Korean
- Mandarin
- Spanish

Individual, on-site consultations were conducted in English or Spanish, and a Korean translator was available upon request.

3. Results/Findings (preliminary or final observations and conclusions)

VERY ABBRIEVIATED FINDINGS (more provided at request)

By the second follow-up visit, compliance to the intervention program was significant for each program component. Employee training was the most frequently implemented intervention component. Neighborhood crime level, primary language spoken by the business owner, and the number of employees were all related to level of implementation. While crime rates generally increased for all businesses from the pre- to post- intervention periods, businesses with high compliance to the program experienced a decrease in overall violent crime and robbery.

4. Outputs (reports, publications, products, methods, etc.)

PRESENTATIONS, PUBLICATIONS AND REPORTS

Community Presentations

"Workplace Intervention to Reduce Workplace Assault Injury, Pilot Study". California Occupational Safety and Health Administration Workplace Security Task Force, Anaheim, California, 1996.

"Workplace Violence Prevention Project". Los Angeles Restaurant Association Annual Conference, Los Angeles Convention Center, California, 1997.

"Workplace Violence Prevention Project". Alcohol Beverage Control and Security Seminar - Southwest Division, North Hollywood, California, 1999.

"Workplace Violence Prevention Project". Business Watch Meeting, Korean American Grocers Association and Los Angeles Police Department, 77th Los Angeles Division, California, 1999.

"Workplace Violence Prevention Project". California Beverage Merchants Board of Directors Meeting, Korea Town, Los Angeles, California, 1999.

"Epidemiology of Workplace Violence and Injury". American Society of Safety Engineers, Orange County Chapter, Costa Mesa, California, 2000.

"The Value of a Community-Based Crime Prevention Program for Law Enforcement". Oxnard Police Department, Oxnard, California, 2000.

"Workplace Violence Prevention Project". Business Watch Meeting, Korean American Grocers Association and Los Angeles Police Department, Southwest Los Angeles Division, California, 2000.

"Workplace Violence Prevention Project". Business Watch Meeting, Korean American Grocers Association and Los Angeles Police Department, Southeast Los Angeles Division, California, 2000.

"Workplace Violence Prevention Project". Business Watch Meeting, Korean American Grocers Association and Los Angeles Police Department, Newton Los Angeles Division, California, 2000.

"Workplace Violence Prevention Project". California Crime Prevention Through Environmental Design Association Meeting, Irvine, California, 2000.

"Workplace Violence Prevention Project". American Society for Industrial Security, Santa Barbara Chapter, California, 2000.

"Workplace Violence Prevention Project". American Society for Industrial Security, Inland Empire Chapter, California, 2000.

"Workplace Violence Prevention Project". Retail Special Agents Association, Los Angeles, California, 2000.

"Field Evaluation of the Workplace Violence Prevention Project: Gas/Convenience Stores". British Petroleum Security (ARCO), Torrance, California, 2000.

"Field Evaluation of the Workplace Violence Prevention Project: Gas/Convenience Stores". TOSCO – Unocal, Orange, California, 2000.

"Workplace Violence Prevention Project". Korean American Grocers Association Meeting with Councilman Mark Ridley-Thomas, Los Angeles, California, 2001.

"Crime Prevention Through Public Partnership". Ventura County Law Enforcement and Security Summit, Oxnard, California, 2001.

"Violence Prevention Techniques for the Workplace". American Society for Industrial Security, Inland Empire Chapter, California, 2001.

"Violence Prevention Techniques for the Workplace". American Society for Industrial Security, Santa Barbara Chapter, California, 2001.

"Workplace Violence Prevention Project". Central Coast Police-Security Summit, Oxnard, California, 2002.

"Crime Prevention Through Public Partnership". Law Enforcement/Private Security Conference, Inland Empire, California, 2002.

"Crime Prevention Through Public Partnership". Los Angeles Police Department/American Society of Industrial Security – Valley Chapter Security Symposium, California, 2002.

"Workplace Violence Prevention Project". The Flair Park Security Manager's Round Table, Rosemead, California, 2002.

"Workplace Violence Management Techniques: Prevention, Rage Management, and Customer Service". American Society of Threat Assessment Professionals, Glendale, California, 2002.

"Workplace Violence Management Techniques: Prevention, Rage Management, and Customer Service". Retail Special Agents Association, Los Angeles, California, 2003.

"Workplace Violence Management Techniques: Prevention, Rage Management, and Customer Service". American Society for Industrial Security, Inland Empire Chapter, California, 2003.

"Workplace Violence Management Techniques: Prevention, Rage Management, and Customer Service". American Society for Industrial Security, Orange County Chapter, California, 2003.

"Workplace Violence Management Techniques: Prevention, Rage Management, and Customer Service". Flair Park Retail Special Agents Association, Rosemead, California 2003.

"Workplace Violence Management Techniques: Prevention, Rage Management, and Customer Service". St. John's Hospital, Oxnard, California 2003.

Presentations with Published Abstracts

Peek-Asa C. Reducing Violence in the Workplace - Experience of the United States. International Commission on Occupational Health, Stockholm, Sweden, 1996.

Peek-Asa C. Inappropriateness of the Capture-Recapture Method to Determine Incidence of Workplace Assault Injury from two Reporting Sources. Society for Epidemiologic Review Annual Meeting, Edmonton, Canada, 1997.

Peek-Asa C, Erickson R. Fatal Occupational Injuries in the Retail Industry, United States, 1992 - 1995. National Symposium on Occupational Safety and Health, Morgantown, West Virginia, 1997.

Hartman C, Peek-Asa C, Howard J, Erickson R. Prevention of Workplace Violence in Liquor Stores, Santa Monica, California, National Symposium on Occupational Safety and Health, Morgantown, West Virginia, 1997.

Casteel C, Peek-Asa C, Kraus JF. Evaluation of Risk Factors for Violence in Liquor Stores. 125th Annual Meeting of the American Public Health Association, Indianapolis, Indiana, 1997.

Peek-Asa C. An Intervention Program to Reduce Workplace Violence in Retail Liquor Stores. 4th World Congress on Injury Control, Amsterdam, Netherlands, 1998.

Peek-Asa C, Howard J. Effectiveness of OSHA Compliance Inspections in Reducing Workplace Violence. American Public Health Association Annual Meeting, Washington, DC, 1998.

Grayson J, Vargas P, Peek-Asa C. Community Factors in Predicting Business-Level Crime. Violence Prevention Coalition of Greater Los Angeles Bi-Annual Meeting, Long Beach, California, 1999.

Smith P, Peek-Asa C. Take-over Robberies: A Changing Paradigm of Adolescent Crime Perpetration and Victimization. Violence Prevention Coalition of Greater Los Angeles Bi-Annual Meeting, Long Beach, California, 1999.

Peek-Asa C. Injury Prevention in the Occupational Setting. American Public Health Association Annual Meeting, Chicago, Illinois, 1999.

Casteel C, Peek-Asa C, Kraus JF. Evaluation of a Crime Prevention Through Environmental Design (CPTED) Intervention in Reducing Violence in Liquor Stores: Preliminary Findings. 33rd Annual Meeting of the Society for Epidemiologic Research, Seattle, Washington, 2000.

Casteel C, Peek-Asa C. Evaluation of Risk factors for Robbery and Employee Injury and Compliance to a Workplace Violence Intervention in High-Risk Business Settings. National Occupational Injury Research Symposium, Pittsburgh, Pennsylvania, 2000.

Peek-Asa C, Casteel C. Evaluation of a Workplace Violence Intervention in Small Businesses. SafeUSA Conference, Atlanta, Georgia, 2001.

Casteel C, Peek-Asa C. Crime and Injury: An Environmental Design Application in the Retail Sector. 46th Annual Human Factors and Ergonomics Society Meeting, Baltimore, Maryland, 2002.

Publications

Peek-Asa C, Schaffer K, Kraus J, Howard J. Surveillance of nonfatal workplace assault injuries using police and employers reports. J Occup Environ Med 40:707-713, 1998.

Peek-Asa C, Erickson R, Kraus J. Traumatic occupational fatalities in the retail industry, United States, 1992 - 1996. Am J Ind Med 35(2):186-191, 1999.

Peek-Asa C, Howard J. Workplace violence investigations by the California Division of Occupational Safety and Health. J Occup Environ Med 41(8):647-653, 1999.

Casteel C, Peek-Asa C. Effectiveness of crime prevention through environmental design (CPTED) in reducing robberies. Am J Prev Med 2000; 18(4, Suppl.):99-115.

Peek-Asa C, Runyan CW, Zwerling C. The role of surveillance and evaluation research in the reduction of violence against workers. Am J Prev Med 20(2):141-148, 2001.

Casteel C, Chronister T, Grayson JL. Police, security and academia team up to prevent workplace violence. Clinics Occup Environ Med.

Casteel CH, Peek-Asa C, Howard J, Kraus JF. Effectiveness of crime prevention through environmental design in reducing criminal activity in liquor stores. J Occup Environ Med. May;46(5):450-8, May 2004

Peek-Asa C, Casteel CH, Mineschian L, Erickson R, Kraus JF. Implementation of a workplace robbery and violence prevention program in small retail businesses. Am J Prev Med. 26(4):276-283, May 2004.

Peek-Asa C, Casteel C, Whitten P, Kraus JF. Employee and customer injury during violent crimes in retail and service businesses. Am J Pub Health. November, 2006.

Reports

Grayson JL. Enhanced community policing through public/private partnerships.

Grayson JL. Workplace violence prevention project: service station security review.

5. Outcomes (how outputs have been used, e.g. change in behaviors, processes, technologies, guidelines, etc. that have made a difference in measurable endpoints related to exposures or health and safety indicators)

1. The Oxnard Police Department integrated the WVPP into their crime prevention program. This effort is currently being evaluated by Dr. Carri Casteel and Dr. Corinne Peek-Asa.
2. The Korean-American Grocer's Association offered the WVPP as a membership incentive for several years after the end of the project.

3. Dr. Harlan Amandus is currently developing an internal NIOSH project, working with Drs. Peek-Asa and Casteel, to develop sustainable models for the WVPP in law enforcement agencies.
4. Two stories of participants demonstrate the programs impact:

TWO WORKPLACE VIOLENCE PREVENTION PROGRAM STORIES

Although the development, implementation, and evaluation of the intervention program are the main components of this research project, some of the project's value can be demonstrated through individual experiences. The following two stories clearly illustrate the impact such intervention programs can have.

When considering these stories, it is important to note that the project focused on very small businesses. Some of the participating businesses had only two employees, and often these were family members. These businesses were frequently operating on very small profit margins and with very restricted personnel. In addition, many owners were foreign born, and as such may be less familiar with patterns of violence in the United States. A violent event in these small businesses thus has important implications for the victims physical, emotional, and family well-being.

A WVPP success story.

The UCLA research team was introduced by a collaborating Los Angeles Police Department detective to the owner of a restaurant chain after a violent event had occurred. The businessman owned nine local family restaurants comprising a chain. The event involved a homicide/rape/robbery in which two employees were killed and one raped. The event was highly publicized and led to the closure of the restaurant after revenue fell 80%. The owner had not believed that such a thing could happen and had taken no security precautions. He was eager to enroll his eight remaining restaurants in the WVPP, and he implemented each recommendation of the program.

Seven months after implementation of the program, a man entered one of the restaurants. He took a seat at the counter next to the register. When asked what he wanted to order, he held up the menu, pulled out a handgun, and told the waitress that "this is a robbery." The waitress could see that the robber was nervous and told him "calm down, I will get you the money." After she gave the money to the robber, he walked out of the restaurant. The manager reported to the police and the UCLA research team that due to the UCLA WVPP, the store had implemented employee training, cash control policies, and had installed a video recorder and CCTV system. The robber was captured on video coming into the store, sitting down, pulling the gun, and then leaving with the money. An interview with the waitress indicated that she knew what to expect and how to respond because of the UCLA video and training. She returned to work two days later and felt good about the experience. The robber, who was later arrested, absconded with only $57.00 because of new policies to reduce available cash.

Although being robbed is a strange success story, we believe the WVPP helped not only reduce potential injuries and psychological trauma associated with such events, but gave the employee a sense of control over the event.

A WVPP Missed Opportunity.

The owner of a small corner liquor store was invited to participate in the study. The store served a range of clients and included an inventory of wine, beer and hard liquor. The windows of the business were covered with advertising posters, and the internal visibility was poor. When asked to participate, the owner said that robberies were part of the business, that he knew how to handle them, and that he did not have time to participate in the program. He and his wife were the only employees of the business. His business was included as "declined participation."

Six months after he had been invited to participate, a robber entered his store and was able to leave with a large sum of cash. The owner, who was the only employee on duty at the time of the robbery, chased the robber out into the street in front of the store. The fleeing robber then turned and shot the owner, hitting him in the face. Luckily, the owner survived his injuries. However, the business never re-opened and remained vacant for several years. The robber was never caught. We do not know if the owner has re-established a business elsewhere.

Although we cannot know if participation in our prevention program would have prevented this event, there were many characteristics of the business and of the event that could have been easily altered to reduce risk. For example, the intervention program would have recommended that the visibility of the store be improved, making it a less attractive target for robbery. The program would also have recommended a cash control policy that would have reduced the amount of money available. Perhaps if the robber had not gotten away with so much money, the owner would not have chased him into the street. In addition, the training materials strongly emphasized appropriate actions to take during a robbery. One specific element instructed employees not to confront or chase the robber.

Title: **Reducing Violence Against Nursing Home Caregivers**

Investigators: Donna Gates, Evelyn Fitzwater, Paul Succop and Marilyn Sommers

Problem

Growing violence against health care workers prompted the Occupational Safety and Health Administration in 1996 to publish employer guidelines. Certified nursing assistants (CNAs) working in long term care represent the occupation most at risk of workplace assault. These caregivers receive minimal education regarding the care of some of the most challenging and aggressive patients. As the number of nursing home residents and CNAs increases in the near future, efforts are needed to improve the nursing home environment for both CNAs and residents (patients). Previous studies indicate that CNAs, who daily experience verbal and physical violence, lack the knowledge and skills to prevent violence. However, there have been very few studies designed to identify the most effective approaches for decreasing violence against CNAs.

Aims

The aims of the study were to: 1) describe the context in which assaults occur, 2) increase CNAs' skills to prevent assaults, and 3) decrease the incidence of assaults against CNAs

Partners

- College of Nursing, University of Cincinnati (office space; resources including financial expertise, secretarial support; computers, and printers; graduate students)
- National Institute for Nursing Research (R15 funding)
- National Institute for Occupational Safety and Health (R01 funding)
- 6 nursing homes in Cincinnati Ohio (provided access to workers during work time, assisted with organizing the project, provided patient room to conduct simulations, and assisted with recruitment of participants).

Customers

Customers of this project included nursing home employers and administrators, nursing assistants, professional nurses, and residents (patients) in nursing homes.

Approach

Investigators conducted a quasi-experimental study with 138 NAs in 3 intervention and 3 comparison homes. A baseline questionnaire was used to obtain information on demographics, employment, and past violence experience. At pre-, post- and six months after the intervention all subjects completed the State Trait Anger Inventory (STAXI), the Occupational Stress Inventory (OSI), the Knowledge and Self-efficacy Survey, carried an Assault Log for 80 hours of work, and participated in a simulation exercise to assess violence prevention skills. Tabulations, ANOVA and Poisson regression were used to analyze the data.

Results/Findings

The intervention was successful in increasing self-efficacy, knowledge and skills one week after completion. Although the intervention was successful in increasing knowledge six months after intervention completion, the significant increases in self-efficacy and skills were not sustained.

Although the intervention had no significant main effect on the incidence of assaults, there was an interaction effect between the intervention and number of pre-intervention assaults. The intervention had a significant effect on those NAs who had less than 8 assaults pre-intervention ($p<0.001$) and no significant effect ($p>0.05$) on those who had more than 7 assaults on pre-intervention. Additional findings include the following:

- The incidence of assaults against CNAs from patients was very high. During an 80-hour work period (baseline measure), 94 CNAs (71% of subjects) reported 624 assaults from patients and 31 injuries. The mean number of assaults for an 80-hour work period was 4.5 (range 0 - 64).
- The following variables were found to be positively related to the number of reported assaults: state anger, trait anger, role insufficiency, role ambiguity, and number of assigned residents. The CNA's age was negatively related to the number of assaults. Duration of employment and previous training were not related to the number of assaults.
- 59% of CNAs responded on a survey that they are assaulted by patients once a week and 16% responded that they are assaulted by residents every day.
- 51% of CNAs responded on a survey that they had been injured by a patient while working as a CNA during their lifetime and 38% responded that they had received medical treatment for an injury.
- 10% of CNAs responded on a survey that they had been assaulted by a co-worker while working as a CNA during their lifetime.
- 4.3% of CNAs responded on a survey that they had been assaulted by a patient's family member while working as a CNA during their lifetime.
- 56% of CNAs responded on a survey that they always report assaults to supervisors, while 15% seldom report assaults.

Conclusions: The results of this study have implications for practice, policy, and research. Although the incidence of violence cannot be eliminated, it can be decreased and it should never be viewed as "part of the job". To do so devalues the NA which in turn has devastating implications for our growing, elderly population.

Outputs (reports, publications, products, methods etc.)

Publications

Gates, D., Fitzwater, E., Telintelo, S. (2001). Using simulations to assess skill performance. *Clinical Nursing Research 10(4),* 387-400

Gates, D (2002). *Violence Against Nurses: The Silent Epidemic*. Ohio's Nurses Association Continuing Education

Gates, D. (2002) Violence against caregivers in nursing homes in the U.S.A, in *Violence in Nursing: An International Perspective* (eds.Haberman & Uys). J. Lang Publishers: Hamburg, Germany.

Gates, D., Fitzwater, E., Telintelo, S., Succop, P. & Sommers, M.L (2002) Preventing assaults by nursing home residents: Caregivers' knowledge and confidence – A Pilot Study. *Journal of the American Medical Directors' Association 3,* 366-370.

Gates, D., Fitzwater, E., & Deets, C. (2003). Testing the reliability and validity of the assault log and violence prevention checklist. *Journal of Gerontological Nursing* 29, 18-23.

Gates, D., Fitzwater, E. & Succop, P. (2003). Predicting assaults against caregivers in nursing homes. *Issues in Mental Health Nursing, 24(8),* 775-793.

Gates, D., Fitzwater, E. & Salazar, M. (2003). Dealing with workplace violence: Strategies for prevention. *AAOHN Journal 51, 243-5.*

Fitzwater, E. & Gates, D. (2004). Clinical consultation. How do you manage the aggressive behavior of cognitively impaired patients. *Rehabilitation Nursing* 29, 5, 13

Gates, D., Fitzwater, E. & Succop, P. (2005) Reducing assaults against nursing home caregivers, *Nursing Research, 54(2),119*

Gates, D.M. (2004). The Epidemic of violence against healthcare workers: No longer silent. *Occupational and Environmental Medicine Journal,* 61, 649-650. Invited editorial

Gates, D (2004). Burgers or bruises? *American Journal of Nursing*. 104(9), 13.

Gates, D., Fitzwater, E. & Succop, P. (2005) Reducing assaults against nursing home caregivers, *Nursing Research, 54(2),119.*

Additional products
1. The Knowledge and Self-Efficacy Survey: measures NAs' beliefs about their knowledge and self-efficacy to prevent aggression and assaults.

Gates, D., Fitzwater, E., Telintelo, S., Succop, P. & Sommers, M.L (2002) Preventing assaults by nursing home residents: Caregivers' knowledge and confidence – A Pilot Study. *Journal of the American Medical Directors' Association 3,* 366-370.

2. Assault Log: tracks assaults

Gates, D., Fitzwater, E., & Deets, C. (2003). Testing the reliability and validity of the assault log and violence prevention checklist. *Journal of Gerontological Nursing* 29, 18-23.

3. Violence Prevention Checklist: used with observation to evaluate violence prevention skills

Gates, D., Fitzwater, E., Telintelo, S. (2001). Using simulations to assess skill performance *Clinical Nursing Research 10(4),* 387-400.

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Gates, D., Fitzwater, E., & Deets, C. (2003). Testing the reliability and validity of the assault l log and violence prevention checklist. *Journal of Gerontological Nursing* 29, 18-23.

4. Intervention program that includes educational materials for classroom sessions and for problem-solving sessions (unpublished)

5. Over 25 poster and paper presentations were given at local, national, and international professional conferences.

Outcomes

Intermediate outcomes.

Our work has been cited by many other authors. In addition, our work was cited in the following reports:

- Guidelines for Preventing Workplace Violence for Healthcare Workers and Social Service Workers
  OSHA 3148-01R 2004
  http://www.osh.govt.nz/order/catalogue/drafts/ViolenceDiscussionPaper15Oct04.pdf
- The Risk of violence in Mental Health Work and Health Research Center
  University of Maryland
  Sept. 2006
  http://www.seiu1199nw.org/docUploads/UM%20Safety%20Report.pdf
- Preventing Violence to Employees In Health and Social Servers
  Discussion Paper
  October 24
  New Zealand Occupational Safety and Health
  http://www.osh.govt.nz/order/catalogue/drafts/ViolenceDiscussionPaper15Oct04.pdf

Dr. Gates and Dr. Fitzwater were invited to present at five in-services and workshops for nurses, nurse aides, and long-term care managers. Currently, Drs. Gates and Fitzwater are assisting Dr. Blair Irvine at the Oregon Center for Applied Science to develop a web-based approach to teach nurse aides how to prevent assaults from nursing home residents. They are serving as consultants to develop the program and in the near future will assist him to test the newly developed media in 6-8 nursing homes. Dr. Gates was asked to write an editorial for *American Journal of Nursing* (2004) about the problem; this journal's readers include registered nurses who supervise CNAs.

End outcomes.
Our research did find that assaults against nurse aides can be reduced with our intervention program.

Potential outcomes.
Although researchers have been studying the disruptive behavior of nursing home residents for several years, our research was the first in the literature to examine the aggression as violence from the viewpoint of the worker. In fact, when we were planning the research and in conversation with nursing home personnel, several administrators and managers stated that this type of violence would not be upsetting to nurse aides due to the fact that many of the offenders (residents) have dementia. Our research demonstrated that not only is the violence a concern to many workers, but that the violence also results in injuries, and is related to decreased job satisfaction and turnover. One of the conclusions from our work is that violence in the healthcare setting should never be expected, tolerated or accepted. The nurse aide turnover in the long-term

care industry is traditionally very high. We believe our work has encouraged many nursing homes to view their nurse aides as valuable assets to their facility and to develop interventions to decrease work stressors, including violence.

Title: **Effects of OSHA Guidelines on Violence Prevention in Mental Health**

1. **Definition of the problem being addressed (e.g., number of workers affected; rates of injury, illness, or fatality; hazards)**

Workplace violence is recognized as a significant occupational hazard in the healthcare and service sectors, in particular in the mental health setting. According to data collected annually between 1993 and 1999, the Department of Justice National Crime Victimization Survey (NCVS) reported that 1.7 million victimizations occur at work annually, on average, during this period. The victimization rate for mental health professionals and custodial workers was 68.2 per 1,000 compared to a rate of 12.6 per 1,000 workers across all occupations (Duhart, 2001).

2. **Aims of the project**

- To document and describe a process for implementing OSHA violence prevention guidelines within the in-patient mental health setting;
- To compare assault rates, risk factors for assault and job satisfaction one year prior to and one year following implementation of a comprehensive OSHA guideline-based violence prevention program; and
- To assess the cost and benefits of implementing a comprehensive violence prevention program.

3. **Partners**

The following partners (their representatives) served as co-investigators and members of the statewide project advisory group that was charged with facilitating the overall project including data collection, intervention development and implementation and impact evaluation.

- OMH Multi-Union Health and Safety Committee
- New York State Office of Mental Health (OMH)
- Civil Service Employees Association (CSEA)
- New York State Public Employees Federation (PEF)
- New York State Corrections Officers and Police Benevolent Association (NYSCOPBA)

4. **Customers**

- 26 NYS OMH facilities and 20,000 staff
- Other mental health settings
- VA system

5. **Approach**

Study sites - Early in this 4-year project, a Request for Applications was sent to all in-patient mental health facilities in New York State inviting them to serve as intervention sites (n = 26). Criteria for selection as a study site included management commitment, as measured by willingness to commit the resources necessary to develop and implement a program and labour/management cooperation demonstrated by the presence of an active health and safety

committee. Seven applications were received and three psychiatric facilities (two for adults and one for children) were selected to receive the interventions. Later, three facilities similar to the intervention sites in terms of the type of facility (i.e., for adults or for children) and location (i.e., upstate, downstate), as well as having established labour and management cooperation, were selected for comparison. Within each intervention and comparison facility, three wards were selected as the focus of the intervention and evaluation so that the study team could concentrate our efforts and resources on a feasible number of study units.

The intervention **- The OSHA *Guidelines for Preventing Workplace Violence for Healthcare and Social Service Workers* served as a framework for the study. The study used a participatory action research approach, with management, labour, and direct-care staff representatives working closely with researchers in the design and implementation of the project (Israel, Eng, Schulz, Parker, & Satcher, 2005). A Project Advisory Group (PAG) made up of labour, OMH, and academic partners provided guidance and oversight for the overall project. The intervention had three main components: (1) developing and supporting a facility-level PAG to design and implement a facility-specific program, (2) conducting a comprehensive risk assessment, and (3) designing and implementing feasible recommendations evolving from the risk assessment.**

Focus Groups - Purposive sampling of direct-care workers at each of the three intervention facilities was conducted in such a way that non-supervisory direct-care workers were recruited to participate in focus groups on work time prior to the commencement of the intervention. Two focus groups at each intervention facility were conducted, allowing for participation across shifts and non-supervisory job titles. The pre-intervention focus groups launched the intervention in the sense that, by discussing the issue, the workers became sensitized and engaged in violence-prevention efforts. The post-intervention focus group was conducted with members of the Facility Project Advisory Groups (FPAGs) from each of the three intervention facilities and observed by the PAG members. Instead of being a confidential forum for staff to discuss violence, the post-intervention group represented an opportunity to share best practices and what worked for each facility.

Focus groups were conducted with direct-care staff to inform survey development and to provide qualitative data on staff perceptions of risk factors for violence on their wards and proposed solutions. Sixty staff members participated in one of six focus groups (two per intervention facility) conducted across all shifts at the three sites. Each 90-minute discussion was led by a trained facilitator, external to the OMH.

Staff Survey - A representative staff survey was conducted prior to full implementation of the participatory intervention and 1 year post-intervention. In each of the six facilities (three intervention and three comparison), all staff, including supervisors and administrators, were invited to participate in the survey. Staff were provided release time to complete the survey during work hours. The study coordinator visited the facilities and administered the survey on all three shifts.

Identical direct-care staff surveys were conducted in 2001 and 2003. The survey was adapted from a Washington State survey developed for assessing assaults in state mental hospitals (Bensley et al., 1997). It included sections on risk factors for violence, violence-prevention measures, threats and assaults, and staff perceptions of the quality of the OSHA elements on

their ward. The self-administered survey took approximately 20 minutes to complete and was completed on work time.

The survey analysis consisted of the change in staff perceptions of the quality of the OSHA elements on their ward, as well as their change in frequency of assault experience over the preceding 12 months. Staff were asked to evaluate the quality of (1) management commitment to violence prevention, (2) employee involvement in violence-prevention efforts, (3) environmental design of ward (environmental controls), and (4) staff teamwork and cooperation (administrative and work practice controls) on their ward over the preceding 12 months (1 = *poor,* 2 = *fair,* 3 = *good,* 4 = *excellent*). Staff were also asked if they had participated in PMCS training during the previous year (yes/no).

Staff assaults were assessed by asking the number of times in the preceding 12 months the worker experienced patient aggression while assigned to duties on their current ward. There were six levels of violence: (1) threat but no physical contact, (2) physical assault but no physical injury, (3) physical assault resulting in mild injury, (4) physical assault resulting in moderate injury, (5) physical assaults resulting in major injuries, and (6) physical assault resulting in permanent/partial physical disability.

Frequencies were examined by facility and also by intervention and comparison group. Analysis of variance was used to test the change in scores, using an alpha of .05 to evaluate level of significance. All analyses were conducted using SPSS Version 11.0.

6. Results/Findings

Findings from the focus group discussions including the following themes: the changing patient populations, inadequate staffing and deployment of staff, hierarchical management style, low management commitment to staff safety, ineffective patient programming and problems such as long wait times in food lines.

Between May 2001 and January 2002 the pre-intervention survey was completed by 406 direct-care staff (90% response rate) from three intervention and three comparison facilities. The post-intervention survey was conducted in the spring of 2003 and was completed by 319 direct-care staff (70% response rate). The number of respondents from individual facilities ranged from 43 to 117 for the pre-intervention survey and 36 to 69 for the post-intervention survey. Responses from staff in intervention and comparison facilities were compared to examine changes in their perception of the quality of the OSHA elements (mean value on a scale of 1–4) pre- and post-intervention. Staff in both intervention and comparison facilities reported statistically significant (or borderline) improvements in the first four elements, while the intervention facilities also reported significant improvement in the fifth element.

Overall, nearly 90% of staff reported threats of assault in the preceding 12 months (data not shown), with the mean number ranging from 35 to 70 threats for the two time periods and two groups. By comparison, less than 40% of staff reported a physical assault with moderate injury, with the mean number ranging from 0.8 to 1.76 per staff member. When the difference (or change) in reported threats and physical assaults during the preceding 12 months was calculated for the pre- and post-intervention periods, a slight reduction in the mean change in physical assaults with any level of injury among intervention facility staff and among severe and permanent injury among comparison facility staff was noted. An increase was observed in threats of assault among the staff of both intervention and comparison facilities. Possible interpretations for this finding include: a greater tendency to

report these less severe events; a shift of some physical assaults to threats of assault (an averted physical assault); or a real increase in threats of assault.

7. Outputs (reports, publications, products, methods, etc.)

All published outputs (item 7) should be provided in citation format.

Grants:

"Evaluation of Workplace Violence Prevention Intervention" National Institute for Occupational Safety and Health. October 1, 2002 - September 30, 2007, PI: Jane Lipscomb; Co-investigators: Kate McPhaul, Jeff Johnson, Jeanne Geiger Brown, Dawn Foster.

R01 OH009072-01, Lipscomb (PI), 8/31/06-8/30/11, CDC/NIOSH
Evaluation of Organizational Justice Intervention to Alleviate Type III Violence
This study develops, implements, and evaluates effective intervention strategies for preventing Type III (worker on worker) violence in a state government workforce.

Publications:

Lipscomb J, Silverstein B, Slavin TJ, Cody E, Jenkins L. Perspectives on legal strategies to prevent workplace violence. *J of Law, Med & Ethics* 2002;30:166-72.

McPhaul K, Lipscomb J. Workplace violence in health care: recognized but not regulated. *Online J Issues in Nursing* 2004;30:7.

Lipscomb, J.A. Homicide and assault. In Levy BS, Wegman DH, Rest K, Weeks J (Eds.). *Preventing Occupational Disease and Injury* (2nd edition) 2005;253-6. Washington, DC: American Public Health Association.

Lipscomb, J., McPhaul, K., Rosen, J., Geiger-Brown, J., Choi, M., Soeken, K., Vignola, V., Wagoner, D., Foley, J., Porter, P. (Dec. 2006). Violence prevention in the mental health setting: The New York State experience. *Canadian Journal of Nursing Research*.

Presentations:

McPhaul, K.M., Lipscomb, J.A. A focus group assessment of work organization risk factors for workplace violence in mental health. APHA, Washington DC, 2002.

Lipscomb, J.A., "Perspectives on legal strategies to prevent workplace violence." Centers for Disease Control and Prevention Public Health Law Conference, Atlanta, GA., 2002.

Lipscomb, J.A., "How OSHA's Violence Prevention Guidelines Reduce Violence Risk and Assault Injuries: Report from a Study Evaluating OSHA Guidelines in Mental Health." Maryland Occupational Safety and Health Conference, 2002.

Lipscomb, J.A., "OSHA Violence Prevention Guidelines: An Effective Strategy for Preventing Workplace Violence." New York State Public Employees Federation Health and Safety Conference, Albany NY, 2003.

Lipscomb, J.A., "Violence Prevention in the Mental Health and Social Services Workplace: Intervention Effectiveness Research In-Progress." University of California San Francisco, Occupational and Environmental Research Grand Rounds, 2003.

Lipscomb, J.A., "Workplace Violence Prevention in the Mental Health Setting." National Occupational Injury Research Symposium, Pittsburgh, PA, 2003.

London, M., Rosen, J., Lipscomb, J.A., Bain, E. "Workplace Violence Prevention: Responding to the Lack of an OSHA Standard." APHA, Boston, 2006.

Geiger-Brown, J., Muntaner, C., Lipscomb, J.A., Trinkoff, A. "Musculoskeletal Disorders and Demanding Work among Home Care Workers." APHA, Boston, 2006.

8.Outcomes

Intermediate outcomes: The study team was contacted by several employer and or worker organization to provide violence prevention program consultation as an outcome of this grant. Organizations requesting assistance include: Department of Idaho Department of Health and Welfare (2005), VHA (ongoing), SEIU Local 1199NW (2006) Dimensions Health Care (2006) and Sibley Hospital (2006).

*End outcomes***:** In the final year of the project, representatives of the three intervention PAGs met with the research staff to discuss lessons learned and the project's successes. This discussion was conducted as a focus group, with one member of the project staff serving as facilitator. Individuals representing the three facilities were asked to discuss what worked and did not work throughout the project. The discussion was recorded on flip charts, summarized in a report, and shared with participants for review, validation, and revision. In January 2005, the P.I. was invited to present the findings of this report (including following recommendations) at a meeting of the Directors of all 26 in-patient facilities.

Potential outcomes: Upon completion of the NIOSH funded project, the following recommendations were presented to the 26 OMH Directors and the OMH Multi-Union Health and Safety Committee

Management commitment to the violence-prevention program

- management communication of its intentions to reduce violence on the wards
- regular participation of senior leadership in violence-prevention meetings
- senior staff presence at all PMCS training sessions and a requirement for management to comply with annual PMCS training
- participation of upper-level administrators in ward rounds and morning report
- ongoing data collection, data sharing, and discussion of injury data with staff
- use of the courts for medication over-resistance and pressing assault charges

- management responsiveness to staff solutions for reducing violence
- allocation of resources for staff training and overtime related to violence prevention
- strong program for post-assault response staff

Employee involvement in the violence-prevention program

- regular communication via the committee process: rounds, shift-to-shift communication
- multidisciplinary STEP committee membership
- team approach to identifying needs and solutions and consensus decision-making on implementation of project recommendations

Hazard-assessment activities

- use of staff focus groups and staff surveys
- periodic environmental audit/assessment and mapping of high-risk areas with staff input
- encouragement of accurate and timely reporting of injuries
- data collection and analysis and review of reporting practices

Hazard-control activities

Infrastructural/organizational

- creation of violence-prevention infrastructure (STEP/PAG committee)
- documentation of the hazard controls implemented or a timetable for implementation
- assessment of hazard-control effectiveness via the committee infrastructure using ongoing data collection and review

Environmental

- assessment of ward movement to avoid prolonged standing in line
- installation of locks wherever necessary
- installation of staff personal alarm system and alarms in all nursing stations and medicine and treatment rooms
- removal of wire glass

Administrative

- ongoing assessment of data collection and data use
- ongoing assessment of PMCS training and management of psychiatric emergencies

Behavioural

- improvement of the shift-to-shift reporting process
- senior staff rounds of treatment units
- clinical/treatment rounds across disciplines, including treatment aides

Title: **Work-Related Assault: Impact of Training and Policy**

Definition of Problem Being Addressed:
In the United States, occupational violence is frequently one of the top three leading causes of work-related death, and it has been estimated that over 1.7 million non-fatal violent acts occur at work annually; nurses, particularly, appear to be at increased risk of work-related violence. Policy and training on work-related violence are often recommended as part of a comprehensive approach to address this problem; however, evaluation of the impact of these recommendations has been lacking.

Aims:
Specific Aim 1: to examine the relation between work-related violence prevention training and the outcome of work-related assault against nurses.
Specific Aim 2: to examine the relation between work-related violence prevention policies and the outcome of work-related assault against nurses.

Partners in the Project:

Names	**Role:**
1. Susan Goodwin Gerberich, Ph.D.	Co-investigator
2. Patricia M. McGovern, Ph.D.	Co-investigator
3. Timothy R. Church, Ph.D.	Co-investigator
4. Helen E. Hansen, Ph.D.	Co-investigator

Customers:
The intended users of these results include: facilities that employ nurses; nurses; occupational health professionals; researchers interested in work-related violence; and those interested in effective management of nurses.

Approach:
This study is based on data collected for the case-control phase of the Minnesota Nurses' Study. Case participants were surveyed about the month prior to the first assault reported during the previous year; controls were randomly selected, based on months worked, from either 1) months worked by nurses who did not report assaults, or 2) months worked prior to the first assault for cases. A comprehensive causal model, using a directed acyclic graph, served as a basis for survey design, analyses, and interpretation. Multivariate logistic regression was used to assess the impact of policies and training on the outcome of physical assault. Sensitivity analyses were also incorporated to address unmeasured confounders and exposure misclassification.

Results:
Over 40% of cases and controls reported having ever received training about occupational violence. Most often, nurses indicated being trained about reporting violence and managing violent patients. Results of multivariate logistic regression analyses varied by training topic; three types of training appeared to decrease the risk of violence, four types appeared to increase the risk of violence, but none were found to be statistically distinct from one. Results of multiple regression analyses, regarding written work-related violence policies indicated that the odds of physical assault decreased for having a zero tolerance policy (OR=0.5, 95% CI: 0.3, 0.8) and for having policies regarding types of prohibited violent behaviors (OR=0.5, 95% CI: 0.3, 0.9). Sensitivity analyses were conducted for exposure misclassification and the presence of an

unmeasured confounder, providing further confidence that some work-related violence policies may be protective.

Outputs:
Results of this study have been presented at: the American Public Health Association conferences in 2002 and 2003; the Minnesota Health Services Research Conference in 2003; the National Occupational Injury Research Symposium in 2003; the National Occupational Research Agenda Symposium 2004; and the American Association of Occupational Health Nurses conference in 2005.

In addition, two peer-reviewed papers have been published:

Nachreiner, N., Gerberich, S.G., McGovern, P., Church, T., Hansen, H., Geisser, M., and Ryan, A. (2005). Impact of Training on Work-related assault. Research in Nursing and Health, 28(1): 67-78.

Nachreiner, N., Gerberich, S.G., McGovern, P., Church, T., Hansen, H., Geisser, M., Ryan, A. (2005). Relation between policies and work related assault: Minnesota Nurses' Study. Occupational and Environmental Medicine. 62(10): 675-81.

Outcomes:
This research has served as a model for additional work-related violence studies. For example, doctoral students at the University of Minnesota are now assessing the impact of policies on violence against Minnesota educators. The published studies have been cited in other publications, and conference attendees have had great interest in these presentations.

Title: **Risks for Workplace Violence in Long-Haul Truckers**

Debra G. Anderson, PI, Deborah B. Reed, Co-I, Steve Browning, Co-I

1. Definition of Problem: The U.S. truck driving industry employs nearly nine million Americans. A significant subset (3.16) million) of these workers consists of long-haul truck drivers (U.S. Bureau of Labor Statistics, 2001). The Bureau of Labor Statistics (BLS) rates truck driving as the third largest growth occupation (tied with Registered Nurses), with a projected growth of 561,000 jobs from 2000-2010 (Eisenburg, 2002). Only teachers and computer software engineers are estimated to be growing more quickly in numbers than truck drivers. This growth is affecting not only the number of long-haul drivers but also the gender make-up of the driver workforce. The number of women truckers has increased from an estimated 513 drivers in 1970 (Lembright, 1982) to between 174,000 and 290,000 (6-10%) currently (American Trucking Association, 1999; Renner, 1998). The overall size of this sector of the economy, and projections for its growth, coupled with the non-traditional aspects of long haul truckers' workplace environments and employment arrangements, underscores the importance of assessing this population in terms of workplace violence and the specific risk factors associated with long-haul truck driving.

Several studies have examined health risks of truckers (Bolster, 1989; Korelitz et al., 1993; Magnusson et al., 1996; Reed et al., 2000). One of the key issues revealed by these studies is the finding that truck drivers have more heart disease that any other occupations (Leigh & Miller, 1998). Stress is an identified risk factor for heart disease, however few studies have investigated violence and stress related to long-haul truckers. The existing research is further limited by the fact that the majority of studies among long-haul truck driving have used exclusively male samples (Gruber, 1976; Hakkanen, 2001; Ho et al., 1993; Korelitz et al., 1993; Patenaude et al., 2001). In light of the rapidly increasing number of female long-haul truckers, it is important to address their specific needs in addition to the needs of truck drivers in general.

From 1992-1996, the number of injuries and illnesses for all occupations decreased 20% while increasing 5% in truck drivers. In 1999, truck drivers had more workplace injuries and illnesses involving time away from work than any other occupation (Bureau of Labor Statistics, 2001) and heavy truck driving is one of the occupations with the most costs related to job-related injuries and illnesses (Leigh & Miller, 1997). It is important to determine the nature of these injuries and illnesses to enable the development of appropriate interventions to prevent them. Rates of workplace violence specifically for long-haul truckers are not available in the existing literature or from national surveys and agencies. One reason cited for the lack of national data is that, although truck hijackings are investigated by the federal bureau of investigation, personal crimes against truckers are generally handled by local authorities and are therefore not always reported to federal authorities (Strah, 1994). A crime bill signed by then President Clinton, in 1994, instructed federal authorities to work closely with state and local authorities (Strah, 1994). It also specified that prosecutors should aggressively prosecute crimes against truckers and that penalties for crimes against truckers should be more than the maximum set by law. Truck driving is listed as one of the occupations that loses work time due to violence at the worksite (Toscano & Weber, 1995). A review of news articles also provides evidence of the dangers of truck driving (Campbell, 2000; Lockridge, 1994; Magner, 1999; Spencer, 2000; Strah, 1994). The National Crime Victimization Survey uses the occupational category of transportation workers,

which includes taxi drivers, bus drivers, truckers, and other transportation industry workers. Based on data from this survey, workers in the transportation industry experienced average annual rates of aggravated assaults (3.5 per 1,000 persons) and simple assaults (10.2 per 1,000 persons) that ranked this industry fourth and sixth, respectively, in comparison to the other surveyed industries (Duhart, 2001). The transportation industry, in general, has the highest average annual rate of robberies in the workplace, as reported for the years 1993-1999 by the Bureau of Justice Statistics. Further, in comparison to other industries, the transportation industry has the largest percentage (31.7%) of workplace victims who were victimized by the offender with a weapon. Data from this survey suggest that a substantial proportion (63%) of the workplace victimization crimes for employees in the transportation field were not reported to the police. In general, rapes/sexual assaults and simple assaults tended to be severely underreported in the study population.

2. Aims of the project:

Aim 1: Identify the types of violence that women and men experience while working as long-haul truck drivers.

Aim 2: Identify risk factors that contribute to violence against truckers and between truckers.

Aim 3: Differentiate the risks of work-related stress among distinct socio-demographic groups of truckers as they relate to specific exposures experienced by long-haul truck drivers.

Aim 4: Determine the prevalence of domestic violence experienced by long-haul truck drivers when their driving partner is also their intimate partner.

Aim 5: Identify work environment factors that place truck drivers' safety at risk.

The aims of this project are consistent with the Healthy People 2010 objectives that address the reduction of work-related homicides (Objective 20-5) and work-related assaults (Objective 20-60) and with the National Institute for Occupational Safety and Health National Occupational Research Agenda (NORA) objectives. It also addresses the types of violence identified by the Iowa Report to the Nation on Workplace Violence (Loveless, 2001). The project specifically focuses on types of workplace violence and risk factors related to that violence in the long-haul trucking profession.

3. Partners: Various truck shows and truck stops across the U.S. were used as sites for the collection of data.

4. Customers: Truck drivers, truck stops, trucking companies, delivery sites, and the justice system are potential users and beneficiaries of this project.

5. Approach: A cross-sectional design using both quantitative (Phase I) and qualitative methods (Phase II) were used to collect data from long-haul truck drivers. This multi-method approach should allow for the development of a strong conceptual understanding of violence at the workplace not available from the use of one method (Miles & Huberman, 1994). The qualitative data should be useful in validating, interpreting, clarifying and illustrating quantitative findings from the truckers. The different methods may yield different results because they are sensitive to

different nuances (Patton, 2002). Combining quantitative and qualitative approaches in a process of methodological triangulation, will strengthen the data collection process (Patton, 2002) by allowing for the fullest possible descriptions of risks for violence in long-haul truckers.

A written survey was administered to a non-probability volunteer sample (N = 987) recruited at truck shows and truck stops to assess episodes of workplace violence and the circumstances surrounding the episodes of violence. Qualitative data was collected via phone interviews with a small sample of female and male participants who have completed the written survey and have identified themselves as having been a victim of workplace violence. The phone interview was conducted to assess in more detail the episodes of violence identified in the written surveys and to evaluate the context of those violent episodes. Unfortunately, the target of 60 interviews was not met as the truckers selected often were not available when contacted for follow up.

The target population for this study was female and male long-haul truck drivers. The inclusion criteria were: (a) commercial drivers who spend the majority of their work hours in long-haul trucking; (b) age 21 or older; and (c) ability to speak English. For the purpose of this study, long-haul trucking was limited to truckers who spend one or more nights per week away from home while driving. The age of 21 was used because many states require truckers to be at least 21 years of age to obtain a commercial driver's license. Length of time on the job was collected to assess potential differences in novice and experienced drivers. Because the measures in the study were not available in other languages, only English speaking truck drivers were included.

6. Results/Findings (Preliminary): The funding for this project concluded on September 29, 2006. Data analysis is ongoing, thus the findings discussed in this section are preliminary and may change based on more in-depth analysis.

- The participants (N = 987) had been long-haul truckers an average of 14 years; 64% were married;
- 38% had children under the age of 18 (of those, 37% had children who traveled with them);
- 87% had a high school education;
- 46% attended college;
- 91% were Caucasian;
- 12% (n = 119) did not have a residence outside of their truck;
- mean BMI for male truckers (n = 797) was 31.6;
- mean BMI for female truckers (n = 174) was 31.2;
- 34% of male truckers were overweight and 52% were obese;

- 26% of female truckers were overweight and 49% were obese;
- 73% of truckers feared for their personal safety at work;
- 88% had had their safety threatened while driving; and
- 44% carried weapons (Gun = 23.5%; Knife = 56.8%)

7. Outputs:

Heaton, K., Browning, S. and **Anderson, D.** (under review). Variables predicting falling asleep at the wheel in long-haul truckers. Accident Analysis and Prevention.

Heaton, K., Browning, S., & **Anderson, D. G.,** (under review). Epworth Sleepiness Scale. Journal of Nursing Measurement.

Anderson, D. G., Westneat, S., & Reed, D. (2005). Violence and stress in female long-haul truck drivers. Security Journal, 18 (2), 31-38. *(Pilot Study for NIOSH study – funded by NIOSH ERC).*

Anderson, D. G. (2004). Workplace violence in long-haul trucking: A review of the literature. AAOHN Journal, 52 (1), 23-27.

Conference Proceedings:
Anderson, D.G. and Reed, D.R. (2006). Risks for workplace violence in long-haul truckers. National Occupational Research Agenda (biennial meeting), Washington DC.

Allen-Bryant, K., Westneat, S., **Anderson, D.G.** (2006). Disparities in the Prevalence of Workplace Violence Among Long-Haul Truck Drivers, Southern Nursing Research Society, Memphis, TN.

Anderson, D.G., Reed, D.R., Lennie, T. & Westneat, S. (2006). Truckers and Nutrition. Southern Nursing Research Society, Memphis, TN.

Allen-Bryant, K., Westneat, S., **Anderson, D.G.** (2005). Disparities in the Prevalence of Workplace Violence Among Long-Haul Truck Drivers, American Public Health Association, Washington, DC.

Anderson, D. G., Westneat, S., & Kenworthy, E. (2005). Workplace violence in vulnerable occupations. Midwest Nursing Research Society, Cincinnati, OH.

Anderson, D. G., Westneat, S., Reed, D. (2005). Risks for Workplace Violence in Long-haul Truckers: Preliminary Data. NCIPC, Denver, CO.

Anderson, D. G., Westneat, S., & Reed, D., (2004). "Workplace Violence,"for the 15th International Nursing Research Congress, Dublin, Ireland.

Riley, P. & **Anderson, D. G.** (2004). Data collection methods for workplace violence in long-haul truck drivers. Western Institute of Nursing, Portland, OR.

Anderson, D. G. (2004). Workplace violence in female long-haul truckers. Southern Nursing Research Society, Louisville, KY.

Anderson, D. G. (2004). Workplace violence in long-haul truckers. Southern Nursing Research Society, Louisville, KY.

Anderson, D. G., Allen, K., & Riley, P. (2003). Risks for workplace violence in long-haul truckers. American Public Health Association Annual Meeting. San Francisco, CA.

8. Outcomes: This project provides information that should be useful in improving safety at the worksites of truckers related to the design of truck stops, rest areas, delivery sites, and training of employees. In addition, findings unrelated to violence are also important, and include nutrition and housing status. We have submitted a proposal that focuses on the nutrition and injury of truckers partially due to our findings that 85% or truckers are obese or overweight – and other studies that indicate that overweight and obese lead to injury. Over 12 percent of truckers responded that they have no residence outside of their truck – this has implications for health care access, stability, and support systems.

Title: **Evaluation of California Initiatives to Reduce Violence**

Submitted by: Corinne Peek-Asa, PhD
10/14/06

1. Definition of the problem being addressed (e.g., number of workers affected; rates of injury, illness, or fatality; hazards)

Health care workers, especially those providing emergency and psychiatric care, have long been recognized as having a high risk of work-related assault. This study evaluated state policies to reduce violence against health care workers. In response to a growing awareness of violence against health care workers, the State of California has implemented two initiatives to reduce workplace violence in health care facilities. The first initiative was Cal/OSHA's "Guidelines for Security and Safety of Health Care and Community Service Workers," released in 1993. The Cal/OSHA Guidelines provide a comprehensive list of intervention approaches to reduce workplace violence and offer a strategy to design and implement a comprehensive security program. The second state-based initiative was the passage of the California Hospital Safety and Security Act (Assembly Bill 508) in 1993. The Hospital Security Act required licensed acute care and psychiatric facilities to implement a comprehensive security program by July, 1995.

2. Aims of the project (major objectives for the period of the work)

Objective 1: Impact Evaluation

Specific Aim 1: Evaluate the level of compliance in hospital security plans pursuant to the Cal/OSHA Guidelines and the Hospital Security Act and identify characteristics of hospitals that are related to level of compliance.

Specific Aim 2: Determine if hospital security programs are more comprehensive in California compared to hospital security programs in New Jersey, where no state-based initiatives have been implemented.

Objective 2: Outcome Evaluation

Specific Aim 3: Using interrupted times-series analysis, determine if rates of reported violent events in all California hospitals decreased from the pre-initiative to the post-initiative period compared to hospitals in New Jersey.

Specific Aim 4: Identify individual components of hospital security programs that are associated with decreased rates of violence. Individual components will be divided according to the Cal/OSHA Guidelines into the categories of: environmental modifications, work practice changes, policies and practices implemented, training, use of security and law enforcement, management commitment, risk assessments and integration with the security program, and surveillance of violent events.

3. Partners (participants in the project and the roles they served)

1. California Department of Health Services, Occupational Health Branch conducted the field work for the California hospitals.

2. New Jersey Department of Health and Senior Services conducted the field work for the New Jersey hospitals.
3. University of North Carolina, Chapel Hill, participated as part of the research team
4. University of California, San Francisco, participated as part of the research team

4. Customers (intended users or beneficiaries of the results)

Health care administrators, security directors and risk managers, health care providers, public health officials, state hospital administrations, patients

5. Approach (tasks involved in conducting the project)

Using a quasi-experimental design with a nonequivalent control group, this evaluation compared hospital security programs and violence rates in a similar sample of intervention and comparison hospitals. Hospitals in the State of California were considered the intervention hospitals that have been "exposed" to the two California hospital security initiatives. Hospitals in the State of New Jersey were the comparison hospitals, in which general guidelines are available but no specific state-based interventions have been implemented.

Nearly 150 licensed hospitals in California and 50 in New Jersey were recruited to participate. Hospitals were chosen through a stratified random sampling process, with the strata based on hospital size and urban influence of the county. Acute Care and Psychiatric Hospitals were eligible; in the acute care hospitals the security assessment will include the Emergency Department and the Psychiatric Unit.

We conducted a comprehensive assessment of each hospital's overall security program as it related to the Cal/OSHA Guidelines and the Hospital Security Act. This included environmental modifications, work practice changes, policies and practices implemented, training, use of security and law enforcement, management commitment, risk assessments and integration with the security program, and surveillance of violent events. Information about the security program was collected through interviews of the Emergency Department Nurse Manager, the Psychiatric Unit Nurse Manager, the Risk Manager/Director of Security, and an average of three staff in each unit. In addition to the interviews, existing printed materials that described the training program and hospital security policies were requested.

Information about events in each hospital was obtained through several sources. Statewide trends in hospital violence and events in each facility were identified through the Worker's Compensation Information System, a statewide electronic database of Worker's Compensation Claims. Events in individual hospitals were evaluated through OSHA 200 logs, employer's reports, and security logs. Information about the employee population will be obtained from the personnel office and will be used to derive rates of violent events.

6. Results/Findings (preliminary or final observations and conclusions)

Data for this project are still being analyzed. Some of our basic findings:

- Hospitals in California had all responded to some extent to the California Hospital Security Act, although there was a broad range of programs in place. While some hospitals had organized and integrated programs, others were piecemeal and disorganized.
- New Jersey hospitals had all implemented some types of workplace violence strategies. California had significantly more workplace violence program elements in training and in policies/procedures, but there was no significant difference between the states in security and environmental approaches.
- The majority of hospitals had ongoing workplace violence training programs, and although none were comprehensive enough to comply to the letter of the legislation, most were thorough. All hospitals had implemented some types of environmental approaches to prevention, which was usually in the form of security equipment. The environmental approach, however, was often the least developed aspect of the security program.
- Workplace violence program components of training, administrative policies/procedures, security, and environmental measures were not highly correlated, which indicates that having a strong program in one component (such as training) is not related to having a strong program in another component (such as administrative policies and procedures). In fact, many of these different program elements were negatively correlated.

7. Outputs (reports, publications, products, methods, etc.)

Manuscripts in progress:

Peek-Asa C, Casteel C, Allareddy V, et. al.. Impact of the California Hospital Safety Act on Workplace Violence Prevention Programs in Hospital Emergency Departments. In Progress.

Peek-Asa C, Casteel C, Allareddy V, et. al.. Impact of the California Hospital Safety Act on Workplace Violence Prevention Programs in Psychiatric Facilities. In Progress.

Casteel C, Peek-Asa C, Nocera M, et al., The effects of the California Hospital Security Act on Workplace Violence Events in Health Care Facilities. In progress.

Peek-Asa C, Casteel C, Nocera M, Allareddy V. Reporting sources for violence events in hospitals: can we do it better for fewer resources? In progress.

Casteel C, Peek-Asa C, Nocera M, et al., Epidemiology of workplace violence in health care facilities. In progress.

Blando J, OHagan E, Valiante D, McPherson K, Peek-Asa, C. Community crime rates and their influence on hospital violence. In progress.

Umbarger-Mackey M, Peek-Asa C, Allareddy V. Under-reporting of violent events in health care facilities. In progress.

8. Outcomes (how outputs have been used, e.g. change in behaviors, processes, technologies, guidelines, etc. that have made a difference in measurable endpoints related to exposures or health and safety indicators)

Most participating hospitals have asked for results from this study, and these were provided to them. These results are being used by hospitals to benchmark their programs in relation to like hospitals (Note: no results were produced to identify individual hospitals, which was a condition of our IRB approval). The CADHS conducted a symposium with participating hospitals to discuss approaches to prevention. The NJDSS research team met with members of the New Jersey Hospital Association to help improve training programs for hospital staff.

Title: **On-the-Job Injury in South Texas Middle School Children**

September 30, 1998 – September 29, 2000

Sharon P. Cooper, PhD, Principal Investigator

Nancy F. Weller, DrPH, Co-Principal Investigator and Project Director

Susan R. Tortolero, PhD, Co-Investigator

Steven H. Kelder, PhD, Co-Investigator
Sponsored by the National Institute for Occupational Safety and Health
Grant Number 1R03 OH03786-01

1. Definition of the problem being addressed

State and national child labor laws prohibit the employment of children younger than 14 years of age. Despite these proscriptions against work in young children, emerging evidence suggests that some unknown proportion of young people work during their middle school years (6th through 8th grades or about 11-14 years old), probably in the informal sector, but possibly during the school year and in formal sector positions. Although early adolescents commonly relate working during their 6^{th}-8^{th} grade years, documentation of these work experiences in the scientific literature is largely unconfirmed. Information on the extent and nature of employment during the middle school years is also deficient. Like their older adolescent counterparts, middle school youngsters may also be at risk for various occupational hazards, including work-related injury, already documented as a substantial public health problem in high school students. Additionally, these youngsters may be susceptible, especially as hours of weekly work increase, to the negative academic, social, behavioral, and health effects that older adolescents have experienced as a result of working long hours weekly.

Finally, no information is available on the social variation in work patterns among lower-income and minority middle school youth, youngsters who may work more hours weekly due to their socioeconomic circumstances. The purpose of this study was to describe the prevalence and patterns of work and work-related injury among mostly low-income and minority 6^{th}, 7^{th}, and 8^{th} graders from South Texas, and the associations of school-year employment with quality of life issues, and environmental and behavioral factors among these students.

2. Aims of the project

Anecdotal data from the popular literature and other limited, scientific data indicate that as many as one-third of youth have been employed during their middle school years, some in occupations that have been documented to be hazardous.. Interventions are needed to address occupational safety and health concerns among these employed children, their parents and employers, and other concerned professionals. Toward this objective, a one-year grant under multiple National Occupational Research Agenda priority research areas (Special Populations at Risk – young, minority, low-income workers – and Traumatic Injuries) was awarded by NIOSH in September 1998. Specific aims included the following:

1. To determine the prevalence of employment and weekly work intensity levels among middle school youth;

2. To describe the prevalence of reported work-related injuries in middle school students;

3. To describe the demographic characteristics of middle school students who work and who report work-related injuries;

4. To describe quality of life issues (sleep, leisure time, stress) associated with working and work-related injuries;

5. To determine environmental factors (i.e., number of hours worked weekly, type of job) and behavioral factors (i.e., substance use, violence-related behaviors) associated with employment and work-related injuries.

3. Partners (participants in the project and the roles they served)

Partners included Texas Education Agency who helped recruit schools and school teachers and students who made the survey possible.

4. Customers (intended users or beneficiaries of the results)

Potential customers include researchers, other public health professions, school personnel, parents, legislators.

5. Approach (tasks involved in conducting the project)

During May 1995, data in this descriptive, cross-sectional study were collected as part of the Safe and Drug Free Schools Program's (SDFS) regular assessment of the prevalence of substance use among Texas Education Agency Region Two students who represented 27 junior high schools in 11 contiguous counties in South Texas. The SDFS's data collection provided an opportunity to examine issues of employment in relation to health and other behaviors.

The SFDS program coordinator recruited all 42 school districts in these counties. Thirteen districts declined participation due primarily to time constraints. Participating and nonparticipating districts were located in small towns and rural areas except for a single, small urban area in the nonparticipating group. The total student population in the participating middle schools was 11,523. At the larger schools, classes were randomly selected by grade from a master list of second period classes using a random number table. In schools with fewer than 200 students, all students were surveyed. The number of students eligible to complete the survey was 8,757. A total of 7,420 6^{th}, 7^{th}, and 8^{th} graders, representing 85% of the eligible, was surveyed. The number of 6^{th} graders who responded was 2,365, 7^{th} graders 2,487, and 8th graders 2,450. The study protocol was approved by The University of Texas Health Science Center Institutional Review Board (HSC-SPH-95-018). During the week prior to survey administration, parents received a passive informed consent form explaining the study and providing an opportunity to decline participation. Following the Center for Disease Control and Prevention's (CDC) Youth Risk Behavior Study (YRBS) protocol, teachers received instruction packets and administered the survey during student's regular classes. The survey was anonymous; students recorded their responses directly on a computer-scannable answer sheet.

6. Results/Findings

Data on the work experiences of children and early adolescents are scarce. Preliminary evidence suggests, however, that very young workers – especially poor, minority youth – may be at risk

for adverse work-related effects, including on-the-job injuries. Pre-existing work-related data from 7,420 South Texas middle school students, were analyzed according to the specific aims of the study: to determine the prevalence of employment among middle school youth; to document the prevalence of work-related injury in middle schoolers; to describe the demographic characteristics of working middle school students and injured workers; to describe quality of life issues associated with working and work-related injuries; and to determine environmental factors and behavioral factors associated with work-related injuries. Results indicate that 25% of employed students reported having ever experienced an occupational injury. Of the injured, 30% required medical help. A dose response effect was observed where increasing weekly work hours were significantly related to work injury. Types of jobs associated with work-related injury were restaurant work, agriculture, construction, and retail work. Restaurant work was associated with injury requiring medical help. The overall prevalence of employment was 56%. Three-quarters of workers were employed 1-10 hours weekly. Employed students worked an average of 8 hours weekly. Middle school students were more likely to work in childcare and yardwork than in other types of jobs. About half of students reported working to earn spending money. Working longer hours weekly was associated with using several substances, decreased sleep, increased stress and frequency of having headaches, and dissatisfaction with amounts of leisure time. Working more than 10 hours weekly was also correlated with poorer school performance and school disengagement. We found that students from families of migrant farmworkers are particularly vulnerable to sleep deprivation, decreased academic performance, and an increase in the likelihood of work-related injury. Further investigation is needed to examine the impact of school-year work on youth functioning and to develop interventions to reduce work-related injuries in this population. Parents and professionals should monitor the number of hours of weekly work of middle school children.

7. Outputs (reports, publications, products, methods, etc.)

Weller NF, Cooper SP, Kelder SH, Basen-Engquist K, Tortolero S. Work-related injury among South Texas Middle School Students: prevalence and patterns. South Med J 2003; 96: 1213-1220.

Weller NF, Basen-Engquist K, Cooper SP, Kelder SH, Tortolero SR, Hassan S. School-year employment among middle school students in South Texas: prevalence and patterns. Journal of Children's Health 2004; 2:87-102.

Weller NF, Tortolero SR, Cooper SP, Kelder SH, Hassan S. School-year employment among South Texas middle school students: effects on academic, social, and physical functioning. Journal of Children's Health 2004;2:103-117.

COOPER SP, Weller NF, Fox EE, Cooper SR, Shipp EM. Comparative description of migrant farmworkers vs. other students attending south Texas schools: demographic, employment, and health indicators. Texas Medicine 2005; 101:58-62.

Cooper SP, Weller NF, Fox EE, Cooper SR. Comparative description of migrant farmworkers vs. other students attending South Texas schools: substance use, work and injuries. J Rural Health 2005;21:361-366.

8. Outcomes

This was research that was intended to shed light on the work, injury, academic and psychosocial experiences of middle school students. Since there is a paucity of data in these young workers, its full contribution remains to be seen. In addition to being cited in the peer-reviewed literature, this research could be used to educate legislators on such pending legislation as the CARE Act (The Children's Act for Responsible Employment) or by researchers or public health practitioners to develop interventions.

Title: **Adolescent Occupational Toxic Exposures**

NORA R03 NIOSH PROJECT
P.I. – Alan Woolf MD, MPH
Children's Hospital Boston
Harvard Medical School
Boston, Massachusetts

1. DEFINITION OF PROBLEM

There was scant national data on the frequency or characteristics of toxic exposures occurring in workplace settings that involve adolescents 12-17 years old as victims. Databases usually used to obtain such information (e.g. workmen's compensation claims, Medicaid claims, emergency department visits) did not reliably include the age spectrum of interest and/or were not national in scope.

2. PROJECT AIMS

Project aims included:

- description of occupational toxic exposures among adolescents in the U.S.
- analysis of trends over time
- comparison with such exposures occurring among adult workers and contained in the same database

3. PROJECT PARTNERS

The project was based at Children's Hospital Boston, and the Harvard Medical School. Partners included the regional Massachusetts Poison Control System, based in Boston. Partners included epidemiologists (Dr. Sam Lesko) at the Slone Epidemiology Unit at Boston University School of Public Health, Boston, Massachusetts and Dr. Hillel Alpert, a statistician at the Harvard School of Public Health.

4. CUSTOMERS

Users of such data included academic-based health professionals, public health officials, and those responsible for public health policy and public education outreach programs.

5. APPROACH

Secondary retrospective analysis of the Toxic Exposure Surveillance System (TESS) database maintained by the American Association of Poison Control Centers (AAPCC), comprised of poisoning exposure calls received by all 62 poison control centers in the United States. The analytical plan included descriptive epidemiology, trend analysis, and inferential comparison of rates internal to the database.

6. RESULTS

Of 2,200,000 potential poisonings reported annually to U.S. poison control centers, over 300,000 occupational toxic exposures were reported during the 5 years of interest, 1993-97. Of these, there were 8,779 (3%) exposures occurring among adolescents younger than 18 years old: including 35% inhalations, 27% ocular splashes, and 24% dermal exposures. The most frequent toxic agents involved in these adolescent exposures included caustics, gases and fumes, cleaning agents, bleaches, drugs, and hydrocarbons. Of the total reported adolescent exposures, 14.5% were coded as resulting in moderate or severe medical outcomes, and there were 2 adolescent occupational deaths reported to poison centers during this time period.

Fractional monthly incidence rates were comparatively higher than those of adults in trend analysis over the five years of interest. Such findings suggest (speculatively) adolescents are recruited to entry level jobs where there is exposure to hazardous chemicals, where there is less training and orientation to the hazards of such chemicals and the need for barrier precautions, and where adolescents take fewer precautions and routinely engage in more risk-taking activities than adults.

7. OUTPUTS

Woolf AD, Flynn B: Workplace toxic exposures involving adolescents 14-19 years old- one poison center's experience. Arch Pediatr Adolesc Med 2000; 154: 234-239.

Woolf AD, Garg A, Hillel AR, Lesko S. National variations in the types and severity of adolescent workplace toxic exposures. Presented at the annual national congress of the American Academy of Pediatrics, Chicago IL, October, 2000.

Woolf AD. Studies in adolescent occupational toxic injuries in the United States. Seminar, Int'l Labor Office (ILO), Geneva, Switzerland, October 27, 2000.

Woolf AD. Symposium Organizer and Moderator; also Presenter: Child Labor and Toxic Exposures. in WHO/AAPCC Symposium on Children's Environmental Health. North American Congress of Clinical Toxicology, Montreal, Quebec, Canada, October 1, 2001.

Woolf AD, Garg A, Hillel AR, Lesko S. Adolescent toxic exposures in the workplace: trends in the United States and comparisons to adults. Pediatric Res 2001; 49 (Part 2): A7.

Woolf AD, Alpert HR, Garg A, Lesko S. Poison control center surveillance of adolescent toxic exposures in the workplace: trends in the United States from 1993-97. J Toxicol Clin Toxicol 2001; 39: 272.

Woolf A, Alpert HR, Garg A, Lesko S. Adolescent occupational toxic exposures – a national study. Arch Pediatr Adolesc Med 2001; 155: 704-710.

Woolf AD. Health hazards for children at work. J Toxicol Clin Toxicol 2002; 40: 477-482.

8. OUTCOMES

Project aided in the informing of public health officials nationally and internationally to a new focus for health prevention and education activities. Project recommendations for increased efforts at orientation and on-the-job training of adolescents to the potential toxic effects of workplace chemicals has led to enhancements of such activities. Internationally both WHO and ILO officials were interested in these results. Recommendations for simple measures to avert toxic exposure events – such as wearing eye guards and gloves – should be implemented and considered as routine barriers to injury by employers of adolescents. It is unknown how extensively such recommendations have been implemented.

Title: **Childhood Agricultural Trauma Evaluation System**
NIOSH Grant: R01 OH004265-4
PI (2002-2005): Allan N. Williams, MPH, PhD
PI (2001-2002): Debora J. Boyle, DVM, PhD

1. Definition of the problem being addressed (e.g., number of workers affected; rates of injury, illness, or fatality; hazards)

Agriculture is one of the most hazardous industries in Minnesota and rural Minnesota adolescents are frequently employed in both agricultural and non-agricultural jobs. Previous surveillance studies of agricultural work and injury have generally been limited to emergency room data, surveys of only farm families, or inclusion of only paid work activities. Consequently, the broader scope of work experiences, injuries and illness among adolescents in rural or agricultural communities has been less well characterized. The purpose of this study was to develop and implement surveillance methods to more broadly characterize injury, work, and asthma occurrence among rural Minnesota adolescents.

2. Aims of the project (major objectives for the period of the work)

The specific aims of this study were: (1) determine the magnitude and scope of agricultural injury and asthma among adolescents in 9^{th} - 12^{th} grades in rural Minnesota; (2) describe the change in work hours between 9^{th} and 12^{th} grades in terms of total work hours, and the shift in work hours between agribusiness, traditional family farm work, and non-farm work; (3) evaluate the reliability of adolescent self-reported information about agricultural and non-agricultural work hours and injury experiences; and (4) use a cohort analysis to calculate rate ratios for risk factors for injury and to facilitate planning for future prevention and intervention activities.

3. Partners (participants in the project and the roles they served)

This study involved four categories of partners and/or participants:

a. University of Minnesota faculty and researchers – these researchers had key roles in the design and implementation of this study:
Peter Hannan, MA, M.Stat, M.Ed, Epidemiology, University of Minnesota
Susan Gerberich, PhD, Environmental Health Sciences, University of Minnesota
Bruce Alexander, PhD, Environmental Health Sciences, University of Minnesota
John Shutske, PhD, Biosystems & Agricultural Engineering, University of Minnesota
b. Youth at Work Advisory Group – This group was comprised of current and former high school educators, representatives from the state department of education, county public health, and University of Minnesota researchers.
c. Administrators and teachers from 41 rural Minnesota high schools who agreed to participate
d. The approx. 14,000 students from 41 rural Minnesota high schools who completed up to 5 surveys over two successive school years.

4. Customers (intended users or beneficiaries of the results)

Customers include (a) rural high schools that were provided with data about their students (injuries, work hours, sleep hours, homework hours, tobacco and alcohol use, seat belt use,

patterns of school commuting, asthma, and other survey data); (b) state and local public health professionals; (c) University of Minnesota agricultural and occupational health researchers; and (d) other researchers.

5. Approach (tasks involved in conducting the project)

Self-completed in-school questionnaires were developed and used to ascertain injuries, work experiences, asthma, and potential risk factors among adolescents attending a stratified random sample of 41 rural Minnesota high schools from four agricultural regions and three categories of school size. Questionnaires were administered to students four times over two consecutive school years. Fall surveys ascertained events from the previous summer while spring surveys ascertained events during the school year. All 9^{th}, 10^{th}, and 11^{th} grade students were asked to complete the questionnaires during the first year, and all 10^{th}, 11^{th}, and 12^{th} grade students were asked to complete the questionnaires the second year. Participation declined with each survey; the initial survey included 13,869 participants from 41 high schools, while the fourth and final survey included 7,802 participants from 35 schools. A brief midyear work and injury survey was administered to a sample of students during the second year to evaluate differing periods of recall.

6. Results/Findings (preliminary or final observations and conclusions)

Using a very broad definition of work (paid or unpaid work or chores), this study found that the vast majority of rural Minnesota adolescents are engaged in work or chores. Data from the most complete surveys (first year) showed that just over 80% of 9^{th}-11^{th} grade students reported some work during the summer, while 65% worked at some point during the school year. More girls reported working than boys both during the summer and school year, and the proportion of adolescents working, as well as their work hours, increased with grade level and age. About one out of ten reported jobs were related to agriculture. The majority of agricultural jobs were with traditional farms and there appeared to be no shift toward agribusiness work versus traditional farm work. Among students who completed all four surveys, 23% reported at least one agricultural job over the two-year period. About 9% of adolescents reported one or more injuries both during the summer and during the school year. About one in five injuries occurred at work during the summer and about one in eight injuries occurred at work during the school year. Agricultural injuries were reported by 0.5% of students during the summer and by 0.3% of students during the school year. In a multivariate analysis, age, current smoking, agricultural work, farm residence, obesity, and increased work hours were significantly associated with work-related injury during both the summer and school year. Male gender and reduced sleep hours were also significantly associated with work-related injury during the summer. Among students who completed all four surveys, about 4.5% of working students reported at least one agricultural injury. Ever-diagnosed asthma was reported in 12.6% of students during the initial survey and smoking, female gender, and obesity were significantly associated with risk of asthma, while farm residence was protective. There was inconsistent evidence of a recall bias for injury and work.

This survey confirms that the great majority of rural Minnesota adolescents participate in work or chores, both during the summer and school year. Many rural youth are engaged in agricultural work activities, regardless of whether they reside on a farm. About one in ten jobs were related to agriculture and there was no evidence of a shift in patterns of agricultural work over the span

of this study. Work-related injuries comprised only a small portion of total injuries, and agricultural injuries represented a small proportion of total work-related injuries. Nearly one in eight students reported ever-diagnosed asthma. Falling participation rates and a sharp decline in reported rates of multiple-item survey questions (injury, work, asthma) on the second year surveys limited their usefulness and suggest that fewer or shorter surveys are warranted. Survey data should be useful in targeting intervention and prevention activities.

7. Outputs (reports, publications, products, methods, etc.)

Report: Williams AN, Langner DM, Lindgren PG, Brunner W, Hickman C, Hill D, Boyle D. Childhood Agricultural Trauma Evaluation System, Final NIOSH Technical Report, February 2006. 198p.

Publication: Brunner WM, Lindgren PG, Langner DM, Williams AN, Yawn BP. Asthma among rural Minnesota adolescents. Journal of Asthma 42(9):787-792, 2005.

Presentation: Brunner W, Langner D, Williams A. Keysser J. Asthma in Rural Minnesota Adolescents, CDC 4th National Asthma Conference: Winning with Asthma, Atlanta, GA, April 14-16, 2004.

Presentation: Williams AN, Langner DM, Lindgren PG. Childhood Agricultural Trauma Evaluation System, NIOSH Childhood Agricultural Safety and Health PI Research Conference, Pittsburgh, Pennsylvania, September 2004.

Minnesota Department of Health Fact Sheet and Press Release: Asthma in Rural Minnesota Adolescents. May, 2004
http://www.health.state.mn.us/divs/hpcd/cdee/asthma/documents/RuralAdolescents.pdf

Report: Asthma in Minnesota – 2005 Epidemiology Report. Asthma Program, Minnesota Department of Health, Minneapolis, MN. September 2005.

PhD Dissertation, University of Minnesota. (Pending as of 10/31/06).

8. Outcomes (how outputs have been used, e.g. change in behaviors, processes, technologies, guidelines, etc. that have made a difference in measurable endpoints related to exposures or health and safety indicators)

This project was funded under the NIOSH program area, "Research to Strengthen Occupational Safety and Health Surveillance." This study was designed to evaluate a surveillance strategy to identify work experiences, injuries, asthma, demographic data, and other possible risk factors for those outcomes in a representative rural population of Minnesota adolescents. Study outcomes can be characterized in terms of surveillance methodology and surveillance data. Surveillance Methods. By using broad definitions of work and injury and in-school questionnaires, this study provides a broader look at youth work, injury, and asthma than studies of only farm families or only emergency department admissions. Students were surveyed four times over two consecutive school years. While in-school surveys and a stratified random sample design proved to be a cost-effective method to obtain work, injury, asthma, and other data from

adolescents, interpretable data were largely limited to the initial two surveys. For the final two surveys, a sharp decline in participation at both the school level and individual level were evident. In addition to the declining participation, even among those students completing the final two surveys, a significant decline was noted in positive responses to the key multi-part questions involving injury, work, and asthma (declines not supported by other concurrent data sets).

Surveillance data. Key findings from the two initial surveys have been disseminated in two separate communications to all participating high schools. Unfortunately, the study protocol did not include time or resources for follow-up to determine how schools may have utilized these findings to address issues related to occupational health and safety among their students. Work and injury data have not been more broadly disseminated or published pending completion of a doctoral thesis. However, asthma prevalence and risk factor data have been widely disseminated and utilized by the Minnesota Department of Health (MDH) CDC-funded program, "Addressing Asthma from a Public Health Perspective." Asthma data from this study represent the best estimates to date of asthma prevalence in rural Minnesota adolescents and prevalence and risk factor data have been disseminated through a published paper, an MDH press release, and inclusion in the MDH Asthma Program's 2006 asthma burden report, "Asthma in Minnesota." These data continue to be utilized by the MDH Asthma Program and its partners in program planning and will inform the 2007 update of the state's "Strategic Plan for Addressing Asthma in Minnesota."

Title: **The Wisconsin Youth Employment Training Pilot Program**

Abstract

This project will develop and implement a new model for youth occupational injury surveillance in Wisconsin. This model will link injury surveillance with the Wisconsin youth work permit system. Within the next two to three years, the Wisconsin Department of Workforce Development (DWD) plans to computerize the current child work permit system. Now, during the initial computerization planning process, is an opportune time to develop a surveillance component that can be incorporated into the work permit application system. Upon successful completion, the proposed pilot study could affect the statewide implementation of the DWD program and expand the linked injury surveillance and the work permit application system to all of the public high schools in Wisconsin.

There have been no youth surveys to determine the incidence of occupational injuries in Wisconsin. Existing data comes from Workers' Compensation Claims. Currently there is no comprehensive occupational safety training program for working Wisconsin youth nor is there easy youth access to safety information or a mechanism for getting questions answered.

The project will:

- Develop a computerized youth work permit application.
- Develop and maintain a computerized work permit database in order to make sure that jobs applied for are not prohibited by State or Federal rules, or individuals whose permits have been revoked do not receive another.
- Develop a computerized safety training program for working minors.
- Develop a computerized survey for minors who are working that can be administered during school.
- Create a website/hotline to address any student work safety concerns.

Data from the anonymous school based surveys will be used to determine whether youth who have obtained a work permit are less likely to experience a work related injury.

a. Specific Aims

This research project will develop and implement a new model for childhood occupational injury surveillance. This model will link injury surveillance with the childhood work permit system. Within the next two to three years, the Wisconsin Department of Workforce Development (DWD) plans to computerize the current child work permit system. Now, during the initial computerization process, is an opportune time to develop a surveillance component that can be incorporated into the work permit system. Upon successful completion, the proposed pilot study could affect the statewide implementation of the DWD program and expand the linked injury surveillance and the work permit system to all of the public high schools in Wisconsin.

Program goals:

- Reduce the incidence of injury and death for Wisconsin working children.
- Provide an educational program for children so they become knowledgeable about basic occupational health and safety principles.
- Identify and remove youths who are working in hazardous situations and prevent them from working in jobs prohibited by State or Federal rules.
- Educate employers who are attempting to employ youths in prohibited jobs, who are having higher rates of injury, or who have an unsafe work environment. Companies that have fewer than 250 employees would be given information about OSHA Consultation services and how those free services could benefit them and their employees. Because OSHA Consultation is totally voluntary, the company would need to call and invite the consultants to their facility to assist them with any problem they may be experiencing. A referral to an OSHA Enforcement agency would also be done when the situation warranted.

It is our goal that this pilot program will not end once the program has been completed. By working with the Department of Workforce Development, this program eventually could be implemented in every public school in the State of Wisconsin. The Bureau of Occupational Health and the Department of Workforce Development want all of our children educated about occupational hazards so they are less likely to become injured while working.

We also want to create a program that could be easily implemented by other states that would like to create a similar program for their children. Wisconsin would be able to work with individual states to provide information about the best ways to start their own educational program.

This program will be completed in coordination with the Department of Workforce Development and the Department of Public Instruction and would be tested in four public high schools: two rural and two urban schools. This would allow us to see how the program would work with students who are working primarily in the private sector as well as students who are working on farms and the informal working sectors. The program will be comprised of four components:

1. Computerize work permit applications so that Federal or State rules (copies of these rules can be found in Appendices B and C) do not prohibit the jobs applied for. This component will be done in conjunction with the Department of Workforce Development, the department which currently oversees the work permit system. In the new computerized work permit system, if a child enters a job description that is in violation of State or Federal rules, the work permit will not print out and would not be issued. The denied permit will be flagged. This will allow us to intervene and make sure that the child does not work at all in those hazardous sites and therefore reduce the risk of injury or death for the children involved. The system will also determine if the child has had a revoked permit or other violations that will disqualify the child from receiving a (new) permit.

2. An anonymous cross sectional computer survey at each of the participating pilot schools will be developed and administered to all working minors (regardless of whether they have been issued a work permit). The survey will be completed every six months. All students during a particular class (for example, a mandatory English, Math, or computer class) will complete this questionnaire by accessing a secure computer system or website. Paper forms could be used as well to complete it. The survey will ask specific questions to determine if the student is being asked to do tasks that are prohibited by State or Federal rules and if tasks they are currently performing are different from those stated on the work permit. The survey will also determine if the student is being asked to do tasks

that he/she feels are unsafe, why they feel it is unsafe. We will also learn if they had been injured on the job that quarter and how the injury occurred. This will allow us to get more accurate data regarding the types of injuries the children have had during the quarter. The survey would also ask the students with work permits if they are still working and if the job listed on the work permit is the same as what he/she is presently doing. Although anonomous, this information will allow us to focus intervention programs toward industries that seem to have the higher rates of injury for children and to quickly intervene for the children who voice concerns about working in an unsafe environment, before they become injured. We will also be able to work with individual companies to educate them about the tasks children are able to legally perform if it is shown that a company is placing children in work activities that are hazardous. If necessary, other referrals to OSHA Consultation or OSHA Enforcement would be made in order to ensure the safety of the working children.

3. A computerized training program for students will be developed so that they can receive accurate information regarding how to work safely and what jobs they are able to perform in the State of Wisconsin. Currently, there is no formal training program in Wisconsin to train working minors about occupational safety and health issues. A computerized training program will allow the students to complete the training program at their own pace and would give all students a basic understanding about safety in the workplace and the importance of working safely. By computerizing the data, it will also ensure uniformity of the data being taught throughout the school systems of the pilot schools.

4. A website/hotline for students to ask questions or voice concerns regarding unsafe work practices or other work related questions will be developed. This communication method will allow students to express concerns that might otherwise not be discussed with parents, teachers, or others. This will allow us, if necessary, to quickly refer the situation to the Department of Workforce Development or other regulatory agency so that the Department of Workforce Development (DWD) or other agency could intervene on behalf of the student so that they will not be injured on the job. This will also give the student a sense of empowerment so that they will also be less likely to allow unsafe working conditions to occur when they are working adults.

b. Background and Significance

At the State and Federal levels, we hear speeches delivered expressing how our children are a priority and how they are the future of our country and society. Programs have been created to promote the physical and cognitive development of children so that they can achieve their maximum potential. Our country has taken pride with its health promotion and hazard reduction activities, but often overlooked are the hazards a child may encounter while on the jobsite. More than 75 years ago, the U.S. Children's Bureau in the Department of Labor was developed to end the exploitation and hazardous conditions working children were subjected to. Unfortunately, unsafe conditions still continue to exist. Even today in Wisconsin, we recently read about the illegal working conditions an employer subjected Wisconsin children to and how those conditions led to injury and deaths.

A review of the Wisconsin Worker's Compensation data for 1997 was done to specifically look at children who were injured while working. The results showed that there were 550 non-fatal injury claims for children aged 10 through 17 years old. One farming fatality of a 12 year old child was also noted by the Wisconsin Fatality Assessment and Control Evaluation (FACE) Program. During 1997, there were 26 Worker's Compensation claims filed on behalf of Wisconsin children aged 10 (5), 12 (3), 13 (4), and 14 (14). Their injuries included 8 lacerations;

4 contusions; 3 fractures; 3 strains; and 1 each of inflammation, sprain, crushing, and puncture injuries; as well as 4 other unspecified injuries. The industrial sectors in which these children were predominately employed were newspaper publishing (7), eating/drinking places (6), timber tracts (2), and construction (2).

During 1997, 524 Wisconsin children aged 15 to 17 years of age filed Worker's Compensation claims for non-fatal injuries. There were 43 (8.2%) 15 year olds, 183 (34.9%) 16 year olds, and 298 (56.9%) 17 year olds. For the children aged 15 – 17, the leading type of injury claims were strains (124), lacerations (109), contusions (60), burns (40), and fractures (31). Thirty-percent (158) worked in eating, and/or drinking places, 9% (49) in grocery stores, and 3% (17) each in department stores and skilled nursing facilities. The types of injuries that predominated in eating and drinking places were lacerations (52), burns (30), strains (21), and other specific injuries (16). In grocery stores, most injuries involved strains (15), lacerations (10), or contusions (9). In department stores, strains (6), other specific injuries (5), and contusions (4) predominated; however one electrical shock was reported. In skilled nursing care facilities, strains (9), and other specific injuries (3) accounted for the majority of reported claims. In the miscellaneous amusement and recreation sector, 2 fractures were noted in addition to lacerations (3), strains (3), and other specific injuries (3).

When looking at all children aged 10 to 17 who were Worker's Compensation claimants in 1997, about three fourths were clustered in the retail trade or service industries. An additional 70 young claimants were employed in agriculture/forestry, construction, and manufacturing, which are high risk industrial sectors. Because Worker's Compensation only records injuries that are severe enough to cause the employee to be unable to work at least three consecutive days due to the injury, it is unknown how many Wisconsin children are injured and do not have those injuries reported as a Worker's Compensation claim. Some other problems using only Worker's Compensation data for calculating injury rates for children are that we know many children work on family farms and in the informal sector, which we do not have reporting or claimant mechanisms for non-fatal injuries. We must also acknowledge the incompleteness of Worker's Compensation data that results from eligibility requirements, as well as the fact that employees must seek out this form of compensation. With the review of injuries in 1997, it has been shown that many children were injured on the job in Wisconsin severely enough to file for a Worker's Compensation claim and some of the children were engaged in hazardous work contrary to child labor laws in Wisconsin. Copies of 1997 and 1998 Worker's Compensation data for youths can be found in Appendix I.

According to the Wisconsin Department of Workforce Development (DWD), there are on average 130,000 work permits issued annually to Wisconsin youths. (A copy of a Wisconsin work permit can be found in Appendix A.) According to the DWD, the issuing of work permits began around 1916 in the State of Wisconsin and the process has not changed since it was first created. Paper work permits are completed at a designated work permit issuing site and then are mailed back to the DWD. The problems that the DWD is encountering are that the work permits are being sent to their agency anywhere from one to four months or more after they have been issued. This leaves the children at risk if they are working in a prohibited work area for a length of time before the work permit is revoked.

c. **Research Designs and Methods**

This research project will develop a new model for childhood injury surveillance. This model would create an opportunity to link surveillance with the work permit system. Since the Department of Workforce Development (DWD) plans to computerize the work permit system for the State of Wisconsin, the augmentation of surveillance with the work permit system could be

done during the initial computerization process. The pilot study could also affect the statewide implementation of this program by expanding the linkage of surveillance and the work permit system to all of the public high schools in Wisconsin.

Analysis of the surveillance data from this youth injury surveillance model will address the following hypothesis.

Hypothesis: Does obtaining a work permit reduce the incidence and severity of injuries and diseases for employed minors?

Definitions

A minor is an individual under 18 years of age. This definition may be subject to change due to discussions and input from DWD and the Department of Public Instruction (DPI). The case definitions of injuries and disease will be defined during year one of the study prior to any implementation of the program. The case definitions will be reviewed by the State Occupational Surveillance Consortium (SOSC) to ensure that the study designs and data collection protocols will be uniform so that other states could use them.

The surveillance study will enroll a cohort of students from four Wisconsin public high schools. Two urban public high schools of approximately 3,000 students each and two rural public high schools of approximately 250 students each will be selected, creating an estimated cohort size of 6,500 students. Parental consent would be obtained prior to performing the student surveys. This consent will be either a formal written consent or a passive consent. With passive consent, the principal (or other person such as the superintendent or school board) would give information to each parent explaining what the survey is and how the information is to be used. The parent must contact the school if the parent didn't want the student to participate in the survey. With a formal consent, the parent will be given information and then must sign the written consent to allow their child to participate in the survey. The Department of Public Instruction (DPI) has indicated that each school district is independent and most have adopted methods of obtaining consents. DPI reports that consent would be either formal or passive depending on the school and that many of the schools already have consent forms for formal parental consents. DPI said we would need to ask if their forms would be required if that school district felt that formal consents were necessary.

Wisconsin is a good choice for this type of study because both the Department of Workforce Development and Department of Public Instruction are highly supportive (see letters of support). They support a pilot program and have offered their assistance to ensure that the pilot program will succeed. Both Departments have voiced their concerns regarding youth related injury and disease and feel this program would be a viable method to reduce those conditions.

Title: **Work injuries among young people: A prospective study**

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List of abbreviations

National Occupational Research Agenda (NORA)
Survey of Labour and Income Dynamics (SLID)
Work Disability Absence (WDA)
Institut de recherche Robert-Sauvé en santé et en sécurité du travail (IRSST)
CEGEP (a French acronym meaning College of General and Vocational Education)

Abstract

Issue addressed: This study examined the relative contribution of individual factors and job characteristics to the risk of lost days of work due to a work-related disability among Canadians 16 to 24 years old.

Approach: Our analyses used a representative sample of young workers from a longitudinal survey. Our regression analysis of work-related disability included the following predictors: age, gender, physical demands of the job (manual, non-manual, and mixed), hours worked, highest education achieved, multiple concurrent job, job tenure, school activity, and living in a rural or urban area.

Key findings: Young workers holding manual jobs were at increased risk for a work disability absence compared to young workers with non-manual jobs. Low education level was associated with the increased likelihood of a work disability absence. Other demographic factors such as gender were not independently associated with work disability absences.

Implications: This is the first longitudinal study on young workers that found that job characteristics are the predominant risk factors for work disability absences for young workers, and individual factors such as gender were not independently associated with the outcome. Young workers with less education appear to be particularly vulnerable, possibly due to inadequate job skills or particularly dangerous jobs.

Definition of problem being addressed

Work injuries and illnesses among American and Canadian young people 15 to 24 years old are a public health concern. In developed countries, both teenagers and young adults have consistently higher rates of work injury than older workers (8-10). For U.S. teenagers alone, the economic cost of work injuries was estimated at $5 billion in 1993 (11). The purpose of the current study was to examine the relative contribution of individual and job factors to injury risk in a prospective study.

Among young workers, the risk of work injuries is often attributed to individual characteristics. For example, young males sustain work injuries at about twice the rate of young females (12). Also, cognitive and physical developmental factors of teenagers are widely believed to increase injury risk, leading to the current emphasis on school- and community-based educational programs in North America (13;14).

The job characteristics can also influence injury risk. Young workers in manual jobs (e.g., stockhandlers, janitors/cleaners), jobs in the goods-producing sectors (e.g., agriculture, manufacturing, and construction) and food service jobs have higher work injury rates than youth in sales jobs or administrative/clerical jobs (12;15;16). In particular, the physical demands of the job have been shown to be associated with the chance of a work injury (17).

With regard to temporal factors, working longer hours is sometimes associated with injury risk (18), possibly due to fatigue or simply a function of increased exposure time (19). Some studies of work injury records find that new young workers are at increased risk of work injury compared to their more experienced counterparts (20-22). However, self-report studies find the opposite relationship (19) or no association between experience and work injury risk (23). These mixed findings may be due to self-report studies not pinpointing when the injury occurred during each worker's job tenure. Had the studies done so, it would have been possible to track the specific risk of injury for each phase of job tenure. Without this detailed analysis, such job tenure findings address cumulative injury risk versus phase-specific risk.

Several methodological limits complicate the risk estimates provided in previous studies. First, most studies of young workers are descriptive and do not adjust for the fact that males are more likely to hold hazardous jobs (e.g., manual work, jobs in industries with higher injury rates) than young females.

Second, for studies using administrative data sources, underreporting may be an issue. For example, studies which rely on workers' compensation claims could fail to capture all work injuries ((24)), especially if filing a claim might affect a firm's insurance premium or increase their risk of being inspected. Underreporting of claims could bias risk factor estimates if the likelihood of reporting injuries to the compensation system differs by industry or by young worker characteristics. Relying on health records (i.e., health care visits) as a data source can also be problematic and lead to reporting bias, since not all injured workers seek health care services. Research shows that only 34 percent of occupational injuries are treated in emergency departments (25).

Finally, virtually no studies have utilized longitudinal data to examine risk of work injury. An exception is Feldman and colleagues' one-year follow-up of high school students on incidence of

musculoskeletal pain (26). In this study, jobs such as baby sitting or non-manual work led to more neck/upper limb pain and back pain (respectively) than those not working at all.

Aims of the project

One of the key aims of this project was to better define the nature and magnitude of injury risk experienced by young workers. In particular, the proposed multivariate analysis of longitudinal data will overcome the threats to causal inference associated. Specifically, we used longitudinal data from a nationally representative sample of teenagers and young adults to examine the relationship between individual, job, and temporal factors and self-reported work absence due to a work-related illness or disability.

Partners

The federal agency Statistics Canada is the custodian of the data that we used for these secondary data analyses and was a partner in making these secondary data analyses possible.

Customers

These findings are relevant to employers who employ young workers, occupational health and safety practitioners, and public policy decision makers who develop and finance youth work injury prevention programs.

Approach

Data and sample

The Survey of Labour and Income Dynamics (SLID) consists of a series of six-year overlapping panels (each of the six years is considered a wave within a panel), with a new panel being introduced every three years to replace the oldest panel (27). Available data from these panels cover the time period from 1993 to 2003 inclusive.

Respondents are interviewed annually about their work experiences over the previous calendar year in up to six jobs and report monthly on the characteristics of each job. These secondary data analyses were approved by the Health Sciences I ethics committee at the University of Toronto.

Population

The target population for SLID is all persons living in Canada, excluding people in the Yukon or Northwest Territories, residents of institutions, persons living on Reserves, and full-time members of the Canadian Armed Forces living in barracks. The initial representative sample of each panel is drawn from respondents of Statistics Canada's Labour Force Survey. For each panel, the sample is approximately 15,000 households, comprising about 31,000 persons aged 16 years and over.

This analysis focused on respondents who were between the ages of 16 and 24 years old and were employed at some point during the observation period.

Outcome, Work Disability Absence

The outcome measure (event) was the first observed occurrence of a work disability absence (WDA) for a person in a given job. A WDA was defined as any absence for one week or greater due to a work related illness or disability. Providing evidence of concurrent validity, this WDA measure showed similar time trends as workers' compensation claim rates in a Canadian province (28).

For each respondent, every job start over the six waves of the panel provided a new person-job episode to be used for the analysis. However, person-job episodes that started prior to the respondent entering the panel were not included in the analysis due to difficulties in determining exposure time and because a WDA could have occurred prior to panel entry.

WDAs were not linked to a specific job when multiple concurrent jobs were being held. Given this, we attributed the work accident of respondents who held multiple concurrent jobs and experienced a WDA to the job identified as the main-job for that month (the job with highest usual hours for that month). A sensitivity analysis was undertaken to assess the impact of assigning the WDA to the respondent's main-job.

For person-job episodes with a WDA, all months of observation after the month of the WDA were excluded. For respondents who held multiple concurrent jobs at the time of a WDA, observed months in all concurrent jobs after the month of the WDA were excluded.

Covariates

Covariates for each person-job episode included in the model were age, gender, job type, hours worked, highest education achieved, having multiple, concurrent jobs, job tenure, school activity, living in an urban versus rural area, and a flag indicating what panel the person-job episode arose.

Age was considered a time-varying covariate, calculated in months and updated each month.

Jobs were classified into three categories of physical demands: manual, mixed, non-manual using the Institut de recherche Robert-Sauvé en santé et en sécurité du travail (IRSST) occupation coding system (29). The coding system is based on observations in workplaces and agreement among experts in the occupational health and safety field on the typical frequency of handling loads and the weight of the load.

Hours worked in a given month for a particular job were assessed by multiplying the average number of paid hours in weeks by the number of weeks worked in that month. Total hours were categorized into four groups (0 to 60, 61 to 120, 121 to 160 and 161 or more hours per month).

Highest education achievement was identified with a three category variable (no secondary degree, secondary degree, post secondary degree) in December of each year of observation.

Job tenure was calculated as the number of months between the start date of the person-job and the current month of observation.

A flag indicating current full time school activity in a given month of observation was used to assess the differences between those respondents who were balancing work and school commitments compared to those who were not.

Given the potential differences in employment patterns and the varying types of jobs held by youth living in urban environments compared to living in rural environments, a flag indicating urban residence was used in the model.

An indicator of the panel (1-4) from which the data arose was also used in the model to control for any difference that may exist between the different cohorts.

Analysis

The complementary log-log model for continuous time processes, as described by Allison (30), was employed. This model is based on the assumption that events are generated by a proportional hazards model with an exponential hazard within a particular time period, but makes no assumptions are made about the overall shape of the hazard across time periods. The analysis was undertaken on a month by month basis. Therefore, a single person-job episode could contribute a maximum of 72 months of observation over the six year observation period. This modelling framework allows for time-dependent covariates.

A list-wise deletion was employed, deleting any observation that did not provide complete responses to all covariates. All covariates were entered in the analysis model simultaneously.

Given the complex nature of the survey and the non-independence that arises due to the clustering of person-job episodes within individuals (respondents may hold more than one job over the six-year period of observation either consecutively, concurrently or both) we calculated robust variance estimates using a weighted bootstrap method with 1000 replicates to adjust variance estimates. The bootstrap technique assumes independence across respondents when estimating the coefficients but accounts for the true non-independence of respondents when estimating the variance of coefficients (31). The weights take into account sampling probabilities and non-response. The weight from the first wave of each panel was used for all subsequent waves of data.

Potential for bias due to sample selection and proxy responses

To assess the potential impact of a person-job episode due to exclusion or non-response, an analysis of those jobs selected for analysis compared to those jobs not selected for analysis was undertaken. A job-based logistic regression model was developed where the outcome was whether or not the job was included in the analysis with the independent variables being the job holder's age (at the start of the job) and gender.

The SLID allows one household member to answer questions on behalf of any or all other members of the household, provided he or she is willing and able to do so (i.e., proxy response). Given this study examines 16 to 24 year old respondents (and that the younger a respondent the greater the potential to have responses through proxy) an estimate of the impact of proxy reporting was undertaken. A logistic regression model was estimated with the job holder's age

(at the start of the job) and gender as predictors and whether or not the job was reported through proxy response as the outcome.

Results

Background characteristics

The 16 to 24 year old respondents who had complete covariate information and met the study inclusion criteria provided 360,808 person months of observation from 45,125 jobs. During the observation period there were a total of 281 WDAs observed. The number of jobs, person-months of observation, number of WDAs and the WDA rate per 1000 person-months is provided in Table 1 for each covariate.

Table 1. Number of Jobs, Person Months of Observation and Work Disability Absence Rate for SLID respondents aged 16 to 24 years old. Weighted.

	Jobs	Person Months		Work Disability Absence	
	N	N	%	N	Rate per 1000 PY
Total	45125	360808	100.00	281	0.78
Gender					
Female	22452	184879	51.24	122	0.66
Male	22673	175929	48.76	159	0.91
IRSST Job Type					
Manual	21621	149119	41.33	177	1.19
Mixed	13273	110144	30.53	66	0.60
Non-Manual	10231	101546	28.14	39	0.38
Total Hours Worked (month)					
0-60	9623	86995	24.11	22	0.25
61-120	11525	94391	26.16	40	0.42
120-160	18837	145518	40.33	158	1.09
161+	5140	33904	9.40	61	1.81
Highest Education					
Less than High school	11383	65773	18.23	98	1.49
High school	22711	182894	50.69	126	0.69
Post-Secondary	11031	112141	31.08	57	0.51
Multiple Concurrent Job					
No	36348	293000	81.21	252	0.86
Yes	8777	67808	18.79	30	0.44
Tenure (months)					
0-2	13094	24730	6.85	43	1.75
3-4	10290	37597	10.42	56	1.50
5-6	4624	25254	7.00	43	1.70
7-12	8347	18538	5.14	58	3.11
13+	8770	194689	53.96	81	0.42
School Activity					
No	29702	223634	61.98	236	1.06
Yes	15423	137174	38.02	45	0.33
Living in Urban Area					
No	11805	60139	16.67	66	1.09
Yes	33320	300669	83.33	216	0.72

Multivariate regression results

Results of the fully-adjusted multivariate regression analysis examining the antecedents to WDA are presented in Table 2 including the hazard ratio (HR) and the corresponding 95 percent confidence interval (CI). The final column of the table represents the percentage deviation of the hazard ratio from the null value (1.00).

Manual occupations were 165 percent more likely to experience a WDA compared to non-manual occupations (HR: 2.65, CI: 1.59, 4.41) while mixed occupations had only a 70 percent increase (HR: 1.70, CI: 0.78, 3.68).

Total hours worked per month showed a dose response relationship with increasing hours and increasing risk. Jobs with monthly hours between 61 and 120 hours had a 86 percent increase in the likelihood of a WDA compared to jobs with hours between 0 and 60 (HR: 1.86, CI: 0.89, 3.89). A 381 percent increase was seen for jobs in the 120 to 160 hour range (HR: 4.81, CI: 2.15, 10.76) with a 623 percent increase for jobs working greater than 160 hours per month (HR: 7.23, CI: 3.22, 16.22) compared to jobs with hours between 0 and 60.

Respondents who had completed high school or post-secondary education were seen to decrease their risk of a WDA by 51 to 65 percent (HR: 0.49, CI: 0.27, 0.92 and HR: 0.35, CI: 0.17, 0.73 respectively). Little difference in risk was noted between those who finish high school and those that have finished some sort of post-secondary education.

As noted, when a respondent had multiple concurrent jobs and a WDA, the WDA was assigned to the main-job. In a sensitivity analysis for this treatment of the WDA, the WDA was not re-assigned to the main-job. The full multivariate model was then regenerated with no differences in the direction or relative relationship between the original hazards and the hazards from the sensitivity analysis noted. Given the small number of WDAs that are re-assigned this outcome was expected and demonstrates the minimal effect this decision has on the hazard estimates.

Potential for bias due to sample selection and proxy responses results

The three reasons for not being selected for analysis were examined (job started before the period of observation, missing covariate information and non-response during the first wave of the survey). Overall, gender did not vary greatly between those jobs selected for analysis compared to those jobs not selected for analysis. And, as age increased, the likelihood for selection into the final model decreased.

Proxy responses were 1.47 times more likely to be provided for jobs held by male respondents compared to jobs held by females respondents independent of age (CI: 1.34, 1.60). The likelihood of a proxy response was decreased as age increased. For example, proxy responses were 9.72 times more likely to be provided by jobs held by 16 year old respondents compared to jobs held by 24 year old respondents (CI: 6.32, 14.93), independent of gender. By the time respondents were 20 years old, the likelihood decreases to 2.10 (CI: 1.36, 3.24).

Table 2. Estimates of Hazard Ratios for Work Disability Absence

	Parameter Estimate	Standard Error	Hazard Ratio	95 % CI	Percent Change
Intercept	-9.08157	0.97277			
Gender					
Females			1.00		
Males	-0.27592	0.24384	0.76	0.47 , 1.22	-24.11
Age (years)	0.06010	0.04276	1.06	0.98 , 1.15	6.19
IRSST Job Type					
Non-Manual			1.00		
Manual	0.97449	0.25944	2.65	1.59 , 4.41	164.98
Mixed	0.52963	0.39504	1.70	0.78 , 3.68	69.83
Total Hours Worked					
0-60			1.00		
61-120	0.62170	0.37648	1.86	0.89 , 3.89	86.21
120-160	1.57010	0.41127	4.81	2.15 , 10.76	380.71
161+	1.97772	0.41239	7.23	3.22 , 16.22	622.63
Highest Education					
Less than High school			1.00		
High school	-0.70533	0.31746	0.49	0.27 , 0.92	-50.61
Post-Secondary	-1.04555	0.37235	0.35	0.17 , 0.73	-64.85
Multiple Concurrent Job					
No			1.00		
Yes	-0.17401	0.31059	0.84	0.46 , 1.54	-15.97
Tenure (months)					
0-2	-0.55565	0.38290	0.57	0.27 , 1.22	-42.63
3-4	0.19342	0.27224	1.21	0.71 , 2.07	21.34
5-6	0.32052	0.28554	1.38	0.79 , 2.41	37.79
7-12	-0.02507	0.20636	0.98	0.65 , 1.46	-2.48
13+			1.00		
School Activity					
No			1.00		
Yes	-0.48234	0.26869	0.62	0.36 , 1.05	-38.27
Living in Urban Area					
No			1.00		
Yes	-0.15220	0.19831	0.86	0.58 , 1.27	-14.12
Panel					
1			1.00		
2	-0.22443	0.24427	0.80	0.50 , 1.29	-20.10
3	-0.22754	0.26295	0.80	0.48 , 1.33	-20.35
4	-0.67751	0.38777	0.51	0.24 , 1.09	-49.21

Discussion

Findings and limitations

This is the first prospective study of the predictors of work-related disability among young workers. We found young males had a higher work disability absence rate compared to young females. However, the adjusted odds of a work disability absence showed no significant gender differences. The lack of significance in the multivariate model may suggest that gender differences are due to differential work exposures of young males and female workers.

Job characteristics were the strongest predictors of work disability absence. Factors such as the physical demands and hazards of the job have been identified in previous cross-sectional studies as important variables mediating the risk of work injury in this age group (17;19;23). As would be expected, we observed a positive linear association between hours worked and work disability absence, with over time work (> 40 hours / week) showing more than a 600 percent increase in risk.

We found that independent of individual and job factors, a higher education level was associated with a decreased risk of WDA. Studies of adult workers have found higher education levels to be associated with lower risk of work injury (32). Future research might investigate the role of residual confounding since we controlled for only work hours and one of several job characteristics that may be associated with both injury risk and level of education. In addition, understanding the influence of different educational experiences (e.g., high school drop out, work experience programs) on job quality and during the school-to-work transition period may be a fruitful research direction.

Our findings need to be interpreted in the light of certain methodological limitations. Error could have been introduced into the reporting of WDAs by respondents' different definitions of work disability, different recovery times from sustained injuries and different financial pressures to remain at work. Also the type of work and the employers' policies and practices bear on whether a worker needs to take time off work when injured, or whether the worker can be accommodated on the job. These measurement biases would have generally reduced our ability to detect associations with the outcome. In addition, we cannot rule out the possibility that a WDA was a recurrence of a condition that arose in a previous job prior to entry into the panel.

The panel design led to a portion of the jobs held by youth to be excluded because we did not observe part of the work episode and therefore we did not know if a WDA occurred in the job prior to entering the panel. Therefore these findings may not generalize to young people's jobs with longer tenures. The information provided by proxy may be subject to recall biases that may further affect accuracy. Finally, we were not able to include other factors that may also have influenced the likelihood of a work disability absence such as previous work experience.

Implications and summary

Our findings support the notion that an important supplement to current school- and community-based education programs on work safety would be reducing the physical hazards youth encounter at work, potentially through technical safety improvements in the equipment and work environment.

In terms of work hours, U.S. Federal laws have restrictions on hours of work for youth 16 and under (6). However, our findings raise the question of whether work hour restrictions should be considered for older teenagers as a method of decreasing work disability.

Finally, young workers with less education appear to be a particularly vulnerable population, possibly due to inadequate job skills or particularly dangerous jobs (i.e., residual confounding of hazard exposures). Consequently, job training and injury prevention programs targeting this subgroup of workers may be warranted.

In summary, this prospective study indicates that job characteristics are a key risk factor in determining occupational health among young people. This study also contributes methodologically to the young worker literature by modelling the complex work patterns during the school-to-work transition.

Outputs

Breslin FC, Pole JD, Tompa E, Amick III BC, Smith P, Hogg-Johnson S. Antecedents of Work Disability Absence Among Young People: A Prospective Study. Annals of Epidemiology, submitted.

Outcomes

Our findings on the etiology of young worker injuries fit well into the public health approach to prevention (1)). Etiological research can help occupational health and safety practioners to identify modifiable risk factors and guide intervention development. Accordingly, our findings suggest that an important supplement to current school- and community-based education programs on work safety would be reducing the physical hazards youth encounter at work, potentially through technical safety improvements in the equipment and work environment. The practical implications of finding that young workers with low education are at risk is that job training and injury prevention programs targeting this subgroup of workers may be warranted.

Our findings on the consequences of work injuries also figure into a public health approach to prevention in that it is important to document the burden of work injury on young workers. Our finding of substantial earnings losses among injured young workers can raise awareness among employers, workers, OHS practitioners and policy makers that injuries potentially can have more than a health cost for the individual.

This finding is also relevant to workers' compensation systems. If such earnings losses are found to be persistent among injured young workers, this information can be used to revise compensation policies so that they are more equitable to those injured while their earnings trajectories are still increasing.

In addition to dissemination of the findings through the scientific literature, the Institute for Work & Health has had a dedicated department for knowledge transfer and exchange since 1999. With assistance from the Institute for Work & Health knowledge exchange specialists, dissemination opportunities for the research will include web-based and print newsletters, media releases, research summaries, and stakeholder meetings. These dissemination strategies will allow us to network with interested researchers, stakeholder organizations, and labour/employer groups in North America.

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