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Proceedings of the NIOSH Symposium on Efforts to Prevent Injury and Disease Among Agricultural Workers

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
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National Institute for Occupational Safety and Health

PROCEEDINGS OF THE NIOSH SYMPOSIUM ON EFFORTS TO PREVENT INJURY AND DISEASE AMONG AGRICULTURAL WORKERS

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FOREWORD

In 1990, the Congress directed the National Institute for Occupational Safety and Health (NIOSH) to undertake and lead a series of surveillance, research, and intervention initiatives, which when sustained over a period of time, would result in significant and measurable impact on reducing occupational diseases and injuries among American workers in agriculture. The Congress believed that NIOSH was in a unique position to lead a comprehensive national effort to prevent injury and disease in agriculture. The NIOSH program is intended to provide a balanced approach to substantially reduce the incidence of fatal and nonfatal traumatic injuries, chronic injuries, and occupational diseases among the 3.4 million agricultural workers in the U.S. Since 1990, NIOSH has expanded its research program to address the safety and health of workers in agriculture and has awarded 47 cooperative agreements to 26 states to enhance the Institute's existing program in the areas of surveillance, research, and intervention.

The purpose of the *NIOSH Symposium on Efforts to Prevent Injury and Disease Among Agricultural Workers*, which was held in Kentucky in 1993, was to highlight accomplishments by both the states and NIOSH in reaching our common goal of improving the health and safety of agricultural workers and their families. The general design of this first symposium was to afford, insofar as possible, presentations by each of the state and NIOSH programs in plenary sessions. This format allowed for an exchange of information among all participants. The sessions were divided into the three main prevention categories of surveillance, research, and intervention. In addition, the symposium included a poster session.

I wish to thank Melvin L. Myers, Tim Groza, and Betty Dryden for their hard work in planning this symposium. My thanks also to Rosemary Cianfracco for assisting with the conference and special thanks to Jan Basehart for all of her hard work in editing these proceedings.

Richard A. Lemen

Richard A. Lemen, Ph.D.
Deputy Director, National Institute for
Occupational Safety and Health

TABLE OF CONTENTS

FOREWORD iii

Opening Session 1
Moderator: *Tim W. Groza, M.P.A.*

Welcome to Kentucky 3
State Representative Mark Farrow

Kentucky's Role in Agricultural Health and Safety Activities 6
Rice C. Leach, M.D.

NIOSH's Role in Agricultural Health and Safety Activities 9
Melvin L. Myers, M.P.A.
Special Assistant to the Director, NIOSH

Plenary Session I - Surveillance 20
Moderator: *John P. Sestito, J.D., M.S.*

Occupational Agricultural Injury Surveillance in California 20
Carol S. Conroy, Ph.D.

Agricultural Hazard Surveillance Training 25
David H. Pedersen, M.S.
National Institute for Occupational Safety and Health

Injuries Related to Potato Harvesting in Aroostook County, Maine 30
Norma Stacey-Scott, R.N.

Real-Time Video Monitoring of Noise in Agriculture 34
Alice L. Greife, Ph.D.
National Institute for Occupational Safety and Health

An Investigative Protocol for the Evaluation of Safety and Health Hazards on Family Farms 38
Tod E. Kramer
Colorado State University

Questions and Answers
Plenary Session I - Surveillance 43

Luncheon Speaker 45
E. Roberta Ryder
Executive Director, National Migrant Resources Program, Inc.

Plenary Session II - Research 56
Moderator: *Steve Olenchock, Ph.D.*

A Two-Part Study of Agricultural Health and Safety Communication 56
Judy B. Oskam
Oklahoma State University

Air Sampling Strategies to Assess Exposure-Response Relationships for Respiratory Disease in Dairy Farmers 59
Peter F. Waldron
University of Iowa

Pulmonary Toxic Components in Wheat Dust at Farms and Elevators in Colorado 63
Don Beard
Colorado State University

Green Tobacco Sickness: An Occupational Hazard Among Tobacco Harvesters 67
Terri Ballard, Ph.D.
National Institute for Occupational Safety and Health

Minnesota Cancer Control in Farmers Study 72
Peter W. Carr
University of Minnesota

Questions and Answers
Plenary Session II - Research 77

Plenary Session III - Intervention 80
Moderator: *Eugene Freund, M.D.*

Farm Safety 4 Just Kids Chapter Development: Capacity Building in Local Communities to Utilize NIOSH Developed Resources 80
By *Marilyn Adams*
Farm Safety 4 Just Kids
and *Gayle Olson*
University of Iowa

Agricultural Educational Resources Centers 86
Stephen Hudock
National Institute for Occupational Safety and Health

Computer Based Safety Programs for Middle and High School Youth 89
Glen H. Hetzel, Ph.D.
Virginia Tech

Questions and Answers
Plenary Session III - Intervention 97

Plenary Session IV - Surveillance 99
Moderator: *Barbara Connelly*

A Farm Family Health and Hazard Surveillance Program for Cash Grain Farmers in Ohio 99
J.R. Wilkins, III, Dr.P.H.
Ohio State University

Mandatory Reporting of Farm Injuries in North Carolina 103
Susan A. Randolph
North Carolina Department of Environment, Health and Natural Resources

Minnesota Farming Health Project Survey Results and the Response to Surveillance Data at the Local Level 107
Catherine Lexau, R.N., M.P.H.
Minnesota Department of Health

The Farm and Agricultural Injury Classification Code (FAIC) 115
Dennis J. Murphy, Ph.D.
Penn State University

Occupational Health Surveillance of US Farm Workers 120
Lorraine Cameron, Ph.D, Nina Lalich, Joyce Salg, Ph.D, Janie Gittleman, Ph.D. and Carol Burnett
National Institute for Occupational Safety and Health

Questions and Answers
Plenary Session IV - Surveillance 125

Plenary Session V - Research 127
Moderator: *John Myers*

Agricultural Research at the National Cancer Institute 127
Aaron Blair, Ph.D.
National Cancer Institute

Assessing the Health and Injury Concerns of African American Farmers: The First Steps 132
Thomas A. Arcury, Ph.D.
University of Kentucky

Locus of Agricultural Injury Control: A Cross Cultural View of Hispanic Farmworkers and Farmers Beliefs About Work Safety 138
Martha C. Stiles
University of California at Davis

Roll-Over Protective Structure (ROPS) Design and Testing for Pre-ROPS Tractors 150
Paul D. Ayers, Ph.D.
Colorado State University

Development of Analytical Methods for Agricultural Chemicals 154
Eugene R. Kennedy, Ph.D.
National Institute for Occupational Safety and Health

Questions and Answers
Plenary Session V - Research 159

Plenary Session VI - Intervention 161
Moderator: *David L. Hard, Ph.D.*

Agricultural Safety and Health Ohio-Style 161
Thomas L. Bean, Ph.D.
Ohio State University

Hearing Conservation Program for Agricultural Youth 164
Mary Jo Knobloch
National Farm Medicine Center, Marshfield Clinic

Agricultural Safety and Health Promotion Program for Older Kansans 169
John Kramer
Kansas State University

Using the Model Safety Program Concept to Establish Agricultural Safety Programs . . . 172
C. Lance Fluegel

University of Arizona

Impact of Farm Safety Educational Programs on Farm Operator Safety Awareness and Behavior 176
Charles V. Schwab, Ph.D.
Iowa State University

Questions and Answers
Plenary Session VI - Intervention 185

Plenary Session VII - Surveillance/Intervention 187
Moderator: *Robert F. Herrick, Sc.D.*

A Statewide Surveillance Program for Agricultural Injuries 187
Larry L. Shireley
North Dakota State Department of Health and Consolidated Laboratories

Development and Refinement of On-Farm Physical Screening for Older Farmers 191
Deborah B. Reed, R.N.
University of Kentucky

Multimedia Safety Training 198
Joel B. Lown
University of Tennessee

Farm Women's Seminars May Be Impacting Missouri's Safety Behaviors 202
David E. Baker
University of Missouri

Comparing Kentucky Farm Injury Severity with Existing Injury Models 207
Michael Auslander, D.V.M., M.S.P.H.
Kentucky Department for Health Services

Mortality After Workers' Compensation Claims for Disease and Injury in Agriculture . . 213
James Beaumont, Ph.D.
University of California at Davis

Questions and Answers
Plenary Session VII - Surveillance/Intervention 218

Plenary Session VIII - Research/Intervention 221
Moderator: *Robert McKnight, Sc.D.*

A Study of Osteoarthritis of the Knee and Hip in Dairy Farmers 221
John J. May, M.D.
Director, New York Center for Agricultural Medicine and Health

Filling the Gap: Recruiting Professionals for Careers in Agricultural Safety and Health . 228
Barbara Pies, M.S.

Stimulating Interest in Pesticide Protection 232
Lori M. Vidlak
Nebraska Department of Health

Knowledge Gaps About Stress-Related Disorders Among Agricultural Workers 237
Larry Chapman, Ph.D.
University of Wisconsin

Questions and Answers
Plenary Session VIII - Research/Intervention 246

Plenary Session IX - Research 248
Moderator: *Thomas R. Bender, M.D., M.P.H.*

Secondary Analysis of Focus Group Data in Investigating Farm Stress 248
Pamela Kidd, Ph.D.
University of Kentucky
and
Frederick E. Scharf, M.A.
National Institute for Occupational Safety and Health

Questions and Answers
Plenary Session IX - Research 261

Closing Comments 264
Richard A. Lemen, Ph.D.
Acting Director, NIOSH

ACRONYMS 268

INDEX 270

Opening Session

Moderator:
Tim W. Groza, M.P.A.

MR. GROZA: Welcome to the NIOSH Symposium on Efforts to Prevent Injury and Disease Among Agricultural Workers. Since 1990, NIOSH has been developing a comprehensive national program for the prevention of diseases and injuries among agricultural workers and their families. Most of you in the audience today have been active participants in these efforts, and we really look forward to an exciting time for the next two and a half days.

Before I introduce our first speaker, however, I want to make some general announcements that will help you during your stay at the Hyatt. You have probably already seen the poster session which is located in the adjacent rooms. These posters depict various projects that our NIOSH grantees and some of our NIOSH employees have been working on during the past year. For those of you who are exhibiting in those rooms, however, we would like you to take the posters down after the final plenary session on Thursday afternoon. Also, for those of you who are presenters and would like to preview your slides, there is a preview room adjacent to the poster room. There is a slide projector set up with a portable screen. Those of you who want to make last minute changes, you can feel free to use that room.

You have received a lot of material in your packets. One of the books is called the "NIOSH Fact Book." It is a 1993 program fact book which provides fact sheets containing specific information relating to projects addressing the NIOSH National Program. I want you to take these books back with you and review them. They are still in the draft stage. If there are any changes that need to be made, you can send those to me by September 17. Feel free to do some editing on those. A lot of you have already sent in your material, but there are some of you that have taken the opportunity to do so.

A reminder about our final plenary session on Friday. It will not be in this ballroom, it will be in the Regency Ballroom East. That is in your program, but I just want to remind you so that you do not come here on Friday morning and find another session in progress.

For those of you who are expecting messages, there is a message board outside in the lobby. There are some fine restaurants within walking distance of this area. There is a Victorian mall across the way. It has some fine restaurants, for those of you who would like to go out to eat tonight.

We have a luncheon planned for noon today, and be sure to wear your name tag because that is going to be your ticket to lunch. It is your pass, so be sure to have that name tag on your person.

Also in your packet, there is a draft "Farm Safe 2000 Newsletter." It is the summer edition and we are going through final editing, and it is in your folder along with an item that states that we want your news. That is exactly right. We want you individuals in the States and the institutions to send us relative news about agricultural safety and health issues in your particular area. The managing editor is Janice Huy. She is in Cincinnati, and will help you prepare a news article for this newspaper.

Wednesday evening, in this room at 7:00 PM, there is going to be a meeting of anyone interested in responding to the rains and flooding in the midwest. Gene Freund from NIOSH is coordinating that effort and you may want to contact him. Gene, are you here? Good. ■

Welcome to Kentucky

By *State Representative Mark Farrow*

Mr. GROZA: Our first guest speaker this morning is representative Mark Farrow. He is the State Representative from Harrison and Scott counties in Kentucky. He has been a member of the Kentucky House of Representatives since 1980, and is a practicing attorney in Georgetown, Kentucky.

Representative Farrow has previously served on committees on legislation, labor and industry, counties and special districts, judiciary and elections, and constitutional amendments. He is currently serving as the Chairman of the House Agricultural and Small Business Committee, as well as the Chairman of the Personal Service Contract Review Committee. Additional legislative committee membership includes the Economic Development Committee, Banking and Insurance, Budget Subcommittee on General Government, Tobacco Task Force, Task Force on Business Climate in Kentucky Committees, and the Central Kentucky Caucus and Capital Caucus. Please welcome State Representative, Mark Farrow.

MR. FARROW: Thank you Tim. It is a real pleasure to be here with you this morning. I would like to welcome you to Kentucky for a very important event because I know in many states, as in Kentucky, agriculture is still the number one industry. We are blessed in Kentucky with a multitude of heavy industry, but agriculture is still the number one industry in Kentucky. A lot of people make a good living from agriculture and the state is very fortunate that we get a lot of tax dollars from agriculture. I think many times the contribution that agriculture makes to Kentucky's society and to its tax base is often overlooked, as I am sure it is in many states.

You are here for a very important reason. That is to discuss the problems with farm injuries, farm fatalities, general farm related incidents that are real problems in the agriculture industry. Kentucky, for example over the last ten years, has averaged about 43 fatalities a year on the farm. We have a lot of coal mining in Kentucky. But agriculture usually outranks coal mining in the number of deaths. That is a pretty strong statement, because a lot of our mining is underground and obviously leads to a lot of fatalities, but agriculture is still the number one cause of fatalities in industry in this state.

To show the type of people that are involved in agriculture, 257 of those fatalities over the past 10 years have involved people over the age of 45. So you can see that in Kentucky, as in many states, the agriculture workers, the farm owners, are getting much older. The average age is much older. The younger people are just not coming into agriculture, and probably the older population are a little more susceptible to farm injuries and farm accidents, because they have done things so long in a certain way, and they just take it for granted that "it is not going to happen to me." Unfortunately it has happened to 431 people over the past 10 years.

The bulk of these injuries are caused by tractor accidents. I notice, Tim, you have a section on tractor rollovers and those types of injuries. We have a lot of unlevel ground in Kentucky, I guess, and a lot of people unfortunately try to mow up and down hillsides or across hillsides, and the first thing you know the tractor is overturned and they are underneath it. In the community that I live in about 20 miles northwest of here, about three or four months ago we had a very incident such as that. A gentleman was out mowing on a hillside, got one of the tractor wheels caught in a guidewire on a utility pole, flipped the tractor over on top of him, and he was killed instantly.

Sometimes people just get careless. Sometimes they get in a hurry. Not only are tractors a major problem on the farm, other farm equipment has caused a number of fatalities and a number of injuries: corn pickers, hay balers, whenever they get stopped up, clogged up, most farmers do not take the time to shut the equipment down. They jump off of it, go around to the back, and try to dislodge whatever is clogging it up, and the first thing you know a piece of clothing or an arm or something has been pulled into the machine. The result is always tragic.

There are numerous other ways of getting hurt on the farm. Many we do not even think about: woodcutting, chainsaws; if you have ever had an experience with a chainsaw it can be a very terrifying instrument. You better know what you are doing or the first thing you know you are minus a leg, or an arm, or some fingers, or something like that. I am not trying to be gory about this and paint a dark picture, but these are the realities of the agricultural business.

It seems as though most of the accidents in Kentucky happen in the afternoon hours. I think this is probably because people are getting tired then. They have a tendency to get a little more careless. They have a tendency to try to rush things, and that is when the accidents happen. Not only do we have the farm accidents, but there is also a problem these days with chemicals. Most chemicals have warnings on them. Most chemicals say, "Use protective clothing. Use rubber gloves. Use a mask." I doubt if one in 1,000 farmers or agricultural workers use any kind of protective clothing when they are mixing chemicals.

In Kentucky we raise, a lot of tobacco. We have some very strong chemicals that are applied to the plants. It is not unusual at all to see someone out mixing a tankful of chemicals with their hands. They probably do not really realize what they are doing or what the long term impact will be. This is not just an isolated incident for that person, it is something that happens year after year after year, and they pay it no mind until they come with some terrible illness, cancer or something that is equally as bad. Then they look back and think about what they have done and they realize where the problem may have come from.

So Kentucky, as all other farm states, has this problem. It is a problem that is going to be rectified, I think, only by education, by making the agriculture industry aware of what the problems are, and how they can best be resolved. The only problem, as I said earlier, is that a lot of these agriculture

workers have been in the business for 30 or 40 or 50 years and they are set in their ways, and they do things their own way, and you cannot really get them to change. "I have done it like this for 50 years, and my father did it like this for 50 years, and his father did it like that for 50 years. It was good enough for them, then it is good enough for me."

Again, it is a real pleasure to have you in Kentucky, in Lexington. We hope you enjoy your stay at the Hyatt, and hope you have a great conference. Thank you very much. ■

Kentucky's Role in Agricultural Health and Safety Activities

By *Rice C. Leach, M.D.*
Kentucky State Commissioner of Health

MR. GROZA: Our next speaker is Dr. Rice Leach, who is the current Commissioner of Health for the Commonwealth of Kentucky. A lot of you know Dr. Rice Leach already, so he really does not need an introduction, but I am going to introduce him anyway.

Dr. Rice Leach is a native Kentuckian. He has been the Commissioner of Health since July of 1992. Prior to this, Dr. Leach served in the Office of the Surgeon General, where he was Surgeon General Antonia Novello's Chief of Staff from May 1990 to June 1992. Prior to that appointment, he was the Chief of the Public Health Service Recruitment Program of the Health, Resources, and Services Administration, Bureau of Health Care Delivery and Assistance.

He began his career in 1966 as a rotating intern at the Public Health Service Hospital in New Orleans. He has served the Indian Health Service in numerous clinical and management assignments, including the Director of the Indian Health Service Area, Manager of the Indian Health Service Aids Program, and Associate Director of the Indian Health Service Office of Research and Development.

Dr. Leach has also served in the Bureau of Medical Services. He was born here in Lexington, Kentucky. He received his Bachelor of Arts Degree from Amherst College, his M.D. Degree from the University of Kentucky, and a Master of Science in Health Services Administration from the Harvard University School of Public Health. He completed his preventive medicine residency at the University of Arizona, and an internal medical residency at Tulane.

In addition to the numerous honors and awards throughout his career in the Public Health Service, Dr. Leach has served on the Federal constituency section of the American Hospital Association, South Dakota Statewide Coordinating Council, the Board of the Arizona Hospital Association, and the Education Committee of the Arizona Medical Association.

Thank you for being with us, Dr. Leach. We look forward to your comments.

DR. LEACH: Thank you very much. When someone reads that list I've worked, I always wonder whether the audience thinks that I am someone with extensive experience or one of those guys who can't hold a job! In my case, its a combination of a varied career and continuing effort to learn something new. I spent 27 years as an officer in the Public Health Service, beginning as a rotating intern. During that year I learned that I had a malignant melanoma, underwent radical neck surgery and became a career officer. Twenty-seven years later I am retired, living 25 miles from where I began my Public Health Service career, and am serving as a commissioner of health and acting commissioner of mental health and mental retardation.

These experiences have a bearing on my message to you today because they have shaped my view of health services delivery. The melanoma scared the daylights out of me and forced me to reassess my idea of what is important in life. After several years, I decided that what really counts is the trip and the passengers because its a one way journey and we are all going the same destination. All those years working with American Indians helped me decide that the health system is in business to help people be well. That is our mission. The mission

elements are to ensure normal growth and development, cure conditions that are curable, and to contain conditions that cannot be cured. As public health workers, we spend most of our time at the ensure normal growth and development spectrum.

The combined jobs of Commissioner of Health and mental health have helped me find increasing ways to share resources for the common good. As participants in the state's health care reform activities, I have been really pleased to see members of our legislature increase their knowledge and understanding of issues related to health care funding, accessibility of services, and health care insurance. I am convinced that when they decide what is best for Kentucky, they will be making what clinicians will recognize as an "informed consent."

How do you tie agricultural safety and health together with the concepts I've mentioned above? To begin with, our Governor, Brereton Jones, is concerned with health and is active in agriculture himself as a thoroughbred horse breeder and general farmer. The Dean of the University of Kentucky Medical School once said during an introduction, that he wasn't sure to call him Governor Jones, the farmer or Farmer Jones, the governor. In any case, the top level of the executive branch of state government has first hand knowledge and interest in health care reform, prevention, and agriculture. This is certainly a strong underpinning for subsequent success. The legislature has many members with strong ties to agriculture and a strong interest in improving health services while reducing costs. The University of Kentucky, through Dr. Frank, is generating information to help us focus our energies on those conditions which most affect our state. The Commissioner of Health and Mental Health has a strong background in health services delivery and, thanks to Don Millar, Dick Lemen, and Mel Myers, has been thoroughly indoctrinated in the need to pay close attention to agricultural health and safety.

In time, the body of knowledge that you and others are developing, will identify methods to help those of us charged with reducing morbidity and mortality from risks associated with agriculture. In time, the risks of chemical exposure, trauma due to injuries, and even depression associated with certain aspects of farm life can be significantly reduced. We are all looking forward to seeing the results of work in the Southeast Center for Agricultural Health and Injury Prevention and the College of Agriculture's work with disabled farmers. The work on safety being carried out by the Kentucky Farm Bureau and the Kentucky partnership for Farm Family Health and Safety should provide valuable information for the future.

Kentucky is different depending on what part of the state you visit. It was unified during the NCAA basketball playoffs this spring when we were all backing the "Big Blue". However, most of the time we are three or four different areas with different needs and different solutions to problems. We have one hundred and twenty counties, different economies, and different ideas. That combination creates real challenges, but it also presents the opportunity to find a variety of workable solutions. It seems to me, then that it all ties together because the leadership of state government, the health department, and the universities all have an

interest in making improvements. The information being collected will be an opportunity for us to change how we do business from relatively independent group efforts to increasingly coordinated and shared group efforts. These shared efforts should fit into some of the precepts of health care reform by preventing illness, promoting health, and reducing costs.

Let me finish by saying that we are glad to be part of this broad based endeavor and we look forward to putting your results into action. I don't want to leave without thanking the NIOSH staff in Cincinnati for the strong support they have given me as commissioner, as I dealt with "in house" problems associated with asbestos and then fiberglass fragments in our department. The expert consultation resulted in a prompt diagnosis and recommendations which were deeply appreciated.

Thank you for inviting me and thank you for coming to Kentucky to share your experiences. ■

NIOSH's Role in Agricultural Health and Safety Activities

By *Melvin L. Myers, M.P.A.*
Special Assistant to the Director, NIOSH

MR. GROZA: Our last speaker, Melvin L. Myers is the Special Assistant to the Director for NIOSH. He has served in that capacity since 1988. He, as you know, was instrumental in coordinating the first Surgeon General's Conference on Agriculture Safety and Health in Iowa in 1991.

Mel grew up on a dairy and hay farm in Idaho where he was active in 4-H and FFA. He is a captain in the U.S. Public Health Service with more than 25 years of service.

Previous assignments include Executive Secretary to the Mine Health Research Advisory Committee; member of the OSHA Advisory Committee on Construction Safety and Health; Deputy Assistant Director to NIOSH from 1986 to 1988; he was the director of the Office of Program Planning and Evaluation with NIOSH from 1979 to 1986; Technical Assistant to the Assistant Administrator for Research and Development at EPA from 1975 to 1979; and he has served in various other capacities with the Public Health Service.

He holds an M.P.A. degree from Indiana University in Bloomington, Indiana; and a Bachelor of Science from the University of Idaho in Agricultural Engineering. He holds numerous awards including the Surgeon General's Exemplary Service Medal. Please welcome Mel Myers.

MR. MYERS: Thank you Tim. I would also like to thank Representative Farrow for putting right up front, the urgency of the problem that we are here to discuss, and Dr. Leach for talking about a strategy that we call win-win. I recall he talked about the same strategy at the Surgeon General's Conference. This strategy is becoming a fabric of the federal government and is called "re-inventing government." I will talk more about that later.

INTRODUCTION

A theme of what I am going to be speaking to you about today, is change; that reinvention process, where we are now and where we are headed.

Part of that change is right here at NIOSH. We are going through some transition. Dr. Millar retired the first of this month. Dr. Lemen, our Deputy Director, is the Acting Director of NIOSH. He will be here to speak to you on Friday.

There are other changes: a CDC directorship has changed. Last Friday the new Director of CDC, Dr. David Satcher was named. I am going to give you a quote from him later on, in terms of some of the changes he sees taking place, particularly in health care reform. Dr. Satcher comes from Meharry Medical College in Nashville, Tennessee, and will be arriving at CDC on January 1, to take command there.

I see a lot of colleagues here who I know and have worked with for a number of years now in the area of agricultural safety and health. I also see some new faces. I know whenever there are new faces, there is always this question about why is the Navy in town! My uniform may need a little explanation. The U.S. Public Health Service is a very old organization in this country. It

was founded in the marine business of this country. The Merchant Marine have been provided health care by the Public Health Service for a number of years. At one time the Public Health Service was even the medical corps for the U.S. Navy, so coming from that background you see the adoption of the uniform that the Navy uses, but with some important differences. That difference is the insignia that you see on the shoulder boards of the Officers who you see here. It is an anchor crossed with a caduceus.

Another change that we hear a lot about, and that is going to get some attention at this meeting, is the flood in the upper Mississippi River area. This is an unprecedented flood, something very different from the past. There are going to be some different ways of building and thinking about flood plains in construction.

One problem that has surfaced out of the flood issue, is some deaths in wells. There is a report out of Iowa of one farmer going down in a well and dying, probably from the lack of oxygen.

There is a report in Nebraska of a family of three people, involved in agricultural services repairing a well. The father of the family went down and collapsed in the well. His wife ran up to a house to call 911. As she did, a son said he just could not stand it, he was going to go down to rescue his father, so he did. He collapsed. Then the mother, waiting for 911, thought she ought to do something. She went down and collapsed. The only survivor out of the three who went into the well was the son. Even now we are not sure that he is going to survive from the brain damage that he has incurred from that exposure, more than likely to the lack of oxygen.

A story I was told related to this. In fact, I went out and got the book to read the story. It is from "The Little House on the Prairie," by Laura Ingalls Wilder[1]. In that story it is about Pa as a pioneer farmer in the Midwest, digging the well. A neighbor, Mr. Scott came over to help out. Pa always took this candle down the well because he knew of a hazard down there, the potential lack of oxygen, and if the candle went out then he should not be down there. Each day they went down in the well and the candle burned okay.

Mr. Scott came over early one morning and wanted to get a head start on helping to dig that well. Ma went out of the house and saw that Mr. Scott's horse and buggy were there. He had collapsed in the bottom of the well. They ended up getting him out.

Mr. Scott thought that this whole business of bringing a candle down in the well did not mean anything. He had been in a lot of wells many different times and never had that problem before.

This is an old story that many of us here know about manure pits as well. People go down in the pits with no problem. But there comes a time when there is a problem. So there is a need for change too! Not only is change taking place, but problems just cannot keep happening.

This problem in terms of wells may or may not be associated with the floods, but we are seeing them in the aftermath of the floods. We are still investigating them. I am sure

this is going to be a discussion topic that will come up in the meeting related to the flood that is ancillary to this meeting.

There are some documents that are part of your packet. One is this draft of the, "Farmer Safe 2000 Summer Edition." In front of this draft is the topic about the flood problem.

Related to this, just last Friday we issued an "Update." It is not out here yet, but will be out here later this week. NIOSH warns the midwest of hazards of flood clean-up work. The well issue is mentioned here as part of the general problem of going into confined spaces. This is an area that is of sincere interest by NIOSH. We have one person already assigned in the State of Missouri to help the state health department there with such problems as these.

In terms of the change, I would like to go through three areas. One is the NIOSH role as it is now and how it is evolved. Two, I want to talk about the Vice President's work on the national performance review, what may be happening in terms of reinventing government, and how that might affect us. Three, I want to go into the whole issue of something, and I will call it here, "reinventing NIOSH." We started a process of total quality management over a year ago at NIOSH. We are now getting down into the grassroots in terms of that training.

As part of that process, some people who are here from Cincinnati just came from a Deming Seminar in Cincinnati.

ROLE OF NIOSH

I started thinking about the title of my talk, "The Role of NIOSH in Agricultural Safety and Health". I did not want to be static, and that is why, because things are changing so much, I wanted to focus on change. It does bear mention to go back and see how we got to where we are.

NIOSH was created by the Occupational Safety and Health Act of 1970. In 1971 NIOSH was created as a result of that Act. Shortly thereafter, OSHA, which was also created as a result of that act, convened an Agricultural Safety Standards Committee, on which NIOSH participated. There is a gentleman, not the one here from New York, but one that was with NIOSH at that time, Dr. John May, served on that committee. John May is a close friend of mine.

That committee recommended several standards, one of which led to the roll-over protection structure (ROPS) standard by OSHA in the mid-1970s, as well as the machine guarding standard. Many things came out of that process, but a lot happened politically that stopped that process at OSHA.

NIOSH, however in 1974, did convene a conference in Iowa City. It was on agricultural health and safety. Several conclusions at that time came out. One of those was agricultural safety and health received much less attention than it should. Another was related research was generally scattered and had low visibility. There might be some research going on, but you could not capture it as part of an agricultural problem. State programs and occupational safety and health had not been applied to agricultural safety

and health. It had been an ignored area.

Many of those things remain true today, although I think there is a lot of movement today, in terms of recognition of the problem, and a lot has happened at both the state and the national level in terms of occupational safety and health.

Over time, we have had different sets of objectives in the Public Health Service. The latest set is called, "The Year 2000 Objectives." Within those objectives in occupational safety and health, some are specifically targeted at agriculture, particularly fatalities and injuries. That is another part of our time line and the things we watch at NIOSH.

Probably the most significant "happening," in terms of agricultural safety and health at NIOSH, was the Appropriations Act of 1990. In that Act there was a statement made to launch an initiative, which NIOSH would lead, when sustained over a period of time, would result in a significant and measurable impact on health affects among rural Americans. That is the guiding principle given to us by the Congress in our program. That still remains our guiding principle. Thus, we are looking for measurable impacts in safety and health.

REINVENTING GOVERNMENT

Some other new things are happening that are affecting us. Some of you were in Morgantown in the early spring at the meeting of the health promotion grantees, as well as some from the centers and nurses programs, where I talked about OSHA reform. OSHA reform, at that time, was projected to be enacted this fiscal year. A lot of competing items on the President's agenda overwhelmed that particular initiative for this year. Also OSHA and NIOSH have taken more of a systematic interest in how that language might read. This is going to probably continue into and be debated next year. OSHA reform will probably be passed, within two years. That is the best projection we currently have.

Another reform that is taking place is health care reform. Dr. David Satcher, as part of his news release upon his appointment on Friday, said that CDC's injury and disease prevention dimension will be an essential ingredient of health care reform. In other words, prevention is going to be a big part of what happens in terms of health care reform. I think that, since that is first thing he said about his appointment, is very noteworthy.

Speaking about reinventing government, we at NIOSH are following, the Deming philosophy. He follows a logic called a "profound knowledge." It is a system of profound knowledge that includes four elements. One is optimizing systems. Two is understanding variability in data. Three is applying the theory of knowledge, which is a scientific approach. Four is understanding psychology. Psychology is so important in terms of agriculture and the people who work in agriculture.

SYSTEMS

First, looking at optimizing systems, refer to **Figure 1** which illustrates a NIOSH system. It is customer focused. Everything should be leading towards those customers against some common goal. For our purposes to-

NIOSH				Customers
gathering information→	creating knowledge→	packaging interventions→	delivering interventions→	→Farm families →Farm workers →Farm owners →Farm suppliers →Safety and health professionals

Figure 1. *The NIOSH System with a Focus on Customers.*

day, I have named several customers here from the NIOSH systems standpoint; farm families, farm workers, farm owners, farm suppliers, and the safety and health professionals wherever they may be, maybe in state health departments, agricultural extension agents, people who work at OSHA. It is broad range of people.

The systems approach is understanding that there are customers out there who need to be served. They are the people who should be driving that whole system.

UNDERSTANDING VARIABILITY

Figure 2 Second is understanding variability. Normally the control chart, which Figure 2 shows, is applied to quality control within internal system. I started thinking that this is a way to look at our programs using a control chart. There may be some errors in my interpretation. A statistician may be able to do a lot better with what I have done, but I want to demonstrate some of the tools of total quality management.

This is taken from our National Occupational Traumatic Fatality (NTOF) database for 1980 through 1985. States that have five or fewer fatalities in agriculture over that period are not listed here. I have ordered these States in order of industry population, primarily to look at possible patterns by size of population in States.

In Figure 2 you can see the average fatality rate of the whole country. The control limits are three standard deviations above the average and three standard deviations below the average. Anything within those two limits is considered to be a stable system. In other words, there is a common cause for these fatality rates. Anything that is outside those control limits, we are taught under the Deming principles, is unstable. There are unique causes for those.

As to a pattern, in the higher population numbers on the left side of the figure, there is more stability in the system, or more common causes. There may be some data problems On the right side that represents smaller working populations. That is a hypothesis. If you look at the very end on the right side, there is Alaska, and if this chart would go up to 300, that is where it would go to; very, very high. What do you think is the unique cause in Alaska? There is not a lot of farming there. (Comment off mike.)

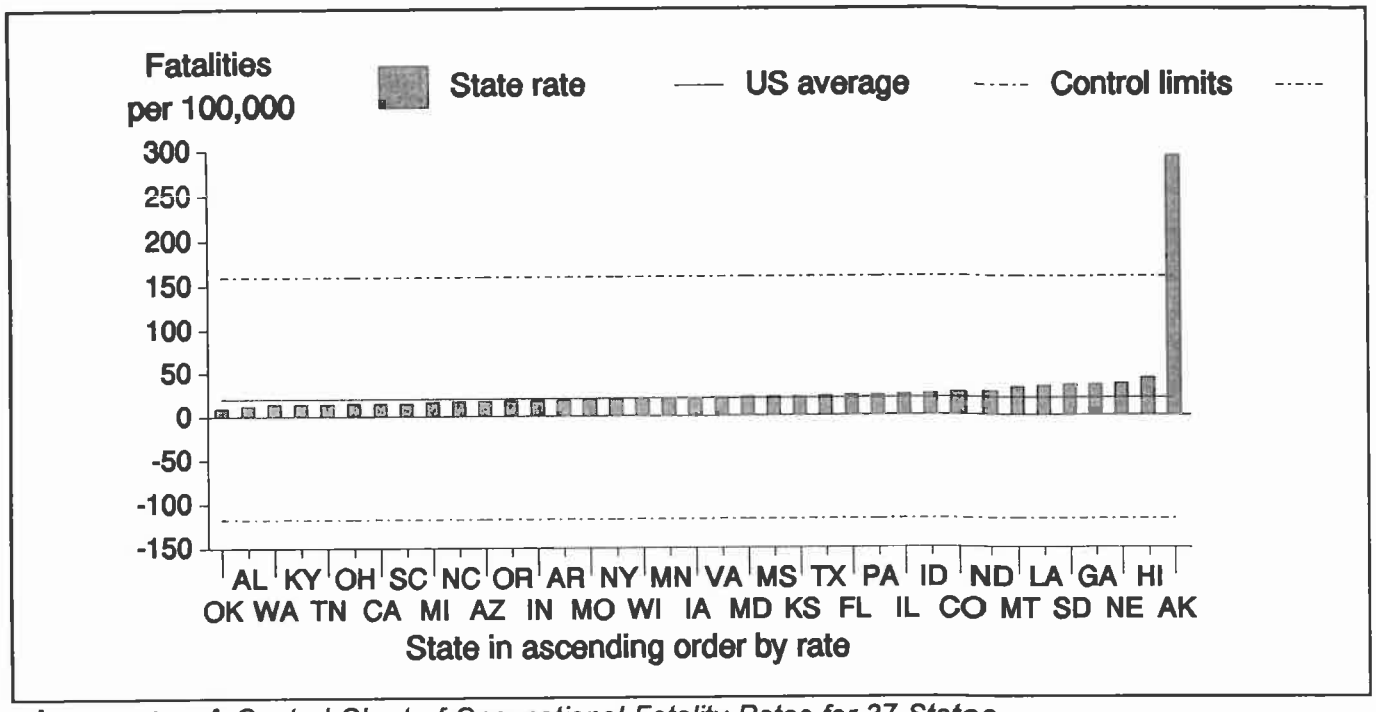

Figure 2. *A Control Chart of Occupational Fatality Rates for 37 States.*

Bering Sea. Good! It is fishing. When we talk about agricultural safety and health we look at standard industrial classifications. We include farming, forestry, and fishing together in this classification. In Alaska, while I was there three years ago, there were 37 fatalities in fishing and one in farming. So it is the fishing numbers there that are the unique cause. This idea of variability data that Deming talks about seems to have creditability. We have established an office there to look specifically at the problem of the high fatality rates in that State.

Conversely, in terms of where is the best State, well, Oklahoma is down here. One could ask the same question. What is going right in Oklahoma? I do not know. That is the question. It could be a subject for research. I have looked at an analysis by the State health department under an injury control grant. When looking at the different causes of death, they were measured differently than we do with the NTOF. It included children, it excluded incidents on the road, and it excluded any incidents inside the home.

The highest number of fatalities in terms of frequency were violence (suicides and homicides) either by firearms or by hanging. That is number one in Oklahoma. Number two was drownings. A lot of kids get in the ponds. Finally you get down to the causes that we are typically concerned about, tractors and machinery.

The picture is a little different depending upon how you look at the data. One message here is that there may be different ways of looking at the data. Another is understanding what the problems are. They are

very different in Alaska and Oklahoma.

THEORY OF KNOWLEDGE

Another area is applying the theory of knowledge. This is the scientific method where you set up a hypothesis. You say you are going to try something, then you set out to do it, and you test it to see if you did it or not. Then based upon that result, you take further action. There is something called a Deming cycle that is used in that process. But for us at NIOSH and many of us in this room, it is known as the scientific method. It is basing your actions on facts.

UNDERSTANDING PSYCHOLOGY

Number four is understanding psychology. I mentioned the win-win philosophy. The whole approach under Deming is cooperation, not competition. You try to get all the actors who are affected and create a scenario in terms of prevention where everybody comes out ahead.

As one example of cooperation, there was a childhood agricultural injury symposium a year ago last summer the Marshfield Clinic in Wisconsin[2]. The major funding was providing by B.P. America, CIBA-GEIGY Children's Miracle Network, W.D. Connor Charitable Lead Trust, Deere and Company, Farm Foundation, W.K. Kellogg Foundation, Saint Joseph's Hospital, NIOSH, Pioneer Hybred International, and *Successful Farming*. Look at all those actors coming together around a common problem. That is cooperation.

So those are the four elements of the Deming system. I think there is already a foundation for NIOSH in reinventing government.

REINVENTING NIOSH

When we come to NIOSH what does this mean? We started with a vision statement. Our vision statement is, "Delivering on the Nation's Promise, Safety and Health at Work for All People Through Prevention". One promise is the statement that I referred to earlier, made by the Congress for this program, three years ago. That is a promise to the nation. Also, the Occupational Safety and Health Act has language that was a promise to the nation. These are the promises that we look at to guide us.

We included, "for All People," because at work we want to make sure that we include people who are self employed and children at the work place. In this way, the vision is very broad, but we wanted focus too. Focus comes with that word "Prevention". That is the "punch" line for the vision statement. This vision statement guides us.
The Congress defined this program on three processes: surveillance, research and intervention. In defining our system, in terms of processes at NIOSH, is a definition of four processes: gathering information; evaluating, integrating, and creating knowledge; packaging our interventions; and delivering our interventions. I am going to give you some examples of each of these.

GATHERING INFORMATION

In the area of gathering information, we are working with the USDA and their national Agricultural Statistical Service in collecting data in selected States to help us define, much more specifically, problems of safety

and health. In addition, we are broadening out, as you will see in a couple of the presentations later on in this meeting, into the area of migrant farm workers and their unique problems in this country. These are examples of needs to gather more information.

CREATING KNOWLEDGE

In terms of creating knowledge, there is a lot of research in progress. In the back of the draft "Farmer Safe 2000 Newsletter," are listed several NIOSH projects. Most are research projects. The value added that we get from the Creating Knowledge process is predictability. If we do good in science then we can predict what causes something, do something about that cause, and predict what the potential impact may be from controlling that cause.

We are moving with some of our grants next year to focus on some demonstrations, using ROPS to control these serious problems that Representative Farrow mentioned earlier. These problems are the fatalities from being crushed under a tractor when it rolls over.

PACKAGING INTERVENTIONS

Historically, we have just hoped that things are going to happen based upon what we do. What we need to do is start refocusing better in terms of making things happen. I will give you some examples of some interesting actions going on now from this program.

In terms of packaging interventions, Pierce Jones at the University of Florida, has put together a CD ROM system; some of you will see him around here with his laptop. Some very innovative things have happened there. In that particular grant, as a result primarily of the meeting in Morgantown last spring, he has connected with several different people in the health promotion program as well as in the nurse's program. He is drawing information into that CD ROM system so if something is done on, say, chainsaws here or in Tennessee, south of here, then it might be useful in Florida where they had a hurricane. In Florida they thought little about chainsaw safety until they had the hurricane. They can import that information right away and use it a network of agents or public health people.

The types of information that he has collected, include documents in Spanish. There are over 20 different documents from the nurse's program in California, both in English and Spanish. Florida also has documents in English and Spanish. A document from New Jersey which is also in English and Spanish is going into this system. Each of three States have different dialects of Spanish, so it is to be a test of how we may be able to transfer these documents from one part of the country to another. This is part of what we are trying to learn, how can these different dialects communicate? Is there some way to change the translations in a way so that the documents can transfer across the country easily?

There are six fact sheets in the system from Michigan. One of them is on zoonosis. From North Carolina, there are five documents of which one is on protective clothing. There is one that I mentioned from Tennessee, the chainsaw document; from Ohio there is wood dust; from Pennsylvania, one on power takeoff (PTO) safety; and from Kentucky, one about grain bin

suffocations. Of note from New Jersey, is something on marine safety, which may be useful in Alaska.

These are examples of some packaging interventions, some new things going on that just happened this year, and they are going to pull it together. I think there is some future in that.

DELIVERING INTERVENTIONS

In terms of delivering interventions, Bob McLymore from North Carolina is convening a conference next month, called, "Harvesting Safety and Health in the Southeast." There will be a focus on some different populations. Migrant workers are one of these populations. Coming to that conference, will be people from 15 different States in the traditional black land grant colleges. They are going to be part of the network in receiving CD ROM products from the University of Florida.

Delivery will take place there in getting this information out to special populations in areas that we have not targeted before. So there are some exciting things taking place there.

I wanted to review some traditional areas of intervention, which in the early 1980s, Dr. Millar and I collaborated on, in focusing " The 1990 Objectives for the Nation."[3] There is an order of coerciveness in interventions, from being very friendly to being police-like. How we classified those, was in five categories.

1. The first category was providing information. An example is the NIOSH Updates. You will see a lot of these at our exhibit at the symposium. One example is a gasoline powered pressure washer that can lead to exposures to carbon monoxide and death. That is becoming a potential problem, in the flood areas, in terms of clean up operations there.

2. Second is offering services. This is things like the NIOSH 800 number. If you do not have that, it is 1-800-35 NIOSH. You call it and ask about information on occupational safety and health. They may send you something or refer you elsewhere. You will see an exhibit at this symposium on an item that is a result of such a service, our health hazard evaluation program. That exhibit is on brucellosis, a problem that was investigated in North Carolina.

3. Third is enunciating policies. An example is NIOSH recommendations. We make recommendations on safety in the area of welding, as an example. In the case of respirators, we endorse through certification, a design of a respirator that we determine to be safe.

4. A fourth category that NIOSH is not involved in, is establishing incentives such as economic incentives. These can be established through tax incentives or through grants through a farm bill. Right now that is not something that NIOSH has within its authority, at least from an appropriations standpoint.

5. The fifth category is "compelling citizens." This type of intervention uses inspection and enforcement, and it would be like the OSHA standards approach.

That is a range of interventions that could be used in some combination depending on the problem. A large problem, in terms of fatalities in farming, is on the roadways. Maybe there are ways through compelling of citizens, to do better in being more safe on the roads.

By the way, just last week, the National Center for Health Statistics came out with a reranking of its top ten leading causes of death in this country. Injuries fell down from number four to number five. The reason for that drop is improved safety on the roads. Something has been going right, at least in the general population.

CONCLUSION

In conclusion, I want to just talk about youth, because I think they are a principal agent of change. We have been involved with the FFA over the last three years. In the back of this document you will see some abstracts of FFA safety projects. Each year we have honored seven different FFA chapters, now totalling 21. We did not have them here at this meeting, because this is their first week of school, which presented a conflict for some chapters. So rather than not having only a few here, we thought it would be better to treat them all the same. We sent them a plaque to honor them for their safety program.

The background on this FFA program is that companies provide support for FFA's safety program that results in about 50 gold award winners each year. We wanted to make a special point of recognizing those that meet certain criteria, such as conducting a community assessment ahead of time, focusing on agricultural safety (they all do not necessarily focus on agricultural safety), and having accomplished something unique.

The Marshfield Clinic has also used the FFA in their cancer program, to teach young children. In this program, the FFA go beyond high school students. It gets down to the children at the third and fourth grade in teaching about wearing protective clothing. The clothing keeps the sun from getting on the skin, which is the principal cause that we associate with skin cancer in agriculture. FFA and youth are an important focus for us in the future.■

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Occupational Agricultural Injury Surveillance in California

By *Carol S. Conroy, Ph.D.*

MR. SESTITO: My name is John Sestito. As the program says, I am with the Division of Surveillance, Hazard Evaluations, and Field Studies. That is a mouthful. We are one of the field research divisions in NIOSH. We are located out of Cincinnati, Ohio. We have five presentations this morning. Given the amount of material that is going to be presented, we are going to go in series with the talks. At the end we will take questions. In that context, if you would like to ask any of the presenters a question, I would ask that you come to the mikes and identify yourself. With that I would like to start with the first presenter, Carol Conroy. Carol wears two hats in California. She heads up our nurse's program there, and she is also the principal on our farm surveillance program. So Carol, if you would like to come up and tell us a little bit about agriculture injury surveillance in California.

DR. CONROY: If I could have the lights down a little bit I think the slides would show up better.

Good morning. I am here this morning to talk about a surveillance project that is funded through NIOSH, and first I would like to acknowledge my coauthors, most of whom are in the audience today, and also thank Robin Rudy for doing the graphics on my slide.

I am going to discuss the methodology and just present some very preliminary descriptive results, and then also touch on the investigation and outreach components of our project.

California is one of the 10 States funded to do surveillance through the Occupational Health Nurse's in Agricultural Communities Project. We are the only State in the west. Agriculture in California really is quite different from that in the midwest or the east. For example, California grows over 250 crops. In fact, there are only three crops or commodities that we do not have in the State. We also have a very unique workforce. It is primarily Hispanic, and we have a migratory workforce coming up from Mexico and Central America into California to work during the summers.

I just wanted to orient you geographically to where the project is. Berkeley is our headquarters, and we are in the Occupational Health Branch of the State Health Department. **The counties where the surveillance actually goes on are Monterey.** We have a nurse and a field office down there, and the office is actually housed within the county health department. In Fresno we also have a field office, and that is the other county where we do surveillance. We have a nurse and a safety engineer in that county.

We also work quite closely with the California Agricultural Health and Safety Promotion System Project, which is up at UC Davis. This has been really important in terms of collaborating on outreach, sharing of information and ideas, and just a few weeks

ago we even had a joint booth at a farm worker information fair.

Just briefly, the objectives of our surveillance system are, first of all to design and develop a system that was based on the medical care system within each county. They are very different. For example, Fresno has two Level I trauma centers. One is a pediatric center. Monterey County has no trauma center. Second objective was to identify cases for in depth investigation out of the surveillance system. So besides collecting data through the system, we want to target cases for investigations. Third was to develop prevention strategies, both by using data in the surveillance system, and also investigations, and disseminate this information.

The first thing we did, and this will just orient you a little bit to the counties, Fresno is the dog boned shaped county over here, and this is Yosemite and Sequoia and King's Canyon National Park, so it is very mountainous up there. This is Monterey. The Pacific Ocean is off here.

First thing we did, was identify all the medical care facilities in the county where farm workers and farmers might go for medical treatment. This includes hospitals, clinics, any hospital that had an emergency department. Some of the hospitals are private. Some are county-based. Then we met with them and recruited them into the system. Sometimes this took one meeting, and sometimes it took ten meetings. Third, we developed reporting mechanisms, and tried to determine how we could obtain the data that we needed for our surveillance.

We set up different reporting mechanisms with each of the different facilities. It's a very active system. We found that it really worked best to have the nurses actually go into the hospitals, into the clinic, and review the trauma logs, the emergency medical service records, coroner's laws. California OSHA also reports to us the fatalities and disabling injuries. We also found that newspapers are an extremely useful way to identify some cases.

We also have reporting through — some clinics send us their doctor's first report. In California we do have mandatory reporting of occupational injuries and illnesses. It is mandatory reporting to the Department of Industry Relations. We just ask for the clinic to send us a copy also.

This is an example of a poster that we put up in the Fresno County medical examiner's office. We use reporting guidelines. These are intentionally broad for the new reporters, because this really works better then to have them report to us, instead of trying to determine if it met our more strict case definitions or not. Then we apply filters, and use a more strict definition for our own data analyses.

Predominantly what we are capturing through our surveillance, are injuries or deaths that occur on the farm or at an agricultural processing facility, a packing shed, for example. Also, any injuries or deaths that occur as a result of an agricultural machine. We also include injuries or deaths that occur to farm workers when they are commuting to the different fields during the harvest season.

This is just an example of a one page fax form that we developed for the Pediatric Trauma Center, and originally they were faxing us in cases, but we found this really did not work well. Now the nurse actually goes and reviews the trauma registry and also the medical records. I just wanted to put this in, to point out, that you really have to be flexible in your surveillance system and be willing to change your mechanism.

Just briefly I want to touch on the investigations that we do. We only investigate about 2 percent of the cases in our surveillance system. We do have selection criteria that we use to identify cases for investigation. This is the surveillance component up here. We get a minimum amount of information on all the cases. Then if we do an investigation we interview the worker, if they are alive, the coworkers, the employer, and we do an onsite investigation, and then we eventually write a report and distribute this. We do have some examples of the reports at a poster presentation in the next room.

This investigation approach is modeled after the NIOSH Fatal Accident Circumstances and Epidemiology (FACE) investigations. We use a modular approach to collect our data, depending on whether we do an investigation or not, and what additional data are available. All cases in the surveillance system have the first report completed, and that is actually the data that I will describe today. Then again, if we do investigations we use different modules and collect additional data.

Another component that I am really just going to touch on today, is if we do an investigation, we go back six months later and do an onsite evaluation again, and see if the grower has implemented our recommendation. More important, if they have not, we document those barriers. Why weren't those implemented? We also always send our reports, besides to the employer, we send them to the worker in Spanish. They are actually written at a lower literacy level.

I am just briefly going to describe some of the data that we currently have. We are working on a technical report which will be a more detailed analysis. If anyone is interested in getting a copy of that, please see me. This shows the first 18 months of data collection, beginning in the summer of 1991 through 1992. I just wanted to show you this slide for two reasons. One is, it demonstrates the great seasonal variation that we have in California. This coincides with the fluctuation of the workforce in and out of the county. The second reason I put this up, is that as we added different medical care facilities who reported injuries to us over time, you can see that that greatly influenced the number of injuries we were getting.

Most of our cases do survive. We only have about 4 percent that are fatally injured. I think this really reflects our surveillance system because we do include clinics, and so we are not just capturing the more severe injuries.

It is predominantly men that are being injured. Only about 15 percent of our cases are women, although this does vary a little bit across the county. This pretty much reflects the gender distribution of the workforce. Also if you look at age, again, this reflects the distribution of the age force with most of the injured workers being between

about 20 to 40 years of age.

If we look at race and ethnicity, about 82 percent are Hispanics, although we do have Caucasians, Asians, and some East Indians who have been injured. Again, this reflects the workforce.

We do collect data on the nature of injury. We use the International Classification of Disease N Code systems to code these. When we take a look at the distribution, you can see that sprains and strains, lacerations, abrasions, and fractures and dislocations, are the predominant nature of injuries that we get. You can also see that we have some that are below 800, ICD code below 800. That is because we do capture some cases that turn out to not be injuries. For example, sometimes there will be a fatality, and we will not know it until the autopsy that they actually died of a myocardial infarction.

We also code the external cause of injury using the ICD E codes, and we looked at the distribution we saw that falls, being struck by or against objects, being cut, and overexertion were the predominant causes of injury.

This is quite different if you look at it by vital status, because we found for our fatalities, motor vehicles were by far the most important and predominant cause of death. This is a really important finding. We are actually working with Gene Freund at NIOSH on writing a MMWR article on this finding.

I just want to touch briefly on the outreach aspect of the project. This is funded as a surveillance project, but the staff are very proactive and really felt it was important to get the information out to the farmers and the farm workers, and not just collect data for five years and then write a report.

We really have two goals in terms of our outreach. One is to increase awareness of the project in the community. The second one is to promote health and safety in our population at risk. Currently we have written 25 reports that have been based on our investigations that have been released. Nurses have done many, many local presentations in their communities, held press conferences in each county, had many meetings with the local agricultural groups, the Farm Bureau, the Agriculture Commissioner. We have published articles and trade journals and we have got three public service announcements in Spanish and English on the T.V. and on the radio. The nurses have also done T.V. and radio talk shows. We have developed a number of promotional items: caps, stickers, and posters to hand out.

I just wanted to touch on some of the limitations of the surveillance system. First of all, it really takes a lot of time to maintain this. Secondly, the reporting accuracy varies quite a bit depending on the different medical facilities. We are actually evaluating this currently. We do rely on voluntary cooperation for reporting and for letting us do investigations. Finally, not all the cases are captured. We think we are missing a lot of the children who are being injured. This is partly due to a disincentive for these to be reported as occupational injuries because of labor law violations. Also, we may be missing cases as they are not identified as occupational. Finally, we may be missing workers who are injured but do not go to medical facilities

for treatment.

Just in conclusion, we have found that it is absolutely essential to have extensive interaction with the community and with the medical care facilities. This has to be ongoing. You have to be flexible and adapt to their needs. Second, we found that having different sources report cases to us that are overlapping has been really effective. Third, we found that it is necessary to do multidisciplinary indepth investigations in order to obtain detailed information to construct some prevention strategies. Finally that we have found, through this project, that we feel that nurses really are an important resource in the agricultural community. We think that they have certainly improved the safety and health of our farmers and farm workers in California. Thank you.■

Agricultural Hazard Surveillance Training

By *David H. Pedersen, M.S.*
National Institute for Occupational Safety and Health

MR. SESTITO: Our next speaker is Dave Pedersen. David is an industrial hygienist in our surveillance branch in Cincinnati. Dave has been working for over three years with us under the farm program in conjunction with many of our collaborators to develop an agricultural safety and health hazard training program. He is going to share a little bit with you today, what we pulled together collectively with many of you in the hall. So, Dave, if you would like to spend some time with us.

MR. PEDERSEN: Good morning. As John just said, what I am going to try and talk to you about is an agricultural hazard surveillance training program. I have three things I would like to try and accomplish in this presentation. First, to describe the reasons for this type of training. Second, to very briefly describe the development of such a training curriculum, and finally to give you a fast look at the contents of the course as it was developed.

The course came to be known as the Cooperative Agricultural Surveillance Training (CAST) Program because it was indeed a cooperative effort. It is a component of the Farm Family Health Hazard Surveillance Project within NIOSH, and that particular program involves six States: Colorado, California, Iowa, Kentucky, Ohio, and New York. There are two major components within that program: an assessment of health status and the demographics in the agricultural sector, and an assessment of the hazardous exposures that are known to exist or should be known to exist in the agricultural sector.

The intentions of the course that was ultimately developed was to address knowledge gaps. By this I mean the interface between traditional occupational safety and health and the knowledge that resides in the agricultural community. What we have found in a cooperative sense was that there had been a lack of communication in those two major discipline areas that needed to be addressed. We cooperatively wanted to provide basic, and I do emphasize basic instruction, in this interface area; to essentially acquaint occupational health specialists with conditions in the agricultural sector and, conversely, to provide some information to agricultural specialists, specifically in hazard surveillance, about the techniques that had been utilized in the past.

We also wanted to provide a mechanism for standardizing survey protocols across the six States that were participating in this effort, and finally, in a developed package, we wanted to provide assistance to any other efforts that might be ongoing in agricultural hazard surveillance.

Very briefly, let me describe the process that we went through in developing the curriculum for this course. The topic or lecture recommendations came cooperatively from the six States that were participating in this project, and from every one of the six research divisions within NIOSH. All of these recommendations were collated and discussed at an open forum, two-day meeting in Cincinnati, from which we derived a list of the lectures in general, the specific topics

within those lectures, and identified people with adequate expertise to address the topics that we needed. I would emphasize that those lectures came from the agricultural sector, from within NIOSH, and from experts who provided their services by contract in order to obtain needed expertise.

Finally, all the lecture materials, as developed, were reviewed by panels consisting of individuals from both the agricultural sector and from within NIOSH. They were edited in accordance with these reviews, and ultimately presented at a week-long classroom setting in Cincinnati.

As it ultimately evolved, the CAST or Cooperative Agricultural Surveillance Training consisted of 18 presentations or lectures. You can loosely divide these into five categories with the understanding that there is a lot of overlap between these particular categories. Basically, there were three lectures in background information, five in safety hazards, six in health and safety hazards, two specific lectures in protective equipment, and two in standard protocols. These lectures range from 30 minutes to 110 minutes in length, in final edited form.

Let me then give you some idea of the specific content of each of the lectures. The three lectures within background information consisted of agricultural health problems, which was an overview of health effects in the agricultural sector, and discussion of specific health effects and their causes in agriculture. Agricultural ethnic considerations was an examination of the unique cultural characteristics in the agricultural sector and how they might affect the conduct of on-site hazard surveillance activity.

The interview techniques lecture provided basic information for the conduct of onsite interviews to include preparation, the actual conduct of interviews, and control of those interviews.

The second category of safety hazards consisted of five lectures. The first two of these concerned general safety, providing an overview of occupational safety concerns and an examination of safety concerns as they exist in the agricultural sector.

The second of the five lectures dealt with Buildings and Structures. This concerned itself with the design and construction of buildings, building use, and retrofit or utilization of agricultural structures for purposes they may not have been intended for originally. Safety hazards associated with agricultural building safety was also covered in some detail.

As an example, let me show you a couple of slides that derived from the materials for that lecture; a directional force diagram, displaying the stresses that are put upon buildings in agricultural use. A fairly decent example of a hazard is a collapsed silo. The hazards are obvious.

The third of the five lectures concerns itself with commodity handling and storage, and contained generic discussions of the common practices, equipment and structures, and health and safety hazards in the area of commodity handling. Again, let me show you a couple of examples of the illustrations from this lecture. First, typical grain handling operations, and a discussion and diagrammatic representation of grain entrapment.

The fourth of the five lectures was Implements and Mobile Equipment, which provided an overview examination of farm equipment, and in-depth discussion of specialized equipment related hazards, and over-the-road transport. Examples of the illustration from this lecture include power take-off (PTO) shaft entrapment and tractor overturn.

The fifth lecture was agricultural electrical systems. This is concerned with typical service installation, maintenance, electrical hazards in an agricultural setting, power tool use, and general shock/electrocution hazards. Example illustrations include diagrammatic layout of a farm electrical system, and an example of a hazardous agricultural electrical system. This particular lecture has a slide that the lecturer is particularly fond of, which he refers to as the flying switch. That is where, there is an off/on switch hanging in space, suspended from two pieces of wire running from either side of the room.

Within the category of health and safety hazards there are six lectures. The first of which is agricultural welding, providing information on welding, soldering, and brazing, and spoke of welding equipment operations, both in industry and in agricultural settings. Finally, the specific hazards as they exist for the utilization of welding equipment in agriculture were discussed.

The animal handling and treatment lecture spoke to the structures and facilities used in agriculture for animal handling and treatment. The safety hazards of animal handling range all the way from hazards associated with buildings, to human hazards resulting from the fact that you are handling animals. There was a specific and very interesting section on veterinary treatments and medicines which included a discussion of zoonosis. Let me show you some example illustrations from that lecture. These include a schematic diagram for typical and fairly high grade animal housing, and a very nice example of proper veterinary medicinal storage.

The third and fourth lectures in this particular category included agricultural chemical and fuel storage, and respiratory hazards. The lecture on chemical storage dealt with common practices, and proper storage of chemicals and fuels.
The lecture on agricultural respiratory hazards gave a lot of very valuable information on the hazards of respirable dust and the sources of those dusts. It also provided specific information on biological dust hazards, dust sampling, and exposure measurement.

This particular lecture was interesting in that it really represented the cooperative nature of this training course in that the material was about half from expertise in the academic agricultural sector, and half from expertise within NIOSH.

The fifth and six lectures in this series, concerned themselves with agricultural confined spaces and ergonomics. The confined spaces lecture discussed confined spaces as generally understood, and then specifically discussed them as seen in the agricultural sector.

The ergonomics lecture provided discussion of cumulative trauma disorders, occupational factors leading to those disorders, and a discussion of proper tool designs and the rede-

sign of work processes which could avoid the onset of cumulative trauma.

An example illustration from the confined spaces lecture was a schematic for manure pit operation, which displays the gas hazards that are relevant to that situation.

Finally, the two lectures within protective equipment, included a lecture generically entitled, "Personal Protective Equipment," which subdivided itself into a discussion of respirator selection, fitting and maintenance, and more specifically, agricultural applications for such respirator equipment.

It also contains a discussion of general personal protective equipment, as well as the use and suitability of such equipment in an agricultural setting.

The agricultural noise exposure lecture gave us information relating to the effects of varying sound levels on hearing, agricultural noise sources, hearing protection equipment, and their effectiveness as well as the onsite measurement of sound levels.

Example illustrations from the protective equipment lectures include the penetration of chemical agents through protective clothing and the utilization of protective clothing in agriculture.

One of the diagrams or schematics used in the noise lectures is an illustration of the sources of agricultural noise. It shows the diminution of the effect of that noise, based on distance from a noise source.

The final category, then, discussed standardized protocols. In two lectures, it provided a standardization process for observational walkthroughs, their planning and conduct, the identification of exposure agents during the course of that walk through, and information relating to the controls for such exposure, as well as the durations.

The last lecture was Field Observation and Coding, which dealt with a system of computer compatible coding systems, standardized work area definitions and task definitions, the encoding of exposure observations, and the conditions of such exposures.

In its final form, the CAST package consists of 24 hours of edited videotaped lecture in 20 separate videotapes. There are both student and instructor manuals which differ primarily in that the instructor's manuals contain very detailed outlines of every presentation, whereas student manuals are intended as an aid to notetaking and are therefore not as detailed. These outlines also include a justification and an explanation of the purpose of each of the lectures, contain bibliographic resource citations, and contain discussion questions and exercises intended to stimulate discussion.

I should mention that this course is intended to be utilized by a qualified instructor for the instruction of a class of students. Presentation of this material by an instructor and guidance in the study of this material, is imperative. It is not intended as a self-study course.

I have already mentioned the supplemental materials that are contained in this package. In addition, there are a number of NIOSH publications, including certified equipment lists, which are very applicable and can be

obtained. Finally, one product from the effort to generate this training course was a library of 35 millimeter slides. There are somewhat in excess of 800 of these. They provide, as you have seen, some excellent illustrations and instructional materials for hazard surveillance in agriculture. These are available only on a lending basis, simply because I do not have many of them.

In summary then, let me say that this package has been developed and disseminated to the six States that were engaged cooperatively in their development. We are in the process now of developing additional, although limited, quantities of this material as an aid to other agricultural surveillance programs. I have already promised a number of these packages to various individuals and programs. Those who are interested in these materials should contact me sometime during the course of this symposium, and I would more then happy to discuss it with you, or alternatively, simply contact me within the DSHEFS division of NIOSH, or through Tim Groza. Thank you.■

Injuries Related to Potato Harvesting in Aroostook County, Maine

By *Norma Stacey-Scott, R.N.*

MR. SESTITO: You will recall from Carol's slide, that NIOSH is supporting 10 States in promoting nurse base surveillance programs. We have a second presentation from such programs normally. Norma Stacey-Scott is here today from the State of Maine and she is going to be sharing with us some information on injuries relating to potato harvesting in Aroostook County, Maine.

MS. STACEY-SCOTT: Good morning. I am one of the three agricultural safety and health nurses in the State of Maine. My territory is Aroostook County, which is the northernmost county in Maine.

As you can see from this slide, Maine has varied agricultural crops. Forests cover two-thirds of the State. Maine is also the largest blueberry producing State, growing 90 percent of low bush blueberries. Maine is third in potato acreage, fourth in potato production, and the potato industry in Maine contributes 74 percent of the cash receipts of farm marketing.

This slide represents Aroostook County. We are bordered on the west and half of the north by the provinces of Quebec and New Brunswick in Canada. New Brunswick also borders on the east.

My presentation today addresses injuries related to the potato harvest in Aroostook County. Aroostook County consists of 4,129,000 acres of which 3,879,000 are in forests. That is 94 percent. We do a lot of logging, and we investigate injuries in that field also. Approximately 80,000 acres are in potatoes. This acreage has been decreasing over the last five to seven years for various reasons, but mostly financial. The last three years the weather has taken its toll on the potato harvest, and our growing season is very short.

The population of the county is approximately 90,000. In 1981 a cooperative extension safety specialist collected data on the potato harvest injuries by surveying Aroostook County hospitals. This data served as a basis for educational programs offered to junior and senior high school students, farmers, and the general public. To provide more current data, a similar study was conducted in 1988, and continues annually. In 1988 we did have a 16-year old that was killed during potato harvest.

This comprehensive study which collected data in many varied categories: age, sex, type of injury, body part injured, if the injured was treated and released or hospitalized, how the injury occurred, weather conditions when the injury occurred, and so forth. You will find a complete report in the blue folder.

The limitations of this study are, one, it is not known how many of the injuries occurred which were not reported to the participating hospitals or were treated injuries at other medical facilities. Two, it is not known how many of the injured reporting to the hospitals were inadvertently not entered on the data sheet. Three, it is not known

exactly how many adults and/or youths were working in the harvest, so it is difficult to place the injury totals in context. Hence, the proportion of injuries reported may or may not reflect the makeup of the labor force.

How is data collected? These are the four major medical centers in Aroostook County: Houlton is the southernmost and Northern Maine Medical Center in Fort Kent is the northernmost. As you can see by this, the population of Aroostook County is concentrated in the eastern part. This Western part is forest.

Since 1991 I have participated in the collection of this data. During the first week of August, I visit each hospital, provide them with the copies of the survey injury log, and meet with emergency room personnel to answer questions and/or iron out any problems. Every two to three weeks I revisit the hospitals, collect the completed forms, and see if any more problems have occurred. The data is collected between August 15 and October 31. Information from these logs is then compiled by cooperative extension, and reports are distributed to participating hospitals, extension personnel, and the farming community. Safety programs are based on the results, and we hope to gain permission to do case follow up.

I would like to expand on that a bit. In the State of Maine we are not allowed, due to the privacy act, to contact any of the injured, unless they sign a permission form. In the last legislature we have had that changed so that agricultural injuries are now part of the mandatory reporting.

This is a copy of the log which the Emergency Room Personnel fill out. Sometimes they complete the log, and sometimes they do not; many times they leave blanks, so we have to compile data with what information is recorded.

This slide compiled by cooperative extension last year shows how the injuries occurred, (the percent of the total). These slides compare results with all the surveys which have been completed. Most injuries, except for 1989 and 1990, resulted from a body part being "caught in" usually, the equipment, and most often, the harvester. There are some farmers who still have the potatoes manually picked, and you will see later that many of the younger children participate in that process.

The harvester is most frequently involved in injuries. Women who are injured, are usually injured on the harvester. More men are injured in the potato house.

This slide shows a comparison of injuries according to age, (percent of total). The first year, 1981, the 9 to 19-year old age group (the youth group), had the highest percentage of injuries. It was on the completion of this survey that education was started in all the junior and senior highs in Aroostook County. A decided drop in injuries for that group followed.

This slide represents the total number of reported injuries. Again, the numbers for 1990, 1991, and 1992 are a little higher. There is a diversity of reasons for that. We feel that the surveillance has been better, and also that possibly employees are more cautious now concerning injuries to workers because of liability, and are referring them

more frequently to hospitals for evaluation.

This slide differentiates injuries to body parts. As stated previously, the upper body parts have been where the most injuries occur. On the harvester, upper body parts are most at risk. The potatoes are dug by the harvester, and come up from the bed on a conveyor belt where the tops are separated from the potato, and then to the higher level where the workers sort out rocks and debris which remains on the belt. This is when fingers, hands, and wrists are injured.

Types of injuries are noted in this slide. Fractures were the most prominent injury in the first survey in 1981, and have become much less a problem in later years. Again, the safety program started after the first harvest survey, and this probably played a great part in the decrease of injuries. Crushing injuries became more prevalent during later surveys probably due to an increase in mechanization. There were four finger amputations during the harvest this past year. Three of which involved women. Additional information is in your handout.

Again, these surveys have served as a basis for safety presentations given to the junior and high school students. Every year before the harvest break, they are also used by the farmers to educate their workers on the first day of the harvest. We, as nurses, find the education given to the students is much more fruitful and long lasting. A separate survey has been conducted in the public schools since 1985. Prior to the late 1950s, many junior and senior high school students missed several weeks of school because they were needed to help with the potato harvest. In the late 1950s a decision was made by the school district to have a three week harvest break. To adjust for this break, school starts approximately the 15th of August and closes around the 21st of June. **The harvest break starts about the 15th of September.** This break not only helped the farmers, but also allowed students to earn money for clothes, for college, etc.

Since 1985 potato production has decreased and educators and many parents strongly believe that the harvest break should be discontinued. A survey has been in progress since 1985 to determine how many students actually work in the harvest, how many worked at jobs which released an adult to work in the harvest, and how many students did not work. Reports from several schools are included in the handout.

These are (small dots) the school districts which participate in the school break for potato harvest. Each year cooperative extension sends out a form asking them to report on the students activity and monies earned. One or two school districts have discontinued the potato harvest school break.

This is a copy of one of the pages in the most complete report received from one of the school districts. This shows since 1985, grades kindergarten through twelfth, (as you can see, they even have some kindergarten students that work), exactly how much money was earned. It is very interesting to note that the amount of students working has declined. I am finding that the senior high school students are not as active in the potato harvest as previously noted. The largest number is from the junior class. The complete report of this is included in your hand-

out, and there is also a complete report from one of the other schools showing information from grades nine through twelve.

I hope that this presentation gives you some insight into the Aroostook County potato harvest. The involvement of the students in the harvest, and the attempt of cooperative extension, the NIOSH agricultural safety and health program, the county school districts, and participating hospitals to work together, to make changes which will result in a safer harvest. Thank you.■

Real-Time Video Monitoring of Noise in Agriculture

By *Alice L. Greife, Ph.D.*
National Institute for Occupational Safety and Health

MR. SESTITO: Our next speaker is Alice Greife. Alice is an industrial hygienist toxicologist, and she also leads our hazard surveillance program in the surveillance branch. Alice is going to be sharing with you a presentation entitled, "Real-Time Video Monitoring of Noise in Agriculture." Alice.

DR. GREIFE: As John said, I am going to give you a discussion this morning about real-time video assessment of noise in an agricultural setting. I would like to give some credit to Herb Venable, Mike Gressel, and Randy Tubbs, who collected the data and participated in analysis of development of the videotape.

The purpose of our activity was to pilot test the application of a video monitoring technique for the assessment of exposure to noise in an agricultural work place. There has been a great deal of research of noise in an industrial setting, but looking at tasks and the assignment of specific noise values is a rather new approach in agriculture.

There have been several reports of noise as a hazard in agriculture. Gregg, in 1972, did a review of active patients of an otolaryngologist and found that approximately 6 percent of those patients were being seen and treated for noise induced hearing loss.

Sullivan, in 1981, did an analysis of several studies and suggested that between 6 percent and 18 percent of agricultural workers, at sometime during their working lifetime, suffered a handicapping noise induced hearing loss.

Plakke, in 1990, did a prevalence study of farmers and their spouses, and the spouses were those who were indirectly exposed to noise, that they observed operations, or were near the operations, but did not directly participate, in that they did not operate the machinery. Plakke found that, as expected, the farmers had a noise induced hearing loss which was greater than the control group, but their spouses unexpectedly also had a noise induced hearing loss, which was greater in comparison to a control group of spouses of individuals who were not farmers.

Broste, in 1989, observed that children frequently are in and around noisy agricultural settings as well as in participating in situations which reduce noise. Broste suggested that the noise induced hearing loss, which we are seeing in adults, may have some foundation or be initiated in these early childhood exposures.

There are many difficulties in evaluating noise in agricultural settings. There are numerous sources of noise. For example, there are mechanical sources such as tractors, combines, power tools. There are also nonmechanical sources such as hogs, pigs and chickens. There are different types of noises. There are continuous noises, impact noises, as well as a variety of exposure conditions. For example, there is a very great seasonality in exposure to noise. A farmer may be exposed to noise in a tractor without

a cab for 18 to 24 hours at a stretch during harvesting; but in the middle of the season, in the summer, he may only be exposed for a few hours.

Sometimes farmers are insulated from noise exposure such as on combines which have cabs, or directly exposed to noise on tractors which do not. So there is a great deal of variability in the exposure conditions.

We elected to employ a video monitoring technique which would make a video and audio record of the noise, coupled with a monitoring system. In this acquisition system we had a video camera which could record on a video tape the work task that was being performed, and make an audio record of the exposure. The monitor we employed was a sound level meter which was attached to a data logger, which could continuously record and store the data. Those were then downloaded into a personal computer which was fitted with the specific graphics board. A computer program for producing a video overlay of a vertical bar indicating the sound level, and then the computer is also equipped with a variety of different software which can manipulate the noise data further such as SAS or SPSS or Lotus.

This is the backpack which was fitted with the sound level meter and the data logger. It is lightweight in construction and is worn on the farmer's back. Placement of equipment such as this is very important. It is up high enough so that when he sits on the tractor or on a mower, does not impede his work. Because it is behind him, he has free use of his hands. You do not want to impede the farmer's work activity, and you certainly do not want to endanger him at what he is going to do.

Here is an illustration of the backpack being placed on the farmer. As you can see, it is lightweight. It wraps around his shoulders and his waist, and will not interfere with the use of his hands or his legs.

We investigated three different noise operations. The first was mowing with the tractor. As you can see the backpack on the farmer's back and he proceeds in his normal activities. The second operation is in the construction of a grain bin. In this particular activity, shown here, you can see the use of a power rachet. The third operation was of a grain dryer, more specifically in the area of the rear exhaust.

After collection of the data with a video camera which is, to remind you, a video as well as an audio record of the noise, the sound level meter collects the actual noise levels. The two are integrated using a specially designed computer program written by Mike Gressel with NIOSH, in which the video image has a vertical bar which is overlaid onto the video tape itself, which rises or falls in response to the sound level. So as you see a work task, you hear the sound rise on the audio portion of the video tape. You see a vertical bar rise as well.

There are very interesting results based on this technique. First of all, the highest level we have recorded in a mowing operation was 90.5 dBA. In advance of the data collection, the industrial hygienist estimated that the highest level that would be collected would be, first of all, greater than this, and secondly, there would be a great deal of variability in sound intensity. In listening to

the tractor, in listening to the mower bar being engaged and disengaged, and the tractor gears being engaged and disengaged, there appears to be a great deal of variability in the noise level. Indeed, we found that there was not. The maximum noise level was 90.5 dBA, the average was 85.1 dBA, so very small a variability that there was no one single task that could be isolated using the technique that was responsible for the noise.

In looking at the grain bin dryer, the highest level that was recorded was 97.7 dBA, with an average level of 80 dBA and a range of 60 to 97.7 dBA. By analyzing the video tape and the vertical overlay, we found that this very high exposure level was associated with the use of a hand held power ratchet. So in this case we were able to isolate a specific source of noise, and would be able to, perhaps, have an intervention strategy in place.

The grain dryer had the highest overall level of 105.7, dBA. We were able to determine that when the farmer walks behind the grain dryer near the exhaust, was this high level of exposure occurred. The mean of the exposures was 96.3 dBA on his other operations, but this very high exposure level, using this technique, was isolated to his work around the exhaust.

There were several problems that we encountered in collecting this data. The first one was the response time of the noise level meter. There was a perception on the part of the industrial hygienist hearing the noise fluctuate faster than the sound level meter would record the sound. This could be solved by simply having a sound level meter which has a faster response time. There are instruments on the market which do give a faster response time than the instrument that we used.

The second is placement of the microphone to record the audio signal to be combined with the video input. We used the microphone that was on the video camera itself. By using a remote microphone which would be attached to the farmer, one would have a much more representative sound associated with the video tape, and that would also greatly enhance its usefulness as an educational tool, by clearly being able to hear the sound, as the farmer does, as it increases and decreases.

The third problem we had was with the data logger itself. The data loggers will average several data points in order to give one value for the recording time. We selected a rather long recording time, and because of the capacity that the data logger had to store the data point, the peak levels that were recorded were actually an average of several data points. The solution would be either to use a data logger, which has a greater capacity, or simply select a data collection time that was smaller. But all of these problems are problems with equipment which can be solved.

NIOSH has developed a training course on how to use its video monitoring technique. This technique could also be an effective tool to educate farmers and farm families from workers. It documents exactly what are the sources of noise; what they do that causes an overexposure to noise. It can be used in design and validation of prevention strategies to other reduced noise, to change

the farmer's work habits, to encourage them to wear hearing protective equipment. It could also be used by manufacturers of the equipment to show them what operation of equipment causes an increase in overexposure to noise. This information could then be used in engineering and modifications.

We found that this video monitoring technique can be used to assess noise in the work place; that it can be used to isolate specific tasks or operations having excess noise exposure. It can also be used to identify potential or possible intervention strategies.

Broste indicated that exposure of children to noise may lead to increased hearing loss in the adult farmer. By starting early in education programs promoting the use of hearing protection, loss of hearing in the adult farmer may be lessened. Using this technique to point out how one can help themselves, how work practices can be modified, procedures can be changed or controlled, may be useful in reducing hearing loss in the future. Thank you. ■

An Investigative Protocol for the Evaluation of Safety and Health Hazards on Family Farms

By *Tod E. Kramer*
Colorado State University

MR. SESTITO: In surveillance we do quite a bit to develop sources of information, to work with institutions and public health agencies to increase the number of eyes and ears, if you will, of people out there who are engaged in health surveillance activities. Through programs like this we are also in the business of developing new capacity and new health research resources. I have observed that are a number of graduate students who have come here today. We are fortunate enough that one of those graduate students is going to be making a presentation. We have, from Colorado State University, Tod Kramer. He is a second year graduate student. He is going to be sharing with us some information on an investigative protocol for the evaluation of safety and health hazards on the family farms. Tod?

MR. KRAMER: Good morning. The Colorado Farm Family Health and Hazard Surveillance was designed to collect selected agricultural safety and health information for family farms in northeastern Colorado. Colorado State University is involved in two separate parts of the study.

The first part is a personal interview with the primary operator and their spouse. In this personal interview questions are asked concerning farm characteristics, demographics, work history, general health, mental health, behavioral risk factors, occupational injuries, occupational illnesses, pesticide usage, and safety knowledge.

The second part of this study that CSU is involved in, is an industrial hygiene walk through of farming operations. This walk through is a focus of the presentation that I am doing today.

During the industrial hygiene walk through health and safety concerns are noted, and screening tests are also performed to evaluate hearing acuity and lung function of the farmer and their spouse. There are a couple of relevant occupational exposure surveys that were used as a basis for this protocol: The National Occupational Hazard Survey or NOHS, was a sample of 4,636 businesses that employed nearly 900,000 workers — illnesses reported. The National Occupational Exposure Survey was designed to describe potential occupational exposures to various chemical, physical, and biological agents, and describe the distribution of those potential exposures. In addition the NIOSH division of Surveillance, Hazard Evaluations, and Field Studies, produced procedures for the cooperative agricultural surveillance training project which we heard about earlier this morning. These were incorporated in the protocol. It was through the continued work with the people at NIOSH that we were able to come up with the desired protocol for use in our project.

There are six main sections in our data collection protocol that I am going to go through. We have training, quality control, recordable exposures, exposure agents, supplemental information collected, audiometric and tympanometric assessment, and pulmonary function assessment. I will go ahead and discuss these in more detail followed by some of our preliminary audit results we

have collected thus far.

Our training and quality control program that I have been a part of and have been through, includes graduate courses in occupational disease and hazard recognition, industrial hygiene equipment use, calibration and data collection, noise measurement and control, toxicology, hazardous processes, and respiratory protection.

We have formal training as an audiometric and spirometric technician, and a minimum of two semesters of supervised field work with certified safety professional and certified industrial hygiene professional at our university. Additional processes in hazard training are supplemented by using NIOSH videos that were sent to us, and in addition we perform up to five supervised field visits annually with our certified industrial hygienist.

We had to, first of all, decide what we were going to collect, and make a recordable exposure. We defined the recordable exposure as chemical, physical, or safety hazards which must be observed during occupational activity with sufficient proximity to an individual such that one or more physical phases of the agent or product are likely to enter or contact the body of the farmer. Once we have the recordable exposure, it must meet a minimum exposure duration criteria.

For chemical and physical hazards we have four classifications for exposure duration. We came up with part time, which is an exposure at least once per month in the past calendar year; full time which is at least daily for 90 percent of the work days over the past calendar year; seasonal part time which is exposure at least once per calendar year as part of the seasonal operation, but less then five days within a season; and seasonal full time which was defined as exposure five or more days per calendar year as part of the seasonal operation.

For safety hazards we had three classifications that we put safety hazards into. They are safety occasional which is contact time less than once per week to a safety hazard with the potential to cause an accident which impairs the individual from performing normal work activities; safety part time which is contact time one to three times per week to a safety hazard; and safety full time which is defined as contact time at least four times per times week annually to a safety hazard with the potential to cause an accident which impairs the individual.

Once we have classified the agent that we observe as a recordable exposure and it meets the minimum duration criteria, we then try to describe and classify the exposure agent. For chemical agents we try to use the general product terms which were adopted from the National Occupational Exposure Survey, and agents identified as veterinary medicinals, pesticides, fertilizers, and food contact cleaning/sanitizing agents, are listed by their trade name and registry number. Physical agents are identified and some of those are noise, vibration, excessive heat and cold, and cumulative traumas. Some examples of safety hazards that we list are guarding, electrical, walking working surfaces, fire, explosion, and unsafe work practices etc.

Supplemental information that we collect during our onsite walk through, includes a

classification of the agricultural areas that the exposures are noted in — some of the areas we came up with are repair, maintenance, and fuel storage areas, crop land operations, commodity handling and storage, animal confinement and handling, and a few others we will see later. Agricultural tasks are identified and intended to describe categories of agricultural activity. Some of the examples are livestock operations, field preparation, crop harvest, equipment maintenance, pesticide application, as well as others.

Controls are identified and these controls are also noted. Once we list the control, we try to note whether the control is effective for the exposure or not effective for the exposure. Some of the controls listed are respirators, hearing protection, gloves, boots, and ventilation; the list includes engineering controls and we also have some that are a basis for administrative controls.

Peak sound pressure levels are recorded for all hazards identified as potential noise sources. Tractor exposures are obtained if we can get the farmer to start up their tractors, which is a little easier in the summer than it will be this winter, I do believe. The equipment that we look for here are tractors, both open and closed-cab tractors, and other agricultural equipment, chainsaws, three-wheelers, four-wheelers, the whole gamut.

We then try to obtain an exposure estimate from the farmer to determine the exposure duration to each identified hazard. We ask them how many hours per day, how many days per week, how many weeks per year you are exposed to this hazard.

For our audiometric and tympanometric assessment, we perform the tests in the farmer's kitchen because that is usually the most quiet place in the house where we can set up equipment. It usually requires that we unplug the refrigerator to get rid of the low level background noise. Then I remember to tell them to turn it back on also! Then, background noise levels are measured by octave band analysis and recorded, and then they are compared to the maximum background noise level criteria for audiometric test rooms. To validate our documented results, the audiologist gets those measured values. A pretest questionnaire is administered which asks information about current colds, sinusitis, and/or earaches. It also probes for pertinent surgeries, tinnitus, and recent exposures to a loud of noise.

The audiometric test procedures that we use fall under the Council for Accreditation in Occupational Hearing Conservation Testing Guidelines. A tympanometric evaluation is performed and all of these test results are evaluated by our audiologist and a formal report containing test results and interpretations are sent to the participant.

We also do the pulmonary function assessment in the kitchen where we can set up. We administer a pretest questionnaire. Any individual with heart disease, chronic bronchitis, emphysema, or any lung disease are excluded from this test. We conduct the test using a NIOSH PJ5 spirometer and follow the NIOSH Division of Respiratory Disease Studies Spirometry Procedures. A maximum of five tests are performed with a minimum of three tests, having forced vital capacity results within 5 percent variance, unless we cannot get that in our five tests. The test

results are sent back to NIOSH for interpretations and once they are returned to us, we send a formal report with the test results and the interpretations back to the farmer and their spouse.

Data that we collect is transferred to an R-base data base for storage and analysis. We have five tables set up in our data base, and they are all linked by the farm identification number that we assign to the farm. We have the farm identification table, a chemical, physical, and safety hazards table, and our noise hazards go into a separate table, which contains exposure measurements. The audiometric and tympanometric results go into a table, and the pulmonary function results go into another table. This data base provides a good mechanism for manipulation of the data. Hopefully in the future we can try to separate out different farm types and farming operations, and see if the hazards on each type of these farms are similar, or if they are different.

Now we have a few numbers that we have collected thus far. We have got nine complete farm visits done, that I did earlier this summer. On these nine farms we had 384 separate chemical, physical, and safety hazards identified that met our duration criteria. This is an average of just under 43 hazards identified per farm. In the next few slides I have classified these hazards by agricultural area, agricultural task, exposure duration, and exposure type.

In agricultural areas we have eight separate classifications that we feel that we can fit all of our hazards into. Out of 384 hazards, 193 that we identified occurred in the repair, maintenance, or fuel storage area, which are places where maintenance and repair is done on the equipment, and it also includes fuel distribution areas. Eighty-eight were in cropland, a lot of those are pesticide application, field preparation, crop harvest, and other duties that take place there. Animal confinement and handling are feeding, moving, treatment, etc.

In agricultural tasks we have 384 hazards. Out of those a large portion, 173 were in the equipment maintenance tasks. A lot of those hazards we have identified as electrical hazards or work practice hazards. I will define that in the next slide. After equipment maintenance was pesticides, which were mostly chemical exposures. Hazards identified in ground preparation, crop harvest, and crop storage, were guarding hazards and noise. In the crop transport and storage tasks, the main one we're finding is augers and dust. Then in the livestock feeding, handling, and treatment tasks, there are pharmaceutical and their ergonomic concerns.

Exposure durations, 384. We have safety hazards being the major component that we are finding out on the farms. After that the seasonal exposures are pretty high and that can be expected because there are not too many operations that farmer will do day in and day out for the entire year. So he changes his job description, job duties, and they meet a seasonal criteria.

Finally, for the data analysis, we have 20 separate classifications that we came up that we felt that all exposure types found on the farm could be classified into. We have not been stumped yet on putting our hazards

into these sections. Out of 384 hazards, 153 of them were found to be electrical hazards. These range from such things as flexible wiring to fuel distribution with numerous splices of duct tape, electrical tape, etc.; grounding problems; reversed polarity; and damaged and exposed wiring in the equipment areas. Following that, guarding is a major problem. This includes the PTO shaft shielding, augers, and other equipment and moving parts guarding.

Just a few of the other ones for definition, pharmaceutical are injectables. The physical agents that we are finding, are mostly vibration, and work practice we defined as a hazard created through no fault of the equipment or intended process. It is where the farmer is, because of the way he is doing it, creating the hazard. Walking working surfaces are fall hazards and equipment design hazards are such things where the hazard is inherent in the design of the equipment. Personal Protective Equipment (PPE)/safety devices or the lack thereof. Rollover protective structures or lack of proper use on tractors equipped with ROPS are included in PPE/safety devices.

I must say, sorry I forgot, we had four livestock operations we visited, four irrigated crop land operations, and one dry land crop operation. So if you all noticed, the dairy operations were all zeros. We have not visited a dairy yet, so that is the reason.

In summary real quick, this protocol provides a method for collecting comprehensive safety and health hazard information in agriculture, which will assist in identifying high risk individuals, problem areas, and the hearing acuity and lung function of the farmers and their spouses. It is a good protocol to provide the Colorado Farm Family Health and Hazard Surveillance with a standard procedure for data collection, and hopefully its design and methodology will enable future investigations to use or adopt this protocol for continuing work in agricultural safety and health. Thank you. ■

Questions and Answers

Plenary Session I - Surveillance

MR. SESTITO: Can we have the lights please? We have about nine minutes before we break for lunch, so we have an opportunity for some questions. If you have any questions or comments, we have some mikes there in the middle. I encourage you to come up and identify yourself and ask your question.

MR. MCFARLAND: My name is Kory McFarland. I am with the nurse project in California. My question is in the last survey, did you include environmental in your survey, in your hazard evaluation?

(Answer off mike.)

MR. SESTITO: Any other questions?

MS. MULL: I am Diane Mull with the Association of Farm Worker Opportunity Program. My question is directed to Carol. You mentioned in your talk that there were a number of people that you think that were not being reported. How much do you think, or what percent would be from workers who just do not come forward because of fear of losing their jobs if they report?

DR. CONROY: We would like to know what percent that is. We really do not have that data. We do have anecdotal information, and some of the cases are actually pretty shocking. We had one case where the worker was told to burn some chemical containers filled with the chemicals to get rid of them. We think they are probably pesticides. The fire got out of control and he was burned. His employer drove him to the emergency department and went into the examining room, and told the worker to tell the physician that he was burning a wheat field, which was also illegal on that day. We did ascertain this. We think that quite often there is an incentive for the agricultural employer to not want this reported as occupational.

MS. MULL: We work with agricultural workers, and we would tremendously agree. We just came from migrant camps yesterday where workers were saying to us verbally, "There is no way we are going to go forward. We fall off the ladder, we complain, we lose our jobs." So they are not coming forward at all. I just wonder how much are you utilizing other farm worker organizations who have day to day contact other than health clinics.

DR. CONROY: We try to do most of our outreach through other organizations, and there are some farm worker unions in California. We try to identify anybody that is out there working with the farm workers already, whether it is government agencies or unions, and we try to give our information to them because they are in a better position to distribute it to the farm workers, and they already have the trust of the farm workers. We do try to tie into any infrastructure that is already existing.

MS. MULL: There is the Migrant Education Programs who work with the kids in school. You have head start programs, migrant head start centers working with the

smaller children. You have farm worker employment and training programs who do excessive counseling on agricultural employment as well as non agricultural employment. So there is a huge network of other farm worker organizations other then unions and health centers that are resource.

DR. CONROY: Right.

MR. SESTITO: I hope the audio taping got all that. That was some pretty good information being exchanged there. Any other questions or comments?

SPEAKER: This is for our last speaker also. I wondered, earlier Melvin Myers noted that interventions can include incentives. I am wondering if there are opportunities for the hazards that were identified that were related to repair and maintenance by place or task, if corrected, would allow farmers to perform repair work more quickly and of higher quality. Are these hazards possibly an area where higher production and a better place to work coincide?

MR. SESTITO: Excuse me. Could you introduce yourself?

MR. CHAPMAN: My name is Larry Chapman. I am from the University of Wisconsin.

MR. KRAMER: (Beginning of answer off mike.) So we actually send them back a report with the hazards that we found, and then we make recommendations. We do not go back and visit the operation. We make recommendations on how to reduce or eliminate the hazards, and that works pretty good. We have a High Plains Intermountain Center for Agricultural Health and Safety (HI-CAHS) operation at our university which we refer them to further if they have further questions. We will help them if they have selected information during the interviews that they would like us to send them, then I will collect that information and pass that on to them.

MR. SESTITO: We have time for one more question.
If not, we will bring this section to a close, and you all can break and get ready for lunch. Thank you very much.■

[Whereupon, the meeting was recessed for lunch.]

Luncheon Speaker

By *E. Roberta Ryder*
Executive Director, National Migrant Resources Program, Inc.

DR. WAGNER: Good afternoon. Thank you. That is Mel Myers on the glass there. You can give him a round of applause. My name is Gregory Wagner. I am Director, Division of Respiratory Disease Studies for NIOSH. It is my pleasure to have the opportunity to introduce this afternoon's speaker.
While I was thinking about it, last weekend I was reading a book by Bruce Chatwin called, "Dreamlines," which really confronted me with a certain irony. It is about the original people in Australia who were hunters and nomads. They were originally migrants. The book concerns, a lot, the way that people who are essentially nomadic or migrant, are being precluded from moving as they used to. In the book he talks about the original agricultural people as being the community settlers, the migrants being the hunters, and the herders and the kind of activities that they had with one another. The irony in contemporary America is that we have a certain branch of agriculture that, instead of precluding people from settling as they were accustomed to, it forces people to be on the move. It presents them with tremendous challenges in housing and health care, etc. People with challenges often bring people of excellence along with them. Our speaker today has had her life engaged in the advocacy education and human service delivery and administration for migrant workers, migrant agricultural workers. After a distinguished academic career at Michigan State University, Bobbi Ryder spent time as executive director of The Migrant and Rural Community Health Association in Michigan and subsequently moved to Austin, Texas, in 1986, where she has been the executive director of the National Migrant Resources Program, Inc. I hope you will help me welcome Bobbi Ryder.

MS. RYDER: Thank you all very much. Is the mike good? Should I pull it down a little?

I guess I would like to start real briefly, just tell you a little bit about the organization that I run called the National Migrant Resource Program. Unless anyone has any strong objections, what I would like to volunteer to do is to put all of you on our mailing list so that you can receive our newsletter which comes out six times a year. Any major objections?

The National Migrant Resource Program works as a support organization to a network of 400+ migrant health centers around the country. I have some slides that I am going to show you towards the end of my speech that will show you where those are located and what the migrant streams are like. Those migrant health centers are made up of people like you and me: individuals, professionals, in all walks of life, everything that it takes to run a health center. Some of our health centers run on the traditional medical model with the doctor, nurse support staff. Some of them run in less traditional models including the use of lay health workers as critical agents of change in health status for farm workers.

So part of what I am here for today, and the reason I appreciate the invitation to come, is that most of our health centers tend to function in isolation. They are rural like so many of the communities that you all serve. Their isolation is enhanced by the mobility

of the population. In a rural community, health professionals would be able to associate with other people within that community. In our migrant community the folks that they need to communicate with are sometimes 2,000 miles away.

We do a lot of things that are related to educational opportunities for collegial networking, that sort of thing. We also find it to be one of our most important missions, is the fostering of research. I know that you are probably the premier research organization in the country when it comes to looking at people that do agricultural labor, so I am very pleased to be invited to come and join you today.

Personally I come from a farm background. I was born on a farm in southeastern Michigan, and I spent 18 years, I hate to say as a farmer's wife because I was a farmer too, in southwestern Michigan, and my children started driving the Case 970 when they were 10 years old, and I did not have the sense to know that they needed roll bars. Our backyard got wiped out one year when my husband decided to rinse out the herbicide tank in the back yard. It was a puddle of mud for — we made it through our marriage, let me put it that way! Shortly thereafter he went and abrogated his license, but it was not quick enough.

So I have had the experience of being on a farm, driving down the road and getting sprayed as airplanes were flying over. I also had the unique opportunity of living and working with migrant farm workers, and I say unique, because a lot of times those two groups often seem to be in conflict with one another. Many times the farmers, the growers, are blamed for the plight of migrant and seasonal farm workers.

I do not believe that. I think that there are some very specific instances in which growers, as employers, need to be responsible and are not responsible. I certainly cannot say that they are to blame, because the situation with migrant and seasonal farm workers has been with us forever. I could go back to biblical times. Ruth is cleaning in the fields.

It is a phenomena that is not unique to the United States. There are always workers leaving one part of the world to go to another in hope of providing shelter and food for their families. It happens in Europe. It happens here. It is not always agricultural work. But in this particular case, migrant and seasonal farm workers were viewed to be an important part of the ecosystem, the food system in the United States. About 25 years ago there was a recognition by the United States government that we needed to begin to have programs to serve migrant and seasonal farm workers. Thus, we had the authorization for the public health services migrant health program.

I really appreciated your explanation of public health service this morning. I think I mentioned to you at lunch that it took me several years to figure out what you said in two minutes. So I appreciate that explanation.

My personal interest in occupational issues comes from an experience that I had in 1982, when as the executive director of a five county migrant health service area, serving 20,000 migrant farm workers in less than

9 months out of each year, I had 44 workers present themselves in the clinic in one day who had been poisoned by exposure to a pesticide.

It turned out that the only pesticide that had been applied within the last 30 days was Captan, which is known by most to be rather innocuous, but a systemic, and unfortunately the field was plowed up within two hours of the arrival of the first worker in the clinic, so we really were unable to ascertain whether it was that substance or something organic within the weeds that was in the field. The field had lain fallow for several years, and this was the first year that it had been planted to anything, in this case strawberries, in many years. There was one section of the field that was very, very wady, with real tubular weeds, and again, we think that we are preparing people by telling them to wear protective clothing.

In this case the people that had the third degree burns, were the people who got them in parts of their body where they had protective clothing, because the protective clothing kept the solution next to their bodies. When they were working without gloves and those who were working in short sleeves had no problem at all. We had three youths who were hospitalized because of systemic problems as a result of this, and the remainder had, again, third degree burns.

That began a very serious commitment on my part to learn more about that aspect of agricultural labor. I have been involved with the Environmental Protection Agency to a very small degree. I was a member of an ill-fated advisory council sponsored by the University of California at Davis in the mid 1980s. I was privileged to participate in the surgeon general's first conference on agricultural safety and health, and I know I see a number of familiar faces here.

Most recent work that we have completed is a video with EPA funds called, "The Playing Field," which is designed for children in fourth, fifth, and sixth grade in age, but is actually interesting and exciting, even to adults. It is a bilingual film and it is a real basic prevention film that is told along the lines of a novel, involving real live people, no talking heads. If any of you are interested in that I think we sell that for about $25.00. We have a small price tag on everything that we sell, just to keep it in publication.

I would like to talk to you a little today about migrant seasonal farm workers and who they are and where they are. I agree that farm workers can include farm worker farmers, farmer's families, and farm workers themselves. We do not traditionally think of people who work on dairy farms as, I say "we" meaning in the program that I work in, we do not traditionally think of dairy farmers as seasonal farm workers, but I know that they definitely are.

There are also a number of people who do other things most of their year or most of their lives, who go into agricultural labor because of necessity; sometimes laid off construction workers. In fact I had a meeting in the early 1980s with a group of people in southwestern Michigan who had all been laid off from a major industry, a major factory. They were talking to me about health care, and I had some guy sitting in the back of the room, and he was asking

what they were eligible for. There was something that farm workers were eligible for that non farm workers were not eligible for. He goes, "Well you know, if I got out and steal me a bushel of tomatoes, does that make me a farm worker?"

Unfortunately I think it is that narrowmindedness that helps to keep us from truly getting to know people who are different from us. The majority of migrant seasonal farm workers that I have worked with over the years tend to be people whose origins are of Mexican-American beginnings. Many of them have been in the United Stats for many generations, longer than my family. As a matter of fact, I think we took their land. That is part of why they are here with us now. So it is real important as we begin to look at how to serve migrant seasonal farm workers, it is important to think of them as a part of our country, and not to let the myth of the "wetback" to get in the way of our sense of responsibility of providing care for them.

In North County, San Diego, where I visited last fall, I found roughly 50,000 migrant and seasonal farm workers who were living in caves and holes in the — I am thinking of the word in Spanish, not English, excuse me — in the canyons of North County, San Diego. It is one of the wealthiest parts of the country, and yet we have a large number, estimated at 50,000, primarily Hispanic workers, the majority of them are now United States residents who live, literally, in No Man's Land. I have a couple of shots of those scenes that you will see.

Those people are farm workers because that is what brought them to the area, but in that particular area we have a phenomenon that is happening more and more in various parts of the country, where real agriculture meets urbanization. These people who at one time worked primarily in agricultural labor, are now considered to be day workers. They go out of the canyons into town, and are picked up by a truck who drives by and wants some laborers. They never know until they get to where they are going, what it is they are going to; whether it is construction, whether it is domestic work for the day, whether it is yard work, or it might be agricultural work. There is a real big mix here, and there is no black and white on who the population is.

Within the federally funded programs there are multiple legal definitions of what a migrant and season farm worker is. Some say you have to have been doing it for 12 months, others say if you declare your intention to do it, you are a migrant farm worker. Most of them all agree, that in order to be considered a migrant farm worker, you need to change your place of abode in the seek of employment, in seeking agricultural employment.

My point is that you cannot pigeon hole farm workers. They are very different from farm owners in many ways. They are also very similar. Differences sometimes include race, economic status, although that is certainly not the case with a small family farm. The mobility, of course, is the difference. Cultural factors, also, are also very different.

I would like to piggyback on what you said this morning about the importance of psychology in looking at the population's needs. I also had a chance to look at the poster in the room — I guess it was downstairs, that

was talking the effective means of reaching Amish families. It is very important to get in at the psychology and the cultural background of the people that we want to serve.

The biggest similarity between migrant and seasonal farm workers and all farm workers, is that they all share risks. Sometimes the risks are a little bit different, but they equally share in those risks. What kinds of places do migrant and seasonal farm workers work? Everything from small truck farms to large agricultural business industries. The area of Michigan that I was in for so many years, we started the season in the early spring with asparagus. That was in April. We went all the way through until the end of November with apples. There were always additional people that were kept over the winter in the snow, to turn the vineyards, so that the mechanical harvesters could come in, again, and harvest the grapes. I have got some slides of those things that I think will be helpful to you.

MRP has been involved in the formulation of migrant and seasonal farm worker objectives for the year 2000, and in this process I have got a couple of copies here, and we would be glad to send them to anyone who wants them. In this process we had to look at both environmental and occupational health, because the terms had been used almost interchangeable for so long. What we did was to plot them on a spectrum. I would like to share some of the items on that spectrum, with you, at this point starting with the occupational end of the spectrum.

It is real hard to say where one ends and the other one starts. That is why we put it on a spectrum. Certainly equipment related accidents, orchards, ladders — I once saw a farm worker, and of course most of these people work on a piece rate, so they are working as fast as they can, to pick as much produce as they can. I realized that this man, that I had come out to the orchard to see, was standing at the top of a very tall ladder. I cannot say whether it was 12 ft. tall, but it was way up there, and he was leaning. He had the top of the ladder leaning against the outside branches of an apple tree, and when he picked everything that he could pick in that reach in the ladder, rather than lose the time to climb down and move the ladder over, he walked it as if it was a pair of stilts around the tree; from the top of the ladder. He did not fall.

I have seen people doing that since, and it never fails to amaze me. Knives, like cutting things like cabbage, cauliflower, broccoli, working the hops in the Pacific northwest, sugarcane, work with conveyor belts, sometimes at very high heights, stew flavor, use of the short-handled hoe, equipment roll over, spray equipment traveling at night. Quite often pesticides will be sprayed at night because that is when the wind is down. Farm workers will go out on a piece of equipment to do the spraying, cross a small farm lane, cross a road to go from one field to the next, inadequate lighting, boom!

Infants in automobile when they should not be in automobiles. Children locked in cabins because there is no place for them to go for day care, and their parents do not want them out playing loose. I am talking about a padlock on the outside of the door that locks the children in. We have had a couple of deaths, in fact two of them two years in ago in southwestern Michigan, in which an

infant was left in front of a blanket in front of a car that was parked by the side of the field, and somebody else jumped in the car and crushed the infant.

Certainly the lack of productive clothing, both from the pesticides and the crops that are being handled, because some of the crops themselves create allergic reaction; early reentry times to fields; automobile accidents while in the road. This is one that I think is very, very important because it is easily overlooked. Farm workers moving on the road, traveling with a large number of people in the car with all of their possessions in the car, traveling at slower speeds, are very frequently rammed from behind by faster moving vehicles. Also falling asleep at night because they tend to drive straight through rather then stopping is a real serious danger.

Accidents related to housing. Social problems related to housing and crowding. Alcohol substance abuse, child abuse, domestic violence. Now we are crossing over the line from occupational into environmental care. Certainly reaction to low grade pesticide exposure, repeated exposure over a period of many years' symptoms which include common things like headache, nausea, dermatitis, complications of pregnancy, things that we cannot verify; the fact that we can do cholinesterase(?) testing for organic phosphates is fine if we are talking about an organic phosphate, but we have very little way of proving or ruling out actual pesticide exposure in most illnesses. Physicians find themselves in the situation where all they can do is treat the symptom.

Lack of facilities. I am talking about bathroom facilities. You will see a couple of slides. Lack of potable water, no handwashing facilities in the field. Defecation and urination in the field because there is nowhere else to go.

I think there has been a myth for a long time that farm workers are out there under the blue sky working on God's green earth, therefore we do not need to have things like potable water and toilets and handwashing facilities, but really it is a factory. It just happens to the outdoors. As a result of that it is open to the elements.

If we think of it in terms of a factory, if you have a 600 acre field of strawberries, and you have got 300 to 1,000 workers out there, they start at one end in the morning and they work all the way to the other end at the end of the day, and if it is your grandmother that is out there and she has to go to the bathroom. Where does she go? She goes right there in a row. Nobody should have to do that.

If we cannot change the way things are for the workers themselves, I hope you will assist me in a human cry to appeal to everyone's common sense for public health. As one of my colleagues once said to a joint session of the legislature, "Just exactly what amount of fecal matter present on a strawberry is a tolerable allowance?"

Storage of pesticide containers and reuse of pesticide containers. Use of household sprays. I once had a family of children come to me in the clinic, and the mother in Spanish, said to me that they had recently arrived, they had taken their kids to school, the school had said they could not come into

school because they had lice, and they could not come into the school until after they had been cured. The parents could not work until the kids got in school. So she was spraying their heads three times a day with Raid.

Lack of screens on housing. Insect bites. I know it sounds real small, but when you are a real small child and your body is literally covered with insect bites that turn to impetigo, it is a real serious problem.

We have quite a broad spectrum of problems for farm workers. Why do we know so little about them nationally and statistically? By the way, one of the things that my agency does is to collect all the data we can possibly find, and we do have it on data base, published and non published, specific to migrant health. Anything that you do write and publish, we would love to have a copy of. If you are writing and you would like to use our research facilities, they are available to you.

Certainly lack of vital statistics on farm workers is our biggest problem. In Florida, after the hurricane we had families that literally disappeared right after the hurricane. We had some families who had members of their families disappear and it took them months to finally get to the point where they would report the loss of those family members.

In North County, San Diego they literally do not know how many there are. I stood on one hill next to a small encampment of 30 men, and if the priest who was with me had not pointed out the different small settlements on the other side of the canyon, I never would have known they were there. It is an invisible population. One of my other colleagues said that migrant farm workers in the north are conspicuous by their presence, but in the south they are conspicuous by their absence. So southern areas like Texas, Florida, and California, it is very difficult to say that this is a farm worker or this is not a farm worker, when it comes time to report morbidity and mortality.

In terms of opportunities, if there are two things that you folks could do to help us, it would be to help us to bring pressure to bear on the U.S. Census information to include migrant and seasonal farm worker, or even just farm worker on the census data. The other one is to work with individual States, to ask them to collect that kind of data on the standard vital statistics that are collected on all other populations.

One other opportunity is that for practice based research. We have a network of 400 migrant health centers that who would like very much to work with you, and share what they know anecdotally, in order to validate what we know. Unfortunately at this time all of the research that we are conducting comes out of our service delivery dollars. There are about three to five million farm workers in the country. We do not know how many. We have $57 million to take care of them. We take care of 500,000 of them. That is roughly $100 per patient per year. It is not much.

I think at this point I would like to turn on the slide projector. I am just going to go quickly through it, if I can find my remote. Okay. Do you mind working the buttons for me?

This is a map that shows the general locations of the migrant health centers around the country. You can see the concentration in the areas with the longest growing periods of the country. First largest migrant user State is California, second is Florida, third is Texas, fourth is Washington State, and fifth is North Carolina, in terms of numbers of farm workers.

These are the three streams that I referred to earlier. The first one, which we call the eastern stream, based in Florida, goes up along the eastern seaboard. It includes workers from Puerto Rico and also from Jamaica. We find a much larger predomination of solo male workers in this stream then we do in any of the others. The midwestern stream by far the largest, and about 90 percent Hispanic, goes up like the fingers of your hand, all over the country. The western stream with some crossover into the midwestern, goes up along the western coast.

That is the same slide. There may have been two of them, so you can go on to the next one.

Top 15 States. Well I think I just made a liar of myself here. Farm workers plus dependents, 1990. California, Texas, Washington, Florida, and North Carolina, in that order. As you can see Puerto Rico also has a large number of farm workers, most of whom are seasonal and work right on the island itself, many of whom go up into the New Jersey, New York, Pennsylvania area. Oregon, Idaho, Georgia, Michigan, just gives you an idea of the large employer States in the country.

In terms of specific diagnoses, I referred in the chronic exposure to pesticides, pretty common symptoms that we cannot rule out as being pesticide related. Certainly as you look down this list you see several of them. At the very top of the list we have a number of chronic diseases: hypertension, obesity, diabetes mellitus, hay fever, emphysema, viral infections, back pain, osteoarthritis, all of these you can find occupationally related causes. Thank you. Can you go ahead and change it?

This is based on a study that was conducted, again in 1990. Of those who came to the health centers from a sampling of five health centers in the country, these were the most frequent diagnoses. You see right at the top was eye problems. That tends to be very occupationally related. Depression. Again we see it, the psychological impact there. Anemia, arthritis, high blood pressure, stillbirth, awfully high, kidney problems. It is real hard to tell a woman with a kidney infection to drink lots of fluids and urinate frequently if she lives in a cabin that does not have a bathroom, and she works in a field that does not have an outhouse. Intestinal parasites. Very definitely a part of working in the soil especially in those southern States that you see. Can you go on to the next slide please? I am running out of time here, and I want to go through rather quickly.

Just a little sample of the housing. This is one of the houses that was lived in the canyons in North County, San Diego, that I wanted to share with you. That bucket that you see there is the toilet. Go ahead.

The types of work that these people are engaged in is very heavy work. By the time

this is filled up with oranges it weighs a great deal. Go ahead.

Here is a man working in a packing shed. Again, all types of work. Go ahead.

This guy was not the one that was moving the ladder around the tree. I think this ladder was a little taller than what I had seen. Just to give you a sense of high up that person is.

Okay. Next slide. Just to let you know that farm workers range in all ages. Okay.

Another house. This one also in North County, San Diego, but this is not unique. We have houses. We have, gosh I cannot really call them houses can I? — we have dwellings like this all over the country.

This is an encampment that is on the banks of a river, also in southern California. You can see the runoff here from where people are sitting at the table. This camp is called "El Diablo." They have been forced to move about three times in the last three years. There are about 800 people living in this encampment. Please change it.

Just a little shot on the labor scene itself, a lot of stopping, a lot of heavy lifting, throwing. By the way, these black and white pictures that I am showing you have been taken by a photographer whose name is Alan Pogue, and none of them is older than 1989. If you can change it.

This one was taken in southwestern Michigan. An older man picking raspberries, which we see very little of any more these days. Okay.

This was taken at the top of a pickle grading shed. This young man was up there for the purpose of making sure that the grater did not get jammed. It was about 20 feet up in the air. That was the top of the shed that you see inside the roof of.

This was taken inside of a mushroom growing plant. He is changing the manure beds. Okay.

Again, knowing that this shot was taken in 1990, it looks like something out of the 1920s, but this is an important part of what staying clean is all about, and changing protective clothing. It is kind of a never ending battle. Okay.

Child labor. It was not until 1978 that child labor laws were passed that prohibited children under the age of 12 from working in the field. It is still not strictly enforced. However, it is an important element for the family's survival. So you see this young girl collecting her tickets for the berries that she has picked.

Again, this is a young girl. It was her birthday, and she had gone to work with her number who was grating bell peppers. Quite common to find a child in the work place, just as I might take my child to work with me, because sometimes that is where they need to be. But it is not exactly a safe place.

I cannot quote this statistic. I wish that we had better statistics on income. This was based on a study that was conducted in 1991, and I think it is probably pretty reasonable. Migrant families annual income $5,000, single migrants $3,000. That is

based on the knowledge that although farm workers may work very fast and long hours, that there employment is very seasonable, and even in peak harvest times they may not have a full 40 hours of work a week.

Again, just a shot at the different kinds of work that farm workers are involved in from the planting to the hoeing, to the harvesting, to the loading.

Again, we get into the packing, and the processing end of things. We find farm workers in all aspects of this work also.

Just to show you a little bit of the crowding, this is a scene that was taken in the spinach field in Colorado. It gives you an idea of the number of workers that can be in a field at one time. Go ahead.

Again, the types of work. Carrying, stooping, and lifting. If you can see on the far side of the shot, you see that this is a bulk box on top of a trailer, and this man who has just gotten up from stooping and carrying, is now throwing it over the edge of the bulk box.

Older people. Use of knives. Sprain.
A little shot of your modern bathroom in one of the colonials in south Texas. Another shot of the bathroom.
Housing comes in wide varieties.

This is transportation for a large family.

This is reminiscent of days gone by, but people are still living in these trailers today.

This is at a farm in southwestern Michigan called "F&F," and it consists of four rows of houses. Each row has 100 houses in it. When I would forget what I was doing and why I was doing it, and when I would get the most frustrated with the bureaucracy, I would start in between these two rows, and walk all the way down and talk people, and come back down between the other two rows. Usually after about six hours of doing that, I remembered why I was engaged in this type of work.

Barracks. Again I mentioned that on the east cost we have a lot of solo male workers. This is the way that are housed.

Even in our federally funded programs we have crowding. This was a day care center that I ran in southwest Michigan for a long time, and literally no extra room. We had 500 children enrolled in one day care center under the age of five. That was back in the good old days when we had money to run day care centers. Those are no longer operational at this time.

I think that for all families in the world, the children are our future. These kids are in the back of a pick up truck on the edge of a field. They do not know that they are deprived. If you will go to the next slide, that is my last.

I have selected this one because I think this little girl is so beautiful, and just wanted to share with you some of my experiences in working with migrant and seasonal farm workers. Thank you.

DR. WAGNER: Thank you for an incredible introduction to this group of workers. I am impressed with the opportunities as you described them for the collaboration, and

interaction between a wide range of people in the room. Certainly the agricultural centers for health and safety should have an opportunity to link up with clinics serving the migrant workers in their areas, and ought to be able to look for both research and intervention opportunities. ■

Let me thank you once again, and we will be reconvening downstairs in about 10 minutes.

[Whereupon, the lunch session was adjourned to reconvene in plenary session.]

A Two-Part Study of Agricultural Health and Safety Communication

By *Judy B. Oskam*
Oklahoma State University

DR. OLENCHOCK: My name is Steve Olenchock. I'm with the Division of Respiratory Disease Studies of NIOSH located in Morgantown, West Virginia. Our first speaker today is Judy Oskam from the Department of Agricultural Engineering at Oklahoma State University. And Judy is going to speak on a Two-Part Study of Agricultural Health and Safety Communication.

MS. OSKAM: We are going to be talking about communication for a little bit. We have one of the Oklahoma AHAP Programs as you heard earlier this morning. And ours is a video based program. So as we try and communicate to our audience, we wanted to also find out are we meeting their needs and are we communicating in the way that they wish to be receiving that information.

This was a two-pronged research effort where we wanted to take a look at what our farmers wanted throughout Oklahoma and also what agricultural extension engineers were doing to communicate safety and health information. Bill Barfield presented the results at our March Morgantown meeting about our on-site safety survey. But we also did another survey in conjunction with that more comprehensive effort where we wanted to interview 170 farmers about how they get their information. And that was conducted in the summer of '92. Then we also surveyed all of the extension ag engineer departments, 51 of them, Puerto Rico included, and we had a response rate which was fairly high, 45 responding. Some of you are in this room and I want to thank you for your help in this study.

The research questions we wanted answered in the farmer's survey. Where do farmers receive their information? And we broke that up into general news and information, agricultural information and then safety and health information. And then how do they want to receive ag, safety and health information? As far as what we wanted to ask the ag engineers, we wanted to find out which mass media message they were using to communicate this information and also what would they do if they could do one thing to improve their own program.

For the farmer survey, we interviewed 170 and their primary source for news and information was of course television, now this is for general news. Magazines followed second, then newspapers and radio. And then where they get their safety and health information was primarily from magazines and followed very closely by television, newspaper and radio. We asked them where they get their agricultural information, and as we

expected, magazines scored fairly high, followed by newspapers, and television ranked third down there.

And then we asked where they wanted to receive their ag, safety and health information. And overwhelmingly they said magazines. We threw in videos there because we wanted to find out if they were interested in getting some of our information. So that could be one of the limitations depending on how you look at it. But we really needed to know. Television ranked third, followed by newspaper and radio.

We also wanted to know how many farmers had VCRs. And we found that a lot of them do, 93 percent, as probably all of us in this room do. But that was important to know because if we are producing videos do they have a way they can watch them, or does it have to be a workshop environment where we have to get them to the site. Or can we improve our delivery systems to get the videotapes to them. So we found this interesting.

We asked are they interested in getting information from the mass media? Well, almost 90 percent said yes. We had a couple who said I'm tired of the media, I don't want to hear from them and that was understandable.

Okay, as far as the extension ag engineers, we asked them who their primary audience was for reaching safety and health information. And farmers ranked very high, educators were up there, youth and then the "other" category included health professionals. What kind of methods are being used? And here, agricultural engineers could pick more than one, and as you see they did. We included workshops since that's how extension does quite a bit of its educational outreach effort. But you can see that a lot of folks are doing a lot of different things.

What do they think is the most successful? This was interesting. Workshops ranked high of course, videos was second, even though it was only 18 percent, followed by newsletters, radio, fact sheets, and television two percent. And that's interesting since this is how a lot of the farmers want to receive their information.

Okay, how do they evaluate the information and the materials? Positive client response was first, number of clients served, requests, peer review, awards. Other included a number of different things from more in depth peer reviewed and refereed type information.

We asked what would agricultural engineers want to increase if they could? This was not the give us one primary item, this was what would you do. Well, they want more videos, they want more television, and it just went on from there. But they could list more than one here and a lot of them listed a number of things, as we would all like to do more things.

If they could make a single most improvement or addition to their program, this is what you're seeing here, 20 percent of the respondents would produce more television reports or videos. They would hold more workshops, hire a full-time specialist, mail a monthly newsletter, add more staff — only five percent said that which I found interesting — survey instrument for accidents. Increase professionalism of materials, hire a

Spanish speaking specialist, we received that from two percent of the respondents.

We asked the agricultural engineers what they see as the most important hazardous area for their clients. They said machinery was first, chemicals, animal handling and child safety which is an area we're working in as are many of you. Then we asked the farmers the same thing. And chemicals were top on their list. They were very interested in receiving more materials on the chemical area. And machinery is close behind, but still chemicals was first. And they could choose more than one.

And what does this all mean? Well, a couple of recommendations here, which a lot of you are doing since you're in this room with us now. Educators should develop and implement health campaigns in coordination with mass communication specialists, that's very important, in order to get the word out and to reach who we're trying to reach. Use the mass media as much as you can to communicate information to your target populations. Increase the use of magazines which is a primary source of ag information, television which is a primary source of general information for at least our farmers surveyed, and conduct research of your own in your own State. This is a group of Oklahoma farmers, it could be different elsewhere. I do know and have seen several studies where magazines do rank very high among the rural farming population, so that's probably a national trend.

And the media, which is probably something we cannot control, need to recognize farmers as an important population and viewers yes, but an important population nonetheless. And communicate more information about health and safety issues. We tried to shift the focus a little bit in Oklahoma from just calling it safety to calling it safety and health. We find that health sells, safety always doesn't. But at least if we can reach our target with that message, we hope we're actually doing some good.

I think that is my last slide. Thank you very much. ■

Air Sampling Strategies to Assess Exposure-Response Relationships for Respiratory Disease in Dairy Farmers

By *Peter F. Waldron*
University of Iowa

DR. OLENCHOCK: Thank you Judy. Our next speaker is Peter Waldron from the Institute for Agricultural Medicine and Occupational Health at the University of Iowa. And Peter will talk to us about Air Sampling Strategies to Assess Exposure-Response Relationships for Respiratory Disease in Dairy Farmers.

MR. WALDRON: It is usually pretty easy to make fun of agriculture. We're all familiar with nursery rhymes, such as Old MacDonald, and of course, Gary Larson cartoons. It is also pretty easy to make fun of agriculture when we do not understand the magnitude or the complexities of the problems that face professional farming. I think this is all too often true of the non-farming general public but it may also be true of researchers.

In the idyllic setting of the family farm, it is also difficult to believe there are any respiratory disease problems. It is also difficult to believe there is a problem worth researching or preventing.

The reality, however, is that there are about 10 million milking cows in the United States today, and on average those cows weigh about 1,500 pounds a piece. They produce 148 million pounds of milk in a given year. They also drink about 300 gallons of water a day. Now, 87 percent of that comes out in milk, and milk is 80 to 87 percent water. A large portion of it, about 30 pounds average, comes out as urine, about 65 pounds comes out as feces. It's not too difficult to multiply this volume by an average herd size of 65 to generate a waste problem per day of about three tons. And multiply that by 365 days, you have about a thousand tons of waste that must be gotten rid of one way or another.

Now, if you are outdoors it is not a problem, with the exception perhaps of a concern for the EPA. What we are concerned about is when you bring that waste indoors (confinement farming) and the respiratory disease problems that may result.

This particular barn is a relatively new one, having been built in 1987. It was designed for maximum heat efficiency and maximum ventilation during the warm summer months. None of the windows open in this facility, ventilation is supplied by two 48 inch fans at one end of the building. The morning that I was sampling here, it was minus 10 outside. The thermostat on the fans had not yet kicked in and the ammonia levels were approaching 20 parts per million (the OSHA PEL is about 25 and there has been a recommendation in agriculture to keep it as low as seven because of a dust gas interaction). Well, as far as I could tell, the farmer and his daughter were experiencing no ill effects, and I do not think the fans would have come on if the farmer had not noticed that I was looking a little green.

It has been estimated that about 20 percent

of farmers in this country suffer from some form of respiratory problem. In confinement that estimate is as high as 40 percent. In dairy barn confinement, the worker is exposed to several organic dusts: vegetable dust such as grain, corn silage, hay silage, microorganisms, fungi, bacteria, thermophilic bacteria, animal dander proteins, insects, mites, weevils, insect parts. All of these exposures may cause one or more health effects such as rhinitis, asthma, or hypersensitivity pneumonitis.

If you are going to make a study of exposure and health effects in dairy farming, you have to go where the cows are. Now we could have gone to Kentucky. I think that in Kentucky in 1991 about 34 million pounds of milk, cream and cheese were produced, but in Wisconsin (incidentally please note that each dot on this map is equal to 2,000 cows) some 72 million pounds of milk, cream and cheese were produced. Wisconsin also happens to be the home of the Marshfield Medical Research Foundation (MMRF) in Marshfield. In 1991, the MMRF collaborated with the University of Iowa to look at a cohort of dairy farmers for environmental exposure relationships between farmers lung disease, respiratory symptoms, antigen status and lung function. In January of 1992, an occupational exposure assessment was begun in this cohort. Over a period of 15 months, 81 dairy barns were assessed and literally thousands of data points were collected. The analysis of those data is currently ongoing.

What I would like to talk about at this time is some of the sampling strategies we used during that project and perhaps most importantly, discuss those strategies that did not work. There is a tremendous heterogeneity to the organic dusts in dairy barn confinement. No one sampling strategy will cover all the bases. In addition to that, the concentrations can also be enormous. In this particular case, it exceeded the OSHA nuisance dust standard of 10 milligrams per cubic meter.

By breaking up that dust fraction with several less than perfect methods, we can begin to get some idea of what the worker is being exposed to. Our study looked at gases, predominantly CO_2 and ammonia. We would also look at carbon monoxide if it were deemed reasonable, and hydrogen sulfide. Rafter dust was also looked at and total dust using both high and low volume with a 37 millimeter cassette. We sampled for inspirable dust with a 25 millimeter cassette at two liters per minute, respirable using the OSHA method of the 10 millimeter nylon cyclone (which has a collection efficiency of 50 percent at 3.5 micrometers), and particle size distributions using a Marple cascade impactor with cut points at 20, 10, 5, 3.5 and 1 micrometers. I have available detailed lists of the different sampling strategies and methods of analysis that were employed for those who require more information than time allows during this presentation. From the various particular sampling methods, separate analyses were conducted for endotoxin, histamine, spore concentrations, mites, and cow dander (I will talk about viable bacteria and fungi in a short while).

We looked at basically, or tried to look at, four peak exposure periods which are common to all dairy operations. Obviously milking is common to dairy operations. Normally this is not a peak dust exposure

period, but you will notice how close the worker is to the bedding. So depending upon how old that bedding is, what type of bedding it happens to be, and when it was changed last, there can be a significant exposure. In addition, you will see the worker has his face pressed up on the side of the cow. In many instances this is done to assure the cow that everything is okay during the milking process. This may also produce a cow epithelium exposure. Depending on housekeeping in any particular barn, there can be significant dust cascading down into the worker's breathing zone from the animals' backs.

A second peak exposure period is feeding. Feeding can be done either by hand, by manual cart or a mechanical gasoline powered cart. In the latter case we would do carbon monoxide sampling during this operation. You can also see in this particular picture two of our sampling strategies. One is a personal sampler with a tube going up to the worker's breathing zone (the inspirable sampler). This sample would be measured gravimetrically and we would also use it for endotoxin and cow epithelium analysis.

The second strategy employs a basket to support the sampling of all the other analytes that have previously been mentioned. There were two of these multi-sampling baskets. One basket would stay stationary within the dairy barn at all times. The other basket would travel wherever the farmer happened to go. If he went into the feed room it would go with him. If he went into the silo, I took it after him.

Manure transport is our third area of peak exposure. Again, this is an area you would normally not think is a peak exposure. However, when you're cleaning out the individual stalls and brushing down the alleyway, there is a dust exposure. What you will notice here is that the farmer is applying a layer of lime. This is after manure transport has gone. What we have here is an inorganic exposure which was not considered in this particular study.

The fourth area and highest exposure that we found was during bedding. Bedding can be newspaper, it could be sawdust. Frequently it is poor quality hay material. Bedding may also be unloaded as you see here with a manual cart but I've also seen skid loaders or bobcats brought into the dairy barn which have the potential of contributing to a carbon monoxide problem.

Industrial hygiene should be easily applicable to agriculture. What you need is a set number of sampling sites, a proven methodology and a reasonable or reliable analysis. The fact is that agriculture represents a very unique environment that is not always applicable to industrial hygiene.

In this particular case I want to get back to the viable fungi and bacteria that we tried to sample. We used at first the Anderson viable sampler here, the two stage with auger plates in between. This technology has been around since 1950 and used extensively. In dairy barn confinement, we completely overloaded the plates within five seconds. We could not use this particular technology. Instead we went to an AGI or All Glass Impinger which proved reasonably successful. We also discovered that the use of tripods in a dairy barn just doesn't work (there is no place for a tripod in a dairy barn). All

of our sampling equipment needed to be suspended off the floor of the barn. We had to keep it within the breathing zone of the worker but out of the licking zone of the cows.

An important part of indoor air quality is the number of air changes in the room. We thought it would be very important to determine the rate of ventilation in all of the barns we looked at. This proved next to impossible. The tremendous variation in size of fans, mixing fans, and supply fans, just proved too difficult to be able to sample for the time period allowed. You can imagine, if there were 18 fans in a barn, trying to go to each one of those with a hot wire anemometer, particularly if they are variable speed. It doesn't work out very well. The mixing fan in this slide was not supposed to be in operation; however, while I was there, it came on by surprise. My sampling equipment is in the upper right corner of the slide, and that kind of did away with that.

Other animals in the dairy barn contribute to the problem. We did some detailed recording of the other animals that might be in a dairy barn, thinking that may have some significance. We counted the number of calves, the number of heifers, whether or not there was a bull. We also found peacocks, rabbits, rather well established sparrow and swallow populations and, of course, cats. Cats may be indigenous to dairy barns, at least they certainly seemed to be in the ones that I went to. But a healthy cat population was very atypical. Now I am not saying there is a possible zoonoses between cats and man in this particular case, but it is an area that our data does not represent very well.

Respiratory disease can be prevented if you protect the worker from his environment. We know that from classical industrial hygiene. You have to exercise be a little caution when applying industrial hygiene views to agriculture, it does not always work. For example, in general industry, the respirator protection program always comes last. One of the reasons for this, is that a respirator protection program is incredibly expensive. So you always apply engineering administrative controls first. What agriculture needs is a strong and powerful respirator protection program, one that tells the quality of respirators, talks about fit factors, protection factors and when to wear a respirator and why. I think if the study I have been talking about is successful, we will come up with some of those whens and whys. ■

Pulmonary Toxic Components in Wheat Dust at Farms and Elevators in Colorado

By *Don Beard*
Colorado State University

DR. OLENCHOCK: Thank you Peter. The next speaker is Don Beard from the Department of Environmental Health at Colorado State University. And Don is going to speak on the Pulmonary Toxic Components in Wheat Dust at Farms and Elevators in Colorado.

MR. BEARD: Thank you very much for inviting me to speak this afternoon.

First, I would like to say that when I prepared these slides there was a slightly different title but this title would not fit the small abstract space provided. Second, I want to acknowledge my co-authors, Dr. Roy Buchan, Dr. Brent Reeves, and Mr. Mike Salasek who were all very helpful in doing this research and special thanks goes to NIOSH for funding this research.

Our objectives were to quantify and identify fungi and gram negative bacteria genera and species, to quantify the microbiological total plate count, to quantify the thermophilic organisms, to determine the mass concentration of the dust exposures in milligrams per cubic meter, to quantify percent respirable silica, to quantify organophosphate pesticides, to quantify endotoxins and to identify prevalent entomologic genera present in the wheat.

Exposure to grain dust has been studied quite extensively and has been reported to cause such adverse health effects as dyspnea, occupational asthma, organic dust toxic syndrome, hypersensitivity pneumonitis and chronic bronchitis. However, the vast majority of these studies were done at large terminal elevators and not at the farm level. Our effort was to measure exposures at the farm and to compare that to a positive control of country elevators.

Our methods and materials for doing that were to conduct industrial hygiene surveys at eight farms and seven elevators during the summer 1992 harvest season and at four farms and three elevators during the winter 1992-93 when that same grain was brought out of storage and shipped. This summer I examined an additional three farms and three elevators. Our methodology in microbiology was to use nucleopore filtration and elution techniques of actually impacting airborne grain dust onto a filter, weighing it and diluting in sterile buffered saline for serial dilutions. We used standard selective media and incubation techniques. Microbiological parameters included total plate count for bacteria and actinomycetes, mesophilic fungi, gram negative bacteria and thermophiles. The mass concentration and particle size distribution was done by a personal six stage cascade impactor and gravimetric analysis.

Additionally, we conducted respirable silica analysis using the 10 millimeter cyclone and organophosphate pesticides by OSHA method 62 with a two stage fiberglass filter and XAD-2 tube. The insects were collected during the harvest season of 1992 and during the winter of 1992-93 and are what I

would call insects of opportunity. If the insects were present while the grain was being dumped, they were collected and identified to order and genus. However, today I will be reporting only the insect orders identified. Endotoxin analysis was done by *Limulus* amebocyte lysate test and will be reported as well.

Here you see the microbiology cassettes being placed on a worker. This is being done before he goes in to clean out this bin. The setup used a manifold sampling process so that duplicate samples were being done at the same time. Each cassette was filtered at the rate of one liter per minute. Conditions varied widely from site to site. This farmer is actually adjusting the pesticide application to the grain whereby liquid insecticide is being applied as the grain goes up the auger. This method of grain bin loading had dust levels that were more moderate but farms that had an on-farm elevator had dust levels were higher. The farms ranged in size from 640 acres to 7,000 acres of wheat. This next slide shows a country elevator and the dust levels there.

The mean microbiology colony forming units per cubic meter ranged from 4,000 for the thermophilic organisms to 4,000 up to 77,000 CFU for the total plate count at farms while ranging from 15,000 to 1.4 million CFU per cubic meter at elevators. The exposures at the elevators were from one to one and a half orders of magnitude higher than farm exposures.

The major fungal genera identified during harvest by percent of total identified were as follows. *Alternaria* and *Cladosporium* were the most prevalent genera at both farms and elevators. However, fully 88 percent of the identified fungi were these two on the farms while at the elevator 56 percent were comprised of these two genera. This result is in contrast to the norm that you see reported in the literature for large terminal elevators which usually report higher levels of *Aspergillus* and *Penicillium*. These results are due to the time of the year as well as places that I did the sampling. *Alternaria* and *Cladosporium* are darkly pigmented fungi that grow on dying vegetation such as ripening wheat. Whereas, *Aspergillus* at 2.5 and 5.3 percent of fungi identified at the farms and elevators does not live outside in the bright sunshine of Colorado for very long.

As regards the mean respirable silica level found during harvest, all values for respirable silica were less than 0.1 milligrams per cubic meter at both the farms and the elevators. At the farms the total dust concentration was 8.8 milligrams per cubic meter as a mean value with a range of 4.13 to 15.3 milligrams per cubic meter. The elevators as you can see had a much wider range of 8.5 to 41 milligrams and a mean value of 18.6 milligrams per cubic meter for total dust concentration.

The particle size distribution as measured by mass median aerodynamic diameter was 4.88 micrometers at the elevators and 3.9 at the farm level. The winter time measurements were 2.17 micrometers for the elevators and 3.63 micrometers for the farms. The only particle sizes that were statistically different were found at the elevators between summer and winter measurements and they were found to be significantly different by one way analysis of variance, least significant difference method. At the elevators workers

have little opportunity to back out of the dust. On the farm I told farmers to do their job as they normally would, some would back out of the dust while others tended to stand in the dust. This resulted in a greater variety of sizes on the farms.

The microbiological colony forming units per cubic meter for total plate count during winter shipment of grain found exposures at the elevators an order of magnitude lower than in the summer harvest, while the farm exposures were approximately twice the levels found at harvest. These higher levels of fungi can be largely explained by the next slide. Of the four farms sampled during the winter one has a level of 310,000 CFU per cubic meter while the other three ranged from 800 to 7,100 CFU per meter cubed. This one large grain bin that had contained high moisture, weather impacted wheat that was not additionally dried had very high levels of *Aspergillus* and *Penicillium*. *Cladosporium* and *Alternaria* were relatively more prevalent on the other farms.

The major fungal genera found during winter shipment shows the increased importance of *Aspergillus* and *Penicillium* after storage. However, one thing that should be point out is the relative importance of summer field fungi like *Alternaria* which comprised 23 percent of fungal genera after 6 months of storage. So as a part of the overall fungi exposure the field fungi remain significant in the wintertime.

The most common gram negative bacteria present at farms and elevators during harvest and storage was *Entrobacter agglomerans*. However, at the farm level significant levels of *Pseudomonas* species were also present.

The only pesticide reported by the OSHA laboratory that did the insecticide analysis was methyl chlorpyrifos. This is a commonly used insecticide of grain pests and was present at less than 0.001 milligrams per cubic meter in samples where it was detected. It was not a significant problem. The other chemical reported by gas chromatography/mass spectrophotometry at three farms and two elevators was 1-Naphthyl isothiocyanate thought to be a natural breakdown product of organic matter. Although it was detected in five locations its significance is unknown and these levels were not verified in any way.

We did endotoxin analysis of airborne grain dust collected in the summer of 1993 at three farms and three elevators. Endotoxin values ranged from 26.7 endotoxin units per cubic meter as a low to a high of 237 EU per meter cubed. The mean value at the farms was 143 endotoxin units per cubic meter. If endotoxin units are converted to nanograms per cubic meter a range of 7.5 to 118 nanograms per cubic meter results. If placed on an 8 hour exposure for the typical man a dose range of 1.6 to 2.8 nanograms per kilogram results. It should be pointed out that the typical workday for farmers during this period is 12 or more hours not eight. Normally 2 nanograms per kilogram is thought to be the level where respiratory difficulty can start. At the elevators 70 EU per cubic meter was the mean value with a range of 19.6 on a slow day at a small elevator to 128 at another elevator.

One thing that should be pointed out is on the farms that had 164 and 237 EU per cubic meter the grain was being dumped inside of a quonset hut. They had run out of regu-

lar storage bins and were backing the truck into the quonset huts and dumping into an auger that took the grain further back into the quonset hut. So is was like working inside of a grain bin. This was probably the main reason that these two values are so high. The farm that had the 26 EU per cubic meter was outside in the open air, more like the first farm slide you saw.

When the entomology samples were identified, the major orders identified during wheat harvest were the *Coleoptera,* the beetles and comprised 58.5 percent of the insects collected. Grasshoppers, *Orthroptera* - 20 percent, the true bugs, stink bugs etc. *Hemiptera* 12.3 percent, the wasp and ants, *Hymenoptera* 5.3 percent and leaf hoppers and other less. In the winter time grain bins were examined for grain mite and although some were found the numbers were low. The low numbers of grain storage pests were due primarily to the insecticides and aluminum phosphide fumigant used by most farmers.

In summary again in 1993 farms and elevators had 6.8 and 14.1 milligrams per cubic meter as a mean total dust concentration. These figures are comparable to the data collected in the harvest of 1992. All farms and elevators in 1992 and all but one farm in 1993 exceeded the recommended TLV of 4.0 milligrams of grain dust per cubic meter. Respirable silica was less than 0.1 milligrams per cubic meter. Total moisture levels of dust at farms had a mean value of 3.79 percent and 5.5 percent moisture at elevators. Field fungi species were the dominant species during both 1992 and 1993 harvest and remained significant after 6 months storage.

Exposure on the farm is for 12 or more hours per day for three to four weeks during the harvest season. After storage exposure is intermittent, usually of low level; but can be very high inside grain bins as was measured in some instances. Levels of fungi and bacteria decreased from summer to winter but increased on farms per unit time exposure during the winter. This was due to a farmer going into a grain bin to unload high moisture impacted wheat. Thank you.■

Green Tobacco Sickness: An Occupational Hazard Among Tobacco Harvesters

By *Terri Ballard, Ph.D.*
National Institute for Occupational Safety and Health

DR. OLENCHOCK: Thank you Don. Our next speaker is Terri Ballard from the Division of Surveillance, Hazard Evaluations and Field Studies of NIOSH. And Terri will speak to Green Tobacco Sickness: An Occupational Hazard Among Tobacco Harvesters.

DR. BALLARD: Good afternoon. Today I am going to be talking to you about an investigation of an outbreak of green tobacco sickness that occurred last year during the tobacco harvest in the south central region of Kentucky. I would like to acknowledge my co-investigators, most of whom are in the audience today.

Green tobacco sickness is an occupational hazard for tobacco harvesters. It is a form of nicotine poisoning that is caused by transdermal absorption of nicotine that's dissolved on the moisture on the wet tobacco plant. The main signs and symptoms are nausea and vomiting, weakness and dizziness. There is an initial tachycardia and hypertension that is followed by a lowering of the heart rate and blood pressure in the more severe cases. These signs and symptoms are very similar to that for organophosphate pesticide poisoning and also for heat exhaustion. Green tobacco sickness is a self limited condition. It usually lasts only one to two days but it can be very incapacitating during those couple of days.

There have been very few reports of green tobacco sickness in the medical literature. The only two from the United States up until this year were in Florida in 1970 and North Carolina in '73. In the North Carolina Study, the researchers were able to document that non-smoking tobacco harvesters were absorbing large amounts of nicotine as measured by a urinary cotinene, this is a primary metabolite of nicotine. They also found in their studies that non-smokers were a much greater risk for developing green tobacco sickness than smokers.

In 1979 a series of studies were performed in India that were similar to those in North Carolina. Both of those two groups also did intervention trials where they found that workers who wore plastic clothing, raincoats or aprons absorbed much less nicotine than the workers who did not.

In Kentucky an occupational medicine resident did a clinical study to try to distinguish green tobacco sickness from organophosphate pesticide poisoning or heat exhaustion.

The outbreak of green tobacco sickness was detected because Kentucky has a surveillance system for agricultural illness and injuries in place. This program was part of the Occupational Health Nurses and Agricultural Communities or OHNAC. This is a NIOSH funded project in 10 agricultural States. The OHNAC nurses particularly in the Bowling Green and Elizabethtown areas as they were making their rounds to the hospitals to get reports of illnesses and injuries started hearing about cases of green tobacco sickness.

They began to wonder though if this problem wasn't more widespread than previously thought and were concerned that it could have economic and health consequences for the tobacco workers in their communities. At that point in August last year, they started active surveillance in their participating hospitals. They provided literature to the emergency rooms. They did radio and newspaper spots in the local communities to try to get the word out about green tobacco sickness.

I would like to show you a few slides to tell you about the tobacco growing process for those of you who have never seen it. In the early spring, the small plants are set into the ground. And as the plants grow, when the flower appears, the flower is taken off by hand, this is called topping, and then a growth inhibitor is applied to the plant to prevent suckers from growing. Then three to four weeks before the harvest begins, the plants are sprayed with an organophosphate compound against the tobacco worm and other pests.

The harvest begins in August normally and it is done in Kentucky by having a worker walk through a row of densely packed plants and cutting each plant individually. He does that by grabbing the top of the plant with one hand and cutting off the plant at the base. Then the plant is impaled onto a stick through this metal cone-shaped piece which is itself an incredible source of occupational injury. The stakes are left in the field to dry for a day or two, then they are loaded onto the wagon and taken to the barn where they are placed on multitiered drying racks inside the barn until they are dry. And this is a photo from 1940 but the process is the same today. When the plants are dry, the stakes are taken down, the leaves are stripped off the stalks and then bundled up for market.

In the middle of September last year, NIOSH received a report of 33 possible cases of green tobacco sickness, so we went down to the Bowling Green area as well as Elizabethtown to review the records of those reports and also to initiate a medical record review at the five participating hospitals in the OHNAC Project.

We did a case control study to try to determine what the risk factors were and to describe the outbreak. A case control study is one which compares cases with a group of controls who are persons at risk for developing a disease but who did not develop it. We found 47 cases through our reports and medical record review from the five participating hospitals. And our definition of a case was a person who had received an emergency room diagnosis of green tobacco sickness, nicotine poisoning, tobacco croppers illness, a similar type diagnosis, plus who had a work history of having worked in the tobacco patch within 24 hours of becoming ill.

We tried to choose our controls from as many varied sources as possible in order to increase the chance of selecting them from the true population of tobacco harvesters. We used as our definition for control any person in the five county area who had worked in tobacco in 1992 but who did not have any symptoms of green tobacco sickness.

Over a four week period, we interviewed by

telephone 40 of the 47 case patients and 83 of 101 eligible controls. Once we reached these people by telephone, no one refused an interview. We were interested in tobacco workers use of protective clothing and their exposure to wet tobacco, their personal tobacco use and also how long they were working in terms of hours per day and days per week in tobacco.

We also wanted to investigate the relationship between rainfall and the number of cases and to do this we collected data on the rainfall of the day preceding or the day of the illness for the 47 cases using the weather station that was nearest to their home address. This however was not an exposure variable for the case control study because our controls were not time matched to the cases, they were not selected on the same day as the case got sick.

This is what's called the epidemic curve. It describes the number of cases over the time period in the south central region of Kentucky last year. We had cases starting from the week of July 25th through the week of September 19th. But you can see that the majority of the cases occurred in the week of August 22nd which happened to coincide with the first newspaper reports on this in the local newspapers.

Of our 47 cases, 12 of them were admitted to the hospital for a day or two and two of them went to the intensive care unit for low blood pressure and pulse. Thirty-five were treated in the emergency room and released and in the emergency room they received only symptomatic treatment, intravenous fluids and anti-emetic drugs.

We estimated a crude incidence rate for the two month period in the five county region for emergency room diagnosed cases of green tobacco sickness to be 10 per 1,000 tobacco harvesters.

This is a slide showing several demographic factors for the cases and the controls. The age distribution was different. Among the cases the median age was 29 years where the controls were older. Their median age was 39. The sex distribution was equal between both groups, with 87 percent of the respondents being male. We also looked at tobacco use and the controls reported more often to be current users of tobacco during the tobacco growing season last year than the cases.

When we analyzed the data from our study, we found that young age was a strong risk factor for developing green tobacco sickness. We found that the risk of getting this disease was three times greater for those workers who were under the age of 30. We also found that working in conditions where the clothing were likely to become soaked from the moisture that was on the green tobacco plants was a strong risk factor. One hundred percent of the case patients and 83 percent of the controls described this type of working condition. We also found that not using tobacco during the time of working in the field might have been a risk factor for developing it, although it was a small risk factor and not statistically convincing.

We found that gender, the amount of hours or days working in tobacco and the use of protective clothing were not different between the cases and the controls. All in all, reported use of protective clothing at least

once during the tobacco harvest was equal for both groups. Thirty-two percent reported ever having used gloves and only five percent reported ever having used any type of waterproof clothing.

This is a graph showing the rainfall data. On the days when there was .2 inches of rain or more, there were three times as many cases as on the day when there was no rainfall. This does suggest that wet days are associated with developing green tobacco sickness.

The conclusions from our study were that younger age was an increased risk factor for developing green sickness. It may be that the younger workers drop out of the work field once they get sick and we had some evidence of this as we interviewed them. Many people said that they were never going to do that again and find another summer job. And that the workers who remained in tobacco harvesting are most likely older, they have developed protective work practices and have more experience in perhaps staying out of the tobacco patch when it's wet.

We also found that tobacco use was a little bit protective and there is a biological reason why this may be so. Smokers do develop a tolerance to the effects of nicotine, however this tolerance can be overwhelmed if the absorbed amount of nicotine taken during the work situation greatly exceeds the normal intake of personal tobacco use. And finally, we found that wet working conditions were associated with developing green tobacco sickness.

There are several limitations to our study which might affect some of the findings. The controls were not time matched to the cases, so this may have limited our ability to look at certain risk factors. This is probably the case why we weren't able to point out protective clothing as being a protective factor. Secondly, we did not randomly select our controls from the tobacco harvesters in the community and this may have led to some bias in our selection of controls and that may explain the age distribution that we found in our study.

As a result of our case control study and the investigation of this outbreak, we were convinced that green tobacco sickness is an important public health problem in Kentucky. Tobacco is the top ranking legal agricultural product in Kentucky and there may be as many as 60,000 persons who work in it at least part-time who may be at risk for developing this condition. This means that as many as 600 persons may have sought care last year for green tobacco sickness, but even this figure is an underestimate of the true burden of the disease because a lot of people did not seek care who did get sick and had to leave the field for a day or two. Medical costs are not considerable either. The Workers Compensation Program in Kentucky does not cover agricultural conditions.

NIOSH has issued two recommendations to tobacco workers to prevent developing green tobacco sickness. The first is to avoid handling wet tobacco whenever possible. This means staying out of the patch during or immediately after a rainfall or in the early morning when heavy dew is present on the plants, and it may require some sort of flexible scheduling of work. When this is not

possible, workers should try to reduce their skin contact with the wet tobacco and this can be done through the use of protective clothing, rain jackets or aprons or slickers and the use of gloves. We also recommend that workers change into dry clothing whenever their clothing gets wet.

However we realize that these recommendations may not always be practical or feasible. Tobacco harvesters are under an incredible time constraint to get their crop cut before the first frost and they're often working 12 to 14 hours a day and a flexible work schedule may not be possible. The other problem with these recommendations is that there is an increased risk of developing heat stress when wearing impermeable clothing under hot working conditions and this risk needs to be weighed against the benefit of wearing protective clothing. It might be that wearing a rain jacket just for the first few hours of the day would be helpful.

We have been able to use education as our most powerful tool for public health intervention and have identified two main target groups for the educational efforts that the OHNAC nurses have been undertaking this whole year and particularly now as the harvest is starting. The first is to try to get the word out to the tobacco harvesters and farm families. We need to let them know that this condition exists, what it is and how to prevent it. And we have been using a NIOSH Update which is out there in the foyer if you want copies of it. It is a one sheet information leaflet written for the lay public. The nurses have been very active in eliciting the cooperation of agricultural extension agents to distribute materials and talk to their constituents. They also have been using newspapers, radios, and local magazines which we found out is probably the most effective form of communication.

The second group for our educational efforts are the health care providers in tobacco growing regions. We need to get the word out to them what this condition is, how to recognize it and how to treat it. The nurses have been providing in-service education to the emergency rooms. They've been distributing an MMWR article that came out on this in April as well as the NIOSH Update. And they have been stressing with the doctors that the key to diagnosis of green tobacco sickness is to take a careful and thorough work history.

Kentuckians have been harvesting tobacco the same way for the past 50 years or more, but this doesn't mean that they have to keep getting sick in the same way as well. Thank you.■

Minnesota Cancer Control in Farmers Study

By *Peter W. Carr*
University of Minnesota

DR. OLENCHOCK: Thank you Terri. Our final speaker for this session is Peter Carr from the Division of Environmental and Occupational Health, School of Public Health, University of Minnesota speaking to us on the Minnesota Cancer Control in Farmers Study.

MR. CARR: Thank you. The Minnesota Cancer Control in Farmers Study is one of the five demonstration Cancer Control for Farmers Projects funded by NIOSH. In addition to the co-authors, this was a collaborative effort that involved both the Minnesota Extension Service and the Minnesota Agricultural Statistics Service. I will be addressing the study design, as well as preliminary results of telephone interviews that were done as part of the project.
The rationale behind the study is the evidence that the utilization of health care services and in particular preventive health care services is lower in rural populations. Our project addressed this issue by implementing and evaluating a farm family cancer prevention program. The basic approach to the project is a community intervention trial in which survey data are used to assess the impact of a cancer prevention program targeted at farm families.

The study is being conducted in four southern Minnesota counties that are similar in terms of both their agricultural production and their demographic characteristics. There are two intervention counties receiving physician and community based cancer prevention programs and two control counties not receiving any project interventions.

The impact of the interventions will be assessed through a telephone survey conducted before and after the interventions are implemented. The project has three focus areas: breast cancer, skin cancer, and pesticide exposure. These three areas were chosen for several reasons: (1) breast and skin cancer are common among rural Minnesotans and pesticide use is also very common on Minnesota farms, (2) there are screening and preventive measures available for all three of these, and (3) intervention programs for these areas would allow for involvement of the whole family.

The project objectives are to one assess barriers to preventive health services, to determine the utilization rate of breast and skin cancer screening, to assess the farming population's knowledge of cancer risk factors, screening methods and cancer treatment, to implement cancer prevention strategies in two intervention counties, and to assess the impact of the intervention strategies.

The intervention strategies consist of two components - a physician component and a series of community based interventions. The primary focus of the physician intervention was a program of physician seminars which was held in each of the two intervention counties to provide information on each of the project's three focus areas. The goals of the physician intervention program were to increase the use of screening mammog-

raphy, to improve identification of early skin cancer lesions, to increase routine skin cancer screening, to increase physician knowledge of the range of pesticide exposure signs and symptoms, and to increase physician's awareness of the farmers' occupational environment.

The ninety minute seminars were co-sponsored by county medical societies in the two intervention counties and were accredited for three category I continuing medical education credits. All physicians listed with the county medical societies were invited to attend the seminars. The faculty included an occupational physician, a dermatologist, and a Minnesota Extension Service pesticide specialist. The seminars were located at a central site in each county and were offered free of charge.

A series of community based interventions were also implemented throughout the course of the project. These included an elementary school curriculum, community educational mailings, panel displays, and a skin cancer module that was incorporated into an existing pesticide applicator training program. Two elementary school curricula were developed in consultation with educational specialists. The first addressed skin cancer prevention and the second focused on the prevention of pesticide exposure. For both of them, a separate curriculum was developed for Kindergarten through second grade and third grade through sixth grade. The materials were developed to serve as a free standing educational unit, intended to be presented as classroom projects. The curriculum materials included an introductory letter to teachers, a teachers' guide, lesson plans, activity sheets, a letter to parents, posters and a follow-up survey. These were distributed to each public and private elementary school in the intervention counties by local Minnesota Extension Service educators. Extension personnel were also available to supply teacher in-service training at the request of the schools. A second intervention involved a series of community education mailings which were sent to each farm family in the intervention counties. The Minnesota Agricultural Statistics Service list of farm operators was used as the basis for the mailings. Three separate mailings were conducted, one for each of the three project focus areas. The breast cancer mailing focused on the need for the use of routine breast cancer screening for women over the age of 50, including the use of breast self exams, clinical exams, and mammograms.

The skin cancer mailing included information on the types of skin cancer and prevention of skin cancer through limiting exposure to the sun both by covering up with protective clothing and the use of sun screens. Information on the early detection of skin cancer through skin self exams and clinical skin exams was also included.

The last of these mailings covered pesticide exposure prevention. It included information on the adverse health effects of both acute and chronic exposure to pesticides, an emergency action card for managing acute pesticide exposures, information on how to access poison centers, and a washing machine magnet that listed instructions for laundering pesticide contaminated clothing.

Two panel displays were also developed, one for each of the two counties. These

were used by the County Extension Service personnel in the intervention counties. Each county was supplied with a single display unit that contained two separate displays, one on prevention of skin cancer and a second that focused on reducing pesticide exposures. The displays are intended to provide basic information on prevention and are being used at the discretion of the County Extension Service offices. They are designed so that they do not necessarily require staffing during their use, and are being used at sites such as health fairs, training programs, government and professional building lobbies, and in shopping malls.

The primary means of assessing the impact of the interventions is through two telephone surveys, conducted in both the intervention and control counties. The first survey was conducted before the implementation of the interventions and a second follow-up interview will be conducted after the interventions are completed. The purpose of the telephone survey is to assess barriers to preventive health care, evaluate knowledge of cancer risk factors and screening methods, determine the utilization of breast and skin cancer screening and lastly to assess the impact of the interventions.

Participants were chosen randomly from each of the study counties in a two stage process. The first stage involved selecting a random sample of farms from the list of farms maintained by the Minnesota Agricultural Statistics Service. For purposes of their list frame, a farm is defined as any place that sells $1,000 or more of agricultural products in a given year. A farm operation was eligible for participation if there was at least one member of the household age 40 or older who had lived on a farm for the last five years.

The second stage of the sampling involved selecting an eligible person from within the household to serve as the primary respondent for the telephone interview. Only persons age 40 or over were included. A weighted random sampling scheme was used to ensure that there were a balanced number of respondents in each six age gender strata. The initial interviews were conducted in the spring of 1992 and the follow-up interviews will be conducted starting in January 1994.

Telephone interviews were conducted by Minnesota Agricultural Statistic Service interviews using a computer assisted telephone interview (CATI) system. The interviews proceeded in two stages following the sampling procedures. The first stage determined the household eligibility and solicited participation in the study. Eligible households that agreed to participate were then interviewed to collect project data. The selected respondents as well as their spouse or companion were interviewed.

The interview contained questions on demographic characteristics, health insurance coverage, access to and use of screening for breast and skin cancer, and knowledge and use of cancer prevention measures. Additional information was also collected on pesticide exposure prevention, knowledge of cancer risk factors, efficacy of preventive measures, and perceived risk of cancer.

Following are some preliminary results based on the first set of interviews that were conducted in the spring of 1992. Of the 3,039 households that were included in the

sample, 2,448 (81 percent) completed the household eligibility screen. Of those, 66 percent (1,619) were eligible for study participation, that is there was someone living in the household over the age of 40 who had lived on a farm for the last five years. Of the eligible households, 1,327 or 82 percent completed the interviews.

The majority of the respondents were married, and had at least a high school education. Ninety-four percent had some health insurance coverage and two-thirds of the households that answered a question on household income had annual incomes over $20,000, that included both farm and off-farm income.

Among the 625 female primary respondents, 78 percent reported ever having had a mammogram and 48 percent reported having had a mammogram within 12 months of the interview. Eighty-seven percent reported ever having had a clinical breast exam and 56 percent reported a clinical breast exam within 12 months of the interview.

We are also in the process of conducting two sub-studies to follow up on the issue of mammogram utilization. The first involves investigating the possibility that cost may be a barrier to mammogram utilization. Coupons for a free mammogram were distributed to 100 women randomly selected from women who participated in the telephone interview. The coupons are good for one year and at the end of that year, we will compare their mammogram experience with 100 comparable women who did not receive coupons.

The second sub-study is investigating the validity of self-reported mammograms by comparing self-reported mammograms with mammogram histories obtained from medical records. A sample of 200 women is included in this study and both false-negative and false-positive reporting will be checked.

Skin cancer screening is not commonly practiced in this population either through physician full body exams or self administered exams. Only 14 percent of the respondents had ever heard of a full body skin exam and only five percent had ever had one. Additionally, only two percent reported that their physicians had ever recommended having one. Only three percent reported ever having done a skin self exam.

In terms of skin cancer prevention, we asked questions, on how often or whether or not people wore protective clothing when outside exposed to the sun and also on whether or not they used sunscreen. There were some interesting differences between the way men and women approached reducing exposure to the sun. Men were much more likely to wear protective clothing than women, 76 percent of the men versus 44 percent of the women reported wearing protective clothing. The situation was reversed for sunscreen use. Twelve percent of the males reported using sunscreen as opposed to 51 percent of the females.

Relative to pesticide exposure prevention, slightly more than half of the respondents who handled agricultural chemicals, reported wearing chemically resistant gloves 80 to 100 percent of the time. Twenty-seven percent reported using chemically resistant gloves less than 20 percent of the time. Other types of protective clothing were worn

less frequently. Over half reported wearing other protective clothing less than 20 percent of the time and 19 percent reported using protective clothing 80 to 100 percent of the time. We are currently in the process of conducting additional analyses on the data from the initial interviews to identify factors that are predictive of specific screening and cancer prevention behaviors. The analysis of the data from the follow-up interviews, that will be conducted this winter, will be used to evaluate the impact of our intervention programs. Thank you.■

Questions and Answers

Plenary Session II - Research

DR. OLENCHOCK: Thank you Peter. I think everyone can agree we did have five very exciting speakers today. And are there any questions? I would ask you to please come forward and identify yourself.

MR. MYERS: Mel Myers of NIOSH. I have a question for Mr. Waldron about the dairy study. First of all a comment. You looked at how close a person was to the cow as one of the factors. As a person who has milked cows like that, there is another behavior that if a cow kicks or is known to kick, you actually place your head right up in the flank so it's actual contact there. Number one, you can sense whether there's a kick coming, but number two it's a way to control a kick by pushing your head into that flank. So you may actually have direct contact as a matter at work in a technology like that where you use stanchions, so that's just one observation.

A couple questions. Flies are a big problem in dairy barns. I don't know if you addressed this in your study in terms of the insecticide use. A second question, dairy barns have different designs and this one was sort of the stoop labor approach to milking. There are other designs where the cow is elevated with respect to the person working in the milk barn. So you might have a different kind of profile that you're looking at in a barn like that. I was wondering how you selected the stanchion technology that you did.

MR. WALDRON: I'm not quite sure where to begin. This past summer was unusual. I think it was maybe unusual for the entire country. Wisconsin, or central Wisconsin so I was told, is noted for very hot and humid weather. Flies are normally a severe problem. This past summer they were not much of a problem. We would ask if any type of fly spray would be used and in most cases it was: "I use it about once a week", but that was last summer. It just wasn't an issue this particular summer. Had it been an issue, we would have recorded it. We were prepared to record if fly spraying had occurred while we were sampling or if it had occurred recently.

As far as the issues of cow dander and the position of the worker during milking, I thought that made a very good picture. We didn't really measure or in any way analyze where the individual's head was during that time period. What we did do was record the length of milking. I wish I had mentioned during that slide that there are obviously very different types of milking. That was a bucket system. There is also the line system. Some people use a stool to milk or a spring, some don't. Out of the 81 barns that were looked at, three of them were milking parlors. Parlors represent a very, very different kind of exposure. But I would say overall the barns sampled were like the one that we saw here. Did that answer your questions? All of them?

MR. HALL: I am Ron Hall and I am with NIOSH. I had question for Terri Ballard. Would skin barrier creme help reduce the risk of worker exposure during tobacco harvesting? And if it does, would it help reduce the risk of heat stress?

DR. BALLARD: This is something that we have discussed theoretically. I don't believe that it's ever been used and expense is one problem. Maybe someone knows better than I how long they last and whether or not they get washed away with sweat. Workers are sweating a great deal and so that might be a consideration.

Does anybody have any information on barrier creams?

DR. OLENCHOCK: Are there any other questions?

MS. SCHAFER: Schafer, NIOSH. This is directed to Ballard. I had a question about during the stripping season. It's a brown moist leaf and they strip the stalk barehanded. And I know of farmers who complain of nausea and other symptoms during the stripping season. Is there any reason to believe that this nicotine absorption problem is confined to the fall harvest, but maybe it's also possible even to experience that during the stripping season?

DR. BALLARD: It is possible. We had one case I believe in the Maysville area last year that was not included in our study last year who got sick during stripping. There are some respiratory effects of breathing this nicotine that can cause some of the same types of symptoms; this is a different route of exposure from the transdermal. Probably in the harvest season the most likely cause is the leaves when they are wet, because the nicotine readily dissolve in the moisture. When the plants are in the barn and when they're in the drying process, they're moist and pliable like you said, but they don't have that amount of standing water on them.

AUDIENCE: It actually may be the same question because we were talking about this earlier, but we were curious about the whole issue in green tobacco sickness of trying to differentiate organophosphate poisoning, and I am sorry because I missed the beginning of your talk. Because certainly in Ruskin, Florida where they had a large pesticide poisoning, the same problems with dew causing increased absorption were there and I just wondered what your experience had been about number one if organophosphates are used on tobacco in your area and secondly how you sort out those effects from the nicotine effects.

DR. OLENCHOCK: Could you identify yourself for the record please.

MS. POLLACK: Sorry. I am Susan Pollack from the University of Kentucky.

DR. BALLARD: Okay, In Kentucky, and that's really the only State I can speak to, the last spraying on the field occurs three to four weeks before the harvest. A careful work history is really the key to distinguishing this from pesticide poisoning because the people who are working in the harvest are working there 12 to 14 hours a day. They are most likely not also working in another crop that may have been recently sprayed. The compound that is used on tobacco is orthene which has a reentry interval of 24 to 48 hours, so any residue should be mostly broken down after that time period.

There may be a problem this year though because the harvest is staggered, and while some farmers right now may be spraying young plants, other people are already cutting. Therefore, there is an even greater

need for the health care practitioner to take a careful work history.

MS. WILK: My name is Valerie Wilk. I work with the Farm Worker Justice Fund in Washington. Because an increasing number of the harvesters are hispanic, what is NIOSH doing in terms of health education materials and like public service announcements in Spanish?

DR. BALLARD: In Kentucky, there so far are very few migrant workers, but that's coming and we've been hearing rumors that more and more people will be using Spanish-speaking migrant workers. I was in contact with somebody from North Carolina, one of the migrant clinics. I sent her the update and other materials I had and they're working on having some of that information translated into Spanish for the North Carolina workers. And I think that we will certainly keep track of that, and we have considered but we haven't yet had our update written in Spanish and distributed in Kentucky.

MS. WILK: I had a call this week from somebody at the U.S. Catholic Conference who reported that there were about 2,000 hispanic workers from Mexico brought up to the western part of Kentucky. And I don't have specific details about where that was, but I think it's a growing number of workers.

DR. OLENCHOCK: Speak up please.

(Off mike response.)

DR. OLENCHOCK: Additional questions? Okay, I thank our speakers very much for a very interesting afternoon.■

(Brief recess.)

Farm Safety 4 Just Kids Chapter Development: Capacity Building in Local Communities to Utilize NIOSH Developed Resources

By Marilyn Adams
Farm Safety 4 Just Kids
and *Gayle Olson*
University of Iowa

DR. FREUND: It was about the week before last that we were talking about what NIOSH can do with and about the issues of the flood and the rain and the role of NIOSH's agricultural projects in the affected States. And we realized that hey, we are going to have a lot of people who are real resources in this area altogether here at this meeting and it would be a real opportunity to do some thinking about the kind of needs there are out there and the kind of things that we can do both in terms of surveillance research and intervention. But this session is about intervention which I think is one of our biggest challenges in this field. There are a number of things people have done but there's an awful lot of room for doing interventions that we can look to evaluate. There's room for innovation, some of which we have here on this program and other parts of the program throughout the rest of the week. Our first pair of speakers today will be Gayle Olson from the Institute of Agricultural Medicine and Occupational Health at the University of Iowa and Marilyn Adams of the Farm Safety 4 Just Kids Program talking about Farm Safety 4 Just Kids and Chapter Development for that Effort.

MS. ADAMS: Thank you. Well it's my belief that everyone in this room is trying to achieve the same goal. And we all have our own style to do that. We have found our niche at Farm Safety 4 Just Kids to be working on the grassroots level and with the communities across the nation. To do that we are building chapters, and have also found that chapter building is not easy and it's a big undertaking. Our goal is not to create new organizations in communities. It's to foster the cooperation and affiliation between the chapters in different States and amongst the individual organizations and individual people that are already in the communities and utilize their abilities, skills, and expertise to do programming right there in their own territory.

In order to do this whole process of building chapters, we've worked very closely with the University of Iowa, Iowa State and different ones. We've worked very closely with NIOSH and thank NIOSH for their help in getting us started with our chaptering process. With me today is Gayle Olson from the University of Iowa to walk you through our chaptering process so you can see how we can utilize your materials, your expertise and programs to provide information to our chapters and also how you can utilize our chaptering process to pilot some of your projects and programs. Gayle.

MS. OLSON: Farm Safety 4 Just Kids had hundreds of members throughout the United States before the concept of chapter development came up. Even so, there was method behind their madness in trying to get into the whole area of chapter development. For those of you who aren't familiar with the relationship, Farm Safety 4 Just Kids receives NIOSH money through a subcontract from the University of Iowa specifically for the process of chapter development. That was the seed money that formed the basis for getting the chapter development part of the project off the ground. Since then, the project has attracted other corporate sponsors, donors, agricultural businesses, lots of other money from other sources to help feed into the process. That's an overview of the relationship between Farm Safety 4 Just Kids and the University of Iowa and NIOSH.

My role started out as an advisor to the whole process and how we wanted to approach it. As new staff has been added at Farm Safety 4 Just Kids, that role has changed. I'm still in an advisory capacity, not so much in the organization development area, but more with the volunteer development and planning some of the programs and resources that are available.

If we could have the first slide please. Effective community programs must address two major challenges. Those are what we were trying to hit with the chapter development process. First, we wanted to mobilize local communities, not just have local Farm Safety 4 Just Kids members, but to show them how to work in their local communities to make an impact. Secondly, we wanted to provide them with relevant and reliable resources.

The chapter development process is how we decided to do that. This wasn't something that we just decided we wanted to do and went out and did it, but we worked very closely with current Farm Safety 4 Just Kids members from a variety of different places across the United States. At a summer workshop held in Earlham, Iowa three summers ago, we had a brainstorming session in anticipation of the chapter development process. We worked with the people who were in local communities to find out what they thought some of the issues were, how they thought the process needed to be developed, what some of their concerns were, who they worked with, who they didn't work with, how we could fit all the pieces together. The challenge was to come up with some sort of a structure where everything could fit together so we could accomplish the goals we wanted to accomplish, but still be flexible enough to suit all the different situations that the Farm Safety 4 Just Kids members had.

For example, in one community a Farm Safety 4 Just Kids Chapter was primarily started by emergency room nurses. In another community it's a whole coalition of youth organizations. In another community it works very closely with somebody in a professional capacity who can help run it. In still another community it's totally dependent on volunteers with no organizational experience at all. Trying to figure out how each of those chapters with their own individual personality would be able to function as chapters and still be a part of the whole and accomplish the objectives took a lot of doing and we needed all the input we could

get from the individual volunteers.

Based on that, Fall 1991 was when we received the first funding from NIOSH. And during the first quarter of the funding, our goal was to establish 20 chapters in eight States during the first four years of the funding. In the first quarter we hired our first staff members. Shari Burgus is the one in the foreground and she initially was hired as the Director of Chapter Development. Since then, the organization has changed a little bit and her title is now Program Services Director. And Lynn Yontz in the background is the Information Services Specialist. Both of these women have been dynamos, the way they work together, the different skills they bring into the process is really outstanding.

Our first chapter came in the third quarter. The second quarter we spent developing the chapter manual, putting together an evaluation plan and trying to determine how we wanted this whole process to work. We based our decisions on the feedback we had gotten from the workshop with the Farm Safety 4 Just Kid volunteers and then with input from both Shari and Lynn and some other evaluation specialists at the University of Iowa.

The third quarter the first chapter was formed in Bell Fountain, Ohio and in June the second one was added. The fourth quarter we had another national workshop. It was a whole year after the first one. This was the crowd that gathered there, all people who had identified themselves as representing communities who were interested in forming a chapter of Farm Safety 4 Just Kids. That's one of the key criteria. The communities contact us. We don't go out and recruit, but they contact Farm Safety 4 Just Kids when they are interested in forming a chapter. Then we work with them through the process, number one to find out if their community is ready for that sort of a thing, and then, number two, if they realize exactly how they need to proceed to accomplish that.

During the fifth quarter and subsequent quarters, this is a time line of the number of chapters that we had join and how that has grown. At the end of the fifth quarter, we had a total of seven chapters in five different States, and in the sixth quarter we ended up with 19 chapters in 10 States and also Canada. Also during that quarter, Farm Safety 4 Just Kids was contacted by an agricultural business company, which happens frequently, wondering how they could be involved with farm safety and what kind of a relationship or what kinds of activities they could conduct to help the whole effort in farm safety and health.

In this situation it was Cargill. Cargill has a public service project that they adopt every year. One year they had an adult literacy program. This year they adopted Farm Safety for Just Kids as their public service campaign. Part of the incentive; they never would have gone into that if we didn't have the chapter development process underway. It's an example of how having a strong basis was able to attract additional resources towards expanding the whole program.

As a part of their campaign, they sent out a barn box similar to this to over 850 Cargill businesses across the whole United States and encouraged their businesses, using some of the resources in here — there's a banner

and a videotape and a manual — encouraged them to conduct a Farm Safety Walkabout, to conduct a day camp on farm safety in their local community and to become involved with instigating a Farm Safety 4 Just Kids Chapter in their community. The goal of that chapter is to make it self sufficient within the first year. The Cargill Business will not be that sponsor indefinitely, but will work within the community to try to develop a chapter and then to expand that.

The response was great. There were lots and lots of Cargill businesses who were interested in chapter formation, who became members, who became much more active in their local communities. That's the key in this whole issue: it's a national effort, but it's working in the local communities to get feedback up and resources out.

A new goal came along with the Cargill initiative and that was to have 50 chapters (instead of 20 chapters). Cargill wanted to have those 50 chapters in place by the end of this first full year. During the seventh quarter a total of 23 chapters were formed in 10 States and Canada and during the quarter which we are currently in, there's total of 26 chapters in 12 States and Canada at the time that this slide was made. Last week we received five new chapters so now we have a total of 31 chapters in 16 States and two of them in Canada. We still have a full month to go in this quarter, so you can see how rapidly that line is changing.

At first the process was very labor intensive. When we were contacted by a community who was interested in forming a chapter, we worked with them and actually made site visits. We worked with a group of people in that community, led them through the process, had meetings and discussions and talked about different kinds of things that they could do, who they could network with, those sorts of things in that local community.

With such rapid growth, it's just not possible for all the staff to be able to be involved with all of those chapter developments. That has resulted in less site visits and much more dependency on telephone support, more reliance on the chapter manual. The positive aspect that's come out of this and I really think it's an important one, is that each chapter is more dependent on their own local group of people to really be the motivators behind it. Having to do the leg work and the planning really increases the local ownership of the whole overall chapter.

In order to substitute for less staff time actually at the site and development of the chapter process and in order to help facilitate more involvement from the local people, there are a number of other kinds of support that Farm Safety 4 Just Kids provides to each of those chapters, and I will let Marilyn tell you a little more about that.

MS. ADAMS: Well support is an awful big word and doesn't mean that we give them lots of financial support. We do have the chapter manual. And this manual was very very, a lot of work went into it on how to develop a chapter. One of the criteria is for example, if they process their own material, we have them send it to our office. The material is approved through the staff reviewing it, sending it out for peer review and making sure that we give our recommendations and have them send it back for

final approval.

We do the same thing with the things that we develop. This is one example. Several people in this room were involved in helping us start our No Riders Campaign. And what we have to go with that is a brochure and a couple decals. You will notice our tractor does have a ROPS on it, those types of things. So we really expect a lot from these people if they're going to develop their own materials. So we do provide them through people that are in this room and other people with expertise the networking process. It's very important. We feel like we know who is qualified to be able to have input in the types of things that are being produced. And so we're very particular, we're also very particular of how they do their projects. Like we suggested they not have extra riders when they are participating in a fair, in a parade and things like that. So we lend a lot of expertise to these folks because we can share and do the two-way networking of you folks. And we do rely on your expertise out there to help us with what we are doing.

MS. OLSON: Okay, if we could have the next slides. Since we've had chapters for a little over a year now, we wanted to find out exactly what kinds of programs they're doing in their local chapters and what kinds of program help they need in the future. We conducted a telephone survey and were able to reach 23 of the 26 chapters in place at that time. The most common activities were school programs, displays, day camps, educational meetings, media campaigns and parades. School programs were number one and primarily aimed at the elementary age group. Parades were a big one. Displays were number two. There were lots of different kinds of activities that chapters conducted.

The chapters work with a wide variety of organizations. In fact, all but four chapters said they work extensively with other organizations. The number one local organization they worked with was Cooperative Extension. Many identified 4H separately from that. Those, I think are a strong reason for working closely together with some of the health promotion projects in particular. Hospitals came in a very close second, and we also had quite a few who were involved with emergency services and other ag organizations and civic groups.
As far as the kind of materials that they used, Farm Safety 4 Just Kids materials were the most heavily utilized, particularly the videos, the gravity flow wagons, the magazine inserts and staff consultations. But chapters also utilized materials from other sources. Again, the number one source was cooperative extension. Medical and health sources were a second important source of information. Those two were really the standout. Below that, some resources from agricultural businesses and other organizations were cited.

I think the important thing for us here today, the last slide please, is that Farm Safety 4 Just Kids does identify and utilize specialists to review and to help adapt the materials specific to their region. Farm Safety 4 Just Kids is a national organization, but it's different in each region of the State. Agriculture in Iowa is different from agriculture in Kentucky, is different from agriculture in Arizona, et cetera, et cetera. And so the kind of role that we can provide at the University of Iowa in peer reviewing some of

the information and helping to get our information out, it's a wonderful dissemination vehicle for us. But we need the information to be as relevant as possible to each region.

The other benefit for us at the University of Iowa is that it provides the grassroots input. It pulls in information on what kinds of things they're interested in, what kinds of issues they're being faced with, what kinds of information they want to utilize and gives us a lot of valuable grassroots information that can bring our ivory tower a little bit closer to serving the needs of the people that we need to serve. And so again, that two-way communication it becomes very important. Marilyn, do you have a few more comments?

MS. ADAMS: I would like to add a special thank you to the folks here in Kentucky. They were our 20th chapter and so if you want to talk to someone first hand about being a new Farm Safety 4 Just Kids Chapter, you might want to talk to some of the people that are here today that are from Kentucky.

I also want to stress the importance of working together. We have had a real good working relationship with the University of Iowa, University of Pennsylvania, Iowa State, the University of Kentucky and different ones and it's very important that we can all share expertise and work together and work with peer reviews and exchange information. And again I want to thank NIOSH for this opportunity. Thank you.■

Agricultural Educational Resources Centers

By *Stephen Hudock*
National Institute for Occupational Safety and Health

DR. FREUND: Many of you know David Baker and realize that he's on the schedule but not up here. He's currently still awash in flood related activities in Missouri. And replacing him on the program today, he will be on the program tomorrow, but replacing him today is Steve Hudock from our Division of Training and Manpower Development from Cincinnati and he will be talking about the Agricultural Educational Resource Centers.

MR. HUDOCK: As Gene said, I am part of the Division of Training and Manpower Development for NIOSH which happens to be one of the smallest divisions, if not the smallest division of NIOSH. One of the activities of the Educational Resource Development Branch in particular is to administer a $12 million grant program for academic programs in occupational medicine, industrial hygiene, occupational health nursing and occupational safety. These 35 single-discipline training project grants range from a safety program in Maine to an industrial hygiene program in Hawaii, an ergonomics/occupational safety program in Miami to another hygiene program in Montana. So those 35 programs keep us busy.

The Educational Resource Centers are 14 major universities which have academic programs in medicine, hygiene, nursing and safety as well as continuing education and outreach programs. The schools that are Educational Resource Centers are Harvard, New York University, Johns Hopkins, North Carolina, Alabama, Cincinnati, Michigan, Illinois at Chicago, Minnesota, Texas, Utah, the University of Washington, the University of California at Berkeley and the University of Southern California. Those marked with triangles are the four Educational Resource Centers that have an agricultural safety and health component to their program.

This aspect of the program runs on about a quarter of a million dollars a year and it's been fairly static funding for a four year period. The average for each of the grantees, California, Illinois, Minnesota and Utah range from $64,000 at Minnesota to about $30,000 at Utah for each of the past four years.

I'll briefly describe what each of those programs are doing. The University of California at Berkeley, in association with the University of California at Davis, are in collaboration with the Labor and Occupational Health Program which runs the continuing education component of that Educational Resource Center. What they're doing at Berkeley is developing a series of case studies in agricultural medicine on various topics, including cumulative trauma disorders, occupational skin diseases, respiratory diseases and how agricultural policy has implications on the safety and health of individuals in the State of California.

At the Davis Campus, they are involved primarily with the School of Medicine and have three occupational medicine residents working on ag health and safety research programs. At the Davis Campus also they're

working with the California EPA Office of Pesticide Programs and the California Institute of Rural Studies.

The continuing education component, which is through the Labor Occupational Health Program, has done a number of things including putting on one-day programs on agricultural safety and health at the University of Berkeley for the 60 graduate students in the areas of occupational medicine and occupational health nursing and industrial hygiene. The Labor Occupational Health Program has also put on four clinical workshops for the National Migrant Health Center Program. These were attended by 80 physicians, nurses and educators.

The Continuing Education Program is working with AgSafe which is a farm safety network in the State of California, with curriculum development and implementation of training programs for growers who are in turn responsible for executing California's Injury and Illness Prevention Program.

At the University of Illinois at Chicago, when you look at the academic training component of that particular grant, they are getting involved with the University of Illinois' Medical School at Rockford and the Southern Illinois Medical School of Medicine. They are looking at incorporating agricultural safety and health components into their medical curriculum. They are also looking at developing an occupational medicine rotation at a rural health care facility within the State, which as yet hasn't been identified, and they're also looking at using the videoconferencing facilities at Western Illinois University to get agricultural health and safety seminars broadcast in the western part of Illinois as well as eastern Missouri.

The continuing education component of this particular grant has worked with the Walkabout Program in two counties in the State. They served an integral role in the founding of INASH, the Illinois Network for Agricultural Safety and Health, as well as put on pesticide programs for public health nurses, physicians and emergency medical personnel in rural communities, and a three day course for physicians on agricultural illnesses.

The University of Minnesota School of Public Health also has a grant with us. They work in collaboration with the Department of Agricultural Engineering and the Minnesota Extension Service. The academic training component of this particular program is largely responsible for the development of the Center for Research in Agricultural Safety and Health in Minnesota, MNCRASH — everybody loves acronyms I guess. They also have a working relationship with the National Farm Medicine Center in Marshfield and the University of Iowa. They've established a visiting scholars program where people from the community come in on a regular basis throughout the school year for a day or two each month and talk with the professors and the faculty and learn a little bit more about agricultural safety and health problems.

The continuing education component of this particular grant has gone about disseminating some results of the agricultural health and safety research to the community through a quarterly newsletter called Farm Safety and Health Digest and a bimonthly information sheet called the MNCRASH

News.

The Program at the University of Utah is a little smaller program. They are working primarily with Utah State University, the Department of Agricultural Education and are in the process of really working on one course. This Agricultural Safety and Health Course is a required course for industrial hygiene students at the University of Utah and is an elective for students in agricultural education at Utah State University. These courses vary in location so they either drive the 80 or 90 miles between the two sites or the course is teleconferenced, or video-conferenced. That way there's always a live audience and an off-site group of students. Right now they're a rather small program. They have one graduate student recruited and they're looking at recruiting others into the program at Utah.

These are the points of contact for the grant that we have at California. Jim Meyers at the University of California at Berkeley School of Public Health, Dr. Marc Shenker at the University of California at Davis, Occupational Medicine Program, Robin Baker with the Labor Occupational Health Program at Berkeley.

At Illinois, the point of contact is Leslie Nickels at the University of Illinois, Chicago. At Minnesota, it is Dr. Ian Greaves with the School of Public Health. And at Utah it's Dr. Jeff Lee at the University of Utah. Thank you.■

Computer Based Safety Programs for Middle and High School Youth

By *Glen H. Hetzel, Ph.D.*
Virginia Tech

DR. FREUND: Thank you. Our next speaker represents one of the Agricultural Health Promotion Systems Projects. He is Glen Hetzel. Dr. Hetzel is with Virginia Tech and he's talking about Computer Based Safety Programs for Middle and High School Youth.

DR. HETZEL: Some of you who have attended programs in the past have seen the computer based programs that we've developed for use with ag students and with other students, such as 4-H in the school or 4-H programs out of school through the extension office. These programs, as we developed them, were originally pilot tested with two schools and then revised and then sent out last year to approximately 20 schools. Then we received constructive criticism during the summer. We have utilized these suggestions and now are ready to distribute these programs to teachers of agriculture throughout the State of Virginia.

Just to give you an idea of how this has worked out, we used a pre-test first. The number on the left in Figure 1 is the student number. The bar represents the number of wrong responses that the student made. You can see that the highest we had was somewhere in the neighborhood of 11 or 12, 11 wrong responses out of the total of 23 questions, I believe.

Figure 2 shows the post-test results which gave us a chance to make a comparison between the student's knowledge prior to participating in the computer based program and then afterward. In Figure 3 we have a comparison of these two. The striped bar is the pre-test score, and the hatched bar is the post-test score. The first thing you are going to spot is that students number 1 and 35 do exactly what every teacher has found out, they perform differently than most students. They unlearned — that's not a good word — but anyhow they didn't perform as well as the others. The rest of them, for the most part, did very well and we can't really complain on that. It does show that they picked up more of the information that we tried to present.

I would like to address a few other points here before I go into the next phase. We found out that what we had anticipated to be a very good program, and one that people would be receptive to, there are some blocks that get in the way of instituting and using these kinds of programs. One of the first things we found out is of course teachers of agriculture, as many of us knew, were and are very busy all of the time. It is difficult to get them to look at new materials and use them if they don't have very much preparation time.

But there's something else even more important, and this is in our state, the curriculum in the vocational agricultural departments has to be approved by the State Department of Education. So as we've tried to introduce this into the state and to get it to be accepted by all of the teachers, we've got to wait

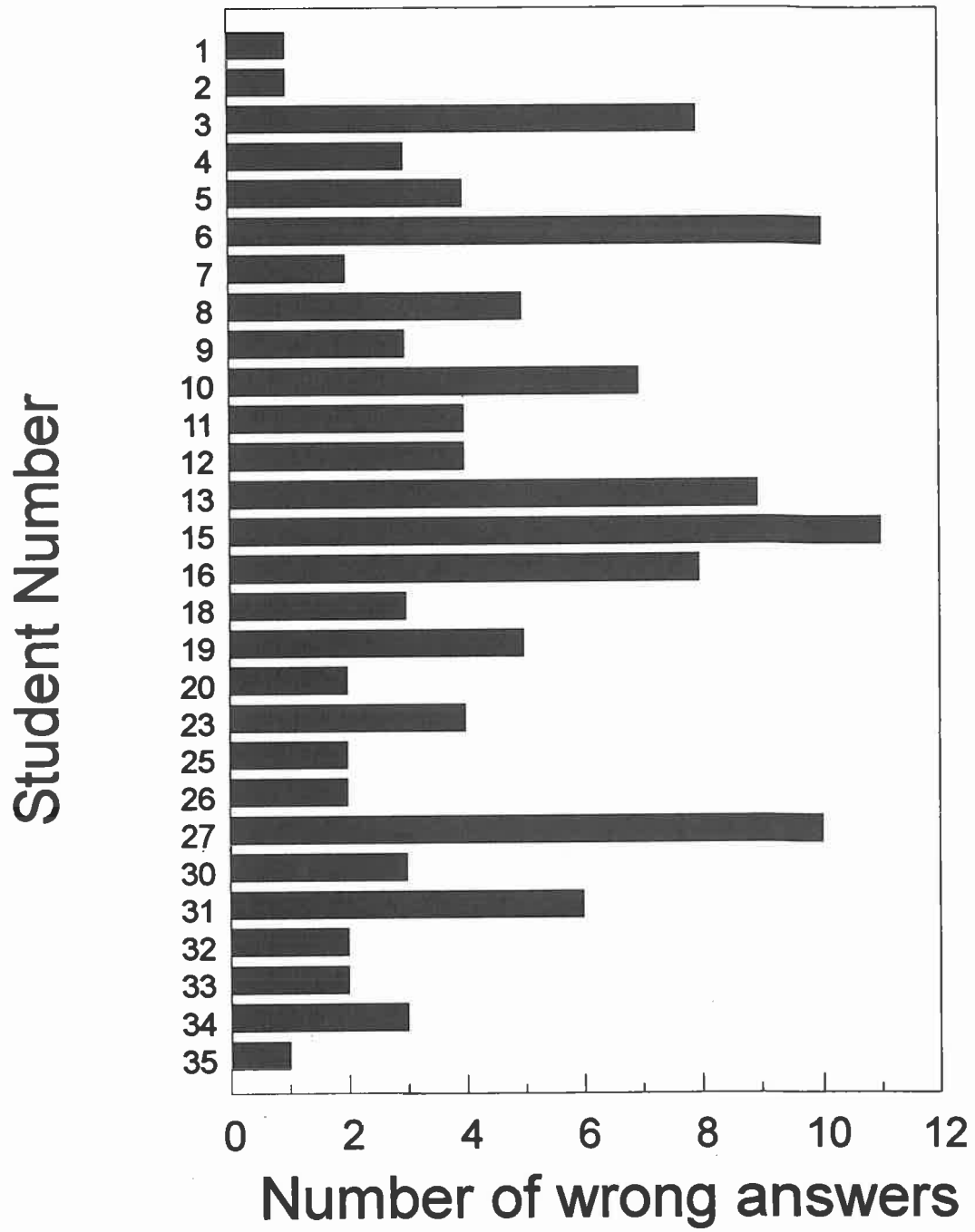


Figure 1. *Pretest Results.*

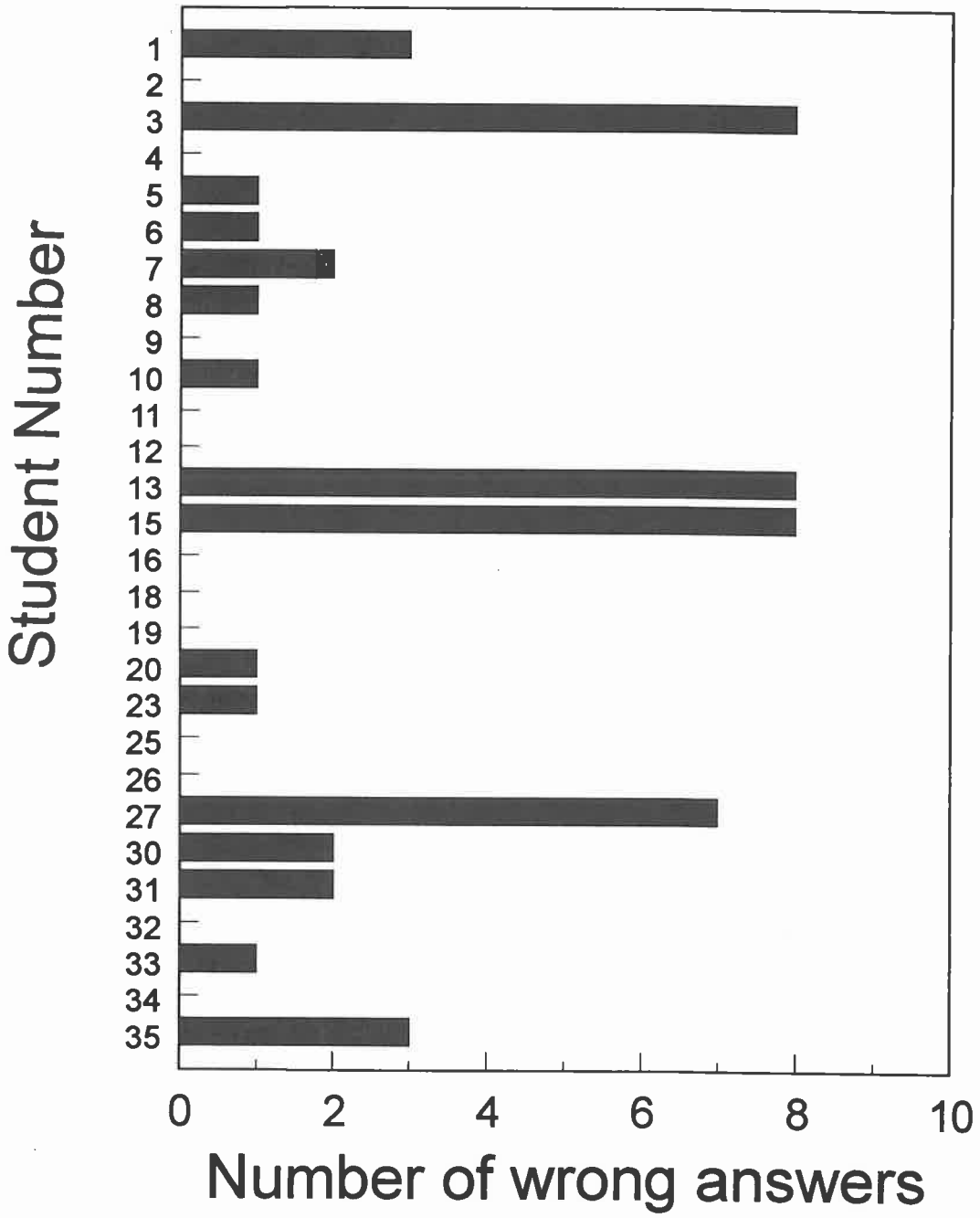


Figure 2. *Postest Results.*

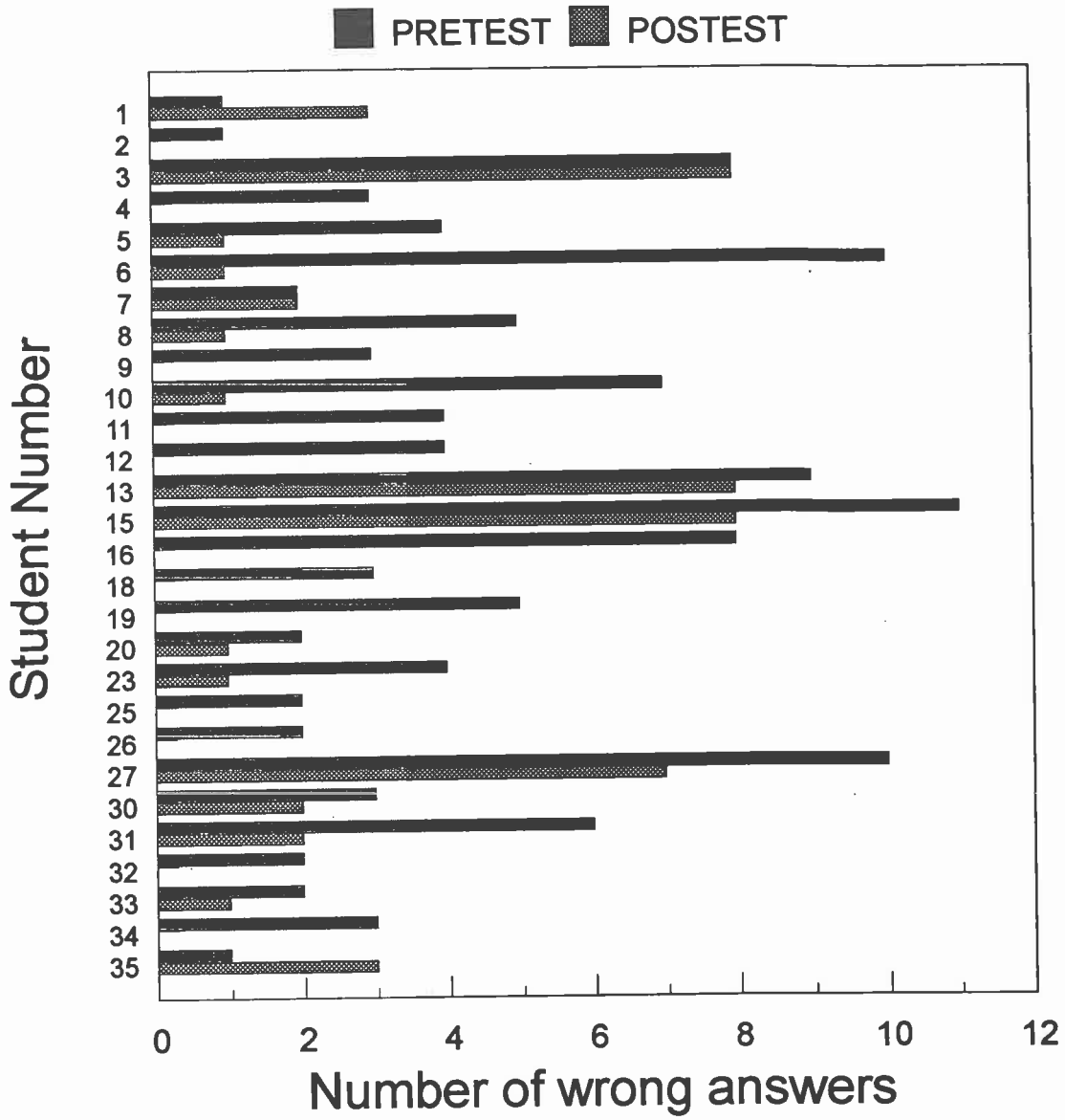


Figure 3. *Pretest and Postest Results.*

until the next time that the state level committee on curriculum meets to approve this. So that is a block we have to get around.

Another thing we found is that teachers get behind in their teaching calendar. So even though something is on their curriculum, they may never get to it. One of the reasons they don't get to it is they have a tendency to teach what they like the best. Sometimes they spend more time on a subject because they feel more comfortable and let go some of the things that they do not feel very comfortable with. We have tried to get to the teachers and to get their attention and to make them want to use these programs.

One way we did that was we went to the state meeting of teachers and we set our programs up where they could see them in the lobby. Some of the teachers came over and went through the programs. These teachers were very enthusiastic and signed up for the programs. They used the programs last year. Now we have to try to reach all of the teachers.

Teachers sometimes are limited in the facilities they have available. Not every school, particularly in our state, has the same amount of equipment. They may not have the same AV equipment, they may not have the same kinds of computers or the same number of computers. For instance, in order to get into many of the departments, we had to develop on of our programs, the one on tractor safety particularly, for use on Apple IIE's. Well Apple IIE's are pretty old as computers go. We had to find one and bring it into the department and find somebody that could still use it before we could even develop the program. We're finding that some of those schools are getting a little money from someplace and they're switching over to IBM compatible machines. Now we've got to go back and revise our programs or have a second program that will be usable on the IBM computers or IBM compatibles. Needless to say, there are some differences and you can't always do the same thing.

The software that we used sometimes will not allow you to do the same thing on one kind of computer system as on another. For instance, in one we built in the ability to keep track of the scores that a student achieved on the pre-test and post-test and at the end it would give the student the score. The instructor could go back and find out which questions were actually missed. On another piece of software we are using, that is not possible. Our programmers do not all have the same level of expertise, so when we get a change of programmer that means we sometimes have to drop back a little bit and get the programmer educated as to what we are doing and move from there.

So those are some of the things that we've been faced with. Another is the teachers sometimes don't have prep time. I've been in schools where the teachers told me that they have one-half hour free per day during the school day, one-half hour. The rest of the time they're in classes or eating lunch and trying to get back. You have to provide them with materials that are either self explanatory or try to have a training program prior to the introduction of the materials.

Another thing that happened in our state was most of the vocational agricultural teachers got put on an academic year and they are no

longer paid during the summer, so you cannot plan on having summer workshops and have all of the teachers show up. Those are the things we are faced with. I think in various states you will find, if you try to do these kinds of things, that you may be faced with similar problems.

Another additional problem is that some teachers will not use these kinds of materials if they have a class larger than 15 student. They feel like they cannot manage it and keep things going in the period of time they have. They are limited in the number of computers and so it presents a problem that way.

We have a program on tractor safety, we have one on respiratory safety and we have one on ATV safety, all of which are in use at the present time. And then there are some other programs we are working on that we expect to get out before too long.

Now if you will permit me to depart a little bit from the topic that I have, I want to tell you about another program that we're doing.

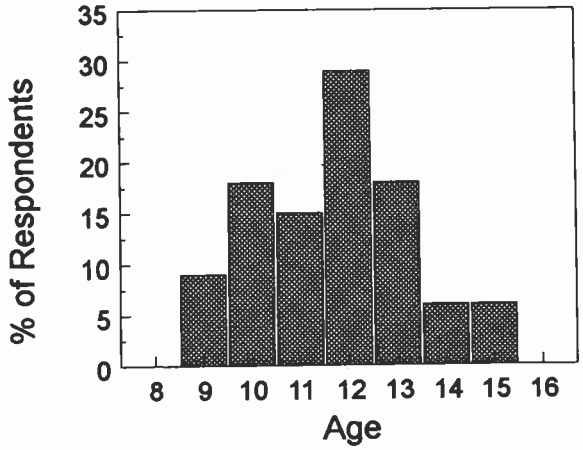


Figure 4. *Age Distribution.*

This one is mainly conducted through the 4-H Program in the state. We are fortunate in that we have a series of state operated 4-H camps, six of them to be exact. About 15,000 students a year go through these 4-H camps during the summer. Since we had indicated that we would be working in electrical safety for the farm as one of the topic areas that we were going to develop materials for, we decided to take advantage of the Camp System. A cooperative program was developed for this past summer where we used electrical cooperatives. We have a number of them around the state, and used personnel from the coops to go into the camps. Every week of camp in every camp there was a demonstration conducted with a table top display on high voltage, like a Neon Leon. These displays are owned and taken around by the various coops and their people.

The programs were coordinated by one of the members of our team, Dr. Lori Marsh. The point is that the demonstrations were given to every camper, and then were was an electrical energy course offered as an option that the 4-Hers could sign up for. So far, based on the reports we have, a little over 2,000 students signed up for and took the electrical energy course, in addition to seeing the demonstration.

As a follow-up to those demonstrations a questionnaire was sent to about 600 randomly selected families after 4-H camp was over. We obtained a mailing list of the 4-Hers who were at each camp. The questionnaire was directed to the parent. The age distribution of the 4-Hers represented in the returned surveys is shown in Figure 4. You can see that it is predominant in the 12 to 13

year age groups. Also notice for some reason the 10 and 13 year olds are about the same.

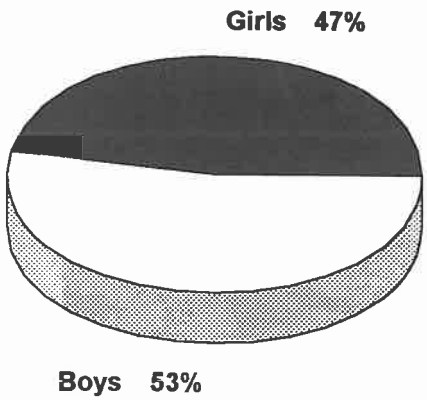


Figure 5. *Distribution of Gender Survey.*

Figure 5 shows the gender of the sample. It turns out it's pretty close to even, 47 percent for the girls and 53 percent for boys. We wanted to find out if the 4-Her went home and told the parent about the safety demonstration. It turns out about 65 percent of the survey respondents went home and told their parents they had sen this electrical safety demonstration. This is shown in Figure 6.

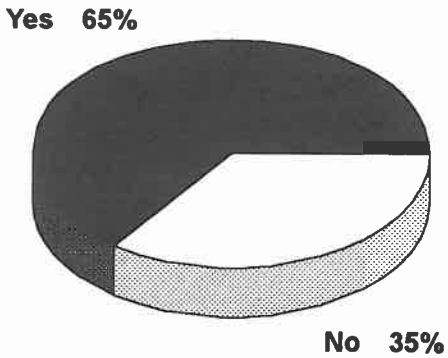


Figure 6. *Discussed Safety Demonstration Before Survey Arrived.*

Keep in mind, a parent completed the questionnaire. According to the parents (Figure 7), 57 percent of the children were very much aware of the dangers associated with high voltage and with electricity as it is on the farm. And then 43 percent said that there was somewhat of an awareness level. The children had talked about this demonstration and they realized there was a problem.

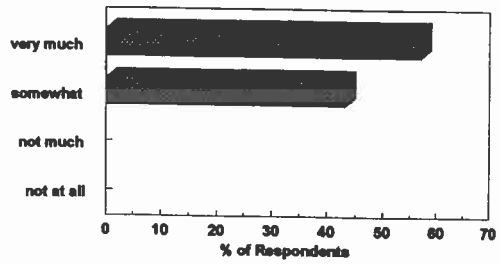


Figure 7. *Perceived Level of Child's Awareness Increase.*

After the parents had talked with the children, all the parents responded they thought their children had a high awareness level, as you would expect (Figure 8). No parent is going to say, well I talked to my kid and didn't get anywhere. Then we asked the parent what they thought their awareness level was with regard to the problems associated with the dangers of high voltage electricity (Figure 9). We found out that about 57 percent of the parents said they had a very high awareness level now. Around 32 or 33 percent of them said, yes, they had some kind of awareness level, ad still a few of the parents, even after they told us their kids had a good appreciation of this problem, somewhere around nine percent of the

parents did not indicate they had much of an awareness level. So maybe we need to go back to the moms and dads and do some kind of program for them.

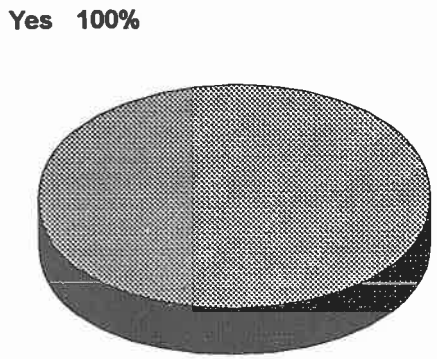


Figure 8. *Awareness Increase After Prompted Discussion.*

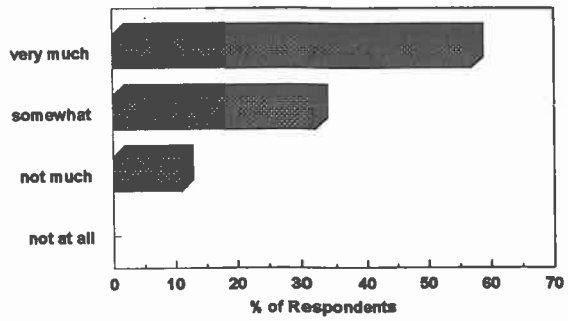


Figure 9. *Level of Parental Awareness Increase.*

That gives you an idea of some of the things you can do if you take advantage of the resources that you have available to you. We are working very diligently to try to do more of these kinds of programs with safety. Next summer we hope we get into the 4-H camps again. I don't think it is going to be a problem as the camp directors have all indicated that they thought these were good programs, and were worthwhile. We are now trying to identify some other subject area that we can go into the camp with and have a similar kind of program.■

Questions and Answers

Plenary Session III - Intervention

DR. FREUND: We can now open the floor to questions. I will remind our questioners to use the microphones and to identify yourselves before asking your questions on these interesting topics.

MR. MAY: John May from New York. For Karen Lappe, how many women had the opportunity to pick up a voucher for a mammogram?

MS. LAPPE: We had the voucher available for all women over age 40 and budgeted for 75 mammograms. The migrant population is younger due to the back breaking work that is done and we're not seeing the older women migrate to Wisconsin. Plus with day care facilities available, the grandmothers are no longer coming along to care for the younger children.

MR. MAY: You had 68 who took you up on it, that was out of a potential how many women over the age of 40?

MS. LAPPE: That is very difficult to determine. We have no method to determine the actual number of women in Wisconsin. The only numbers we have available, are women registered at La Clinica, the health center that serves the migrant population, and I guess I can't give you a definite figure on that.

MR. MAY: Okay, thanks.

MS. LAPPE: Sure.

MR. HALLMAN: Hallman from Cornell University. I have a question for Amy. Did you advocate any replacement schedule for hoses on nurse tanks for anhydrous ammonia?

MS. SPENCER: We recommended a five year replacement date which was pretty consistent with what the manufacturers suggested, and that is Ohio's State law.

MR. HALLMAN: The hoses used to have an expiration date marked on them. I believe they went to a date of manufacture.

MS. SPENCER: They did, yes. I believe it is from the date of manufacture. But we also, in the HAZOP, said that if your State has more strict regulations, (which I think one State might have a four year hose replacement), to go with your State laws if they were stricter.

MR. HALLMAN: Did you look at all at the condition of the tank, any deterioration like rusting or colors other than white as a detriment to nurse tanks?

MS. SPENCER: Absolutely. Our ammonia inspectors told us that they specifically looked for that because when it isn't white or if there is rust, that could concentrate the sun and be a potential for problem. They are very concerned about corrosion of the tanks.

MR. HALLMAN: Thank you.

MR. MYERS: Mel Myers, NIOSH. Another question Amy. We had a report from North Dakota a couple years ago ammonia

tanks and the wash bottle freezing because it was being applied during freezing weather. Did you include this in your HAZOP analysis.

MS. SPENCER: The trough freezing?

MR. MYERS: The wash bottle. You had a bottle on top of the nurse tank in one picture.

MS. SPENCER: That was not addressed. Nobody on the HAZOP team had ever heard of that happening before. I know you did alert me to that afterwards. It seems like there ought to be some type of additive that would be non-toxic but would decrease the amount of freezing.

MS. POLLACK: I'm Susan Pollack from the University of Kentucky. I just wanted to say thank you. It's hard to study migrant farm workers and I thought that was really impressive. Taking care of hispanic patients in New York City, another similar thing I encountered was that they really believed, some people did at least, that asthma medications caused cancer and I had never encountered that before. That was another obstacle.

I actually have a question for Marilyn which is to ask you if any of the Farm Safety 4 Just Kids material has ever been used in an effort to educate health professionals, perhaps most specifically pediatric internal medicine and family practice residents who are going to provide care to farm families and if you thought it might be used that way if it hasn't been?

MS. ADAMS: Some of the physicians have used our materials. What we do is send out the materials by request to anyone that would be interested in using them.

DR. FREUND: If there are no more questions, I think we can conclude this session. We're actually a little bit early, so there is time for more questions. Please note that tomorrow all sessions start at 8:30. They started at 9:00 today and they asked me to make sure that you're aware of that aspect of the schedule. Thank you very much. See you tomorrow.■

(Whereupon the meeting was adjourned to reconvene at 8:30 a.m. the following day, Thursday, August 26, 1993.)

A Farm Family Health and Hazard Surveillance Program for Cash Grain Farmers in Ohio

By *J.R. Wilkins, III, Dr.P.H.*
Ohio State University

MS. CONNELLY: Good Morning. Welcome to the second day of the NIOSH Symposium on Efforts to Prevent Injury and Disease Among Agricultural Workers. I am Barbara Connelly of NIOSH, the Division of Surveillance, Hazard Evaluations, and Field Studies, substituting for Dr. Paul Schulte.
For this portion of the morning's plenary sessions we will hear from five researchers reporting on various aspects of agriculturally related health and safety surveillance activities. First, I would like to introduce to you J.R. Wilkins, III, Associate Professor with the Department of Preventive Medicine, Ohio State University. He will be bringing to us information on the subject of Farm Family Health and Hazard Surveillance Program for Cash Grain Farmers in Ohio. Dr. Wilkins.

DR. WILKINS: Thank you and good morning. May I have the first slide please?

My objective this morning is to describe what is going on in the Ohio Farm Family Health and Hazard Surveillance Program, which we normally call the Ohio Farm Family Health Study, and also to give you a bit of a progress report about where we are at at this point in the program.
I would like to acknowledge the contribution of my principal collaborator, Tom Bean, who is in the Department of Agricultural Engineering at Ohio State University.

This is indeed a cooperative agreement with NIOSH but I would be remiss if I did not point out that it is also a cooperative agreement with a variety of other entities in the State of Ohio which I am showing here in this slide. There are in fact three University departments involved in this program: Preventive Medicine, Agricultural Engineering, as already mentioned, and also the Department of Entomology. Number three on this list is the Ohio Agricultural Statistics Service (OASS), really a principal player in our program since they maintain the best list of farms in Ohio. There are other sources of sampling frames in Ohio but on balance the Agricultural Statistics Service clearly has the best one; I believe that the Minnesota Agricultural Statistics Service was mentioned yesterday. I might point out that the OASS is of course part of a federal program, the National Agricultural Statistics Service. Also involved with us is the Division of Safety and Hygiene, part of the Ohio Bureau of Workers' Compensation. They are providing industrial hygiene support to this project in terms of both training some of our people and also actually incurring the cost of some laboratory analyses. The Ohio State University Extension is also involved

primarily through Tom Bean's work in the Department of Agricultural Engineering. They are going to help us, in part, with access to farms and farmers later on in the project.

We are also using the Ohio Departments of Agriculture and Health primarily in a consultative capacity. Last, we are using consultants from the Ohio Agricultural Research and Development Center, OARDC, primarily in the area of pesticide exposure assessment.

As an overview to the whole project, before I get into some of the details, this has been designed as a five year project — five years worth of data collection broken up into three phases. Phase I, which I will probably spend most of my presentation time talking about since we have already started Phase I, is a mixed mode survey conducted throughout the State of Ohio. Phase II involves collection of health and hazard data on farms and Phase III is a series of environmental monitoring studies of sub-samples which I will describe here momentarily.

This slide gives you an overview of Phase I, like I mentioned Phase I is already started. We worked with the Ohio Agricultural Statistics Service to develop an appropriate sampling strategy. As you see here in the second panel, we sampled close to 5,000 cash grain farms. We did this actually a short time ago because, I am happy to announce, we got Office of Management and Budget (OMB) approval in February of 1993 and started shortly thereafter in terms of data collection.

The sample of almost 5,000 cash grain farms was stratified on two variables — size of farm and also region of Ohio. This is important to appreciate because Phases II and III focus on the 20 county central Ohio area. The sample size was really determined by the necessary sample size for Phase II which was 624 farms.

As to the actual way we are doing this survey, let me give you a little bit of an overview. We essentially followed the Dillman Procedure, which many of you I am sure are familiar with, with some modifications. In terms of the chronology, we sent out an introductory letter at the end of this past May describing the program, describing what our expectations were toward those farms that had been sampled. We also had in that same mailing an endorsement letter from the Ohio Farm Bureau. A few days later we sent out the first questionnaire with a short explanatory letter along with a postage paid return envelope. About a week after that we sent out a postcard reminder. Two weeks after that the second mailing went out and then three weeks subsequent to that we started telephone follow-up.

I emphasize the fact that this is a mixed mode survey involving mail questionnaire with telephone follow-up. We subcontracted with the Ohio Agricultural Statistics Service to actually conduct the survey.

Let me talk a little bit about the questionnaire itself. I have a two-part slide here that gives you an idea of what this questionnaire form is all about. We decided to go with an optically scannable form since the sample size was so large that it was

determined to be cost-effective to try to develop an optically scannable form. It turned out to be a 16 page booklet. When you print an optically scannable form most of your items will be closed ended — there were specific choices that respondents have. There are a few write-ins that will require some coding later on.

The questionnaire is designed primarily for the principal operator, although there are a few sections that ask questions of the spouse or the closest-in-age-householder. The average response time for the principal operator is 60 minutes and about 10 minutes for the spouse or householder.

As far as the contents go there are standard questions on farm characteristics, demographic data and work histories. The rest of the sections deal with what you might expect — tobacco and alcohol use, questions about this for both the principal operator and the spouse. These questions and others were taken from national survey sources, primarily the National Health Survey along with the National Health and Nutrition Examination Survey (NHANES). There were a few questions about medical care, source of medical care primarily; they were imbedded in the section on stress and well-being, where there are actually two instruments that address this topic.

The respiratory symptoms section are the standardized questions from the British Medical Research Council, a questionnaire that many of you I am sure are familiar with. There is a question about hearing loss; I might point out that respiratory disease and hearing loss are two areas of special interest to us. There is also a section in the questionnaire about injury events that happened to anybody who lived or worked on the farm in the previous 12 months. There are some questions provided by NIOSH with respect to occupational safety and health. There is a question on dermatologic conditions and exposures to chemicals that may have gotten on the skin in the past 12 months. There was a section on symptoms of neurotoxicity, although we did not call it that. And the last two sections were standard questions taken directly from the National Health Interview Survey on selected chronic conditions, primarily missing digits or any traumatic amputations. There were also questions about family history of cancer.

I brought one of the questionnaire forms with me if anybody is interested in taking a look at it. I would be happy to share that with you.

I might comment on where we are now as far as the survey itself. We have contacted roughly two-thirds of the almost 5,000 farms sampled. We obviously are in the telephone follow-up phase of this right now.

I cannot give you definitive numbers on what our response rate is but suffice it to say that it is in the vicinity of 70 percent. This is a little bit lower than we had anticipated. We were hoping for 70 to 80 percent, so we are probably going to be at the low end of that. We are running into some considerable fear and loathing of government and there is that common misconception out there that we are OSHA and we are here to regulate you. Believe it or not there is even quite a bit of hostility direct-

ed towards the Ohio State University and OSU Extension. In fact, I might say anecdotally that one potential respondent wrote back, and I will put this delicately, and said that you can put the survey where the sun don't shine. He didn't quite use those exact words.

As far as Phase II goes, we hope to start Phase II about the end of this calendar year. Notice that now the focus is on the 20 county central Ohio area where we will collect health and hazard data estimates on some 624 cash grain farms.

On the left hand side of this graphic I am summarizing the collection of health data by a team of nurses who will conduct health exams of the principal operator, the spouse, and when there is an eligible child, we will do spirometry, audiometry, and measure height, weight and blood pressure. Standard protocols will be used here of course, either NIOSH or NHANES III protocols will be used.

Over here on the other side of this graphic I have summarized our collection of hazard data. In this case a two person hazard technician team will inspect the farms. In order to optimize data collection we have created a protocol on a pen-based computer. I would invite you to visit with Mac Crawford at the poster session. We brought the pen-based computer with us and he would be happy to demonstrate its use for you.

My last slide gives an overview of Phase III, which essentially is a series of environmental monitoring sub-studies. We will conduct both area and personal monitoring for dust, noise and selected pesticides. Our focus will be on herbicides of course since our focus is on cash grain farmers in Ohio.

We also plan on conducting a pesticide exposure assessment sub-study where we will look at urinary metabolites of either Alachlor or Atrazine among a small sample of principal operators who apply their own pesticide as well as among householders who are not involved in mixing or application.

As mentioned yesterday by Alice Greife, we plan on engaging in some video exposure monitoring of both dust and noise. With that I thank you for your attention. ■

Mandatory Reporting of Farm Injuries in North Carolina

By *Susan A. Randolph*
North Carolina Department of Environment, Health and Natural Resources

MS. CONNELLY: Our next presenter is Susan Randolph, Occupational Health Nurse, Consultant. Ms. Randolph is also Director of the Farm Injury Project at the North Carolina Department of Environment, Health and Natural Resources. Susan will be speaking to us this morning on the subject of mandatory reporting of farm injuries in North Carolina. Susan.

MS. RANDOLPH: Good morning. What I am going to try to do in the next 15 minutes is to share with you what is a new venture in North Carolina in the area of occupational disease reporting. I am happy to say that it will also include mandatory reporting of farm injuries.
Occupational disease surveillance is a critical step in the prevention of work related injuries and illnesses. Although our Occupational Health Section within the State Health Department has been in existence since 1935 we have not had any occupational disease reporting which is of interest to me. It has been my personal interest to try to establish that over the last three or four years.

We have had communicable disease reporting for over 100 years. Occupational health and disease always seems to be a little bit further behind communicable disease reporting.

The opportunity arose to develop such an initiative last year in 1992 when we received a SENSOR Grant which was funded by NIOSH for silicosis reporting. It required that we develop an occupational disease reporting law. (Overhead slide shown.)

In trying to do that, we thought about the format and that this would provide a vehicle to try to introduce the farm injury reporting. It was not an easy initiative to do, but because of the Hamlet fire that occurred in North Carolina, the climate was right to develop occupational disease reporting and try to sell that to the legislature.

From our Farm Injury Project in North Carolina I knew that farm injuries were a problem. We are in a small four county area in the eastern part of the state. In 1992 we had 128 reported farm injuries and illnesses. We are currently expanding to another four county area which would make a total of eight. Knowing that there are probably a lot more farm injuries that are not being reported to us, I looked at other data sets to confirm this belief — that farm injuries are more prevalent. I also talked with our Department of Labor.

Our Labor Department is doing a Census of Fatal Occupational Injuries, the CFOI Program. Farm injuries were number five on the list under those fatal occupational fatalities. I also talked with North Carolina State University with the AHPS Program because they have a clipping service for farm injuries. I looked at that data and

found that there were a wide variety and number of farm injuries across the state. That served as the basis to go forward.

With the actual development of this legislation this law came out as a Health Department bill. It was not an idea of the legislators to develop, it came from within our Occupational Health Section. The work for that started a year ago, last August. You almost plan a year in advance from when you are actually going to introduce legislation. If I had known then what I know now I do not know if I would have undertaken this effort.

I also looked at what other states have done with occupational disease reporting, such as Ohio, Colorado, and some other states. I tried to mirror what was in our communicable disease reporting laws, which set a good foundation. Initially, physicians would report, medical facilities would report as well as laboratories. We tried to consider what all we wanted to put in that bill now and in the future so as not to have to go back to the legislature again.

It was a generic reporting law in that we did not actually state silicosis, asbestos adult blood lead toxicity, and farm injuries in the bill. That law was very broad in that occupational diseases, illnesses and injuries are reportable and that through administrative rule making we would actually specify those conditions. If in the future, we wanted to add additional diseases, we would not have to go back to the legislature — just through our Commission for Health Services. That would have been a negotiation point if we would have had to name those conditions in the actual bill. That really gets into part of the negotiation process.

I might add we worked with our State Health Department attorneys in drafting the actual language. The bill also had to be approved by our State Health Director and our Department of Environment, Health and Natural Resources. That showed that we had support from the very top of our department which proved to be a very critical part of getting this legislation passed.

The bill was introduced on March 23rd and actually took four months until July 23rd before it passed both houses. In the negotiation process, the main actors were our Department of Labor, particularly the OSHA Division; the Medical Society; the Hospital Association; and Farm Bureau. Probably most of the negotiation was with our Department of Labor. When they read our bill, they were very concerned because it was so open-ended — that it could mean any occupational disease or illness or injury is going to be reportable — No, we will have administrative rules which will specify what disease, illness, and injury are to be reported.

OSHA had two main concerns: one was the injury reporting. They realized that the State Health Department understands diseases and medical conditions. But the injury — that is ours, that is OSHA's. They really did not want us to get into injury reporting. At that point, in talking with the head of OSHA, I said, "Well, I do not want all injuries; all I want are farm injuries because we have the Farm Injury Project. It is a means to try to extend the reporting of farm injuries state wide, to go

beyond be our eight county area."

Once OSHA heard that we wanted farm injuries, they said, "Oh, that is great. You can have that because we do not have those reports. We believe that farm injuries are a major problem in this state." That helped to gain OSHA's support in that regard.

However, OSHA's second major problem with the legislation was that there was nothing stated about referral to OSHA. Just because you have an occupational disease or condition that doesn't mean that there has necessarily been a violation of an OSHA Standard. OSHA wanted us to refer a reported disease or injury for proper enforcement and evaluation. The did not want our industrial hygienist to go out and do the follow-up. Through a lot of lot of work over a couple of months, we finally negotiated that particular piece out.

The other part of the negotiation came through one of our Senators who did not think there was enough uproar or concern about the bill, so he started talking to the Medical Society and the Hospital Association. He wanted to make sure that they knew about the bill. Consequently, they got more interested in it. The Hospital Association wanted to be paid to do any reporting. We did not have any money to pay them this is a public health issue. The Medical Society was concerned, I think, because it was so open-ended. It was very generic in the language but once we explained that specific diseases and injuries would be set forth in our Administrative Rules, they felt a lot better about it.

Then the Senator started talking with Farm Bureau because of the farm injury component. But actually, Farm Bureau was familiar with our Farm Injury Project, and was very supportive. In fact, a lobbyist with Farm Bureau had a family member that died as a result of a farm injury. She could really speak to the importance of prevention and became a real ally in that particular process.

Some of the other concerns that were being expressed were why we were singling out farm injuries — why not the textile industry, or the furniture industry, which are very prevalent in North Carolina. I explained that those injuries are reported to the Department of Labor. It is not that I am not interested in them, but that information is already available. We do not have the farm injury component. That really set the tone, and I think, speaks to developing relationships with a lot of interesting groups. You have to be willing to compromise.

The bill that actually passed is a lot different than what was initially written, than what we had initially proposed and introduced on the floor of the Senate. I think it is a much better bill for all of that effort, although at the time, it was quite painful to go through. At times, the bill was very near death, but concerns were worked out.

As far as the outcome, the legislation passed through the House on July 23. It made a very circuitous path. It started out as a Senate bill, went through Children and Human Resources Committee, then it went to Appropriations Committee, had a second reading in the Senate, and then there was a

lot of uproar over various things. It finally passed the final reading through the Senate. It then went to the House and sat in House Rules Committee for over a month. There was a question whether it officially met a crossover deadline that our State has set. If it had not been for the State Health Director, our legislative liaison, and some other people at much higher level than I am with state government, that bill would never have gotten out of House Rules. It then went into the Business and Labor Committee in mid July. At this point, it was really getting to the end of the session and legislators were trying to get out of town. They were not planning to have any more meetings. Then they assigned the bill to this committee which had completed its business and were not planning to hold another meeting. Again, through help from our State Health Department — that illustrates the importance of having the support of the top agency — we were able to get a committee meeting held. An emergency committee meeting was held out in the hallway, and the bill passed. Then we waited to see if it was going to be on the calendar.

Actually, the bill passed next to the last day the legislature was in town. The legislators heard second and third readings in one day and passed the bill with only one objection. (Overhead slide shown.)

The title of the bill is *An Act to Institute a Statewide Reporting System for Occupational Diseases, Illnesses and Injuries*. It is effective January 1, 1994. Once the bill passed, I thought that most of the work was done. However, after a week I found out that, in order to develop administrative rules which really defines what we are actually going to be doing with this legislation, the rules needed to be written to go before the November 1993 Commission Hearings. The administrative rules speak to what we want reported, who is to report, when it is to be reported, and how it is to be reported. It is the more detailed, technical aspects of the legislation.

The first draft of the administrative rules has gone forward. We are requesting that silicosis (which is part our SENSOR program), asbestos, adult blood lead toxicity which is of interest to me and NIOSH, and farm injuries. Farm injuries are actually designated as serious and preventable occupational injuries that occur while working on a farm. That is very broad. Again a lot of legislators were asking if every hang nail and scratch that every farmer has is reportable. No, we are really looking at the most serious injuries. We are defining this for the legislation as occupational injuries resulting from tractors, farm equipment, farm machinery. That would be easy for health care providers, for physicians and hospitals to report to us.

It is an exciting time in North Carolina, not only for the surveillance of occupational diseases but also an opportunity to quantify the number of farm injuries statewide. It will enable us to do some specific interventions to reduce death, disability and disease associated with farm labor. Thank you.

One other point, I have some copies of the legislation with me if any of you would like to have a copy of that. See me afterwards and I will be happy to share that. ■

Minnesota Farming Health Project Survey Results and the Response to Surveillance Data at the Local Level

By *Catherine Lexau, R.N., M.P.H.*
Minnesota Department of Health

MS. CONNELLY: Thank you, Susan. Our third presenter this morning is Catherine Lexau, R.N., M.P.H. She is Project Coordinator with OHNAC in Minnesota, that is the Occupational Health Nurses in Agricultural Communities, Health Promotion and Education Division of the Minnesota Department of Health. Catherine will be presenting information on the Minnesota Farming Health Project Survey results and the response to surveillance data at the local level.

MS. LEXAU: Thank you. I am here today to share some results from the survey that we recently completed as part of the OHNAC project in Minnesota. The name of our project is the Minnesota Farming Health Project.

Co-authors of this presentation are Don Bishop, Ph.D. and the three nurses I work with, Colleen Nelson, R.N., B.S.N., Brenda Lenz, R.N., B.S.N., and Susan Voehl, R.N., B.S.N. These nurses have recently completed an on farm survey that involved an interview with male and female heads of household, audiometric testing and spirometry for those individuals.

This has been completed over the winters of 1992 and 1993, with a total of 383 farm families surveyed on 372 farms. (Slide shown.)

This shows our project sites and also our survey sites. These areas are quite diverse agriculturally. In our northwest project site, small grains farming predominates, also sugar beets, potatoes production and some livestock. The central site, is predominantly a dairy area; also corn and soybeans are grown there. In the southwest site hog farming predominates with corn and soybean production as well. I will show you a prettier picture of Minnesota here. (Slide shown.)

Our state is the land of 10,000 lakes, though I do not know if any of us is really excited about seeing this much water this summer.

I would like to give you some background on the goals of this survey. We have anticipated from the beginning using these survey data and other surveillance results with coalitions that we have locally organized in each of the project sites.

The coalitions are made up of volunteers and professionals from each project area. They are carrying out farm injury and illness prevention programs. The nurses that I mentioned before are also working as community organizers.

We have done two presentations so far for our coalitions. We plan to use this data in upcoming months for public awareness activities and also to plan intervention programs.

Group	Any %	Moderate-Severe %	N
Group 1			
Men	69.3	43.3	231
Women	38.4	13.5	310
Group 2			
Men	63.8	29.3	58
Women	34.3	10.9	175

Group 1 Includes all tested except those with possible invalid tests and those with military service who fired weapons.

Group 2 also excludes those aged 60 and over, and anyone who stated they were exposed to loud noise unrelated to farming.

Table 1. *Percentages of Men and Women With Hearing Loss.*

This use of the data has been our primary goal. This has driven what we have chosen to analyze initially. The slides I will show you today were also used with our initial data presentations locally. We have been trying, therefore, to come up with ways of explaining the data in a way that will make sense for local farmers.

I have been inspired by this slide that I got from Dr. Burton Cross from the University of Iowa which he uses to explain parts per billion in a way that I think is very tangible for farmers. I am hoping that some of what we have done so far will be as readily understood by the farming population. I am a little concerned that with some of this we may need to go back to the drawing board.

Just a little more on our methodology. I also have some handouts available with a little more detail.

This slide shows the content of the survey covered with each female head of household respondent.

This slide shows the topics and the testing done for the principal farm operator in the male head of household. In almost every case the principal farm operator is the same as the male head of household.

This shows the overall age distribution of all our survey participants. The age distri-

bution for each of the project sites was not much different from this. We did have in the central site a few more individuals in the 40 to 50 year old age group.

We asked principal farm operators to categorize their main farm enterprise, this was usually one enterprise among several enterprises in terms of income and also in terms of work time.

This slide shows the break down of the operation that took the most work time. A number could not categorize or did not categorize just one operation. In comparison, this shows the break down of the main farm operation by work time just for one site, for the northwest site, showing what a difference is seen given the different mix of different agricultural operations in the different sites. We have used these main farm operation categories for a lot of our analysis hoping that this would provide a good frame of reference for farmers to understand some of the data.

These next results were very interesting to our coalition in northwest Minnesota showing that farmers are reporting an average on-farm work week of 60 hours; those hours are averaged over the whole year.

The survey results that I will next present next, fit into the following categories: hearing loss, back problems and disability, respiratory health and injuries. I will cover just a few points of the initial analysis we have done so far for each of these sections.

Starting with hearing loss, this table shows proportions of the male and female heads of household with hearing losses documented in our survey testing. A hearing loss was one that was 30 decibels or higher, any threshold for either ear. A moderate to severe hearing loss was at least one threshold assessed at 45 decibels or higher.

See Table 1. There are results summarized here for two groups. In the first group we excluded anyone with a possibly invalid test due to unprotected noise exposure the day of the test and also those with military experience firing weapons.

In the second group we have excluded a number of other individuals. We asked a number of questions about other noise exposures and exclude here in addition to the first exclusions anyone who responded yes to any routine non-farm noise exposure and also persons aged 60 or over. This limits our numbers quite drastically especially for the men but we still see large proportions of people, especially the men, with moderate to severe hearing losses.

We asked principal farm operators to tell us how often they used hearing protection when around loud noise, most answered never to that question; however, those who did use hearing protection responded more frequently that they used earplugs and earmuffs which depending on how they fit, should provide effective protection.

I do not want to go into everything on this slide. This displays some of our evaluation results of our testing and teaching that we did as part of the survey. I do want to draw your attention to the 34 percent on the right hand pie chart who stated that six to eight weeks after the survey they had not had any loud noise exposure so the

question on the use of hearing protection was not applicable. Some of these people would have answered the question in the winter so some of these answers may have been appropriate; however, it has made us wonder whether we need to stress more strongly just what noise exposure is hazardous.

Another response to the data on hearing that has been of interest is the question of how kids learning is being affected. We do not have data on this. We did not test kids but there is a lot of interest in this area and in looking at some of the hearing losses in the younger farm operators we see that work to protect kids' hearing is needed.

I will go into some of the results relating to back pain and disability next. Low back pain is of course very prevalent in the population as a whole so we asked women and men to tell us about back pain that had caused them to miss or change work on the farm and other activities.

In looking at the past year about twice as many men as women had lost or changed their work on the farm due to low back pain, that was 14.7 percent of the group for men and 7.5 percent of the group for women.

This slide shows the length of time lost for all of those individuals. About one-third lost a month or more of work time or else modified their work on the farm for a month or more.

In our initial presentations this particular slide or this information on lost work time with back pain has not seemed to be really significant for the coalitions. We presented this information, actually giving them even more information than I am giving you today — on a variety of topics. We may need to present this result a little differently because I think this is a significant amount of disability.

We asked about the prevalence of several disabling conditions for every household member, these included visual impairment, hearing loss, cardiac problems, arthritis, nerve or muscle illnesses, amputation and paralysis. For this chart we have included only adults who had work hours on the farm and found a quarter or more of those working on the farm, and more than a third of the male heads of household, with one or more of these conditions. Of these problems arthritis had the greatest prevalence, about 13 and 17 percent in the male and female heads of household groups. Amputations were much more prevalent among the men, as you might expect, almost five percent as compared with 0.4 percent for the women.

In talking about our respiratory health section I just want to mention that we got an incredible amount of help from DRDS at NIOSH in carrying out spirometry testing on the farms. We used their PJ5 Spirometry Program. They analyzed our data, provided quality assurance, and answered a lot of questions for us.

For our results today; however, we really have just the initial part of our analysis completed. We have a lot of information to sort through yet. Initially we have summarized the proportions of abnormal test

	Number Injured		Number in group	Percent Injured
	M	F		
Male Heads of Household	70		382	18.3
Female Heads of Household		11	350	3.1
Other Adult Households	5	2	133	5.3
Children<18 yrs of age	11	7	490	3.7

Source: MN Farming Health Project Survey

Table 2. *Farm Related Injuries*

results. Included in these abnormals — we tested about 692 people — and there was a total of 106 with abnormal test results, these included 98 with airways obstruction, 5 with restriction and 3 with mixed obstruction and restriction. When you see the information on abnormal test results on the slides following, these are almost all obstructive results.

With current smokers excluded from analysis there was a statistically significant difference at the 0.05 level in the proportion of abnormal test results between men and women. We looked for differences based on this one parameter in the different groups that were divided by main farm enterprise that I had shown you at the beginning of the talk. We did find some differences in those proportions but not ones that were statistically significant at this level.

We asked whether principal farm operators had ever used breathing protection for any farm work. Responses were much more positive than for our hearing protection question, about 79 percent said yes. They responded most consistently to wearing breathing protection when they were working with grain and much less consistently working with silage, working in confinement barns or working with chemicals or pesticides.

When we asked what breathing protection was used however, the most commonly used type was one strap masks. These of course are not considered effective for respiratory protection and are not designed as such. This confirmed the strategy we have implemented in some educational efforts promoting the use of two strap dust masks among farmers for dusty work. Given that they are inexpensive, given that many folks are using one strap masks now, it seems to be possible for farmers to consider wearing two strap masks for some on-farm dust

exposures.

The final results I will cover here today are on farm injuries. On these sections of our questionnaire and also on sections dealing with the farm operation we drew heavily on the telephone interview survey that was developed in the Olmstead Agricultural Trauma Study (OATS) and then used again in the RRIS Study, the Regional Rural Injury Study. This was developed by Susan Gerberich and others at the University of Minnesota. We use the same injury definition that they used in those studies which was any accident or injury that restricted normal activities for at least four hours, or that resulted in a loss of consciousness, or a loss of awareness for any length of time, or for which professional health care was sought.

Overall the number of farm related injuries reported over a one year period came to 1 in every 3.5 farms surveyed. I should say too that the farm operators themselves or the person injured defined whether it was related to the farming operation.

Proportions of those injured in each group, the male heads of household, the children etc., vary considerably. You can see those proportions listed there. See Table 2.

There is also some variation between survey sites and the proportions of male heads of household reporting injuries over a one year period. This proportion in our northwest site was 7.9 percent of the principal farm operators with farm injuries compared with the southwest site where 29.9 percent of them reported a farm injury. We see some differences that are consistent with them when we look at the different main farm operation groups. We see differences with beef and hog producers having higher proportions and small grains farmers having lower proportions of injuries. Our northwest site (with fewer injuries) is the area with more small grains farming of the three survey sites. This is not to say, however, that more injuries came about during work with livestock. See Table 3. This slide shows the agent or structure most directly involved in the farm injuries that were reported, with machinery, livestock, and storage structures being the most predominant causes or factors in those injuries.

Certainly of interest in our local presentations are the types of machinery involved most often, with the power and garden shop equipment being somewhat of a surprise for some of the local farm operators.

We were not terribly surprised with the results on seasons in which most injuries occurred; a little over half took place in fall and spring.

This slide shows the central survey site — we broke out some data for this area alone. This site had relatively more injuries in winter and fewer in spring. This makes sense because of the predominance of dairy farming in that area compared to the rest of the survey areas.

This slide shows the most common injury types. A difference in this data set as compared with some gathered through medical records or with medical informants is that we have included cases that do not present to medical care. We were not sur-

Type	Injured (%)	Total in Group
Beef	**75.0**	**12**
Dairy	11.8	68
Hog	43.8	48
Row Crops	12.7	165
Small Grains	8.8	57
All Others	23.8	21
Total	**18.6**	**371**

Source: MN Farming Health Project Survey

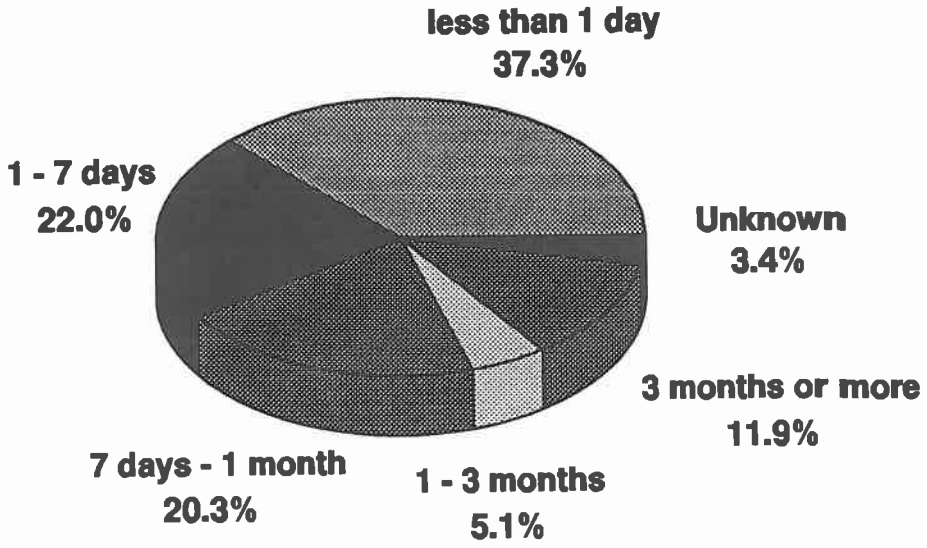
Table 3. *Farm Injuries to Principal Farm Operators Differences by Farm Operation Type.*

prised to see the predominance of sprains, strains and lacerations, but in doing our initial presentations this was a surprise to our local coalitions — I think because of the focus on traumatic injuries seen in local newspapers.

A little over one-half of these farm injuries resulted in lost work time on the farm. With 106 farm injuries reported totally, of the 59 where there was lost work time, this slide shows the length of lost work time. See Figure 1.

This final slide shows results for one site, our central survey site, (though it is consistent for the rest of the state), on what sources of information on farm health and safety were reported by principal farm operators. Our results here are similar I think to some of the information that was presented yesterday with people answering most frequently for farm magazines, television — which was a little surprising to me, and radio. It really pointed to the importance of those media sources.

These are my summary points. Relative to interest and applicability of our data to our local coalitions, in the area of hearing loss we found that we should do more work on getting farm operators to use hearing protection and perhaps more education on what constitutes hazardous noise exposure. Regarding disability we found that quite a few farmers and other people working on farms had underlying sensory and mobility related impairments. Under our respiratory



n = 59

Source: MN Farming Health Project Survey

Figure 1. *Work time lost on the farm due to FARM RELATED Injuries.*

section we found a difference in the percentages of abnormal lung test results, mostly obstructive, between men and women about two to one, men being higher. Regarding injuries we found that a farm related injury was reported on about 1 in every 3.5 of the farms where we conducted surveys. Thank you.■

The Farm and Agricultural Injury Classification Code (FAIC)

By *Dennis J. Murphy, Ph.D.*
Penn State University

MS. CONNELLY: Thank you Catherine. Next we will hear from Dennis Murphy. He will be presenting information to us on the Farm and Agricultural Injury Classification Code. Dennis Murphy is Professor and Extension Safety Specialist with the Department of Agricultural and Biological Engineering, Penn State University.

DR. MURPHY: Let us go ahead and have the slides please.
(Slide shown.)

I would like to acknowledge Mark Firshowitz who helped develop this Code. Mark has just taken a position at the University of Wisconsin.

I do not know how many saw the Code but it was published in the journal of American Public Health in the May 1993 issue. You may be able to refer back to that issue for additional information about the Code.

I will not spend a lot of time going over surveillance problems. I think to say that there are problems with the current methods of surveillance is preaching to the choir. I will try to simply outline some of the major problems that we have with the two major systems. NIOSH's National Traumatic Occupational Fatality (NTOF) System and the National Safety Council are the two major national surveillance systems that classify agricultural accidents.

When we started to develop this Code we used the Standard Industrial Classification (SIC) manual as a starting point because part of the problem that we were trying to address is the comparison of industries. With the way things are now, such a comparison is really comparing apples and oranges. We are trying to get to where we can compare apples with apples. The only way to do that is to start with the SIC code so that we can stay consistent where it is appropriate to stay consistent.

The other thing that we did to try to resolve some of the current problems is to make decisions regardless of the: age of the victim; location of incident; what was involved in terms of major agent or source; and the victim's official status, in terms of a career, student status for young people, non-students or whatever. We ignored these sorts of things and made decisions based upon what was really going on in terms of the activity when the accident happened.

Furthermore, the classification system separates work cases from non-work cases. This is a real big issue, particularly with the National Safety Council's method because they tend to lump everything together. If it just happens out there and it sort of looks like work or if it looks like production work, it all goes into the same category. What this classification system is doing is pulling out things that are clearly work — like cutting fire wood — from

production agriculture. If we are going to compare production agriculture with other industries and their production or occupational work activities, then we have to pull out the things that are just miscellaneous work that occur to people who are living out in a rural area.

The code identifies unique situational exposures. I think you will understand what that means in just another couple of slides.

We have a total of 11 categories. The first 4 categories are, of course, very similar to the SIC code. What we did was combine the SIC O1 and O2, the crops and the animal production activities, and named that category farm production work. In the SIC, Agricultural Services is 07, forestry is 08, and fishing, hunting and trapping is 09.

We are also trying to standardize some terminology. Words such as production agriculture, farm production, and farming all describe activities and occupational sorts of things that happen within the industry of agriculture. The important thing is that all of these words fall within SIC 01 and 02 or FAIC 01.

If we look at the first four of these codes, they represent an industry total. FAIC 01 is, of course, just farm production work. A lot of times when we talk about agriculture, we are referring to SIC 01 or 02 and we are talking about farming activities, which is our FAIC 01. But when we talk about FAIC 01 through 04, we are talking about the industry. We heard about Alaska and their fishing, which is a part of the agricultural industry but which is not "farming" per se.

We get into what we call the "unique situational exposures" with the rest of the code. We have seven additional codes, 05 and 06 are where a majority of cases are falling when we go back and apply this code retrospectively, 05 in particular. I am finding more cases that go into this category than I was expecting. In fact, tractors and machines and barns and other structures are used for a lot of things other than production farm work. Tractors in particular are used in all kinds of industries, e.g. the construction industry, building roadways, maintenance in state parks. There are just all kinds of activities and places where traditional agricultural machines are used for non-farm production work so we have a category for that.

Category 06 is the non-work work site. This is where a majority of the small children are falling: the extra riders; the four and five year olds on tractors; kids just out playing in an area; or playing in a barn and fall through a hayloft opening — a fairly common thing we have in Pennsylvania.

The next category is On-farm Outside Services. This is where the contractor comes in but is in another industry, or is in another occupation. But because an injury happens on a farm, sometimes that gets called farm production work. We had a person just recently in our area that fell off of a barn roof; he was a contractor just putting on a new roof. That is not farm "production work" or "occupational work" as those terms are understood in any other industry. That kind of thing gets separated out in this code.

Here are the remainder of the codes. They

are fairly self-explanatory. There are not too many in FAIC 10, and yet there are some. This category is from the perspective of the victim — not of the person that may be injured. For example, we have people driving in rural areas and all of a sudden a cow is out or a horse gets out and runs across the road, there is a crash and there is a fatality. The person injured perhaps was from a town or a city and just happened to be driving in a rural area. That itself, from that victim's perspective, is not a production agricultural accident.

The interruption unrelated to work category is kind of a unique thing, not too many go in here but these are the kind of things that we find when we look at farm and agricultural data. We have had a farmer that stopped to help a motorist, again just someone from a town that was passing by and their car stalled on them. The farmer got off his tractor, climbed over the fence and was trying to help this individual and another car came along and crashed into him and killed him. He was not doing farm production work when he was killed, he was just out in a rural area trying to help somebody out. When he was on his tractor, he was doing farm production work, but not when he was off that tractor and doing something totally unrelated.

Those are the categories that we have at the present time. I have grouped these things, from 01 to 04, and refer to them as "agriculture as an industry". The incidents in 05 to 11, I have termed rural lifestyle. We could have other terminology to identify this group, but because they happen to people in a rural area, that seems as good a description as anything else. We can certainly come up with a different name if we want to.

The real test of course is to apply data to this code. I had information in Pennsylvania and I had some follow-up information so I could go back — we already had this information. We had already had these cases over a three year period. That is, 108 cases classified as "farm work" when we did not have a code, so we did not have any other way to classify them other than by our usual methods. It sort of looked like a farm accident so we called it a farm accident. When I applied the Code to them, I only found 60 cases out of that 108 that were actual farm production or occupational work accidents as occupational work is defined in all other industries. Thirty-nine of the cases then went into the other groups. Two cases we threw out completely, again just because we did not have a guideline to go by before, so if it sort of looked like it, smelled like it, sort of happened around the farm, we just included it. There were seven cases that even though I had good information I still could not make a determination because the key points of that information simply were not there.

In New York, John Pollock and some of his colleagues went back, they too had already had data, and went back and tried to apply this code. Out of their 93 cases they had 51 that fell into farm production, 25 were rural lifestyle. They also threw out two cases and they had a large number of undetermined cases because they did not have the same follow back information that I had had. They had a larger percentage of their total cases that they could not deter-

mine.

I think there are some real key issues. This is a relatively new thing. There are several people in several states trying to make some use of this right now. Certainly you have to have the right information and you cannot always get that information out of the newspaper clippings, nor off of the death certificate. Even when you have both of those sources you do not always have the right information that you need. We need supplemental information but we cannot always get that. I have been doing this for quite a while in Pennsylvania — going back through a variety of ways sometimes with the next of kin, sometimes from other ways, through our Department of Health and Vital Statistics, to get additional information. I think what is really important is that we be able to obtain supplemental information quickly for use with the code. I think this is important and will reduce the number of undeterminable cases if a person has this code and really understands it and how to apply it at the time that something does happen, or within a few weeks or a month, as opposed to going back two or three years which is what we did originally.

Systematic application of the code, is a real key. We reference the SIC code — I think I understand the SIC Code and I know other people that I am working with understand the SIC Code — and yet I have just found recently that we are making some different interpretations. So obviously, there is some room for improvement. We have not yet gotten into the details of why we interpreted things in a different way. There is some work to be done yet in getting some guidelines out that everyone can use and that will be understandable by enough people so that it does get applied systematically. (Slide shown.)

This is the last slide. I think if we do start using this code I think some things will change. The interesting comparisons will be a lot more accurate than they are now. The NTOF System is underestimating things because they exclude those under 16, and their source document is a death certificate. You cannot get the dual occupations off of death certificates. There are just a lot of problems with that, more from the death certificate than the NTOF System. The National Safety Council procedure is hard to understand, and it is hard for them to explain it sometimes. I think they are way over counting things because they are lumping everything that happens to look like work into occupational work. We know that is not very good.

The picture will change. The picture will become clearer in terms of rural lifestyles versus production work. It is not that we are trying to hide anything, I do not want to do that at all. I think if we understand that many incidents are related to a rural lifestyle, that that actually facilitates bringing a public health perspective into agricultural accidents, at least that is my view.

That may actually help us. It improves our understanding of exposures. I think it will help everyone understand that there are an awful lot of children and there are an awful lot of agricultural things being used for non-production sorts of things. It just clarifies all of that. I think it will help us to talk to each other regardless of whatever

our backgrounds are. Right now when we just say farm work and agricultural accidents we really are not talking about the same things. Hopefully it will just help us in a lot of different ways. Thank you.■

Occupational Health Surveillance of US Farm Workers

By *Lorraine Cameron, Ph.D, Nina Lalich, Joyce Salg, Ph.D, Janie Gittleman, Ph.D. and Carol Burnett*
National Institute for Occupational Safety and Health

MS. CONNELLY: Thank you, Dennis. Our final speaker this morning for this plenary session will be a substitute for Lorraine Cameron. We have Nina Lalich. She is Chief of the Illness Effects Section of the Surveillance Branch, Division of Surveillance Hazard Evaluations, and Field Studies at NIOSH. She will report on the occupational health surveillance of United States farm workers.

MS. LALICH: Thank you, Barbara. I am filling in for Dr. Cameron who could not be here today. I am going to present the results of a study that she did with our colleagues in the Surveillance Branch.

This study was part of a larger project that we are working on to explore potential data sources for occupational health surveillance of farm workers.

The purpose of this study is to describe disease patterns in farm workers based on an analysis of death certificate data from 28 states.

Farm workers are a difficult population to define. Our study does not include farm owners and operators but rather we are interested in farm workers who are defined by the Census Bureau as those who work under supervision to plant, cultivate, harvest and care for farm animals.

Some other definitions you may run into include one by the Department of Labor for seasonal agricultural services workers. These are people who have seasonal employment in agricultural field work and this excludes livestock, poultry and fodder. A subset of farm workers, the migrant farm workers, are defined by the Public Health Service as those who must establish a temporary abode to do seasonal agricultural work.

Our study that I am going to talk about today uses the Census Bureau definition because we are working with death certificate data and the type of occupational information that is available on the death certificate is really most easily classified with the Census Bureau classification system.

Depending on which definition you are using the estimates of the size of this population vary pretty widely, they range from 300,000 to 3 million.

To give you some idea of farm worker demographics we looked at data from the Department of Labor survey, the National Agricultural Workers Survey or the NAWS, that was done in 1990.

This survey only covers people who are defined under that seasonal agricultural worker definition, 71 percent are hispanic, 24 percent white and 3 percent were black. The number of blacks has decreased over time. The median age was 31 years and

11 percent are 50 years or greater. Sixty-two percent are foreign born. Fifty-one percent have been in the United States eight or more years. Twelve percent of seasonal agricultural service workers are unauthorized to be working in the United States.

Looking at some other work and social factors for farm workers the average farm worker spends 26 weeks per year doing farm work. During this time they average about 37 hours per week. Most of the remainder of the year farm workers are unemployed.

Looking at the work histories that were reported on this survey about 67 percent of the jobs that they reported could be classified as farm work. Most of the people plan to remain doing farm work. Forty-two percent are migrant workers who must travel 75 or more miles from their home to their place of work and establish a temporary dwelling. Fifty percent are below the poverty level and 79 percent have no health insurance.

Some of the potential health problems of farm workers include agrichemical related illness, injuries, motor vehicle accidents, and heat stress, musculoskeletal problems particularly back pain, infectious disease and other problems resulting from poor field sanitation, respiratory and skin problems many of which may be occupationally related, and psychosocial and poverty related health effects.

To explore the patterns of mortality in farm workers we used a NIOSH database called the National Occupational Mortality Surveillance System or NOMS. This data base is based on death certificate data for the years 1979 through 1990. The number of states in the data base each year has increased, starting with just 2 states in 1979 and we are up to 22 states in 1990. Some states have dropped out so that the total in the entire 12 years of the data base are 28 states[1].

The usual occupation and industry of the decedent is recorded on the death certificate and is coded according to the 1980 Census Classification System. There are codes for farm owners, farm operators and for farm workers. As I mentioned earlier our study was restricted to the farm workers.

The underlying cause of death was coded according to the Ninth Revision of the International Classification of Diseases. The total number of deaths included in our analysis was almost 4.9 million deaths. The number of farm worker deaths were 12,476 white males, 841 white females, 5,514 black males and 2,297 black females.

Data on Hispanic origin are unavailable in this database until 1990. Most Hispanics are probably classified as white in this data set.

The demographic distribution of our data differs from the distribution that you saw earlier from the Department of Labor data. Obviously we do not have the breakout for the Hispanics. Our database does not include all of the states and you can see that we are missing some important ones such as Texas and Florida. The NOMS states are in blue on this map.

It is difficult to determine the representativeness of our data because a large percentage of farm workers are migrant. It is not really known what happens to them when they retire and therefore where they end up when they die.

The data were analyzed using a NIOSH computer program that calculates cause-specific, age-standardized Proportionate Mortality Ratios or PMRs. A PMR is the proportion of deaths for a specific cause in an occupation divided by the proportion of deaths for that cause in the NOMS database, multiplied by 100. A PMR in excess of 100 indicates an excess risk for that cause of death. The computer program also calculates 95 percent confidence intervals. (Slide shown.)

This slide shows some of the selected results from our analysis. We chose these because the PMRs were elevated for at least two of the four race and sex groups. The bars show the size of the PMR and the black arrows indicate the confidence intervals.

Cerebrovascular disease mortality and injury and poisoning deaths were elevated in all of the four groups. Respiratory disease mortality was elevated in all groups except the black females. Alcohol related deaths were elevated in all groups except white females.

Since the focus of our work in the Surveillance Branch is to look at disease rather than injuries, today I will present in more detail, some of the data on respiratory and alcohol-related deaths.

The PMRs for chronic obstructive pulmonary disease were elevated for white males and white females. PMRs for tuberculosis were elevated in all except the white females, as was pneumonia.

Deaths due to mental disorders related to substance abuse, a category that would include alcoholism, were elevated in all groups, although not significantly in the white females. Cirrhosis was elevated only in the white males. Deaths due to alcohol poisoning was elevated in white and black males.

The results of this analysis should be interpreted keeping in mind several of the limitations of a death certificate based PMR study. PMRs are proportions not rates and they may be biased if the overall Standardized Mortality Ratio for the occupation is either less than or greater than 100 or they may be biased if the PMR is excessively high or low for a common cause of death. In our analysis we found that the cancer PMRs were low for farm workers and this could be resulting in artificially inflated PMRs for some of the other causes of death.

The recorded occupation on the death certificate may be inaccurate. As I discussed earlier, older farmers may leave farm work and it is unclear what may be indicated on the death certificate as their usual occupation.

Since the Census classification system includes codes for farm owners and operators on the death certificate if the person is reported as a farmer I think that those are usually classified as a farm owner or farm

operator; so we really do not know how many of our farm workers are actually misclassified as farm owners or operators.

Not shown on this slide — we are not sure whether there may be problems with the quality of the cause of death information for farm workers. Because of the problems that they have with access to health care they may not be getting good information about the cause of death on their death certificates.

As I mentioned earlier, the NOMS database does not include all states. For some states we only have a few years of data, particularly in California we only have data for the years 1979 through 1981 because they have not been coding occupation and industry on an ongoing basis since that time. We only have the ethnicity data since 1990.

Finally, death certificates, for the most part, do not contain information on important confounders and exposures. There are a few states that are now collecting data on smoking but, that information is not available in the NOMS database.

Our conclusions are that the elevated PMRs for injuries, alcohol related deaths and tuberculosis are consistent with other studies of farm workers. The elevated PMRs for chronic obstructive pulmonary disease (COPD) and for cerebrovascular disease need further exploration. We would like to know whether some of the excess in the COPD deaths is related to tobacco use or whether there might be other explanations. It would be interesting to know whether the excess mortality for cerebrovascular disease might be explained in part by problems with access to medical care. In general there was consistency in the results across the race and sex groups.

Many of the causes of death that were elevated in farm workers are those that would be amenable to prevention or intervention activities.

Some of our future and ongoing activities in our surveillance project include doing some further in depth mortality analyses. We would like to possibly explore analyses that would separate the different geographic regions. As we get more years of data we hope to be able to look at the data on hispanics. We also have data on the contributing causes of death which might be interesting in looking at some of the causes such as the respiratory disease.

We also have some efforts underway to explore sources for morbidity data. We are supporting the California Farm Family Health and Hazard Survey which is collecting health data on farm workers in two counties in California through personal interviews.

We are exploring potential uses of the data from the migrant clinics nationwide through a project that we are doing with the National Migrant Resource Program.

We would also like to do some more work in the area of exploring methods of characterizing exposures for farm workers. In Illinois we are providing technical assistance for a pilot survey that is being done there in conjunction with the migrant clinics where they are trying to do a survey of

pesticide exposure in farm workers.

Finally, we are hoping to encourage more active surveillance of farm workers and follow-up of case reports that are identified through various NIOSH programs such as the Sentinel Event Notification System for Occupational Risk (SENSOR) which includes surveillance for pesticide poisonings, and also our various technical assistance programs. Thank you.■

ENDNOTE:

1. The NOMS data were provided in part by State Vital Statistics Offices through the Vital Statistics Program of the National Center for Health Statistics (NCHS), with the support and collaboration of the National Institute for Occupational Safety and Health (NIOSH) and the National Cancer Institute (NCI). Additional data were provided directly to NIOSH by selected State Vital Statistics Offices.

Questions and Answers

Plenary Session IV - Surveillance

MS. CONNELLY: Thank you, Nina. We have just a few moments to entertain questions you may have. If you have questions if you will step to the mike, introduce yourself and please let us know your affiliation. Questions please? Going once, going twice.

MR. MYERS: My name is John Myers. I am with the Division of Safety Research at NIOSH. My question is directed to Susan Randolph.

The main question I have with the effort you had for getting agricultural injuries as a reportable condition in North Carolina — why you did not try and define something as reportable related to something like hospital admission where you get a broader spectrum of severe injuries rather than just concentrating on machinery.

MS. RANDOLPH: That is a real good question. I think initially it was trying to have something that would be easy to define for health care providers. I think one of the points that I omitted to say is that physicians must report, it is a mandatory reporting, whereas, medical facilities have permissive reporting which is the same for communicable disease. That makes a big difference. However, one of the things we try to do is to look at hospital discharge data — maybe from trauma centers, E-coding, and trying to look at that particular aspect. Thank you.

MR. ROSENMAN: Ken Rosenman, Michigan State University. I guess I just have a comment. We actually in Michigan have mandatory reporting of agricultural related injuries and illnesses. Our best sources are the hospitals. We get very few reports from the physicians. The way we have done it is there are actual International Classification of Disease (ICD) codes that are specific to farm injuries. The record rooms are the best reporting. It is unfortunate to hear that for the hospitals it is permissive because I think you would have gotten a much more reports the other way around.

MS. RANDOLPH: (Inaudible.) — negotiable.

I think that is why it was the same way with communicable disease. The theory behind that is that when patients are admitted to a hospital, they are under a physician's care — the physician admits them. So, if you have physician reporting and hospitals reporting aren't they really doing double reporting? So, unless the physician works out with the hospital, there is duplicate reporting.

MS. FLEMING: Mary Fleming. I am with the Nurses Project in Ohio. I have a question for Dennis Murphy.

On the classification system what do you do with those cases that maybe look like they could fall in a couple of different categories? For example, somebody who may be transporting livestock to market and is injured in a road vehicle accident. Would you put them in the production side or

would you go with the traffic classification?

DR. MURPHY: It would be production. That is a production activity. Again, that kind of thing is explained in the SIC. I think if you really get into the details of SIC you can use that as a guide in most cases. You have to know what AG production is, know the various kinds of activities that are involved in Ag production.

MS. FLEMING: The other part of my question was with the children involved. When you went back in a retrospective review, did you find it difficult to get details about what the children's involvement actually was, and the different structures? My experience is that some farm families are reluctant to acknowledge that the kid was actually working, perhaps in the barn or with the machinery, so the tendency maybe is just to report the injury without giving the descriptive information. Did you find that in your retrospective study?

DR. MURPHY: We did a follow-up study so we asked the questions. We did this before we had the code. We just asked a series of questions as well as got a description of what they were doing at the time. All of that information — along with the death certificate and newspaper clipping — when you put all three of those things together then we had pretty good information in most cases and could make the determination.

MS. FLEMING: Thank you.

MS. CONNELLY: Now for our morning break. We will reconvene in one-half hour. Thank you for coming.■

(Brief Recess.)

Moderator:
John Myers

Agricultural Research at the National Cancer Institute

By *Aaron Blair, Ph.D.*
National Cancer Institute

MR. MYERS: Good morning. My name is John Myers. I am with the Division of Safety Research at NIOSH in Morgantown, West Virginia. I would like to make a little announcement here, this relates to a lot of the NIOSH grantees and so forth who have been working with the Agricultural Center out of Marshfield. They would like me to announce that they have brought some of the information on the upcoming Midwest and High Plains Agricultural Safety and Health Regional Conference that is scheduled to be held October 10 through 12, in Marshfield. Information on the tentative schedule, background on poster sessions and a form filling out on the poster session are out here on the registration desk. Anyone who is interested in that information just feel free to pick it up on your way out here at the end of the session. If you have any questions I assume the person to talk to would be Dr. Paul Gunderson or Dr. Gene Soons, both of them from Marshfield. This is the fifth plenary session. The talks today are generally going to be in the area of research. Our first speaker is Dr. Aaron Blair. He is with the National Cancer Institute. He is going to be giving us a talk on the agricultural research at the National Cancer Institute.

DR. BLAIR: Thank you. It is a pleasure to be at this symposium. I thank NIOSH for allowing me the opportunity to come and speak to you. It is very interesting and illumination to me to see the breadth of activities that are going on regarding agricultural health under the NIOSH effort, both activities within the agency as well as extramural projects. We all know it has been needed for a number of years and it is pleasing to see the amount of work that is going forward.

The National Cancer Institute has been engaged in research in the agricultural arena for a number of years but it is a more restricted effort than the comprehensive approach taken by NIOSH. Our effort has been very strictly focused on etiologic factors in agriculture related to cancer. I am pleased to have the opportunity to share with you the projects we have underway, as well as some of our work in the past.

Over the past 15 years, the Cancer Institute has focused on cancer in agriculture using a variety of approaches. Early on we looked at geographic patterns in the United States. The cancer maps developed by the National Cancer Institute in the mid-1970s revealed a striking pattern of leukemia mortality in the United States. High rate counties, run through the center part of the United States, from the Dakotas through Texas. They are not in the cities, so obviously whatever might be causing this pattern cannot have anything to do with urban living. It could just be chance, but if there are any environmental factors involved, they must be associated with agriculture. This observation spawned a number of other studies. These efforts utilized death certificates in several states and further suggested that there might be some excess

cancer associated with agriculture exposures. Our next step included more analytic studies of both cohort mortality and population-based case-control designs.

The cohort mortality studies focused on a number of different groups that have some relationship with agriculture or have exposure similar to agriculture, in an effort to evaluate cancer risks in relation to specific exposures. For example, we looked at the grain industry and found excesses of non-Hodgkin's lymphoma, particularly in flour mills, the component of the industry that uses considerable amounts of pesticide. We evaluated commercial pesticide applicators and found excesses of brain cancer and lung cancer. We have also studied aerial pesticide applicators and found excess mortality from leukemia and accidents.

We currently have underway two cohort studies of pesticide applicators: lawn care workers and employees of county noxious weed departments. The lawn care workers are employees of Chemlawn, a national lawn care service and is composed of over 30,000 subjects. Detailed information is available from the company that provides information on the pesticides used and the application for each office. We therefore, know a lot about their exposures. This however, is a very young cohort and the young individuals who perform this work, typically do not do so for very long. The real value of the cohort will come after considerable follow-up rather than in the near future.

We also have a cohort mortality study of employees of county noxious week departments in the State of Kansas. These are individuals engaged in controlling particularly troublesome noxious weeds. These weeds do not just only grow in the farmers fields, but also on roadsides and other public lands. The noxious weed program is designed to combat these weeds on parks and road sides, as well as in productive agricultural land. This cohort is unique in that they apply only herbicides, so we do not have the insecticide confounding problem. In Kansas, the predominant herbicide has been 2, 4-10. But also they keep very detailed application records, that typically includes the chemical used, the dilution ratio, number gallons applied, and the windspeed. We are also planning environmental and biologic monitoring in this group.

We anticipate having the incidence and mortality components of this project completed early next year. We hope to go into the field with environmental and biologic monitoring components next summer.

We have also conducted a number of population-based case-control studies to try to look at several cancers that appear to be excessive in farmers. From some of our early work and mortality surveys of farmers from around the world, we find that farmers are a very healthy group of people, there have been presentations on this point by other speakers. They have a lower mortality than the general population for most diseases including total cancer. When we focus on individual cancers, however, we find a group of tumors that tend to be excessive. These are cancers of the lymphatic and hematopoietic systems, and cancers of the skin, lip, brain, stomach,

and prostate cancer. These excesses occur in many countries around the world, and are consistent enough that I doubt that this is a chance phenomenon. There must be some factors in the agricultural environment, or associated with the rural lifestyle that account for the pattern. We have used case-control studies to seek more detailed information about potentially hazardous agricultural exposures, as well as important lifestyle factors.

We completed case-control studies of leukemia and non-Hodgkin's lymphoma in Iowa and Minnesota, multiple myeloma in Iowa, non-Hodgkin's lymphoma and soft tissue sarcoma in Kansas, and leukemia, non-Hodgkin's lymphoma, and multiple myeloma in Nebraska. We found associations with various pesticides, in particular 2,4-D and organophosphate insecticides, non-Hodgkin's lymphoma and several with leukemia.

We have several studies in the field or in analysis. One is a case-control study of multiple myeloma in Michigan, New Jersey and Georgia. This study is designed to look at risk factors associated with tumors that are excessive in African Americans, of which multiple myeloma is one. It is located in urban rather than farm areas, so we do not have a large number of farmers. We do, however, have a farm component in the questionnaire for this study. The interviewing and data collection for this study is complete and we are in the process of analyzing the data.

Two other studies that I will spend a bit more time on are brain and stomach cancer case-control studies in Nebraska. These are currently in the field and interviewing should be complete by the end of the year. These studies were initiated for several reasons. First, brain and stomach cancers are tumors that are excessive in farmers. Secondly, the rates for brain cancer have been increasing in the population as a whole, but explanations for the trend are not available. Rates for stomach cancer, as a whole are going down but cancer of the cardia and the lower esophagus are increasing. We included cancers of the lower esophagus in this study. Finally, there had been almost no analytic studies on brain and stomach cancer focusing on agricultural exposures.

In our study, we have about 300 brain and 300 stomach cancers. It includes both men and women. We are obtaining well water samples because the concern over nitrate levels in drinking water and the potential for nitrosamine formation which may cause stomach cancer. The interview obtains information on pesticides, diet, a variety of non-agricultural exposures, medicinal use, and family history. It is a very comprehensive interview but includes a lot of detailed questions on agricultural exposures.

In most of our case-control studies, we have included methologic components try to validate and improve the assessment of agricultural exposures. We have attempted to assess the reliability of information obtained by interview by corroborating the information through pesticide suppliers. Since cancer is a rapidly fatal disease and often you cannot interview the case directly, we have also included methologic components to evaluate the reliability of information provided by surrogate respondents.

We have some information on reliability. In the study in Kansas, we asked the farmers where they had purchased their pesticides and interviewed up to three suppliers. The percent agreement between farmers and suppliers for herbicides was from 40 to 70 percent and somewhat high, for insecticides. We would like this to be a lot better, but this percent of agreement is almost actually that found for diet. Thus, if you can obtain information on diet in epidemiologic studies, you can also ask about pesticides. This level of reliability is probably an underestimate of the accuracy of farmers' reporting you because the reports from the suppliers cannot be 100 percent accurate. So, part of the disagreement has to be due to inaccurate information obtained from the suppliers.

We have also compared responses from farmers and surrogate respondents regarding use of different pesticides. Their relative ranking of pesticides is almost identical. From the whole list of 30 herbicides, the correlation coefficient between the farmer and surrogate rankings is about 0.75. Surrogates, however, report about 50 percent fewer pesticides so there is a considerable underestimation of exposure if you have to rely upon reports of use from surrogates.

Our studies of farmers have focused primarily on owners and operators. We have not really made much of an attempt to look at farm laborers or seasonal and migrant workers. We have been hesitant because we were not quite sure how to design epidemiologic studies of these workers. Normal resources that are available for farmers might not work for seasonal and migrant workers. We are initiating a project to address some of these feasibility issues. These issues include those mentioned by earlier speakers including the accuracy of the death certificate for disease and also for the recorded occupation, whether or not records of migrant and seasonal workers with cancer will be included in tumor registries somewhere, how to effectively trace seasonal and migrant workers, and finally how to obtain work histories from migrant workers. From this feasibility effort, we hope to learn how we can best conduct etiologic studies of cancer among this poorly studied group.

Finally, in the remainder of my time, I would like to describe the major new effort at the National Cancer Institute, the Agricultural Health Study. We have designed a perspective cohort study to evaluate a number of different cancer and noncancer outcomes that may be caused by agricultural exposures. A prospective design has an advantage in that we can gather information on exposure before disease is diagnosed and, thereby, eliminate the potential for case-response bias that may occur in the case-control studies.

The Agricultural Health Study is a collaborative effort between the National Cancer Institute, the Environmental Protection Agency, and the National Institute of Environmental Health Sciences. The study will be conducted in Iowa and North Carolina. In Iowa, the University of Iowa will be involved in assembling the data.
A major strength of study is that we can look at many disease outcomes. The prospective nature of the study also allows

periodic reassessment of exposures and the opportunity to obtain additional information on various factors. We are also conducting detailed environmental and biologic monitoring on a sample of farm families to provide qualitative data for information obtained by interview.

We will enroll participants as they seek pesticide licensing or certification in the two states. In each state, applicants come to cooperative extension offices between December and March for licensing and we will be at those offices to distribute and retrieve a short enrollment questionnaire. We will also ask them to take home a larger questionnaire that will provide us considerably more information on agricultural and lifestyle factors. We anticipate enrolling about 75,000 applicators (50,000 are farmers and 25,000 other pesticide applicators). We will also enroll the spouses and children of all the farmers. Spouses will receive a separate questionnaire to complete and return. We are not planning to interview the children,but we are gathering information on them so that we can include them in many risk analyses. Information on disease will be determined through tumor registries (both Iowa and North Carolina have cancer registries) through mortality tracing using the National Death Index, and through the questionnaires.

In the pilot work, we achieved about a 95 percent response rate for the enrollment questionnaire. It looks like we will receive excellent cooperation.

The study is composed of several components. The main cohort study (which involves assembling the cohort) the exposure monitoring, (which includes monitoring 200 farm families for occupational as well as environmental exposures that may come through the water and air and other sources), a series of nested case-control studies within the cohort which will allow us to gather additional information that we did not obtain in the general survey, and finally, biologic monitoring which will allow us to look for early evidence of disease, biomarkers and genetic susceptibility.The information that we are trying to obtain from the questionnaires includes details on agricultural practices such as the crops and animals that are produced on the farm, pesticides used and when and how much and how often they are used, and protective equipment used. Other factors of interest include dietary information, tobacco and alcohol use, family history of cancer, medications, disease history and so forth.

We anticipate that the study will continue for ten or more years and believe it will provide us with the needed information to characterize the health of our farm families. Thank you.■

Assessing the Health and Injury Concerns of African American Farmers: The First Steps

By *Thomas A. Arcury, Ph.D.*
University of Kentucky

MR. MYERS: Our next speaker will be Dr. Thomas Arcury. He is Research Coordinator for the Center for Rural Health here at the University of Kentucky. His presentation will be on "Assessing the Health and Injury Concerns of African American Farmers: The First Steps."

DR. ARCURY: I would like to begin by acknowledging my colleagues on this project who are present here. They include Pamella Shaw, William Turner and Robert McKnight of the University of Kentucky, and Richard Enochs of Tennessee State University.

In this report what we discuss our progress in conducting an assessment of health and injury concerns among African American farmers in the Southeast United States. This project is part of the Southeast Center for Agricultural Health and Injury Prevention at the University of Kentucky. It is supported through a cooperative agreement with NIOSH.

This project has two distinct aims. The first of these is to develop a plan of action that addresses the specific agricultural health and injury issues that face African American farmers and their families. The second is to increase the interest in agricultural health and safety research among faculty members in historically black colleges and universities in the South.

To achieve these aims we are using a qualitative data collection approach to learn what Southeastern African American farmers feel are the issues important to their occupational health and safety. Data collection procedures include individual indepth interviews and focus group interviews. The interviews were completed by faculty and staff from four historically black colleges and universities: Alcorn State University in Mississippi, Kentucky State University, North Carolina A&T University and Tennessee State University.

For this presentation we first describe the tasks needed to prepare for data collection. The data collection methods are then discussed. This is followed by a description of our plans for data processing and data analysis. Finally, we present some preliminary results of this project.

Two tasks were completed to prepare the interviewers to complete the indepth and focus group interviews. First, interview guides were developed. Second, an interview training workshop was conducted.

Separate but comparable interview guides were prepared for indepth and focus group interviews. These guides are not the same as standard interview questionnaires. Interviewers are not required to ask about every item in the guide. Rather, the guides list a set of topics or questions that should be considered when talking to the participant.

The interviewer should attempt to elicit information about all topics in the guide, but the interviewer should not force the participant to discuss topics with which the participant is not comfortable.

The indepth interview guide covers four areas. The first of these is personal background information; such as, age, marital history, educational history, and occupational history. The second is a description of the current farm of the participant that included farm size, enterprises, and division of labor. The third is health and safety issues, including assessment of current health status of the participant and their family, perceived health and safety risks of farming, personal and family experience in farm related injury and illnesses. Finally, their access to health care is discussed, including facilities available in the local community, the cost of health care, availability of insurance. The focus group interviews covered two of these areas only: health and safety issues, and access to health care.

A three day interview training workshop was conducted in January 1993, in Lexington, Kentucky. A total of eleven interviewers attended the workshop; nine from the historically black colleges as well as two individuals from North Carolina State University. The topics covered in the training sessions included an overview of the project to familiarize the interviewers with our goals, human subjects considerations, operating the equipment that they would be using to record the interviews, finding and selecting subjects (sampling), qualitative interview methods, and focus group interview methods. In addition, participants completed practice indepth and focus group interviews. These practice interviews were reviewed and critiqued.

The training workshop included presentations by the project investigators as well as by experts hired to conduct segments of the training. Jeffry Suchanek of the Oral History Program at the University of Kentucky instructed the interviewers in the use of the recording equipment. Drs. Sara Quandt and John Van Willigen of the Department of Anthropology at the University of Kentucky were the instructors for segments on qualitative interviewing.
Dr. Pamela Kidd of UK College of Nursing provided instruction on focus group interviewing.

The biggest drawback to our training was the lack of opportunity for the project directors to listen to and critique the tapes of early interviews, before the interviewers completed additional interviews.

The interviews were conducted over the period of March through July of 1993. All of the interviews were tape recorded. The interviewers were instructed to have the participants reflect the variation present among the African American farmers in the communities in which they conducted the interviews. We wanted the participants to be farmers but we wanted to have tenants and owners, part-time and full-time, married and single individuals, operators and farm workers.

Thirty-four indepth interviews were completed. Eight each in Kentucky and Tennessee, nine each in North Carolina and Mississippi. Half of the indepth interviews

in each state, with the exception of Tennessee, were completed with farm women. The interviews lasted between 45 minutes to a little over 2 hours.

Two focus groups, one with males and one with females was also completed in each state. The eight focus groups ranged in size from five to eight individuals.

Each of the interviews is being transcribed verbatim by the University of Kentucky Oral History Program. The oral history program has transcriptionists with the necessary experience for such verbatim transcription. The transcripts are provided to us in paper and machine readable formats for use in the analysis. Most of the interviews have been transcribed. Three indepth and four focus group interviews remain to be completed and, so they could not be considered for the analysis presented here.

We plan an interactive approach to the analysis of these qualitative data. The first step is to review the transcripts to discover the agricultural health and safety issues and themes which are present. Four researchers are independently reading these transcripts to develop the list of issues and themes. We will then develop a code book of these issues and themes. Finally, we will go back to the transcripts and code these in a format that will allow computer assisted analysis of the text with a program such as *The Ethnograph*.

The actual analysis will look at the number of times these themes and issues are mentioned in the interviews, the context in which the issues and themes are mentioned and the degree to which different issues and themes intersect within the interviews. We will also consider differences in themes by such participant characteristics as gender, state of residence and farm ownership.

We are now in the first stage of the analysis, in fact early in it. The results which we present here are some of the major themes and issues which we have found. The presence and importance of these themes are supported by quotations which will be shown on the overhead. (Slide shown.)

There is general agreement among the participants that farming is hazardous as this participant stated in a response to the question: Is farming hazardous? "In a way anything may happen on a farm, especially when you are working by yourself it is hazardous so you cannot get around it. Anything can happen. You cannot be too careful with anything." Later on he said, "Oh, like a tractor or hay baler...any farm equipment...tractors is very, very hazardous."

You can see in the following quote that he gets a little bit more descriptive. I like the quote, "You take a hoe you may chop your toe off if you don't be very careful."

While most of our narrators agreed that farming was hazardous, a couple did not. The interviewer here asks, "Is farming a hazardous occupation?" and the narrator says, "I don't think so. It is something you can't be careless when you are doing, you have to make sure you concentrate on what you're doing." He goes on to describe, that

he started driving a tractor, when he was six or seven years old. He does not feel that this is at all hazardous.

There is also general agreement that farming is more hazardous than it used to be. Participants gave several reasons for the increasing danger of farming, Foremost among these is the power farm machinery. When most participants were growing up they used draft animals. In fact, many of the participants used draft animals when they began farming themselves. They now all use machinery which is more powerful than those animals and the machinery has gotten bigger and more powerful.

Because many of our participants are part-time farmers and their spouses work off the farm, and because they are using machinery they are more likely to be working alone. They saw this as another cause for making farming more dangerous.

Finally, just the gasoline and the fumes from gasoline engines were held by a few to make farming more dangerous than it was in the past. (Slide shown.)

Here the interviewer asked, "Would you say that farming is a reasonable hazardous occupation as a whole?" The respondent says, "Yeah. Worse now than in years back because of the tractors with so many horsepower. Back a long time ago they had horses and it wasn't too much you could get hurt by. One might run off now and then, but you most of the time controlled it. But now you have so many horsepower with all of these tractors that you buy and you get to the place that if you're careless you can get hurt easy and this is what happened on the farm. And another reason what make it bad if you're a small farmer most of the time you're working by yourself and if you work by yourself you could get in a condition that something happened there's nobody to help you and this is why it's so dangerous." The quote goes on.

This is a quote from another interview also stating that farming is more dangerous. "I'd say in a way yeah and a way no. But years ago didn't do nothing but a mule but now you're running all these tractors and things so that's why it be more dangerous because you get more equipment running than you had then." It goes on to say in a later part of the quote, "In some ways it's less dangerous because you have things like seat belts on your tractors."

While participants mentioned several different sources of hazards on the farm including farm animals, chemicals, and visiting relatives, (you just can not trust them around the tractors and the animals), as you can see in some of the previous quotes, most of the emphasis was on farm machinery and its power. Emphasis was also placed on possible hazards of farm chemicals. Several of the participants or their spouses have attended classes to be certified in the use of these chemicals.

Here the respondent, says, "I guess the chemicals would be more dangerous than anything else." The interviewer says, "Well, if you've got children on the farm, what would you feel you would have to be most careful around?"

"I still think the chemicals because what

few cows we got they're all pets and the children plays with them." Then further in the quote he says, "But maybe the chemicals. If you don't keep the sprayers clean, if you don't burn up these containers, and if you go into the tobacco too early after you have put the chemicals on the tobacco that could be very dangerous."

Here we go back to the equipment, the machinery. "Anything else that you think might be dangerous or risky to your family?"

"Well the old tractor would be risky because we got two wild ones." "But other than that and really they haven't did anything with them so they did pretty good even now that the 13 year old drives the tractor." Most of the participants state that the way to avoid farm injury is simply through being careful, cautious and concentrated. Few could or would state more specific rules. Here asked if there was a rule the respondent, the participant states, "Carefulness, being careful is the rule to follow." He couldn't be very much more specific than that.

At the same time several participants noted the role of fate in farm injuries. They believe that some things are just going to happen. Here the participant says, "Well, it's just routine. I mean you run a pretty good size operation, you know. It's just like when these factories and everything every once in awhile somebody gonna get hurt. And I wouldn't just say carelessness because these boys grew up on the farm and they like to farm and you know they know pretty well what to do."

Here the interviewer asked, "No one suffered any injuries in recent years?" "Nothing of major. On the farm you always gonna have a little bit. Sometimes there can be if you involve too much something that is very dangerous but we've been fortunate that we haven't had any too dangerous here lately."

Finally, many of the farmers are not tied into information networks. Not surprisingly several noted getting information about farming and farm safety from agricultural extension agents, particularly those participants who were interviewed by people working for the agricultural extension service. However, many of the farmers could not specify where they get information. The causes for some participants not accessing information networks are not yet clear. This lack of access may result from the number of small and part-time farmers among the participants, their low level of educational attainment or continuing racism within the system. (Slide shown.)

Now this person is talking about their parents and not the current situation. The interviewer asked, "Where did you get information from on the farm? Did you get it from the county agent? The local merchants magazines? Newspapers? Radio? TV?" The participant responds, "More magazines because the extension agency they was kind of like more prejudiced you would say. And they wouldn't really tell the blacks what was going on."

We are still developing other themes and issues found within the interviews. These include the types of injuries participants or their families have suffered, their access to

emergency medical services, their access to health insurance, the maintenance to farm equipment, injuries to children in the use of the farm. As we complete this analysis we will be sure to report it to you all. Thank you very much.■

Locus of Agricultural Injury Control: A Cross Cultural View of Hispanic Farmworkers and Farmers Beliefs About Work Safety

By *Martha C. Stiles*
University of California at Davis

MR. MYERS: Our next speaker will be Ms. Martha Stiles. She is with the Department of Applied Behavioral Sciences at the University of California-Davis. Her topic will be Locus of Ag Injury Control: Beliefs of Hispanic Farmworkers and Farmers.

MS. STILES: Thank you. Good morning. Locus of injury control among Anglo farmers and Hispanic farm workers is the topic I am addressing which speaks directly to the guiding principal that Mel Myers and Roberta Ryder mentioned yesterday and that is "know the psychology" of your target groups.

LOCUS OF CONTROL
Measures

Internality and Externality Including Powerful Others (I-E-PO)

- Internality: characterized by beliefs that the locus of control for one's well being lies within--that life's events, i.e., health or illness, are a direct result of one's personal behavior.
- Externality: haracterized by beliefs that outside factors, such as luck, fate, chance or powerful others, determine one's well being.

As behavioral scientists we are interested in knowing what people do -- their behavior, and what they think -- their beliefs and attitudes. Understanding these two things will help us address the safety issues of the 83,000 farm enterprises in California as well as those of the estimated 1.5 million farm workers who are employed there, the majority of whom are non-English speaking Mexican-American or Mexican Nationals.

These charts show the fatality (Figure 1) and injury (Figures 2 & 3) rates over the last 10 years in agriculture in California. In 1988 alone nearly 22,000 non-fatal injuries were reported. To help reduce these high rates of deaths and injuries we, at UC-Davis, have begun developing some multi-media, multi-cultural training systems; however, before we develop anything we go to our target audiences to find out what "their psychology" is, how they think, what they need, and especially how cultural differences influence acceptability of intervention strategies. That is what this study is all about, to examine the beliefs of farmers and Latino farm workers regarding who or what controls work place injuries.

We constructed two distinct questionnaires, one for farmers and one for workers, which were modeled after nearly 30 years worth of research in locus of control. This past work has largely focused on illness. We adapted, that is, reworded the scale items to address farmer and worker injuries on farms.

This study is an exploratory effort. The

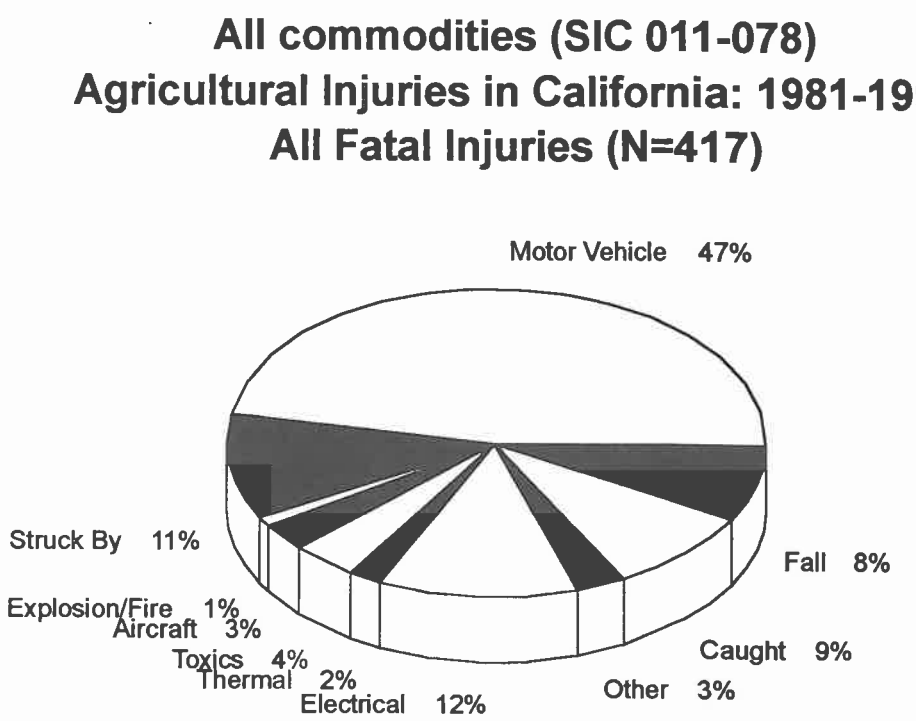


Figure 1. *Cause of Injury Non-Fatal.*

locus of control has never been adapted to work place injuries, especially not in agriculture. This report is considerably more abstract than others presented here so I will try to be as clear and concise as possible.

In addition to the questionnaire itself we also used the "traditional" locus of control statistical analyses which included factor analysis, t-tests, ANOVAS and frequencies. However, due to time limitations today and due to the preliminary nature of our findings, I will limit my discussion to the frequencies, means, and t-tests. This will also allow time to focus on the more important findings gleaned from these studies.

As you will see, this report is as much a critique of the locus of control construct as it is a presentation of our findings.

What is locus of control? It is a scale measuring to what degree individuals feel in control of life's events. Locus of illness control studies have proven useful in predicting the healthy and unhealthy behaviors of those found to be "internals" or "externals".

In a health context an "external" presum-

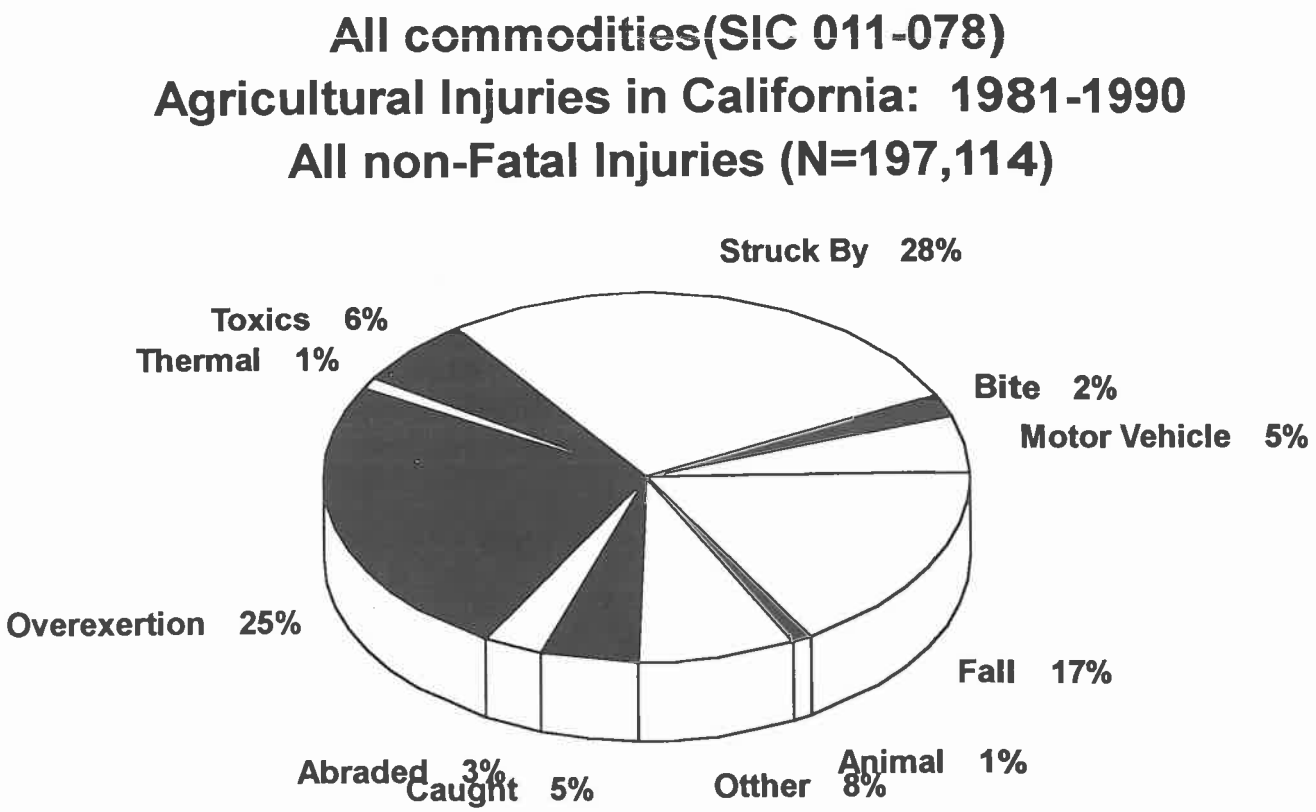


Figure 2. *All Fatal Injuries.*

ably believes that forces outside of him or herself, such as fate, God, luck or other persons, determine his or her health status. "Internals" believe that control lies within.

The next display shows what each sample, farmers and workers, will be measured on. It defines our locus of injury control directional factors including internal/external forces and external others. I will let you read the definitions on the overhead. To lend a multidimensional perspective to the questions or items, two new dimensions were added which we call risk perception strategies.

Searching for safety is the belief in one's ability to create a hazard free work environment, the belief that accidents are prevented through anticipated action and prediction. This is a behavioral strategy.

Accepting danger is the belief in one's ability to deal with hazards when they occur. This is the mental strategy of coping with unanticipated dangers after they have be-

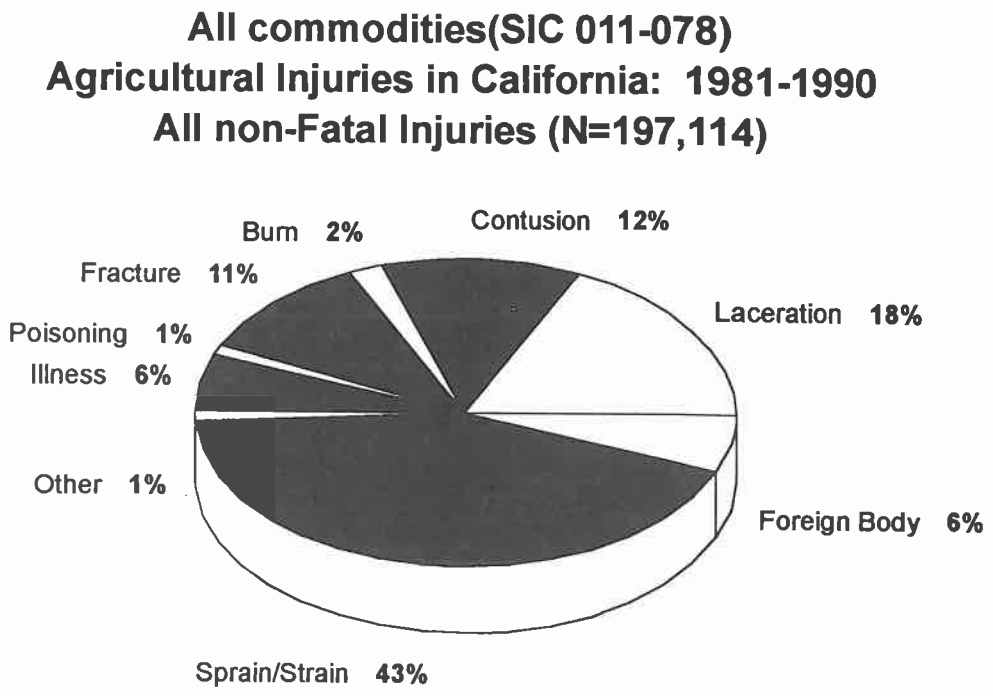


Figure 3. *Type of Injury Non-Fatal.*

come manifest - with the understanding that not all hazards can be predicted.

Table 1 shows the demographic characteristics of the two independent samples. The 302 worker responses were collected by face to face interviews in Spanish in labor camps in California. The mean age of the workers was 36, just over one-half were female.

Workers were born and educated in Mexico, and had 6 years or less of schooling. Spanish was the primary language. With an average of 12 years of work in California agriculture, they were employed mainly by labor contractors so they averaged less than 6 months of work per year. Forty-three percent, and we have reason to believe this is a very low figure, said they sustained injuries at work in the past 5 years yet less than 2 percent received employer health insurance and less than 0.3 percent could afford personal insurance. Less than 12 percent had received any type of training, including safety training in the last year.

The farmer data were collected by administering English written questionnaires distributed at farm expositions and by mail. The 399 farmers were mostly male, averaging 44 years of age, most had gone to college and 20 percent had graduate degrees. Over a third farmed 500 or more acres, the average was about 1,200 acres.

The next table shows the actual questions presented to the workers. It shows the internal and external and risk perception

strategies that are broken down in column two, with mean scores per item and percentage of agree/disagree responses. All questionnaires on the workers and the farmers questionnaires were presented with five point response scales with strongly agree represented as five points ranging down to one point which was strongly disagree. For the sake of brevity, they are collapsed into three categories in this table.

The following are examples of each directional dimension. Question number four exemplifies an internal worker question. It states, "If you have an accident at work it is your own fault." Number 15 would represent external forces, "If God wants an accident to happen to you at work it will happen." And number three, external others, "Regarding safety in your job, you can only do what the supervisor or farm owner tells you to do." As you can see, these are very straight forward questions.

Table 1. Farmworker and Farmer Demographics (Part I)

General Demographics	Farmworker N=302		Farmer N=399	
	%	N	%	N
Gender				
Male	41.5	124	88.0	341
Female	58.5	175	13.0	50
Marital Status				
Married	94.0	284	84.0	334
Single	5.0	15	3.0	48
Other	1.0	3	3.0	11
Age (x years)	36.0		43.9	-
Years of Education				
0	6.0	18	-	-
1-6	60.8	183	-	-
7-9	14.6	44	-	-
10-12	14.6	44	19.0	75
12+	4.0	12	81.0	324
x years	6.1		-	
Birth Place				
Mexico	92.4	297	-	-
United States	7.6	23	-	-
Place of Education				
United States	8.4	24	-	-
Mexico	87.8	252	-	-
Both United States and Mexico	3.8	11	-	-
Language Spoken				
Spanish Only	76.5	231	-	-
English Only	1.3	4	-	-
Both	21.9	66	-	-
Spanish and other	.33	1	-	-
Language Read				
Spanish Only	78.8	238	-	-
English Only	.66	2	-	-
Both	15.9	48	-	-
Neither	3.97	12	-	-
Other	.33	1	-	-
Spanish and Other	.33	1	-	-
Languages Written				
Spanish Only	81.5	245	-	-
English Only	.66	2	-	-
Both	12.3	37	-	-
Neither	5.3	16	-	-
Other	.33	1	-	-
Spanish and Other	.33	1	-	-

(Table 1. Farmworker and Farmer Demographics (Part II)

Household Demographics	Farmworker N=302		Farmer N=399	
	%	N	%	N
Number in Household (Mean)	4.6	-	-	-
Number of Children ((Mean)	2.95	-	-	-
Have Children under 12 (Mean)	1.5	-	-	-
Yes	72.5	219	-	-
No	27.5	83	-	-
Do you migrate to other parts of California				
Yes	28.5	86	-	-
No	71.5	216	-	-
Years of Residence in United States (Mean)	15.7	-	-	-
Years as Farm Work in California (Mean)	12.1	-	-	-
Permanent	2.3	7	77.0	298*
Temporary	97.7	294	73.0	375*
How Many Months of the year, if Temporary (Mean)	5.8	-	-	-
Work for a contractor				
Yes	77.2	220	-	-
No	14.7	42	-	-
Both	8.1	23	-	-
Occupation				
Farm Owner	-	-	42.02	163
Farm Manager	-	-	3.0	91
Supervisor	-	-	12.0	44
Labor Contractor	-	-	3.0	9
Combination of above	-	-	20.0	87

* Do hire

Table 2. Mean & Percent Responses to WORKER Locus of Injury Control Items by Dimension

QUESTION	*I-E-O-F S-A	MEAN	[a]Agree %	Neutral %	[b]Disagree %
1. The main thing which affects safety in your job is what you yourself do.	I S	3.76	65.3	14.3	20.4
2. If the Lord wants you to have an accident, there's nothing you can do to stop it.	E-F A	3.95	71.4	7.0	21.6
3. Regarding safety in your job, you can only do what the supervisor/ farm owner tells you to do.	E-O A	4.09	76.7	9.7	13.7
4. If you have an accident at work, it's your own fault.	I S	1.80	11.2	13.2	75.5
5. There is no point in worrying about accidents. What will be, will be.	E-O A	2.60	36.4	10.3	53.4
6. When you have an accident in your workplace, it's because you weren't paying attention.	I S	2.41	29.4	12.9	57.7
7. Most people have accidents at work because they are careless.	I A	2.84	35.8	22.2	42.0
8. When there i s an accident at work, supervisor/farm owner is to blame	E-O A	2.26	17.6	22.8	59.6
9. Luck plays a big part in determining whether there will be n accident at work.	E-F A	3.38	55.3	12.3	32.4
10. You cannot prevent accidents at work unless the supervisor/farm owner keeps the workplace safe.	E-O A	3.90	72.0	9.3	18.7
11. Some people have accidents at work while others avoid them.	E-F S	3.69	59.7	17.7	22.6
12. Most workplace accidents can be avoided by proper training.	E-O S	4.48	87.7	6.6	5.6
13. No matter how safe your workplace is you are responsible for your own safety.	I S	4.09	76.5	8.3	15.2
14. Modern technology will find a way to prevent most workplace accidents.	E-F A	3.85	59.2	31.4	9.4
15. If God wants an accident to happen to me at work, it will happen.	E-F A	4.16	76.8	8.6	14.7

*I=internal; E=external; O=ext. Powerful Other; F=ext. Powerful Force; S=Searching for Safety dimension; A=Accepting Danger dimension; [a]strongly agree & agree; [b]disagree & strongly disagree; strongly disagree=1 and strongly agree=5.

Table 3. Mean & Percent Responses to FARMER Locus of Injury Control Items by Dimension

QUESTION	*I-E-O-F S-A	Mean	*Agree %	Neutral %	[b]Disagree %
1.When I make a safety plan, my behavior determines how well it will work.	I S	4.37	86.6	9.6	3.8
2. No matter what I do, if there's going to be an accident, there will be an accident.	E-F A	1.84	7.9	15.9	76.3
3. Having regular contact with my worker's comp. rep. is the best way to avoid injury on my farm.	E-O S	2.66	20.5	36.1	43.3
4. Most things that affect workplace health and safety happen by accident.	E-F A	2.30	20.1	18.2	61.7
5. Whenever I have a safety problem on my farm, I should consult my worker's comp. rep.	E-O S	3.22	39.5	34.3	26.3
6. I am in control of safety on my farm operation.	I S	4.12	76.2	17.3	6.4
7. My workers have a lot to do with the workplace being hazardous or safe.	E-O A	4.37	85.1	11.3	3.6
8. When there is an accident, I am to blame.	I S	2.74	21.6	38.6	39.7
9. Luck plays a big part in determining if there will be an accident or illness.	E-F A	1.99	10.0	18.8	71.3
10. Safety laws and regulations control my workplace safety.	E-O S	3.17	38.9	32.7	28.4
11. When my workplace is accident or illness free, it is because I am lucky.	E-O A	1.87	8.1	13.1	78.8
12. The main thing which affects safety in my workplace is what I myself do.	I S	3.83	67.4	21.8	10.8
13. If I take care of the work environment on my farm, accidents can be avoided.	I S	4.17	82.1	12.9	5.0
14. When I correct workplace hazards, it is usually because others (worker's comp. rep. , farm advisor) advised me well.	E-O S	3.16	39.7	33.5	26.8
15. No matter what I do, there is likely to be an accident or injury in my workplace.	E-O A	2.50	21.6	23.7	54.8
16. If it is meant to be, my farm operation will remain safe.	E-F A	2.23	17.3	17.1	65.7
17. If I take the right actions, my workplace will be safe.	I S	4.31	86.2	10.9	2.9
18. Re farm safety, I can only do what my worker's comp. rep. tells me to do.	E-O A	1.61	6.3	6.5	87.2

*I=internal; E=external; O=ext. Powerful Other; F=ext. Powerful Force; S=Searching for Safety dimension; A=Accepting Danger dimension; *strongly agree & agree; [b]disagree & strongly disagree; strongly disagree=1 and strongly agree=5.

Table 4. Farmworkers Dimension Means

Dimension	Internal Mean	External (E-O+E-F)	Dimension	Seeking Safety Mean	Accepting Risk Mean
	2.98	3.63		3.41	3.42

p=.001 (2-tailed t-test) p=.001 (2-tailed t-test)

This table shows the farmer questionnaire with the same statistics and the same breakdowns. Item number six represents and internal farmer question, "I am in control of safety on my farm." Number nine is indicative of external forces questions, "Luck plays a big part in determining if there will be an accident or illness." Number 18 is an external others item, "Regarding farm safety, I can only do what my workers' comp rep tells me to do."

These next tables shows mean scores with highly significant t-test results. We see the extreme contrast between the workers internal versus external scores. If we broke down external to external forces and external others, external forces was significantly higher than the external others score.

For the farmers the scores are quite the opposite. Based on these scores and traditional locus of control interpretations workers would be described as attributing responsibility for work safety to forces outside of themselves with little sense of personal accountability. He or she would be described as fatalistic and passive giving control over to God or others. On the other hand, the farmer would be described as self-motivated with a strong sense of personal responsibility and control.

If we look at the means and t-tests for the beliefs strategies a somewhat different picture emerges. Farm workers' scores indicate no difference between the two strategies suggesting that they perceive prevention as an important factor in reducing injuries and at the same time they believe that not all danger is predictable nor preventable. They show a balance between their behavioral and their mental coping mechanisms. Farmers, on the other hand, do not demonstrate that balance, as there is an apparent rejection of the coping strategy and high adherence to the belief in their own abilities to predict and prevent hazards.

It is at this point that I stopped the "traditional" locus of control analysis because I had a nagging sensation that these "traditional" interpretations fall short of reality.

Much of the literature over the last 30 years, including into the '90s, delve into fundamental explanations of why the farmer accepts more control or responsibility than the Mexican or Latino farm workers. I had to stop here and ask myself what I was learning and why few of these inter

Table 5. Farmers Dimension Means

Dimension	Internal Mean	External (E-O+E-F)	Dimension	Seeking Safety Mean	Accepting Risk Mean
	3.92	2.56		3.34	2.39

p=.001 (2-tailed t-test) p=.001 (2-tailed t-test)

pretations rang true from what we know of our target groups. Then I asked myself, after having done all of this work, what had I succeeded in doing.

That was a scary thing to do. Well, we accomplished several things. Number one, and maybe I am fooling myself, but our instruments successfully measured directionality as gauged by past locus studies and these were supported by the factor analyses that we ran. Two, we succeeded in identifying two cogent risk perception strategies which added depth to the study. We also succeeded in adapting the construct of locus of control to agricultural injury and our results supported results of past studies. And finally, we nearly succeeded in perpetuating an almost institutionalized stereotype of Latino farmworkers. If we had not continued to ask questions beyond these generalized groupings, that is, internals and externals, we may have succeeded at that as well, which is more frightening than not succeeding at anything!

There are obvious and extreme limitations in using **only** traditional locus of control models and interpretations. In our continued analyses of the data we intend to go beyond these barriers. Examining only mean scores serves only to disguise important nuances and richness in the data. Item by item analyses should be done. We have started this approach and found that workers have very high scores, on several internal items as well as the external items. You may have noticed this on previous slides. A similar trend was found with farmers scoring high on many external items as well as internal items indicating that two polar belief mechanisms operate concurrently for both groups.

As far as going beyond the **standard** descriptions and renovating stereotypic models, we are currently reviewing a theoretical model that suggests that vacillation between these two types of systems -- internal and external -- is a normal function of **everyone's** perception and belief processes. This os called the Two-Process Model of Perceived Control and it appears to apply to both of our samples.

These Two-Process theorists believe that the attribution of external characteristics and behaviors associated with externality, that is inwardness, fatalism, and passivity, often reflect a type of perceived control that is generally overlooked or is improperly defined.

People attempt to gain control not only by bringing the environment into line with their wishes, which the Two-Process Model calls primary control, but they also bring themselves into line with environmental forces, which is called secondary control. Neither process exists solely by itself, as both are intermeshed.
Secondary control is described as a proactive means of coping rather than giving up. One type of secondary control is called vicarious control where one ascribes power to God or a deity. Our workers scored high on these types of questions, and, depending on the situation, many of us would also score highly. For instance, this type of secondary control may include prayer.

As a personal story, I spoke with my mother, who is in Kansas City, right before I left California for this trip. She said, "I'll pray that you have a safe trip." To her, as with the workers, she was actively employing a safety intervention strategy. She was doing **all** that she could do under the circumstances and there was nothing passive or fatalistic about that. It is no different for the Mexican farmworker who believes that God's will or luck intervenes in the process of injury and illness prevention. As explained by the Two-Process Model, they also believe that they, themselves, have control over and responsibility for accident prevention.

In closing, from an interventionist's perspective, keeping an open mind and seeking new ways of looking at old problems and looking for new theoretical perspectives to overlay onto issues that have existed for decades has provided us with a fresh look at the "psychology" of our target groups. And, to be quite frank, understanding the proactive or passive nature of externals or secondary mechanisms which characterize the million or so California farmworkers along with understanding cultural influences can only make my job considerably easier in designing prevention strategies. Thank you.■

Roll-Over Protective Structure (ROPS) Design and Testing for Pre-ROPS Tractors

By *Paul D. Ayers, Ph.D.*
Colorado State University

MR. MYERS: Our next speaker will be Dr. Paul Ayers. He is with the Department of Agriculture and Chemical Engineering at the Colorado State University. He will be giving a presentation on Roll-Over Protective Structures Design and Testing for Pre-ROPS Tractors.

DR. AYERS: Thank you, John. It is a pleasure to be here.

What I would like to report on today is some preliminary research that we are doing at Colorado State University on engineering controls. This is work that is being done at the High Planes InterMountain Center for Agricultural Health and Safety.

I think most of us understand the hazards associated with tractor over-turns. Many times it has been mentioned in this meeting that overturns are the primary cause of agricultural fatalities. I think it is safe to say that many of the fatalities or serious injuries that occur during a tractor overturn would not have occurred if a roll-over protective structure and a seat belt were utilized while operating the tractor.

Some of the survey work done at Colorado State University shows, as many states have shown, that there are many tractors out there that do not have ROPS. We conducted a survey in 1985 and in 1991 to look at the trends of ROPS availability on tractors in Colorado. What we are seeing is some of the older tractors still do not have ROPS on them, and this is the problem we are going to try to address.

We have a significant data base of 1,200 tractors from these surveys where we accumulated make and model information. Four-hundred and twenty-nine tractors were identified in the survey as not equipped with roll-over protective structures. By looking at some of the ROPS available in the country, we were able to estimate that 46 percent had ROPS available from tractor manufacturers. The tractor operators could have go out and retrofit those tractors with roll-over protective structures. However, the no ROPS are available on the remaining 54 percent of the tractors.

When looking at ROPS availability in pre-ROPS tractors, it is difficult to put an age on the tractor in terms of when ROPS were available. Some of the tractor makes had ROPS available at an earlier year, and others had ROPS available at a later year. When we are looking at finding ROPS in tractors, I use the term pre-ROPS tractors as tractors and axles were designed to support roll-over protective structures.

Here is a typical box beam with a roll-over protective structure attached. This box axle type is very common for attaching ROPS to axles. This would be what I would refer to as a post-ROPS tractor.

This, however, is an axle of a tractor that was not designed to support a ROPS. You

can see that the mounting bolts there are specifically for the fender, so regardless of the age of the tractor it would be considered a pre-ROPS tractor. This is my definition of post- and pre-ROPS tractors. Based on the axle design and whether or not the tractor was originally designed to support a ROPS.

One of the problems is that there are a lot of pre-ROPS tractors with no ROPS available. In many states farmers or farm operators build their own roll-over protective structures for these pre-ROPS tractors. Some of them do a fairly decent job, and some of them do a fairly poor job using construction material that is available on their site. This is a problem I am trying to address, particularly the mounting of ROPS to axles. As you can see in this slide, some of the mounting bolts are actually missing, and if they were all there, I would question the structural capability of that roll-over protective structure to support and protect the operator during an over-turn.

The area we are trying to address is looking at the design of ROPS and the mounting structures on pre-ROPS structures. We initially looked at some computer aided design work of ROPS deflection to try to incorporate the new standards -- the ASAES 519 and SAE 2194 standards which were recently adopted involves the operator being protected and the ROPS not intruding into the clearance zone as depicted by the blue lines. Also, the ROPS standard states the clearance zone cannot be exposed to the ground surface when the tractor rolls over. We are attempting to look at those two failure criteria when designing our ROPS for pre-ROPS tractors.

The concept is to look at the energy that is absorbed by the ROPS prior to (1) the ROPS intruding into the clearance zone or (2) the ROPS deflection exposing the clearance zone to the ground point.

This is an illustration of a clearance zone in blue and the ROPS deflection. We are attempting to allow the ROPS to absorb energy before the clearance zone is exposed. One way to do this is to define a ground plane using a triangle, so if this tractor had rolled to the side, it would define where the ground is located. Once the ground plane hits the clearance zone, then the ROPS fails by not absorbing the appropriate energy. We are using computer aided design to investigate the new ASAE standard for defining the exposure criteria.

We also have looked at some finite element analyses of ROPS axle designs in preliminary work, trying to define where the potential problem is, whether it is the axle housing itself or whether it is going to be the mounting area. In looking at the finite element analyses it is apparent that the major stresses occur at the mounting area in this type of pre-ROPS tractor. I repeat that we are only looking at one pre-ROPS tractor at this moment. There are a number of different axle categories, but we are investigating the bell housing type of axle.

We have a static test facility at the Agricultural Engineering Research Center in which a ROPS, shown in white here, is deflected using the static test as defined by SAE and ASAE. In this case, the hydraulic cylinder is extended and the deflection and the force on that roll-over protective

structure are monitored. This determines the energy absorbed by the roll-over protective structure.

This is a single two post ROPS with no axle attachments. We calculated and measured all of these parameters, force and deflection, with a data analysis system. We were then able to mount the actual pre-ROPS tractor axle to the structure itself using the existing mounting bolts originally designed for the fender. The ROPS was attached to those mounting bolts, and a static test was run. We also instrumented with strain gauges to monitor deflections.

This is a plot of some of our test results on the pre-ROPS tractor axle. This is a plot of force applied to the top of the ROPS versus the ROPS displacement. Again, this is the displacement at which the load is being applied.

The energy absorbed by the ROPS is basically the area under the curve. The first test where we used the two mounting bolts saw a bolt failure at a very fairly low force, and thus the area under the curve is fairly small, not meeting the ASAE standards. We attempted to modify that mounting support and ran the test again. We saw another force deflection curve with a mounting failure at this point. You can see that by modifying the axle mounting, we are able to have the ROPS absorb more energy.

It was decided to continue to modify the mounting area. In the first test there were only two bolts. For this test there were a total of six bolts supporting the ROPS to the axle giving us this final test which did pass the ASAE standard with no bolt or mounting failure. That static test of the pre-ROPS tractors with the mounting modification would have passed the ASAE and SAE static testing.

Static testing is commonly used in determining whether a ROPS will protect an operator when the tractor rolls over. However, it is also recommended that either field upset or dynamic tests be conducted. Obviously, when a tractor rolls over, this static test is a fairly slow deformation type of test and really does not represent the forces on the ROPS during an actual roll-over.

The next step of the project was to conduct an actual roll-over. This is our pre-ROPS tractor with our designed ROPS. The tractor is remotely controlled. The structure in the front was put on to help protect the tractor engine.

A remote control starts the tractor, turns on the fuel, operates the clutch, and the brake. The operations are conducted using pneumatics or air pressure.

This is a picture of a pneumatic cylinder on the clutch pedal itself so we are able to slowly release the clutch pedal. On the return, it is spring-loaded so that it automatically goes down.

On the other side is a brake pedal. We do have a default, so if the cord is damaged, we do not have a runaway tractor. The brake goes on, the clutch pedal comes off, and the fuel cuts off if something does happen.

The mounting frame shown earlier has dual

purposes. One, the sliding bracket is used to monitor deflection of the ROPS during the roll-over. It monitors both the elastic and the plastic deflection. In addition, this structure is designed to depict or describe the clearance zone. If that part of the structure hits the ground, it will indicate that the ground plane has intruded into the clearance zone, and the ROPS has failed the test. So it has a dual purpose of monitoring the deflection and defining the clearance zone. We conducted the field upset test. I do have a videotape of that if anybody is interested.

We did a rear upset test. Our preliminary results are the ROPS structure would have protected the operator, did not intrude into the clearance zone, nor did it expose the clearance zone to the ground plane. Those are fairly encouraging results. We were able to monitor the deflection of the ROPS at that point, so I feel fairly comfortable that if an operator had been sitting in there wearing the seat belt during the roll-over he/she would have avoided fatality or serious injury.

We do have some graduate students that we would like to put in there to test this in real life. That may encourage them to complete their research at an earlier date.

In conclusion, I would like to say that these are preliminary results in which we investigated ROPS design for just one axle category, but I think they were fairly encouraging in showing that ROPS can be designed and installed on pre-ROPS tractors to protect the operator. Thank you very much. ■

Development of Analytical Methods for Agricultural Chemicals

By *Eugene R. Kennedy, Ph.D.*
National Institute for Occupational Safety and Health

MR. MYERS: Our last speaker this morning will be Dr. Eugene Kennedy. He is with the Division of Physical Sciences and Engineering at NIOSH in Cincinnati, Ohio. He will be giving a presentation on the Development of Analytical Methods for Agricultural Chemicals.

DR. KENNEDY: I would like to acknowledge my co-workers in this. They are Martin Abell of NIOSH and John Reynolds and Don Wickman of Datachem Laboratories out in Salt Lake City. They were all very helpful in pulling this all together. Actually, John and Don did most of the laboratory work and we collaborated back and forth by phone and E-mail.

Well, you cannot see it on this slide, but I am from the Methods Research Branch. One of our functions is developing sampling and analytical methods for chemicals in the work place air. In response to the NIOSH initiative in the area of agriculture we initiated research to develop a model multianalyte method for agricultural chemicals. This was based on the need for a unified sampling and analytical approach for these compounds, that is the use of one single sampler for a whole series of compounds. This is one of the things that had been requested by some of our field people. We thought it was a good way to go.

We started this research effort by grouping compounds in ways that we could use a single analytical technique for the whole class. The method I will be talking about uses gas chromatography for the analysis. I will mention a few other things that we are also looking at as well.

We selected some of the chemicals that we included in our study on the basis of their recommended exposure limit or permissible exposure limit or threshold limit value. Also, often times these values were not available, so we also included annual production figures for where we could find them and the toxicity of the compounds.

Since some of the compounds that we were going to be studying were the organophosphorus pesticides, which could exist in both the aerosol and vapor phase we needed a sampler that would be able to collect both phases. In order to do that, we looked to the literature and found that researchers at the Occupational Safety and Health Administration (OSHA) Laboratories in Salt Lake City had developed a sampler (OVS) for a series of pesticides individually. This was viewed as an excellent device for method development and evaluation. Essentially it consists of a filter in front of an absorbent bed and a back up sorbent bed.

Although this looks like it is a pretty huge device it is only about two inches long so it will make personal sampling quite convenient.

This slide provides a summary of the method that we developed for the or-

ganophosphorus compounds. Basically we used the OVS sampler at a sampling rate of one liter per minute. We can use it for up to 8 hours so we can take a 480 liter sample. The analytes are desorbed with organic solvent. As I mentioned before, we use capillary gas chromatography analysis and can determine up to 19 compounds simultaneously.

We did look at other columns for analysis, so we do know we can use those columns for confirmation of the pesticide identity when we find it on the primary analysis column. We also found that the samples were fairly stable for up to 30 days at either ambient or refrigerated conditions. I will be talking about this a little bit later in my presentation.

For those of you not familiar with gas chromatography these are basically what the results look like. This slide shows all 19 compounds, base line resolved with an internal standard added. That is the type of chromatography that we always like to see when we are doing analysis. It makes life a lot easier for the chemist.

The key element in most of the NIOSH methods or in the NIOSH Manual of Analytical Methods is that the method provide a result that is plus or minus 25 percent of the true value 95 times out of 100 or essentially 95 percent of the time. This element is often referred as a NIOSH Accuracy Criteria.

In order to ensure that the method would meet this criterion we established a protocol for the evaluation of the method. This protocol was based on a previous protocol which was used back in the 1970s during the Standards Completion Program for method evaluation.

One departure that we did make from the original protocol was we did not prepare generated samples. As you can imagine, trying to generate pesticide aerosols in the laboratory and being sure what concentration you have, could be a nightmare. To simulate generation, we took some slightly different steps and fortified the samplers with the analytes contained in a solution. We pulled humid air through these samplers in order to simulate sampling.

One of the things that we did look at was the limit of detection, since we wanted to verify that we would be able to detect the analyte at levels that would be much lower than the exposure limit. We also wanted to verify that the recovery was greater than 75 percent. We wanted to make sure we had adequate sampler capacity so that we could sample at known concentrations for an extended period of time. As I mentioned, we wanted to verify what the stability of the analyte on the sampler was and also to look at the precision and bias in order to verify its performance in meeting the NIOSH accuracy criterion.

In summary of the results that we obtained from our limit of detection work, we saw a typical limits of detection of around 0.04 to 0.6 micrograms per sample per analyte. That essentially was 50 to 100 times lower than any of the recommended exposure limits for these compounds. This meant that we had plenty of sensitivity in the method to be able to detect very low levels of pesticides.

We also evaluated the recovery without pulling air through the sampler, just to see what kind of recovery factor we would have to apply when we were doing sample analysis. In most cases it was greater than 90 percent for all 19 compounds.

We looked at the capacity of the sampler. Essentially we spiked the samplers with between 50 and 400 micrograms of each pesticide. That was essentially equivalent to sampling at 2 times the exposure limit for up to 12 hours.

We did a screening study where we looked at the effect of temperature and humidity on sampler performance. We sampled from these humid atmospheres at one liter per minute and tried to observe sampler breakthrough; that is, if we found five percent of the analyte on the back up section of the sampler, then that would indicate that the sampler had broken through and we would have to look at different sampling times to see where the break through point did occur.

In order to incorporate a safety factor into the maximum recommended sampling times, we would multiply this break through point times two-thirds. It gives us increased confidence that we had not over sampled.

This was basically a summary of the results of our capacity study. Essentially we saw no effect of temperature or humidity on the capacity. We also saw no break through even after sampling for 12 hours at 1 liter per minute. That gave us a maximum recommended sampling time for all 19 analytes of 8 hours which corresponds to a 480 liter sample.

Next we wanted to look at the stability of the samples, so we fortified 24 samplers at a level which was equivalent to sampling at one-half of the exposure limit and then we weathered these for 4 hours at 30 degrees centigrade and 15 percent relative humidity. Then we analyzed this series of samplers over a period of 30 days.

The data I have here is for the pesticide methamidophos. We analyzed 6 samplers on day 1, 6 samplers on day 7, 3 samplers on day 10, 14, 21, and 30. The criterion that we were applying here was that we wanted to make sure that we could get 90 percent of the analyte back from the sampler. The 90% recovery is indicated by this straight line on the slide. As you can see here when we get out to around 28, days we start dropping below the 90 percent line.
This storage was done at room temperature. We also have repeated the storage study under refrigerated conditions and found that all the materials, including methamidophos did give us good recovery and was above 90 percent even at 30 days.

This slide summarizes the data that we had. The samples were stable for 30 days at 25 degrees centigrade and 0 degrees centigrade. You can see that the recovery tended to improve a little bit when we used refrigerated storage, so that is what we will be recommending in the method when it comes out in the Fourth Edition of the NIOSH Manual of Analytical Methods.

In order to determine whether the method met the NIOSH accuracy criterion preci-

sion and bias of the sample results were determined. This curve represents a combination of estimated bias and precision values which will meet the NIOSH accuracy criterion. We have set arbitrary limits of plus or minus 10 percent on the bias. As you can see here any set of values which falls under this curve will meet the NIOSH accuracy criterion. We do have some other limits here like the upper curve is if we have got 4 sets of samples, 6 samples per level, and here we just have 1 level with 12 samples. We use this for our short-term exposure limit data.

Based on this, we prepared 6 samples at each of 4 levels, that is 0.1, 0.5, 1.0 and 2 times the exposure limit for the amount that would be collected for an 8 hour period. These samples were weathered under the humid conditions that we have previously defined in our capacity study.

For compounds which had short-term exposure limits we prepared 12 samples based on the amount of material that would be collected during a 15 minute sampling period. We then determined the estimated average bias of all of these results, calculated the precision of the pooled sampler results and included a five percent pump error into the estimates. The short-term samples and long-term samples were treated separately in the data analysis.

This slide gives a summary of the results that we had. Basically for all 19 compounds, the biases range from between minus 2 and minus 7 percent and the precisions range between 6 and 7 percent. In all cases the methods did meet the NIOSH accuracy criterion for all 19 compounds.

Since the ability of the sorbent to collect pesticide vapor has not been fully verified in our experiments we did one additional experiment to look at this fact. We took a sampler and fitted it with a dropping pipette tip, placed and sealed that into the front end of the sampler with wraps of Teflon tape. Then we placed a piece of quartz wool into the front and then fortified this quartz wool with solutions of the pesticides. We then placed this into our humidity generator system and pulled air through the sampler.

As you can see on the next slide, the volatility of the pesticides varies. The red portion here indicates that we found the majority of that pesticide on the quartz wool. Down in the lower area of the graph, we found the majority of the pesticide on the sampler. As you can see here for azinphosmethyl, fenamiphos, and monocrotophos, they really did not volatilize at all. When we get down to mevinphos and phorate, those pesticides almost exclusively evaporated from the quartz wool and were collected onto the sampler.

I would like to mention a few other things that we are doing right now. We are taking this sampler and trying to expand its use. We are currently looking at 13 carbamate pesticides which we will be determining by high performance liquid chromatography. In a somewhat related project we are looking at the application of enzyme linked immunosorbent assay kits for pesticides. We hope to be able to apply those to filter samples or air collected in the

field. These offer several advantages: they are fairly low cost, I think $10 to $15 per analysis; they have the potential to be field analyzable; and also we want to compare them with our GC/LC methods and see how they do compare in terms of precision and bias. It may be a more cost effective way of looking at these analyses.

Finally, I would like to acknowledge a couple people who helped with a lot of the administrative aspects of getting this work done. They include Dr. Jim Perkins with Datachem Laboratories and Mr. John Holtz in our Division of Physical Sciences and Engineering. ■

Questions and Answers

Plenary Session V - Research

MR. MYERS: We do have some time for questions if there are any.

Mel Myers, NIOSH: This is actually a question to Dr. Blair but it came out of the presentation by Dr. Arcury. In one of your quotes the farmer mentioned fumes from gasoline.

DR. ARCURY: That was not in one of the quotes. I reported it as in a quote. It was in a couple of the interviews I just did not have that quote here but it is not in there.

MR. MYERS: Okay. What it brings me to is the issue of benzene, that is one of the constituents of gasoline which has been associated with leukemia so that is really the substance of my question and sort of the profile. In terms of some of the farming behavior you do have the operation of putting gasoline into tractors and into gas cans and different things so you have fumes coming off. You have a lot of dermal exposure which can be from using gasoline as a solvent because it is a very good solvent and it is used a lot on farms. On the older tractors you have the fuel filter that had a glass bulb, you take that bulb off and you get gasoline all over your hands and that happens. There is a practice that I think is wide-spread, siphoning gasoline from one tank to another especially when you are in the field so you get gasoline in your mouth and your palate absorbs solvents very readily. So benzene in gasoline is a possible factor. I am not sure if that is part of your study.

The second question which is not related to gasoline but there is an outstanding question in terms of avian virus potential in association with leukemia. I do not thing there is any work done on that but if you are separating out different kinds of farm operations at poultry farms as one of those categories then that might give us some information in that area. So I would like to get some feedback in terms of those considerations.

DR. BLAIR: Regarding the issue of gasoline, we are asking questions about a variety of agricultural activities and had several questions dealing with fuels because gasoline is **THE** solvent primarily used on farms, at least it was in the past. Farmers used it in just the way that you describe, cleaning up equipment and for all sorts of other things.

Regarding the viral exposures, we obtain information on the type of farming operation and we ask specifically about bovine leukemia virus. Come to think about it I do not believe we ask that directly about poultry or about the avian virus. I do not think there is any biologic evidence that those viruses can be transferred to humans, but we are trying to gather relevant information on that.

In my presentation I focused on pesticides but we are taking a broader approach and are seeking information on other types of exposures that occur in agriculture.

MR. MYERS: Any other questions?

MR. AHERIN: I am Bob Aherin from the University of Illinois. I have a question for Martha Stiles.

Your study seemed to indicate that you looked at primarily locus of control for these two populations from the standpoint of general agricultural injury issues. That was the way I perceived it. I may have perceived it wrong. Are you planning to look at this from a standpoint of specific behaviors to see if there are any differences as far as locus of control relates to specific maybe high risk behaviors among the populations?

MS. STILES: Right now there are no specific plans to do that. Like I said, this was an exploratory study. It is an attitudinal belief scale. Our future work related to specific behaviors, of course, will depend on this coming year's funding. Hint. Hint.

But we did examine some behavioral measures in this particular survey. We ended up with some 130 variables, some of those were behavioral, that is, specific injuries and actual work activities engaged in by workers. We are just starting to look at these to attempt to get a handle on which behaviors are associated or correlated with certain attitudes.

MR. AHERIN: We are doing some small studies funded by EPA with migrant workers, Hispanic workers in Illinois. We are looking at specific behaviors. We do find some differences between Hispanic workers, what they feel they are in control of as it relates to certain issues. One of the behaviors we looked at is using fresh water available to wash your hands after doing field work where there is chemical residue retention in the plants as opposed to wearing clothing like long sleeves to also prevent exposure to the skin and so forth. We find that the farmers, operators or owners have more control over providing fresh water where the laborer have more responsibility for making sure they are wearing long sleeved clothing and that sort of thing. You might find some differences in specific behaviors that would help in defining intervention programs.

MS. STILES: I agree. As a matter of fact we have just completed a paper on behaviors like handling pesticide exposed clothing among field workers (not official applicators and owners) but field hands. Those are very specific behaviors. We found that among workers who do **not** use pesticides, but who feel they are exposed to residues, engage in safer handling and laundering practices than workers who spray/handle pesticides. I agree with you, more specific work needs to be done.

Our next session begins at 1:30. Lunch is on your own. Have an enjoyable lunch.■

(Whereupon, the meeting was recessed for lunch at 12:00 p.m., to reconvene at 1:30 p.m. that same day.)

Agricultural Safety and Health Ohio-Style

By *Thomas L. Bean, Ph.D.*
Ohio State University

DR. HARD: I would like to welcome you to the afternoon session, Plenary Session VI, which is on Intervention. I will be the moderator this afternoon. We will have 15 minutes for the presentations and then we will have time for questions and answers at the end of the program. Our first presenter this afternoon is Tom Bean, Professor at the Ohio State University in the Department of Agricultural Engineering. His topic is Agricultural Safety and Health Ohio-Style.

DR. BEAN: Ohio has been fortunate to have had National Institute for Occupational Safety and Health (NIOSH) funding for the last three years. It is appropriate that we acknowledge our appreciation for this funding at this time.

We have invested NIOSH funding in a variety of ways. The following is a summary of some of these investment opportunities:

First, we have established a State database. The Farm Fatality and Injury Database of Ohio (FFIDO) utilizes newspaper clippings, workers compensation reports, death certificates and reports from county extensions to compile both injury and fatalities which occur on farms in Ohio. Summaries are used for program development and for news media events in both county and State releases.

Since the Ohio Agricultural Health Promotion Program is based within the Ohio State University, an Agricultural Safety and Health Course has been developed within the Department of Agricultural Engineering at the senior and graduate student level. The course has a two-hour lecture and a one-hour laboratory open to all appropriate students within the College of Agriculture and the University.

In addition, teaching materials such as fact sheets, videos, brochures, models, teaching modules, and media releases have been developed for use and support in field programs. Field programs include: workshops and seminars for farm employers and employees; multiplier groups such as Ohio Farm Bureau, Ohio Grange, Ohio Agro-Business Association, etc.; and specialized short courses for professionals within government organizations who work with farmers and farming groups, rescue personnel who respond to farm accidents, and associated agricultural industry representatives.

The Ohio Agricultural Health Promotion Program has a recognized multicultural project that includes a subculture of the agrarian population. That unique subculture is the Amish. Ohio has the largest population of Amish within the United States who may have some agricultural safety and health needs which are different

than the normal "English" farming population. One conspicuous difference is their mode of transportation. Due to religious differences, their travel, both personal and business (farming) related, is restricted to the use of horse-drawn buggies, surreys, and wagons. Horse-drawn vehicles are used to drive to the store for both personal and farm supplies, to market agricultural products, church and social events, and in the courtship of potential spouses. This presents many highway problems which are rare outside the rural communities in which the Amish reside. Because there are many unfamiliar hazards involved in driving in a mix of motorized and horse-drawn vehicles, both the Amish and the general public are placed at an unordinary risk.

The Ohio Amish project began with an Amish requested meeting to address the driving safety problems both from an Amish perspective, which recognized their cultural diversity and sensitivity to various issues and an "English" public perspective. After many meetings with this advisory council of Amish layman and months of material development, a horse-drawn driving safety course was implemented into Amish schools. The curriculum consisted of a teacher's guide, student workbook and other supportive teaching materials. Since its development, the program has been adopted in many other States.

In addition to the Amish horse-drawn driving safety course, a companion program for the general driving population was developed. Since the Amish are rather unique and attract tourists which visit the counties in which they live, a brochure was developed for use at the community level. It alerts the motoring public about the hazards involved in driving in Amish communities. It is placed in roadside rest stops, motel rooms, restaurants, etc. In communities which have light industry, it has been used as a payroll stuffer to remind employees of the dangers of commuting when the Amish are also driving on the roads.

To illustrate why this particular effort is noteworthy, I am going to take you through a series of slides made from newspaper articles that concern an incident which happened while we were in the development of the horse-drawn driving safety program. A man was involved in truck/buggy crash in which six of the family of ten Amish died: (Slide shown.)

"Man is charged. Jury likely."
(Slide shown.)
"Funeral procession."
(Slide shown.)
"Pick-up driver pleads not guilty."
(Slide shown.)
"Amish will not attend the trial."
(Slide shown.)
"Man charged denies seeing the buggy."
(Slide shown.)
"'Buggy deadly crash visible,' says the trooper."
(Slide shown.)
"Nurse says, 'Driver talked about drinking before the fatal buggy crash.'"
(Slide shown.)
"'Buggy well marked,' say two in court."
(Slide shown.)
"Driver found guilty in buggy deaths."
(Slide shown.)

"Aid still flows for the orphans."

(Slide shown.)

"Can buggies and autos actually share the roadways safely?"

(Slide shown.)

"Amish deaths may alter State law."

As a result of this accident, The Ohio Legislature has been exploring changing the lighting and marking laws in the State of Ohio as it pertains to Amish buggies. Our office has been contacted and we are currently in the process of evaluating the lighting and marking alternatives for Amish buggies. Based on the proposed alternatives, we plan to work with an Amish advisory committee and present the results to the Amish community through a series of demonstration projects.

Other projects we plan for the future are to continue and expand our educational programs, develop new materials associated with the prevention of respiratory diseases in the agricultural community. Thank you very much for listening. ■

Hearing Conservation Program for Agricultural Youth

By *Mary Jo Knobloch*
National Farm Medicine Center, Marshfield Clinic

DR. HARD: Our next speaker is Mary Jo Knobloch. She is a health educator at the National Farm Medicine Center out of the Marshfield Clinic in Marshfield, Wisconsin. Her topic this afternoon is Hearing Conservation Program for Agricultural Youth.

MS. KNOBLOCH: Thank you. This intervention project is titled Hearing Conservation Program for Agricultural Youth. The project falls within the Center for Agricultural Research, Education and Disease and Injury Prevention which is a cooperative agreement funded by NIOSH.

The National Farm Medicine Center in Marshfield was awarded funding for this project. Dr. Paul Gunderson and Dr. Dean Stueland are our co-PIs, and Steve Broste is the Project Director. I serve as Project Manager.

In a 1984 through 1988 study of 872 high school agricultural students from Central Wisconsin the National Farm Medicine Center found approximately twice the prevalence of mild hearing loss and early noise induced hearing loss among farm students as compared to their peers not involved in farm work. Early noise induced hearing loss is defined as normal hearing at low frequencies combined with hearing loss in the high frequency range.

This study, which was published in the "American Journal of Public Health" in May 1989, also suggests that the use of hearing protection may reduce the risk of hearing loss among students who work on the farm, although few students in this study (only 9 percent) reported ever using such devices. The demonstrated effectiveness of the use of hearing protection devices and hearing conservation programs in industry combined with the low reported use of hearing protection by these students prompted this prevention study targeting adolescents.

This intervention, which began last fall, targeted 7th, 8th and 9th graders and will follow these students until they are 10th, 11th, and 12th graders. It involves not just students, but also teachers and parents.

The students are mailed education materials to their homes with ear plugs. There are a number of one-to-one meetings with the students and much of the intervention has focused on the proper fit of ear plugs and getting the students used to handling and inserting earplugs.

Schools were recruited from throughout Wisconsin. We have 34 schools with a total of 750 students. After recruitment, the schools were randomized into either intervention or control groups. The control group only receives hearing testing in the first year and the last year of he project. There are no other interventions with the control student.

The agricultural teacher passed out the data collection form to the students who in turn

took it home to fill out with the help of their parents. Some examples of items on the form are: the students health history, number of hours worked on the farm, do they drive a tractor and do those tractors have cabs, what other equipment do they operate, and what do they think are the three loudest pieces of equipment. Other questions include: do they wear hearing protection devices, do they operate chain saws, woodworking tools, snowmobiles, motorcycles, do they listen to loud music, do they shoot a gun and how often, and do their ears ever feel stuffy or ring after noise exposure.

Ear plugs were attached to the data collection forms and the students were asked to wear them 24 hours prior to the test if they were going to be exposed to loud noise. Since we could not be there to make sure the students knew how to put the earplugs in correctly, we entrusted the agriculture teacher with this activity.

We then travelled to each of the 34 schools to do baseline hearing testing of all the students, both intervention and control. All students also received an otoscopic exam at the time of the hearing test. All testing was done in the National Farm Medicine Center truck-mounted mobile testing unit using a specially designed mini-testing booth. All testing was done either by audiometric technicians or by an audiologist.

Following the hearing test, results were given verbally to each student; however, the intervention students also received a one-on-one educational session while in the hearing van. Results of the tests were reviewed along with a brief explanation of the frequency levels. These students were also given two types of ear plugs to try out within the next three or four weeks and they were also shown an earmuff that they would be getting at the time of the classroom presentation. After reviewing their forms, a brief educational message was given regarding the anatomy and physiology of the ear using posters.

A display of a variety of earplugs was used to talk to the students about the fact that there are many different kinds of earplugs to wear because everyone prefers a different kind and it depends on the size of one's ear canal. Earplug insertion techniques were demonstrated and instructions were given on how to clean the earplugs.

Three weeks later a classroom presentation was given which consisted of a brief repeat of anatomy and physiology focusing on the damage done to the hairs in the inner ear. We talked about noise induced hearing loss and its characteristics and warning signs. A short testimonial videotape was used of three young men from the previous hearing study who were found to have hearing loss while they were still in high school. The videotape also contained scenes of various farm equipment and accompanying decibel levels. Music, missing the high and mid frequencies was included on the video tape to give the students an idea of what music would sound like if they had hearing loss.

The focal point of the program was letting them try various kinds of earplugs. The students also received ear muffs.
A student volunteer was selected to help with distribution of surveys and to help co-teach in the future. Every school has a

school coordinator and some schools have more than one. Most of the coordinators actually volunteered but a few were chosen by their Agricultural teacher.

Educational and motivational materials are sent to the students every four to eight weeks. Mail outs include compliance surveys, reminder letters, project updates, brochures and articles on noise induced hearing loss. Some are sent directly to the students at home, others are sent through school. Replacement earplugs of their choice are sent to them with certain mail outs. The next step was a meeting with pairs of students which and introduced them to a sound level meter along with a work sheet for them to take home. The goal was to get each student to take the sound level meter home and measure sound of a few pieces of frequently used equipment. This intervention is presently underway and it is hoped that this will help them identify significant sources of damaging noise on their own farms and help personalize the intervention program.

The original questionnaire was utilized to find out what farm equipment they used the most and what equipment they thought was the loudest. They wrote those down on the worksheet which then went home with the sound level meter.

The use of the sound level meter was demonstrated by taking the students into the shop area of the school. This was a big hit with the students as they really loved walking around the shop looking important with the sound level meter. Only a few schools had any type of hearing protection available in the shop area; however, safety glasses were provided. Safety glasses are mandated in Wisconsin schools.

The compliance survey was reviewed and they were asked if they still liked the earplug they had originally chosen. If they did not, this was the time to change their preference of earplug. The student was also asked to insert an earplug. This turned out to be a wonderful compliance check on my part because I could tell by the way they handled the earplug whether they had ever used it before. Many students did indicate that they wanted to change earplugs at that time which I thought was a good indication of use.

Discussion followed where they could keep the earplugs or earmuffs handy to remember to use them when they were around the noisy equipment. Utilizing their questionnaire, the students talked about the machine they used most frequently and where to keep earplugs or earmuffs when not in use.

This is a picture of one of the dads of one of the students who keeps his earmuffs around the reflector on the tractor. The next few slides are pictures of what the students have been doing this summer. In checking with the Agricultural teachers over the summer, quite a few of the students did get a chance to use the sound level meter. They were out on their farms testing different pieces of equipment.

Parents were targeted in a couple of the mail outs. This year's school year intervention may focus more on the parents. The parents may be invited to a classroom presentation and may have a chance to

have a free hearing screening. The information the students found regarding noise levels around their farm will be used to let the parents know the decibel levels of their own equipment.

Industrial arts teachers will be targeted this year by offering them a hearing test and then providing their shop area with two or three ear muffs. They will be asked to be role models by wearing hearing protection whenever possible.

Some observations, problems and opportunities.

We obtained some very interesting preliminary information from this first year in the schools. First of all, of those students working on a farm 83 percent operate a tractor, of the 83 percent, 56 percent of those students were 10 years old or younger when they started, 39 percent have no cabs on any tractors and 99 percent have no cabs on some tractors.

You can see the different pieces of equipment. Seventy-three percent operate elevators, 68% operate milking equipment, 60% operate barn cleaners, and then it goes down from there to the lowest percent which was operating a combine.

Secondly, 97 percent of the students use lawn mowers or lawn tractors, 89% listen to loud music, 82 percent use snowmobiles, motorcycles or ATVs. Seventy-two percent use fire arms and of those 72 percent, 70 percent fire more than 20 shots per year. Sixty-three percent use wood working equipment and 38 percent sometimes use a chain saw.

We asked them when working in noisy areas how often do they use hearing protection. Before any intervention, 76 percent said never, 22 percent said sometimes and 2 percent said all or almost all the time. After this first year's intervention, 21 percent said never, 67 percent said sometimes and 12 percent said all or almost all the time.

Other findings of interest: 25 percent have a positive family history of hearing loss, most in the fathers and 62% have had ears ring or feel stuffy after noise exposure. Thirteen percent self-rated their hearing as only fair or poor and 84 percent believe noise can damage hearing.

Just some general observations on my part, I felt that the 7th and 8th graders were very receptive but the 9th graders were a little hard to reach.

Another item of interest was that the Agricultural teacher seems to have a lot of influence on the students. If the Agricultural teacher was interested and was enthusiastic about the project, so were the students.

One problem is that compliance is self-reported or reported from the Agricultural instructor which makes it difficult to accurately assess.

We also found that learning to insert an earplug correctly is essential. Finding a comfortable fitting earplug is also essential. The theory of self-efficacy seems to fit here. The belief that you can perform a behavior correctly has some influence on whether you are ever going to perform that behavior.

One-to-one encounters with students proved very important. Students react quite differently in a classroom full of peers than on an individual basis. One-to-one encounters and mailings may be a future focus instead of utilizing the classroom setting. The mailings seem to be quite popular.

In addition to involvement of parents in this next year's intervention we will conduct a repeat hearing test each of the next three school years. We will use this opportunity to assess compliance and provide additional reinforcement to the intervention. Throughout the next years reminders, educational materials, and replacement earplugs will be mailed to the students.

The study was designed to test whether a hearing conservation program directed at adolescents actively involved in farm work would result in reduced prevalence of mild hearing loss at later follow-up as compared to similar students not receiving the hearing conservation program. We also hope that this exposure to hearing conservation will affect the students' use of earplugs and earmuffs in the future. Thank you.■

Agricultural Safety and Health Promotion Program for Older Kansans

By *John Kramer*
Kansas State University

DR. HARD: Our next speaker is John Kramer. He is with the Extension Agricultural Engineering Department at Kansas State University. His topic this afternoon will be Agricultural Safety and Health Promotion Program for Older Kansans.

MR. KRAMER: Thank you, David. Good afternoon. Is anybody going to respond? Thank you. This is an Agricultural Health Promotion Systems (AHPS) project. Again, we would like to express our appreciation for the funding that NIOSH has provided for the past three years and what we anticipate for the fourth year. (Slide shown.)

It is self-evident from the title of our project that we were focusing primarily on the older producer in the State of Kansas. How did this project come about? First, I think we need to understand a little bit about Kansas agriculture. Number one, it is highly diversified. We go from rain fall in one corner of the State of 14 inches per year to in excess of 40 inches per year in the other corner.

Primarily we are talking family type of agriculture, very few employees other than family. We are not talking about a high number of non-family employees.

We are also talking about a relatively high percentage of deaths in the 60 and over age group. The 10 year average is around 40 percent but there have been years, 2 in particular, that over 60 percent of victims have been age 60 or over. That is a disproportionate number and we thought we needed to do something to target this population.

Once you select the target population you have to decide how are you going to reach these populations. Well, at least our experience in the State of Kansas has been that you can get good turnout at extension meetings, if they are production meetings. You try to hold something targeted at adults concerning specifically safety and you can subtract all but those two presenters up front. That is what seems to happen. We wanted to see how we could slip Ag safety in on these producers. We figured that we would do it in short presentations piggybacked onto normal extension meetings. I guess they could not listen while these messages are presented or they could get up and walk out, but barring that, they are going to get these messages. Once that had been decided, we had to design a delivery mechanism. You are not going to trot a state extension specialist or area specialist out to do a 10 minute presentation. That means that we needed to rely upon local expertise or train some local expertise to deliver these messages.

That is what we attempted to do. We set up county safety teams, initially targeting other agricultural producers, county extension personal, county health nurses, county

Farm Bureau safety chairs and the Area Agencies on Aging. In different counties, different groups came forward. Only the Area Agency on Aging in several counties were really interested in actually working actively in this program. One thing we did find is that we were a little naive in thinking we were going to get other producers to stand up there and deliver a safety message — that happened only in rare instances.

More willing, were the agribusiness personnel whether from the local grain elevators or farm equipment dealerships and the EMS personnel.

Over the last three years our project personnel have presented programs to representatives in 100 counties out of the 105 in Kansas. In the first year we were attempting multi-county meetings, that flat did not work, you might get the extension agent there from each county but nobody else. The last two years of the program we were holding one meeting per county and attendance increased quite a bit. Acceptance of the program was enhanced when we spent a fair amount of time identifying upcoming meetings in the county that were already scheduled and identifying types of safety messages that might be appropriate to be delivered there, and who was going to deliver them.

To support these efforts we also developed a series of tabloids, farm safety tabloids. These differ, as you can see, substantially from your standard extension fact sheet. We tried to use more of a newspaper format to personalize the stories a little more, make it a more attractive reading, something that they would want to pickup and continue to read, (more human interest). In addition, each one had some type of attractive photograph at the top center to attract attention. In addition, each had a lead article that focused on some aging issue. If you will notice the Livestock Safety story, "Taking Age Into Consideration When Working With Livestock."

The balance of the tabloid basically contained safety information that was non-age specific. Eighty to 90 percent of the information was non-age specific.

We tried to have some type of action photo or some attention grabbing photo under the title to make it more attractive. We really did not realize how effective this was until we acquired this literature display rack which we used to distribute the tabloids at farm equipment shows and field days. Our personnel were trying to monitor the usage of each of tabloid to see where the interest was, whether the interest was in tractor safety, pesticides, or anhydrous ammonia for example. It turned out, the topic did not matter, the only tabloids that disappeared were the ones in the front row with the picture showing. You could put any pair in that front row and they would disappear and the ones behind it would not be utilized until that front row was gone. So, subject matter did not make much difference, being able to see the entire brochure with the picture seemed to.

We also had a presenter's guide. We wanted to use that as a mechanism for structuring these five to seven minute presentations that the presenters would give. It outlined the key points to talk about and

examples that they could use. These guides were not used. They required prep time. What did work? Well, last spring when we started having some problems with grain suffocation, we developed a self-contained module, totally self-contained with transparency masters. All they had to do was make a transparency from this, stand up and basically read it if that was what they wanted to do. One to two minutes prep time minimum, very timely, current information. That was used. Well over half of the agents reported using them at least one of their extension meetings over a several week period following our mailing. What does this mean? Again, I think the information we send out has to be timely, we cannot send it out six months before it is needed. We also need to have it totally self-contained where it only takes them one or two minutes of prep time. Otherwise, unless the agent is really enthusiastic about farm safety, it is not going to be used.

The agents also said that they wanted some more safety videos. As part of this project we are developing four of these videos, they are very short roughly five to six minutes long to fit into this time slot. They are also designed to be more or less a trigger mechanism. We are not depending upon them to deliver the whole safety message. We hope it helps to generate some discussion and some thought. If we have time here when I am finished we will show about a three minute clip of one of these.

Booth design contests — this is something that came along at the end of year two. We have designed this contest to encourage additional participation, give additional avenues of participation for local FFA chapters to get involved and promote agricultural safety. As some other presenters have said there is a real hierarchy to go through when working with the FFA. We have made it through the State Governing Board. It has been taken to the instructors over the summer. We will see what kind of participation we get in it this fall.

With that why don't we go ahead and go to a couple of minutes of the videotape and just let you take a look at that. (Videotape shown.)■

Using the Model Safety Program Concept to Establish Agricultural Safety Programs

By *C. Lance Fluegel*
University of Arizona

DR. HARD: Thank you, John. Our next presenter is Lance Fluegel from the University of Arizona out of the Department of Agricultural Education. His topic this afternoon is Using the Model Safety Program Concept to Establish Agricultural Safety Programs.

MR. FLUEGEL: I am the Program Director for the Arizona Agricultural Health Promotion System. This afternoon I am going to be speaking to you basically on one concept of the program.

I would like to introduce our staff by slide.

The gentleman in the middle is Steve Schimpp who is a three-quarter time graduate student who works with our educational model safety programs. He also does surveillance and evaluation.

The gentleman on your right is Bernardo Quintero. He assists me with the agribusiness model safety programs. He is our bilingual trainer and also is a certified first aid and CPR instructor.

The Model Safety Program Concept to Establish Agricultural Safety Programs is one of the methods that we used to test the hypothesis that if a farmer could receive technical and financial assistance from a non-threatening source such as cooperative extension, would they be more likely to include safety in their operation. With guidance from our advisory committee and the assistance of county extension directors and agents we were able to establish 20 agribusiness and educational cooperative model safety programs.

The objective of our program was to establish a program presence statewide. In order to clarify this I would like to give you some of the history of the Arizona Safety Program. When I came on board in 1987 the program was basically a newsletter that went out on a bi-monthly basis. In the first two to two and a half years of the program I added some safety training materials. There was little or no contact with the county offices.

Another goal of the program was to reach students in their formative years before they had a chance to develop bad habits. We wanted to develop and evaluate hazard survey check sheets — a hazard correction plan. I think this is probably the key to the whole program. I mean it does not do a lot of good to go out and identify these hazards if you do not do something about it. Another part of the program that was very helpful to us was the financial assistance that we offered cooperators. Another facet was to promote regular safety training. We wanted to offer it on a bilingual basis. Our goal was to provide weekly training programs and we wanted to bring cooperators into OSHA compliance. And finally, we wanted to develop a manual on implementing a safety program.

In order to announce and promote our pro-

gram we used three methods. I personally contacted the county directors in each county. It is a little easier for us to do this since we only have 15 counties. We have the same geographical area as most of you but in terms of population and counties we are greatly reduced. We met with each County Director in his/her office. We also asked them to announce the program in their newsletters and other county releases. We made a direct mailing to the agriculture teachers, vocational directors, the principals, and the superintendents. We also released it to the Arizona media, all the magazines, newspapers, radio stations, and so forth.

In order to explain about our program in depth, we developed an instructional handbook. We developed one for agribusiness programs and one for the educational model safety programs. The format we used was questions and answers where we tried to anticipate the most frequently asked questions.
We also developed a model safety program application. We wanted to keep the application simple and easy to fill out in perhaps 20 or 30 minutes.

This was page two of the model safety application. After all of the publicity and promotion we sat back and expected to be inundated with applications. I think you are all getting ahead of me here.

We received seven applications of which one we rejected immediately; however, we did receive some very well thought-out applications, like this one, from a landscaping operation.

The applicant gave us a nice feel for their business. Basically we got what we were looking for.

This was page two where we asked them to tell us what they would like to do if accepted into the model safety program.

There were some applications that were not quite as well thought out. For example like this one where we asked them to tell us about their operation and the applicant wrote, "Sod farm."

With a goal of 20 model safety programs we realized we would have to use some other method to obtain the rest of our cooperators. The methods and procedures that we used were to contact several of the Ag teachers directly and the county directors a second time for recommendations of people they thought might be interested in setting up a model safety program. This approach worked very well and we were able to achieve our goal after about 18 months into the grant.

This map shows the location of our 10 agribusiness cooperators. Our goal was to put an agribusiness or educational safety program into every county. We wanted a cross section of Arizona agriculture. Because we accepted almost everyone that applied, we were very fortunate to wind up with a wide variety of operations.

This is a map of the educational model safety program locations. It appears on this map like most everything is in the bottom two-thirds and that is true. Some of those counties in the Northern part of the State are predominantly timberland and

a lot of reservation land. Our model safety program cooperators consisted of one community college and nine high school agriculture departments.

This is an updated map. On this one you can see that the original agribusiness and educational model safety programs are identified. One of the benefits of the Model Safety program is the sales point in your local community. I have used the term "satellite program". For example, in the Northeast part of the state we had a swine farm as a model safety program cooperator and the county agent helped to set it up. He subsequently received requests from the neighbors, wanting to implement the safety programs. This has also happened with some of the high schools as they have learned about the program. The initial response was very poor, but now that they see what is happening, that they have access to safety information and equipment, and financial assistance. We have had people asking if we are going to be continuing this program next year.

This was one of the hazard survey forms that we developed for tractors. This one on chemicals has been revised to reflect the new EPA Worker Protection Standard as well as the OSHA standard.

This is a shot of me conducting a hazard survey in a satellite swine operation. The company is "Pigs for Farmer John". They have a very intensive disease control program. In fact, we are one of the few people who are allowed to get onto that operation. In order for us to come on to the farm, we have to strip down, shower, put on company supplied clothes before going into the operation.

Another tool that we use to publicize our model safety program is a promotional sign.

This is the one that we put up at one of our landscape operations where the front announces the model safety program and the back it shows the number of accident free days and also a little reminder that employees should fasten their seat belt and work safely.

This operation is very progressive in that they put together a 34 page safety manual. They relied on us for a lot of the technical information, the organization and direction. Because 75 percent of the employees are Hispanic, we translated the manual into Spanish for them.

One of the things that we do with our Model Safety programs is go out to the company and put on training sessions. This slide shows a respirator training session. They are so progressive that they brought the employees together one morning at a local school to explain the new safety manual and a picnic and safety awards presentation.

This slide shows a tractor used by an educational model safety program cooperator. We retrofitted the tractor with the ROPS and seat belt. We also equipped it with a PTO master shield and upgraded the lighting. The school has 75 students operating this tractor and also use it for their home projects. So this is a real bonus — when you do a retrofit like this, you are educating 75 students plus the students who will

follow them.

One of our programs made the front cover of "Arizona Farmer Stockman". The Wakimotos are very progressive. They have reported that their injuries have fallen by 50 percent and the days lost to injury have been reduced by 65 percent since they instituted a safety program. The unique thing about this program is that they were somewhat committed to safety but when I first suggested that they have regular weekly safety training programs, Victor just emphatically says, "No, we do not have time." After sleeping on it and thinking about it he said, "Maybe we should give it a try." He gave it a try and has become a strong supporter of safety training. They have an extensive safety awards program. They estimate that it costs them $2,000 per year but feel that it is worth every penny.

Here is a promotional sign for Western Sod. We installed one up at the farm as well as their main office in Casa Grande.

We put this sign up for one of our small farmers. He has only three employees but has been instrumental in helping us conduct safety programs for other farmers in the area. He helps us organize and actually beats the bushes to get people to come to the session.

This is a slide of Bernardo Quintero putting on a back injury prevention session at one of our satellite programs.

This is a summary of the safety equipment and supplies that our program has distributed through 1992. The numbers have increased considerably since that time.

In summary, I would like to say that we have had good success using this approach in establishing safety programs. We plan to add 10 new programs in 1994. I have; however, had to redefine what a model safety program is. If you are like me you would think of it as an immaculate operation, where would not find one thing wrong. It is not going to happen. We have perhaps three or four that I would be very proud to take you out and show you what we have done, three or four of them that are doing very well and then there are three that have shown some progress but not as much as we would have liked. I do not consider them failures. I figure any time that you add one safety training session or correct one hazard, you are making progress. I would like to leave you with the analogy that correcting hazards is something like training a dog. The first part is identifying the hazard. (Slide shown.)

Then you have to address the problem. (Slide shown.)

Then you perform a training session. (Slide Shown.)
(Laughter.)

Then the problem is solved.
(Slide shown.)
(Laughter.)

Or is it? Thank you.■

Impact of Farm Safety Educational Programs on Farm Operator Safety Awareness and Behavior

By *Charles V. Schwab, Ph.D.*
Iowa State University

DR. HARD: Thank you, Lance. Our final presenter this afternoon is Chuck Schwab who is with the Iowa State University. He is the Extension Safety Specialist for Iowa. The topic of his presentation is Impact of Farm Safety Educational Programs on Farm Operators Safety Awareness and Behavior.

DR. SCHWAB: I realize that I am what stands between you and break this afternoon.

I do not have quite the humorous slides that I just saw a few minutes ago from Lance.

What I am going to be talking about is the evaluation process of our agricultural health promotion systems funded by NIOSH. This presentation covers one aspect of the evaluation that we are performing. This aspect is the impact of our farm safety educational message that Iowa State University Extension has delivered during 1992.

The investigators are Steve Daniels, August Ralston, and myself. I have to thank a cast of several hundred for their efforts in getting this information out to the population of Iowa, which is reflected in Figure 1.

Now, you will receive a review or an introduction into our agricultural health promotion systems' mass media campaign. What we are dealing with here is an approach of taking the radio, newspaper, and other types of exhibits and meetings and packaging them into a coordinated effort to preach this safety message.

We selected 12 monthly topics, each corresponding to the 12 calendar months. We produced 12 radio messages. We produced weekly 4 minute radio tapes on those messages, and 12 monthly Public Service Announcements (PSA). In addition, we produced newspaper releases. Newspaper had several types of directions. We used State releases that went out from the University to the State media resources. We used county releases that provided the county staff the means to do a local release. All releases were targeted at the same topic, but they all were a little bit different in content. Our fact sheets and educational programs that corresponded with the message that we were putting out through the mass media were used.

In other words, we sat down and decided that this was the bait we were going to put on the mousetrap. In this particular case we selected smooth peanut butter. We did not choose the chunky peanut butter. (Map of Iowa, not shown).

Next, we looked at the location of all of

the mousetraps. In other words, what was the radio distribution of all our radio releases. The different colors represents the density of overlap of the radio stations in Iowa that played the SAFE FARM PSAs. Those stations shown had used the PSAs in one of the following ways: more than three times per week, at least three times per week, some almost playing three times per day. So what we are looking at is a concentration of our radio messages as they were received in Iowa. This map is for both AM and FM. The lighter shade, (blue) represents a lighter concentration of overlapping radio stations. There are a few areas that are not highlighted. Some of these radio stations only played SAFE FARM PSAs seasonally or when they thought they were appropriate, particularly during planting and harvesting. From the map, you can tell that we did have a wide distribution. We used 107 regular stations that responded to an evaluation survey. We asked them specifically about SAFE FARM radio presentations. See Table I.

RADIO
- PSA, two-30 sec. and two-60 sec. monthly tapes
- 4 minute interviews weekly tapes

NEWSPAPER
- State Release PSAs
- Regional Release
- County Release

EXHIBITS & MEETINGS
- County Fairs
- Safety Day Camps
- Commodities and Association Meetings
- Extension Publications

Figure 1. *AHPS Promotion*

Table I. Summary of Circulation

ISU Agricultural Health Promotion's Articles from the Iowa Press Clipping Bureau, 1992.

Total Circulation for Iowa State University Agricultural Health Promotion's Articles: 3,136,694

Total circulation of ISU Agricultural Health Promotion's Articles per category:

Grain Harvest Clips	459,770	Safety Calendar Clips	414,229	Special News Releases	435,135
Harvest Clips	469,001	Satellite Clips	252,088	Stress Clips	8,800
PTO Clips	26,982	SMV Clips	208,296	Tractor Rollover Clips	482,131
				Youth Clips	380,262

Total circulation of ISU Agricultural Health Promotion's Articles per person quoted:

Chuck Schwab	1,431,268	Linda Engelken Fischer	117,073	Mary Ann Niichel	11,536
Mark Hanna	529,169	Jack Dillon	72,979	Dick Horne	6,330
Laura Miller	435,135	Roger Jensen	54,698	Judy Carlson	6,324
Dale Anthony	256,088	Jim Kuhlman	29,970	Chuck Kolbet	5,188
Pam Delagardelle	252,088	Michelle S. Davis	26,982	Bill Lotz	4,500
Tony Harvey	187,271	John Ley	19,582	Jerry Philip	3,777
Chris Nelson	148,144	Carol Peterson	5,047	Don Lamker	1,400
Mabel Niceswanger	147,232	Beverly Peters	11,890	Denise Wyland	1,200

Total circulation of ISU AHP's Articles per county (excluding statewide newspapers):

Adair	12,248	Fayette	37,375	Marshall	39,456
Allamakee	7,000	FB Spokesman	1,300,426	Mills	10,914
Appanoose	27,426	Floyd	15,108	Mitchell	11,568
Audubon	8,800	Franklin	29,450	Monona	8,188
Benton	31,460	Greene	23,948	Monroe	11,400
Boone	1,400	Guthrie	24,897	Montgomery	9,900
Bremer	13,986	Hamilton	5,475	O'Brien	3,487
Buchanan	65,036	Hancock	700	Osceola	6,742
Butler	2,420	Hardin	21,115	Page	19,650
Calhoun	3,962	Harrison	11,002	Plymouth	9,500
Carroll	28,741	Henry	8,000	Potawattamie	20,740
Cass	49,850	Iowa	12,300	Poweshiek	8,056
Cerro Gordo	125,000	Iowa Farmer Today	285,172	Sac	6,700
Cherokee	6,638	Jackson	11,000	Shelby	1,278
Chickasaw	27,000	Jasper	10,000	Story	37,445
Clay	4,000	Jefferson	4,910	Tama	24,400
Clayton	43,102	Johnson	16,102	Taylor	6,015
Keokuk	3,230	Jones	4,500	Union	5,780
Crawford	22,943	Kossuth	19,582	Warren	6,469
Dallas	11,100	Lee	8,184	Webster	73,604
Davis	11,768	Lucas	7,553	Winnebago	29,354
Delaware	33,540	Lyon	2,600	Winneshiek	6,330
Des Moines	20,159	Madison	2,220	Woodbury	199,072
Dubuque	46,979	Mahaska	10,000	Worth	1,500
Emmet	9,500	Marion	11,974		

The distribution of our media releases in the local newspapers was used as a form of the evaluation. The press clipping service was used to track the number of stories in farm safety. The ones that you see in this slide are the ones that were released through the SAFE FARM project that was either done at the county or the State level or a special release based on a specific problem encountered during the year.

- Names were selected from the Farm and Home Directory[1]
- Samples were spread over 50 counties
- The probability of name selection was the same for all counties
- 1,639 households were selected
- A letter explaining the survey in general was sent to each household
- Telephone interviewer called to screen for eligibility

[1]Farm and Home Publications Ltd. Belmond Iowa

Figure 2. *Survey Process.*

An increase of 71 percent in the Farm Safety story coverage was observed in the media. Fifty-seven percent of that increase in volume of newspapers is directly related to this project. As you can see, we looked at the circulation rate of each of the newspapers that was tracked and tried to give you an idea the concentration of where the message was being delivered. See Figure 2.

After our traps were set, and e know where they are, the next step is to evaluate who is receiving our message. In 1991 we completed a baseline survey. We selected names in Iowa to form a group, randomly throughout our 99 counties. We used abase group of 1,639 households and we contacted them. The reason for contacting them was because, we needed to know if they are going to continue farming. We did not inform them specifically that they were going to be contacted in a re-survey to find out their difference. They were asked if we were able to re-contact them, in other words if they minded if we call them again. At that stage, we passed each individual through a process of evaluation: 1) the person on the phone was the farm operator; 2) the farm was to have at least 40 acres, in Iowa you should have more than 40 acres if you are going to be considered a farmer; 3) of course if they were planning on not farming next year. We wanted to make sure that we kept the highest numbers contacts for the re-survey.

The telephone survey for 1991, was actually conducted during December of 1990. At that point in time we ended up with 517 individuals that we contacted and conducted a 30 minute telephone survey. We received a large amount of information. We came back in 1992, actually February of 1993, and we resurveyed the same group. We lost a few, some quit farming and we actually lost a couple through injuries. See Figure 3.

Now, I am talking about the impact. We developed five scales of what we were going to look at, and these are: awareness, concerns, practices with equipment, prac-

- Awareness Scale is an additive composite of four questions concerning the dangers of farming (100 points)
- Concern Scale is an additive composite of seven questions dealing with the hazards of farming (100 points)
- Safe Farm Practices - Equipment Scale is the mean of the percentage of operator tractors with seat belts and ROPS (100 points)
- Safe Farm Practices - Behavior is an additive composite of eleven questions on farm safety behavior (100 points)
- Degree of Change is a single question describing the degree of change made by farm operators in response to available information (3 points)

Figure 3. *Five Scales to Measure Impact.*

- **Awareness**
  - Pre $\alpha = 0.247$
  - Post $\alpha = 0.365$
- **Concern**
  - Pre $\alpha = 0.839$
  - Post $\alpha = 0.851$
- **Practices - Equipment**
  - Pre $\alpha = 0.794$
  - Post $\alpha = 0.800$
- **Practices - Behaviors**
  - Pre $\alpha = 0.514$
  - Post $\alpha = 0.521$

Figure 4. *Reliability of Selected Scales.*

tices with behavior, and degrees of change. Four of the scales have a 100 point distribution, one has a 3 point distribution. Some of the questions that made up the scale range from one question which is the degree of change, we only used one question. One of the scales had at least 11 other questions from the survey that composed the scale.

How well did we do in selecting the questions asked to develop these scales? That would be the logical step from there. See Figure 4.

The reliability of the scales we selected are illustrated here by alphas. Awareness, pre and post, of our campaign was a little lower than what we anticipated. In other words, we were really not explaining what was happening in our scale with the questions that we had selected. Concerns, practices in equipment, practices in behavior, the alphas were better. We actually had a pretty good idea of what should be asked to determine a reliable scale.

The next step requires talking about the good news and the bad news. The project kind of went out on a limb because we are trying to measure something that is very hard. I think there are a lot of people here that can imagine the difficulty in measur-

- **Awareness of the Dangers of Farming**
  - Mean value for 1991- 67.25
  - Mean value for 1992 - 68.88
- **Significant at the 5% level (one-tailed)**
  - P = 0.035

Figure 5. *Survey Results: Awareness.*

ing behaviors, changes, and practices from a health standpoint that can take years to actually get in to practice. We are trying doing after one year of intensive campaigning to measure some behavioral change. See Figure 5.

The good news, the survey results for the awareness scale showed that the mean is a very high value. In other words, we are over 60 percent of the way up on that scale. That was part of our problem in determining the impact that our group had made because when we tested the baseline, the Iowans were very aware of the dangers of farming. What we did show, which was good news, is that throughout the 1992 year we had a statistically significant change in the awareness level of our farm operators at the 5 percent level of confidence. See Figure 6.

- **Concern over the Hazard of Farming**
  - Mean value for 1991 - 78.50
  - Mean value for 1992 - 79.91
- **Significant at the 5% level (one-tailed)**
  - P = 0.011

Figure 6. *Survey Results: Concern.*

The concerns scale that was used is based on the concerns over farm hazards. Again, looking at the mean you can see a very high value, on a 100 point scale, which is higher than we were expecting to occur. There was a statistically significant change from 1991 to 1992. See Figure 7.

- **Safe Farm Practices - Equipment**
  - Mean value for 1991 34.58
  - Mean value for 1992 35.90
- **Significant at the 5% level (one-tailed)**
  - P = 0.000

Figure 7. *Survey Results: Practices - Equipment.*

Practices in equipment: Out of all the 100 point scales that we looked at, this one had the lowest scale value; however, even though it was the lowest, we observed an increase in the practices in equipment. This indicates that they have become safer. That was statistically significant, at the five percent level. See Figure 8.

- **Safe Farm Practices - Behavior**
  - Mean value for 1991 - 73.01
  - Mean value for 1992 - 74.17
- **Significant at the 5% level (one-tailed)**
  - P = 0.020

Figure 8. *Survey Results: Practices - Behavior.*

Practices in behavior: We are dealing with farm practices that was also another very high mean value for our scale of 100.. We determined there was an increase in behavioral practices that was statistically significant at the five percent level. See Figure 9.

- **Degree of Change in Safe Farm Practices**
  - Mean value for 1991 - 2.02
  - Mean value for 1992 - 2.05
- **Not significant at the 5% level (one-tailed)**
  - P = 0.367

Figure 9. *Survey Results: Practice Changes.*

The last of the five scales that we used was the practice changes. It was not significant. If you look at my slide in very light letters it says "not significant". We did determine that the mean value for the three point scale was a high value from the start. We did not observe a major change. When you are using one question to measure the significance, you might find that significance is difficult to obtain. That was sort of the good news. In other words, we have this group that we targeted and they have made significant changes in four out of our five scales.

The bad news, I did promise some of that. We tried to link specifically the changes and increases, in farm operators' awareness, behaviors and practices to specific messages that our campaign launched. In other words, is it statistically significant that what we presented impacted that change. See Table II.

We found from our five different scales that only four categories were statistically significant and those were radio for the categories of awareness and practices with behaviors and meetings for the awareness and also practices with behavior. So, we had two out of four that showed that the messages actually making some impact on the overall change in the safety of the farm operators.

It was not as high as we had hoped but I think about the methodology that was used and one things come to my mind, because of my forgetfulness. I ask the group here today, do you remember what we had for lunch yesterday, how many here remembers? Come on now, are you telling the truth? How about the lunch yesterday?

What I am trying to emphasize is the difficulty in assessing whether or not the farm operators could clearly identify our product after a period of one year. It could have been a 30 second radio spot that they heard that made them acquire some safety information. I think we placed the material out there, we saw a change, we could not directly relate it to our project but then I examine what our surveyors did tell us. We did not perform a statistical test, but the next slide will show us a little bit about the information that they did receive. See Figure 10.

Sources	Awareness	Concern	P-Equip	P-Behavior	Change
Radio	Sig.	---	---	Sig.	---
Newspaper	---	---	---	---	---
Brochures	---	---	---	---	---
Meeting	Sig.	---	---	Sig.	---

□ Impact of 1992 Information Sources for Farm Safety Campaign Messages on the Five Scales of the Survey

Sig. - Statistical Significant Impact

Table II. *Impact of Farm Safety Message.*

■ 41% of the survey population recalled an Iowa State University Safe Farm Message. (195)

■ 74% of the population from the 191 farm operators that recalled an Iowa State University Safe Farm message listed a written message.

■ 50% of the population from the 191 farm operators that recalled an Iowa State University Safe Farm message listed a radio message.

Figure 10. *Safe Farm Messages.*

Forty-one percent of our population that was surveyed said that they clearly identified 1 of Iowa State's safe farm messages, that is 195 people out of 400. They said they could recall. It is not like, "Did you remember a message that Iowa State Safe Farm gave you?" It was, "Did you, remember one? What was the topic? Where did you hear it?" These recalls were positively identified as something that they did recall. It was not just saying yes or no. They were telling us the topic that we covered and which media source brought them the message. We have the check of where and what the information was, so we did clearly identify 41 percent of the population out there got that message.

Seventy-four percent of the 191 received the message directly from the print material and 50 percent received it from the radio. We saw a lot of mousetraps that were tripped and the bait we used was good material to stick on the traps. We could not tell how many "mice" we caught, but we sure set off a lot of traps. See Figure 11.

- The four out of five scales indicated a statistically significant increase the awareness, concerns, equipment, and Behaviors of farm operators from 1991 to 1992.
- Specific linkage of the Safe Farm Campaign to changes in concerns and changes was not statistically significant.
- High population of Iowa farm operators would have received some form of the Safe Farm Campaign.

Figure 11. *Conclusions.*

In conclusion, we did see four out of the five scales showing a statistically significant increase in the level of safety whether it is concerning awareness, behaviors or equipment. Although we did not see the statistically significant linkage of our SAFE FARM project to the changes, I believe that we can look at the high visibility of our campaign and draw some conclusions that the material we used resulted in some of the changes that were measured. I will close for some questions.

Questions and Answers

Plenary Session VI - Intervention

DR. HARD: We are doing fairly well on time so we will entertain any questions. I would like to remind you that if you have a question please state your name and your affiliation and then your question.

PARTICIPANT: (Inaudible.) — from Cornell University. I have a question for Tom Bean on your Amish program. At what age were the children taught the driving safety? We do have Amish in New York but I do not know much about regulations. Were there practical parts to this driving program and is there an age at which they can start driving on the road?

DR. BEAN: Actually, there is no age restriction for them to drive on the road, in Ohio anyway. There is no age restriction in Ohio for anyone to drive agricultural equipment on the road either. To answer your second question, 7th and 8th grade, basically because the Amish only go to the 8th grade. They do not participate in higher education after the 8th grade. The teachers only have an 8th grade education.

MS. BOYD: Jane Boyd. I am with the OHNAC Project in Western New York. My question is for Tom also. More of a comment than a question and that is that we have a large Amish and Mennonite population, the Mennonite population being based right in my own county. The barn that is out in the other room was basically developed for that group of people because they would not allow audiovisuals, etc., into their classrooms. My comment to you is maybe you could use some of our Mennonite people who use flashing lights on their vehicles (we have not had any accidents in the last five years) to base some of your work with your Amish people.

DR. BEAN: Our future research efforts will be in the area of lighting and marking, using different kinds of retro-reflecting materials plus flashing lights. We think that the Amish are now going to be able to accept some flashing lights. We are going to propose some changes to their buggies, only the attachments to the buggies. We will not change the buggy design. We will then recommend these changes in the communities to see what the acceptance will be.

MS. BOYD: Some of ours have been real creative and real innovative to make their buggies visible at night. Maybe you could use some of them.

DR. BEAN: The Mennonite population that you are speaking of are a little bit more liberal than the Amish population. As you know, the Amish population has one segment of the population called the Swartzentroopers which will not put anything on their buggies and they have made that quite clear. They will go to jail before they will abide by the law. But, then again, the majority of the population appears to be accepting of different things. We are willing to work with that population prior to any legislation. We would rather have it be a voluntary acceptance

than legislate it. It makes a bit more sense.

MS. BOYD: I understand.

DR. FREUND: Gene Freund with NIOSH. I just have a comment that I think other people have made before. I could not help but kind of wince every time I saw a picture of a kid wearing hearing protection on top of a non-ROPS equipped tractor. I know that sometimes it is very hard to find a ROPS equipped tractor but I think that especially when presentations are done more publicly than this one everything that gets put up is modeling some message for agricultural safety and health. It is particularly ironic when you have one form of protection against hearing loss in later life and no form of protection against something that could prevent the later life from happening.

DR. HARD: Any other questions? If not, I have one announcement to make. I would like to meet with all of the Agricultural Health Promotion System grantees after the 5:30 meeting tonight. We will need to meet down in the audiovisual room, the slide preparation room, because they will be setting up this room for the reception later on. Thank you for your attention.■

(Brief Recess.)

A Statewide Surveillance Program for Agricultural Injuries

By *Larry L. Shireley*
North Dakota State Department of Health and Consolidated Laboratories

DR. HERRICK: There are a couple of announcements I need to make. I should introduce myself. I am Bob Herrick with NIOSH in Cincinnati. I would like to introduce our speaker who is Larry Shireley, Division of Disease Control, North Dakota State Department of Health and Consolidated Laboratories. Larry's presentation today is going to be A Statewide Surveillance Program for Agricultural Injuries.

MR. SHIRELEY: Thank you. I appreciate the opportunity to be here. (Slide shown.)

We are part of the OHNAC Program of the 10 states which I think you have seen slides of before. When we wrote this grant I am not quite sure that we knew what we were going to do. Sometimes I think Gene thinks we still do not know what we are doing.

We wrote for a request of five nurses thinking that we would probably get three and fortunately we got five. Fortunately for us we did because there is no way in hell we could do this program with any less than five.

We are the only state, I believe, who is trying to do this program on a statewide basis. You can see the categories which the nurses cover. They cover a range from 8 up to 14 counties. I think NIOSH is directly subsidizing AT&T with the phone and petroleum industries because some of our nurses are putting on 20,000 to 25,000 miles per year on their cars.

A little bit about the agricultural aspects of North Dakota — on the Eastern part we have primarily sugar beets and potatoes grown and we do have a migrant population coming up here during the summer months; in the Center section we primarily have small grains: wheat, durham, and such; in the Western part we have small grains but primarily livestock, primarily cattle ranching because it is much drier, occasionally scattered around we have a tree here and a hill, occasionally. Some of the results we have seen in this program have been correlated to the type of agriculture we have in those areas.

We have a very short report form to try to get a minimum amount of data to get back to us and then we can do a complete follow-up. Some of the nurses in some of the other programs have mentioned negotiations, we negotiate, beg, borrow, steal, whatever we can do. We also coordinate this program with some other programs we have in the state. We have a CDC grant for injury intervention and surveillance which comes into our State Health Department. We also review those forms and

what the nurses do not get then if we have anything agriculture related we also have the nurses follow up on those if they are appropriate.

A couple of other programs that we have, we also coordinate with the North Dakota Poison Control Center in which, on a periodic basis, we get reports from them as well. That also helps with our surveillance program.

We do some coordination with the Emergency Medical Service; however, when you see some of the results, it does not give us a great deal. In September that program will be completely computerized hopefully that will help us to an even greater extent.

We also coordinate with the Division of Vital Stats which is fortunately just down below us in our department so it is easy for us to get down there and get death certificates in agriculture related deaths.

As most of you, if you are conducting any type of surveillance program there is always some "what's in it for me?" from the reporting sources. Besides feedback we do have a program that we are going to start in just the next few months, we are blackmailing for childhood vaccines — we will give you childhood vaccines if you will give us reporting. We will see how that goes. I do not like to hold children hostage but whatever will work for us. As you all know, there is no such thing as a free lunch out there.

I would like to go over a little bit on the results of what we have. Our primary definition is fairly loose, it is, "are injuries related to agriculture", we are excluding businesses such as elevators and such with that so it is primarily a farming base. Because of the whole load or the number of injuries that get reported we do put some priorities on follow-up and those are primarily the ones who are hospitalized and pesticides and chemicals that we can do complete follow-ups such as interview, telephone and actual on-site interviews and certainly on those deaths we do.

This is the first two full years of our program. This is somewhat misleading. You can see we have almost 2,000 injuries reported to us but in 1992 really we have about 1,400 reported, so the first year was really, as Gene was alluding to last night, it was really taking us in some respects a couple of years to get full blown. What we did when we first started with the program is we sent the nurses out to virtually knock on doors to try to establish surveillance with the institutions.

As you can see, our leading cause of injuries, the machines, the agricultural machines — when you saw the slide with the Eastern part which is highly mechanized, certainly contribute to a lot of our injuries. Animal related are at the top too.

When we look at the type of machine that is involved combines are the leading because of a lot of our grain operations but when you see later the fatalities our leading cause of fatalities is obviously the tractor.

Looking at our animal related ones since this is ranching it is primarily cattle, a few dairy cattle associated with those and then

the horse. We still do have a few cowboys in North Dakota, males predominantly, I guess that is no big surprise to anybody.

Our average of the farm is approaching about 50 now so we are seeing a lot of decrease in our younger population. This has an impact, these are their prime years of their lives when they have injuries associated with their farming activities.

Looking at the time of month, I think Carol alluded to some of the California statistics, primarily we are seeing them in the spring associated with the planting operations and then certainly in the fall months associated with harvesting. In some parts of the state, especially in the East when you have the sugar beets, you try to stay off the roads in the fall months because of the trucks.

Because we do not follow-up on all of them we do not have complete information on the person who is actually involved but in those we do the farmer himself there is certainly a significant segment of other family members associated with farming activities in our follow-up.

We really did not see any trend with the day of the week obviously except for Sunday. We may even see a decrease now since we finally got our blue laws and you can shop on Sunday now in North Dakota.

Time of the day associated seems to be primarily in the early morning or when they are first getting out there, obviously that is probably associated with agricultural activity, but then we see later on in the afternoon and we are not quite sure what the fatigue factor might have involved in this trend as well.

Type of injuries, obviously, the musculoskeletal which are fractures, strains, sprains, etc., and the open wounds. We will see a little bit more about this. We broke them down to the type of musculoskeletal. Sixty percent or so were fractures so they are somewhat severe, this is probably something to do with reporting because we are following up on those a little bit and we are more likely to get those reported. We also have a significant segment of musculoskeletals being amputations. Certainly some of you can identify one of our most famous ones, John Thompson who had both of his arms taken off which will soon be a TV movie I understand. It will be interesting to see if they associate the cause of the unguarded PTO with that.

We are also very interested and we follow-up on our chemical exposures and the pesticides. This has been a very interesting one with us and was alluded to by Mel yesterday I believe, a significant number of anhydrous ammonias, primarily related to the hoses either being defective or during that process. I think we have over 20 this year already and we are starting another season where they are going to be very active with anhydrous in the field shortly. Mel alluded to one that the first aid the water had frozen, actually we have got two where there was inadequate first aid unfortunately because the water was frozen and you could not use it for first aid. In one of the situations they just took snow, it was later on in the season, and used it. Fortunately, he was not injured severely.

We look at our type of chemical exposures. Certainly these include multiple exposures but dermal being the greatest and eye and inhalation being the second.

Of these almost 2,000 injuries reported a little bit over 400 required hospitalization. In this 2 year period about 3,500 days of hospitalization which ranged from 1 up to, of those hospitalized 1 individual at least over 300 days hospitalized. It is very difficult to determine costs with those but an injury such as occurred to John Thompson has to be in the hundreds of thousands of dollars I am sure.

We talked about using EMS. Most of the individuals that on our reports are getting injured are self-transported into the emergency room and so our EMS of those 2,000 only about 170 would we be able to pickup through that process although it will certainly augment, most of them are being self transported.

We are averaging somewhere around 10 fatalities a year. You certainly need to recognize that our population is a little bit over 638,000, and losing daily except for the immigrants that come in. It is just the tractor related ones that are our greatest cause of fatalities. If you put those associated with agricultural machinery about three-fourths of them are. Understandably again, most of those are male.

Just a little bit of a note on the benefits of our program, although we thought we could do it from the start we were not sure but I think the statewide surveillance program can be done but to rely on one certain reporting form or one certain aspect it is certainly very difficult if you want to try to get a good representation. Unfortunately we do not have a hospital discharge date insistent in North Dakota. Like many of the other states, E-coding is somewhat haphazard. It can be done if you do have some resources and fortunately, thanks to NIOSH, we have been able to get some of those resources. This program has been very beneficial in allowing us to get a good idea of what is going on out there and some causes of injuries.

The nurses in those areas now have been very active in intervention programs on certain types and causes of injuries which are occurring in those areas. They have been a focal point for the safety movement in North Dakota and they have been able to interrelate with many agricultural groups, extension service, farm bureau and such. We feel very fortunate with this and I want to thank the nurses for really making this program the success it has been. Thank you. ■

Development and Refinement of On-Farm Physical Screening for Older Farmers

By *Deborah B. Reed, R.N.*
University of Kentucky

DR. HERRICK: Our second presentation this afternoon is from Deborah Reed, Department of Preventive Medicine and Environmental Health at the University of Kentucky. Deborah's topic today is going to be Development and Refinement of On-Farm Physical Screening for Older Farmers.

MS. REED: Thank you. In case you wondered which one I was, I am the only female up here so I am in good company up here this afternoon. I do want to thank you for giving me the opportunity to share some of the knowledge that we are gaining here in Kentucky and welcome you to Kentucky. If you want to know what a real Kentuckian sounds like, you are listening to one. As a native Kentuckian of this area I welcome you to Lexington.

I am affiliated with the University of Kentucky and I work closely with Dr. Robert McKnight who will be your host tonight.

That is not him, but as he ages we will let you know. I do not have much of a chance to get back at him so this is my one chance to shine here.

This is one of our older farmers in Kentucky. In Kentucky the average age of the farmer now has escalated to the age of 54 so we are a little bit above some of the other folks.

We would like to take our physical screens down on the farm to the farmers but to do that first we have to develop and refine the on-farm physical screenings for our older farmers in Kentucky.

Now I just have his name up there now. Dr. McKnight is the principal investigator of the Kentucky Farm Family Health and Hazard Surveillance Project and I am the Project Manager.

We are targeting four special groups in Kentucky so our surveillance project is perhaps just a bit different than some of the other states. Older farmers are being looked at very closely because they are a growing percentage of our farm population. Very little is known about their health status. We are also targeting women on the farms, children on farms and part-time farmers which we affectionately term our multi-job holding agrarians but they do not know what that is.

This is an older farmer who made the statement that he would "farm until it gets me", indicating the fatalistic approach of farming. Knowing that their health is deteriorating farmers still do not retire. They stay on the farm because they love it. If they are going to stay on the farm I think it is our responsibility to make sure that they can do that in a healthy and safe manner.

We have a somewhat hazy view of farm life in Kentucky right now as far as the

health status is concerned. In Kentucky our farms are very small. Most of the time they are 100 to 200 acres and they are family owned and operated. In the Western part of Kentucky we have large grain operations similar to that in Iowa and the Midwest but we do have a diverse farm population so it has made it extremely difficult to target one type of a set of questions that we need to ask.

Farmers also tell us that they do not utilize health services as much as perhaps other populations. We know that farmers are ferociously independent and that is probably one reason that they get into farming. They do not like to be told what to do by a physician or anyone else. They maintain that independence by staying away from medical services we found out. They also cite time away from work as being a factor of not going in to have routine physical screenings for some of the health problems that we know do exist. They do not like going in and waiting in a physician's office half the day while their crops are waiting to be harvested. And last but not least they say it is too expensive, they just cannot afford it.

For 360 older farmers in Kentucky we plan to provide that type of service to them on their farm. We are actually going to take a mobile van to their farm and assist them with a physical screening. This is not a comprehensive examination but a screening tool that we would like to develop for future use.

Just to give you a little background of how they get into this — we have a five minute telephone survey that is being completed by the Kentucky Agricultural Statistical Service called FHADES, that is what we affectionately call it, the Farm Health and Demographic Enumeration Survey, that way we know who is in a farm household in Kentucky. From that we pull a random sample of those four subgroups. One of the subgroups, of course, is older farmers. These farmers are called on a 35 minute telephone interview in which we elicit a lot of information about their health and injury status and how it relates to their farm work. Lastly, the 360 older farmers will be pulled from that sample to receive the physical examination and also a concurrent hazard observation walk about on their farm. So, the same farmer that receives a physical screening will also have the hazard observation team going out. So, for final selection they must have successfully completed the FHADES; be actively engaged in farming not retired, but like I said most of them do not retire anyway; and you must be age 55 and over.

We did the pilot testing in order to help develop and then to refine the instruments. This has proved to be a phenomenal task because we would like to gather a lot of information in a short amount of time and make sure it is scientifically correct. To refine the instruments we tried to target different areas of Kentucky and actually target a certain question each time we went out on a pilot. One of the main things we needed to do right away was to decrease the time burden both for ourselves as investigators and for the farmer because we know that he cannot give up a half a day of work while we poke and prod him all that time and neither can we. That is the main emphasis that I would like to leave

you with, when you take the show down to the farm it is very difficult to do in a timely fashion.

We also found out, by the hard route, that weather plays a big factor in how we can actually get the mobile van down on the farm and you will see some samples of that later on. You have been in Kentucky a couple of days so you do not maybe realize it but we change rapidly down here. It might snow one day and be hot the next.

The four counties that we have piloted this in have been across Kentucky. The Eastern edge, you notice, is left out. Mostly in the Eastern part of Kentucky is Appalachia, very few farms are up there, so we are piloting in Central and Western Kentucky just to get a feel for how the farmers are going to receive this instrument, how long it takes us to travel and the basic ways actually that we can access the farmers.

There are some advantages to going down to the farm rather than having the farmer come in to us in a health fair setting or perhaps just in a local clinic. The advantages include a decreased burden to the farmer, he can actually go about his farm work until we arrive and we are set up and we are ready for him. That decreases the time burden on him and makes him much more receptive to us coming to the farm because he knows it will be a minimal amount of time that he will be away from his farm activities and he is still available if needed in the middle of that.

We have a very personal contact with the farmer. Farmers have a sense of pride in their farm, often they have been in the same family for many generations so they really like to show these farms off that way they know that we from the ivory towers are coming out to their farm and they have the opportunity to show us where their expertise lies. They have an appointed time at which we will arrive and therefore they do not have to wait on us, if anything, we may have to wait on them a little while.

It also increases our community exposure. I think this is a very important part. As we enter into different agricultural health incentives for that farming community to actually see us out and have that sign sitting there demonstrates that we at the University and at NIOSH and CDC are very interested in the health and well-being of the community in agriculture. And also, we have the advantage then of actually seeing that farmer's living and work site environment which is very very important in the way we develop the tools and what we want to really hone in on as far as the health status of the farmer.

When I say we go to the farm, I mean we go to the farm. We actually take a mobile clinic out and we pull up sometimes to the side of the barn where the farmer is and begin setting up our equipment while he finishes whatever task he is about at that moment, then he will actually come out in his work clothes and enter our mobile van. We do go **down** on the farm.

Like I said, one thing about the farmer is the older farmer can go in the van and be in the middle of his physical while the sons are still out on the farm but the farmer that is engaged in the physical screening

is still available if needed for questions or whatever might come up. We can stop at any point and his operation continues right along so that is a real advantage to us getting our foot on the farm, so to speak.

Again, the personal contact with the physician, the farmers are impressed that a physician will take the time out to come to their farm and give them their total attention for that amount of time for the physical screening; however, it is not all roses, there are a few thorns to this.

We have some major challenges in going down on the farm, one of those is time constraints. It takes quite a while to get to the farms. It also takes time to set up things once we get there. The equipment has to be calibrated. We have spatial considerations; by that I mean when you work in a 26 foot van and you have 3 people in it, everything has to fit just right. We also have a problem of competing noise from the outside. We have had to work on that quite a bit. I will share with you a little bit more about that. And again, that ever present changing weather pattern. None of us can do anything about the weather. It takes us awhile to get to the farms so we have to allow for travel time. One of the things that we discovered on an early pilot was that we get lost real easily.

We decided that we really did not have two days to drive around Metcalfe County and find where Joe's barn was before Molly's cow took sick and died in that field next to it, so we had to come up with some way to communicate while we were on the road. The first thing that came out of the first pilot was we need to get some cellular telephones, so, we equipped ourselves with cellular phones. Actually, there was a hidden advantage to this because all of a sudden it dawned on us that we have a link to all the rest of the world now. If we have something happen down on the farm we could call for help because you just do not know what might happen when you get down there. Some of these people, you go down there and they say, "Well, our phone has been out of order for two weeks." It is nice to have that form of communication. That was a little serendipitous thing that came about.

It takes a great deal of teamwork. Once we get on that farm everyone needs to know his job exactly and precisely and be able to go about it independently to keep those time burdens to a minimum on everyone. You can tell the weather does play a factor. Kentucky, you think of it being South and warm and this was January and cold and yucky.

Inside the van we have a lot of high tech equipment. We have to make sure that equipment is set up and calibrate each farm we go to. We have to make sure that we can squeeze in small spaces, I think is one of the reasons I have been going out because I am small and I can fit in there. We have to make sure that we can set it up and take it down and know where it is each time between farms. Each person has a task. It is somewhat akin to an operating theater where each person has to know exactly what is anticipated and be trained in that and about the only way we are going to be able to do that is to actually pilot these things and get it down to a fine art.

One of the main problems has been with the audiology component of our physical screening. We have tried a various amount of things and nothing has worked until this point. We think we might have it solved on our next pilot. Because sometimes we have to run the unit off an external generator we were having a horrible problem with noise. The company that has been servicing the van has tried a variety of mechanisms: putting a generator in a box and moving it away and things like that, but we still could not come within the levels of specification so we have devised a different type of cellular block for the van that will be used on the remainder of the tests.

There (on slide shown) was one way we tried and we found out that that was worthless, it did not work at all and besides that it was very heavy. It could give you a hernia. We are into injury prevention and not secondary intervention so we did away with that one in a hurry.

I think the worst factor, particularly for those people from NIOSH who have been out on our pilots, we all agreed that January is a miserable time to go down on the farm and so is March, right after a blizzard. When you have to work in these kinds of conditions I do not know that it is really conducive to good science. We cannot do anything about the weather so one of the things that we have come up with is the fact that if the van cannot make it to the farm or if it gets bad enough that it looks like this (slide shown) at the entrance to the van then perhaps the best thing would be to devise some other way to go about these.

We asked the farmers what they would like and they said the county extension agent's office usually has a conference area. That is a very non-threatening area, a place they are used to and they willingly agreed to come into that. We have pilot tested that and it has worked extremely well. So, if the blizzard hits next year in March or if the rains come again, heaven forbid, we could still go on with data collection. By conducting these pilots we have learned as we have gone along.

Once the participant is inside the van the physician talks with him about his occupational history which I think we must consider the most important part of the whole thing because it lays the framework for the rest of the examination, what the physician will be really looking for during that screening. (Slide shown.) The farmer is really sort of puzzled that we want to know about his working environment and his exposure, and yes, this was this gentleman's farm. I know there is no rollover protection system (ROPS) on that tractor but the reason there is not is because there just was not on that farm. That is what we usually find, older farmers work with older equipment. They do not realize that things like exposure to the noise from a tractor is detrimental to their hearing.

Another advantage that we have of being on the farm is that since we are right there at the farm when that farmer forgets to bring his medications, his hearing aid and his glasses he can run right back into the house and pick those things up and bring them out. We only have one shot at this fellow to get a complete screening exam

done so those things are very important. They can just go back and retrieve those items.

This is a schematic of the mobile health unit. We have rearranged it so many times that this may not even be the latest one. The farmer actually enters in the back of the van and has a physical history taken then we set up a postural sway device, while the farmer is back here having the examination by the physician then the technician is in this middle area calibrating all of the equipment. As soon as we finish here the technician takes over and the physician stays in the back and can actually take that hard copy instrument and can be down loading to a lap top computer. It works quite nicely as a joint effort there. There is not a lot of back and forth for the farmer or for us.

We do a variety of tests and we had to make sure we utilized every inch of space in that little van so we have every cabinet area covered with something. WE have to know where everything is so we can reach it very quickly.

The one problem that we did have is with our postural sway. One thing we are targeting is the propensity to fall among older farmers. We do a postural sway and it is very difficult to level the van for that and have it secure. We also have some spatial considerations as far as the arm length is concerned. We think that we have rectified that by moving some of the equipment out of the back room.

The vision testing machine swings back into the audiology booth and then just swings out. It is pretty tight quarters but so far we have managed to get all of the farmers through it. We have to squeeze sometimes.

One great advantage to this is that while we are doing the physical exam when the Hazard Observation Version (HOV) team goes out we have data available to them on the spot. If that farmer has reported that his hip hurts him when he gets on the tractor in a certain way or he has fallen down a set of stairs we can relay that information to the HOV team and they can go out right and take those direct measurements. We do not lose any time there and the farmer can actually accompany them to that place on the farm. So, if their memory has been jogged by the questions that the physician has asked in the medical history he can then relay that to the HOV team. I think we are doing a better job of getting good data this way.

Just to let you know that all Kentucky farms do not look like Calumet that you saw when you flew in or you drove up Versailles Road, it is very picturesque around here, but a lot of our older farmers farm in this type of situation. This farm was in this family, I think, for 150 years. He told me this barn is 125 years old. These are the types of conditions that older farmers in Kentucky often work under, older equipment, older buildings, and there is certainly much more of a chance for injury and for failing health because if you go in there and you get in the corn crib in that particular log barn you will find out that the dust levels, not only from the corn, but from 100 years of cobwebs that are in there too. There is a lot of different expo-

sure for older farmers in Kentucky and we are interested in all of those.

As we end up our visit to the farm we make sure that the farmer knows that we really appreciate their help. We are giving a little commemorative plaque to the farmer. We display our sign prominently so all the neighbors know that we are not there for some drug bust or something like that that goes on, particularly at this time of the year in Kentucky.

We want them to know it is a farm health survey. When the neighbors call they know what their neighbor has been doing. As soon as we leave the phone starts ringing and they have to explain what they were doing. We wanted to make sure that they realize this is very legitimate. They have this piece of paper that they can hang on their wall. The fellow on the left there, it is kind of a dark slide, we work very closely with the county extension agents. We found them to be just irreplaceable for laying the ground work for us to come in as part of the University to develop and refine this very important tool that we see as perhaps a beginning tool for a fitness for work examination for farming in general, but particularly for our older farmers.

In this industry, it is very unique and physicians often do not know what to look for with older farmers and do not know why the hips are deteriorating or whatever. We hope that the instrument that we are developing for this will give them some guidelines. Thank you.■

Multimedia Safety Training

By *Joel B. Lown*
University of Tennessee

DR. HERRICK: Thanks, Deborah. Our next presentation is going to be by Joel Lown. He is with the Agricultural Engineering Department at the University of Tennessee. As you can see from his title it is Multimedia Safety Training, in keeping with that Joel is going to demonstrate some of his several media here and do it from his position here at the end of the table. He will be making his talk from over here.

MR. LOWN: As you can see there, the title is Multimedia Safety Training. I would like to acknowledge Tim Prather my colleague and the Project Leader. We are shooting from the hip here. We have never done this for a group like this. Between Knoxville and here I lost 240 out of my 256 colors, so I am down to 16. I do not know what else is going to go but we are going to try for it here.

We are part of the Tennessee Agricultural Health Promotion System cooperating those entities shown with NIOSH. Our objectives are to define multimedia training, to show you some samples of some things we have been working on in Tennessee, walk you through the development cycle of a typical multimedia application, talk about some distribution options, user and trainer acceptance, some advantages, and then give you some suggestions of how you might incorporate this in your work. I want this to be more than just what we are doing, I would like it to be a little bit of an advocacy presentation.

First, to loosely define multimedia, I would say that it is computer software that may include hypertext, I am terming this software that lets the user determine both the sequence and the depth of instruction that they want; visuals, this could be drawings, photos, animations, full motion video; audio, you see the component shown there, some of you may not know this but almost any PC compatible computer on the market now does have some rudimentary sound capabilities if you tweak it hard enough; printing on demand, if your facility is like ours we have a very large mail room with aisle after aisle of publications, this type of technology has the ability to print on demand where you get just what you want when you need it; and finally, something I am very excited about and that is user tracking, whether overt or covert, overt being the user knows that you are finding out about him, he is answering questions deliberately, covert, you are making assumptions from his responses and his actions.

Let us go to some samples. Have we got the screen here? Can you see this as well? One of the ways we are distributing this is in a kiosk. Anything I am doing up here can be done by touching the screen but is a little easier for me to do it from here.

I want to talk quickly about four different possible applications for this type of technology, some of which may apply to some of your efforts. The first is as a data base

front end. We have collected a lot of data: fatalities, injuries, that kind of thing. The question is how do you get it out? How do you keep it current? How do you keep those graphs current so that when the newspaper reporter calls and wants to know how many fatalities of this kind did you have you can give him an answer? That is one area that we are looking at.

This is a screen of how we have begun to track farm deaths in Tennessee. At the bottom here you see a section with an individual incident, very limited information there. We can page through and look at various records.

You can also come in and look at it in a different view much as you would with a spreadsheet. Here I want to look at the incident category, some of the causes. You might think about that for your databases. There are ways to pull this information in basically real time.

The second application I would like to discuss is as a catalogue. Many of you have sent us very good videos, one of the challenges is to get those used. Another option is to use it for the ROPS retrofit effort as Marshfield Clinic has done.

Here is a sample clip from a video catalogue. You have got the title of the video, length, date, a short description. This is a bit map from the front cover.

The technology that I am very excited about is the ability to show video on the screen. Again, I told you I lost most of my colors so this normally looks a lot better. If you are thinking, "my that's a mighty small window", this technology is in its infancy and within a year or two we will be able to do full screen full motion video on the screen.

Again, there is no video cassette player involved here. It is all in the computer.

A third application I would describe as user tracking. This kind of falls in the surveillance category.

Here we have got a keyboard on the screen. You can touch type as it were. I am just going to enter my name here. It gets pretty old if you are used to touch typing but it is one way to get around having a keyboard that people can tear up. You do not have to do it all with text, you can use graphics. What you end up with is a database of who your users are and you can ask whatever sorts of questions that you want.

The final application, I think some of you have seen this at other meetings, is in the area of specific hazards, we chose chain saw safety since that is our number two killer in Tennessee. If you notice on the screen we have a graphic here and then some navigation buttons up here. At anytime you can print the screen image. You can navigate through the pages. There is a set of tabs over here that correspond to certain topics. We will look at "Saw Dangers", after the presentation yesterday on real time video noise this would be an ideal application for something like that.

We will go now to "Felling a Tree". One of the biggest problems with tree felling is that people do not make the right kinds of

notches so to illustrate that we have done a little animation here. If you make a notch that is too shallow you have one of two options: either the tree can hang, which is not good, or the hinge of wood that is holding the tree can break prematurely, which is also not good.

Finally, one more sample I will show you. When the butt of the tree breaks loose from the trunk that is called "Butt Rebound". If you see the picture here, you have got a large log lying horizontally and then two small saplings that have been knocked down. If you really want to know what happens, though, you need some help so here we show the tree as it begins to fall, then the top is trapped by other trees off screen and the butt swings up like that. That is actually what happened in that picture.

Once somebody has gone through this they can take a quiz. And for a right answer. (Sound demonstrated.) (Laughter.)

For a wrong answer, we need a better noise for this. Tim keeps getting after me because this one just does not quite do it justice. (Sound demonstrated.)

So that gives you an idea of the chain saw program. It is about 90 screens of information.

I would like to talk a little bit about the development cycle. This is what has seemed to work for us. Collect our current material; reformat into smaller manageable bites; add your clips of audio and video; provide some sort of navigational system, (we have chosen to go with a main screen); get something out the door, this is key; peer review it for accuracy; user test it for friendliness; incorporate the changes and start over again.

How do you get this out? One option is a computer bulletin board. We have not really explored this. Another is you can distribute single floppy disks, and in this age of CD-ROM you may be thinking, "What good is a single disk?" Well, that entire chain saw program fits on a single floppy with sound and with photos. CD-ROM, certainly this is the wave of the future, particularly when you get into video which is very very memory intensive. Finally, a kiosk, such as the one you see here. We are attempting to place a number of these throughout the state.

Is it accepted? Yes and no. We find a great deal more interest among young computer literate audiences, among vocational agricultural teachers, as I think Glen Hetzel has referred to. We have found a good bit of cooperation with existing training programs. We have a Master Logger Program in Tennessee that we are trying to work with.

Certain locations are better. If you can place a kiosk in an area that already has other exhibits or displays, that helps them and it also may bring a clientele that you may need to reach.

Finally, I would like to see some of the OEMs get involved in this, the original equipment manufacturers. Why not distribute a disk with that print safety manual that goes out for those who do have computers?

What are some of the advantages? It is effective. If you remember what you heard about how much of what you hear you remember, how much of what you see you remember, how much of what you do you remember, multimedia uses all of those things together. It is economical. I can put out a disk, for the cost of a small print manual, that has a lot more information in it. It is timely. You can update it. You do not have a lot of outdated publications sitting around.

The audience is growing and that certainly is a drawback at this point because the audiences are not that big but they are growing. It may be a different audience that you are not usually reaching. It offers tremendous possibilities for evaluation, a few of which I have touched on. Finally, it is particularly applicable to the subject matter that we are involved with because safety and health events are often either difficult to capture or difficult to repeat or expensive and multimedia, once you have got one of those, to play it back.

Some suggestions for those of you interested in this — brainstorm, how can you use something like this in your program? Try it out. We have got some sample disks on a first come first serve basis. I know that probably Glen or Pierce Jones of Florida would be happy to speak with you as well. Finally, wade in deeper. Try it yourself. It is not that difficult to do. Thank you very much.■

Farm Women's Seminars May Be Impacting Missouri's Safety Behaviors

By *David E. Baker*
University of Missouri

DR. HERRICK: Thank you very much, Joel. There is a small change in the program, rather than Steve Hudock making this next presentation the presentation on Agricultural Educational Resources Centers is going to be made by David Baker who is an Extension Safety and Health Specialist with the University of Missouri.

MR. BAKER: We even have a bigger change than that. I am not going to talk about Educational Resource Centers.

I do not plan to talk about floods. I would like to thank Tim, Betty and Steve and everybody else who has made it possible for me to be here today and apologize for not being here yesterday. I would gladly change places with any of you and give you the opportunity to have a new challenge in your life and new opportunities if you would like to have them.

First I would like to welcome and say hello from the newest great lake. Currently or at its high point this summer the newest lake was 700 miles long, ranging anywhere from 3 to 10 miles wide with depths estimated somewhere between 20 and 30 feet in some places.

It has been a very interesting and enjoyable summer and to say the least our AHAP Project and other things went on hold the first of July, hopefully to be resurrected sometime this winter when things let up and we can have a new opportunity to take a look at some new challenges.

The State of Missouri is a very diverse state. We have said we have about every industry that you can think of. We have the second highest number of farms in the United States, it depends on whose numbers you look at, somewhere between 105,000 and 112,000 farms. You have rice, cotton in the south, corn, soybean, tobacco, forages and livestock such as beef, hogs, sheep, dairy, and turkeys.

As you start looking at what we have been involved in you can look at our program encompassing primarily these issues here: the State Farm Women's Safety and Health Workshops, which we are going to focus on today; the Safety Youth Initiative, SAFEBASE, a computerized database that we have developed which currently has over 500 plus entries and if anyone would like to have it we would be glad to share one with you. We are currently working on developing our Safety and Health Promotion Technical Assistance Program, Statewide Farm Injury Survey using the Ag Statistic Service, a setting up a course for Vo-Ag teachers and finalizing the newest objective, Regional Cooperation and Coordination with some of the other surrounding states, they are involved in the AHAP Project.

More specifically, I would like to focus on the Farm Women's Safety Seminar and

take a look at what we have tried accomplishing with the seminars. There are a couple of reason I chose this area. One, this audience has taken on a more active role in production agriculture in Missouri. With full and part-time farmers, with the economy being impacted the way it is, this audience, has been very actively moving, I hate to say this it is very sexist, from the kitchen to the farm and taking on the dual roles of a mother, housewife, and a full-time farm operator and managing.

The farm woman is also, as I perceive them, a very key group to impact my target or my industry. One, they will have a direct impact on the behaviors and attitudes I think that the next generation is developing. They will have, and after being married as many years as I have, they do have a direct impact on the way that I do certain things. I think that they can have a positive impact on some of these males, who may be very self-centered, independent, and have done it this way so long and see no reason to change. As a matter of fact, we have some success stories, if you want to classify them as success stories. There are, certain counties that have reported that as the result of the seminars, husbands are complaining that they wish they hadn't sent their wives to the workshop, because they nag them to do things differently.

There is also a need and a willingness to learn. They do not bring some of those same paradigms to the table that we have with our male population. They are willing to do things differently and safely. They do not bring some of those biases and those practices that we have learned to accept in our male population.

The program, typically, is a full day. We would like to start them at approximately nine o'clock in the morning, run until two-thirty in the afternoon. These seminars are primarily run during the school year. We do not want to interfere with the parent part of this, such as getting the kids off to school or picking up the kids after school. That is a situation that we do not want to interfere with.

The womens seminar is focused on a classroom session. The seminar will target on areas that the Planning Committee identify that they would like to have covered. Although, the fundamentals of hazard control, tractor machine controls and operation and the first responder are core pieces that we try to urge local planning committees to include and not change, as a matter of fact, we get at times very difficult and say, "Those are going to be a core piece, from there on we will develop the program based on your local needs."

We also like to have, what we call, a "hands-on" session. That is primarily giving them a chance to operate equipment, work with that equipment, go out in a lab type format and work with the equipment. There are some other key people involved here that make or break this program. Local county health departments provide health screenings, do the first responder type training for us and do it very successfully. The Farm Bureau has been very actively involved in promoting the program. The other key group that is involved are the machinery dealers. Without them, this program would not be possible, as far as I am concerned. We use their facilities and use their equipment.

Probably the most difficult group thought to focus is the emergency medical professionals — EMTs, because when you ask them to do a first responder type program they want to turn it into a 16 hour first aid course and you give them a half hour and that is a little difficult to do. The county health nurse does a much better job of identifying the key issues that they feel the first responder needs to know. A spin off of this program is that we are now doing a full day training program with our nurses to better prepare them to do intervention work.

What we have attempted, is to gather data on perceptions and behaviors and attitudes of our population that attend these seminars or workshops. We have used the Statistics Department and we used the Department of Rural Sociologies to help us develop the instrument. After using that instrument I had some real concerns on the quality of some of the data that we are generating and would like to back up and redesign the instrument. We did not pre-test it, which was a mistake. We did not go through a whole lot of the things that any researcher would love to do. We did try to quantify, at least to some extent, the perceptions and the attitudes of the population.

We gave this survey to everyone that attended the workshop. We now have two years of data. One year later, or approximately six months to one year later we post-tested the audience that had attended or gone through the workshop a year earlier. We had 213 attend the first year's workshop, of that group only about 143 gave us completed forms that were usable such that we had addresses, phone numbers, things that we could follow-up, and were completed. So, out of that sample we received 96 responses to the follow-up survey, or about 66 percent of those that were sampled.

We sent them the same identical survey that they had completed six months to a year earlier in their workshops. Some of the findings — we did Chi squared at the .05 level, so everything I am giving you here will be items that had a significant change. I will say this, of the 47 items that were on the original test 22 items showed significant change, some of them positive, some of them negative unfortunately. About 90 percent of the items did show a positive shift in behavior.

I am just going to review five or six of these items. For example, one of the questions that was asked, "When small children asked to ride on a tractor do you allow them?" On the pre-survey, the majority responded that at "sometime" they had allowed children to ride on that piece of equipment. In the post-survey we saw that 57 percent of the respondents had indicated that they no longer allowed children to ride on the equipment.

To give you an idea of the shift from year one to year two we saw a 23 percent shift in that response. Thirty-four percent in year one said that they would allow the children never to ride on a piece of equipment. In year two, 57 percent indicated that they would never allow children to ride on a piece of equipment.

We did have some failures. For example,

in year one we had less than one percent say they would never refuse the children from riding on farm equipment. In year two, two percent indicated that they never told the kids they could ride on the equipment. It is a small number, but you have to be concerned that all your participants did not change their behavior.

Another question we asked is, "Do you wear hearing protection?" What we did was try to identify the injury and illness issues that we knew or we had data that at least indicated that we had risk levels, whether it be tractor overturns, hearing losses, things like that. We wanted them to take a look at a specific behavior and see what their behavior was in relationship to the potential injury or illness. "Do you wear hearing protection?" Fifty-four percent indicated "no" in the pre-test, post-test 72.3 percent indicated that they did wear hearing protection. I think we had at least an increase in the use of hearing protection.

Another question I would have liked to have asked was the type of hearing protection, where they got it, so I could have a little more quantitative data. We did give them hearing protection equipment when they left the workshops, primarily foam hearing plugs. I hope they are not still using that same set of plugs. We have got at least some accomplishment there at that point in time.

"Do you operate a tractor with ROPS? Are seat belts worn?" You can see we have a great deal of work still to do getting farmers and farm women to use seat belts. Still, one year later, 50 percent of our population are never wearing the seat belt. We do not have and did not differentiate between tractors with cabs or two post frames. But there is at least some increase in that some of the operators are wearing seatbelts all the time.

"Are you familiar with the machine operations on your farm?" "No", indicated 12.2% when they attended the first workshop, 4.2% indicated they still had a lot of learning to do. But you can see that we saw a dramatic increase on the other end, 29 percent felt they did, 44 percent in the post-survey. So, you can see it was a significant improvement.

"Are you aware of the hazards of bypass starting?" This is one of the areas that they were aware of when they attended the first workshop because we had a number of accidents occurring with bypass starting. Pre-test 71 percent indicated they were aware of the hazard. In the post-survey 95.5 percent indicated that they were well aware of the hazard. This survey has provided us with some very — follow-up data to use in planning future seminars.

Another piece of equipment or resource material that we developed — each attendee was given a safety and health resource notebook. We wanted to see if that notebook was being used. This gave us a little indication of the amount of usage that notebook was given as far as their usage after the workshops. We really had urged them to use them with their family, to talk about safety and health issues on their farm during a short workshop dinner type session. The issue I would like to have followed up here, and I did not do it, was to

find out how the notebook was being used, and how we might improve it.

"Would you attend another farm women's workshop?" Eighty percent indicated they would. They strongly urged that we do the workshops on an annual basis. As you can start seeing, we are looking at about 55 percent respondents requesting an annual workshop. I think the need is out there. I think we are accomplishing some things. If put to the test, and you asked me "Dave, are you really shifting behaviors?", I cannot definitively say I am shifting behaviors but I do believe we are increasing awareness.

I would like to thank you. Again, I would like to thank anyone that has sent anything to flood victims in the State of Missouri. Anyone that is looking for some work, we would be glad to take you on a special assignment and put you to work in the state, at least cleaning up at this point in time. Thank you. ■

Comparing Kentucky Farm Injury Severity with Existing Injury Models

By *Michael Auslander, D.V.M., M.S.P.H.*
Kentucky Department for Health Services

DR. HERRICK: Thanks, Dave. I do not think anyone here minds that you gave that talk instead of something called Agricultural Educational Resources Centers; however, I guess I should be a little more cautious in these introductions. Are you Dr. Michael Auslander? Would you like to talk to us about Comparing Kentucky Farm Injury Severity with Existing Injury Models?
DR. AUSLANDER: That is right.
DR. HERRICK: Well, please do so.
DR. AUSLANDER: Today only.

DR. AUSLANDER: Like Debbie, I am a Kentucky native and as an employee of Kentucky I feel like I should welcome you all to Kentucky also. We are glad to have you here. What I am going to present today is one idea, so, I am going to tell you this one idea immediately and then you can take your nap.

Then you can go to sleep. What I am going to do after I give you the one idea is mostly just go off on a tangent and meander for about 10 more minutes to try to prove my point.

But my great idea came as a result of the first year's data in our study, which is an OHNAC Project. We call it Traumatic Farm Injury Surveillance of Kentucky.

My great idea is that after looking at one year of data farm injury severity is greater than the severity of injuries associated with other areas. I am going to show you this through the use of a model which we all know and love and that is the injury pyramid.

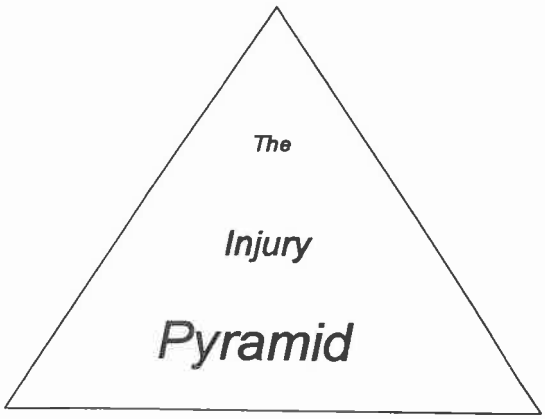


Figure 1

Most of us in injury control have seen this thing at some time or another. See Figure 1. We cannot quite remember where it was that we saw it but we did see that. In most injury pyramids, right at the top, there is usually something that says death or some other measure of disability and then a little further down is hospitalizations or a lesser grade of disability and then at the bottom are emergency room visits or medical treatments or some other less severe measure of disability.

Before I give you some examples of them

I would like to tell you a little bit about how we collected our data. In our project what we are doing is that we are getting case reporting by primary health care providers in nine counties of Kentucky. These nine counties are in three separate areas. This is similar to the map that Debbie showed but I have different colors for different counties. You can see they are distributed through the Central part of the state.

We have an occupational nurse in each of these three regions, who most of you know, and they do an outstanding job for us in collecting our data. We are real happy with the work that they do.

The primary health care providers in these areas provide our data which includes hospitals, of which there are seven hospitals in these areas, also physicians, dentists, and chiropractors, and also we have a working relationship with coroners and EMS units as a way to cross check those reports that we do not catch through the health care system. Obviously, certain fatalities do not ever make it to the health care system.

When we get this data our nurses abstract the material from their medical record. Probably the strong point of our program or the reason it has been so successful, in my opinion, is that the health care providers only have to do a minimum of work. All they have to do is tell us they had an injury. We make it as simple as possible. We have a postcard with one check on it and they do not even send it to us, our nurses go around to the hospitals and health care providers periodically and pick them up.

Once our nurses are notified of an injury they abstract the information we want from their medical record. We have three sentinel events in which we do follow-up interviews. These sentinel events are injuries due to machinery, injuries to children, and injuries due to falls in people over 54. For these three sentinel events our nurses conduct in person or telephone interviews with the injured party or responsible party in the case of a child.

Once they abstract their information into our reporting forms it is transmitted to me on a computer disk and then I am the nerd behind the computer that aggregates it all. Along with my colleague, Dr. Spurlock, we try to analyze it. Once we analyze it, or course we try to disseminate this information, that is one of the objects of surveillance. We do this through different paths. One is I try to produce a little newsletter to all of our health care providers every six months and we try to return information to NIOSH on our quarterly reports, as everybody else does I am sure. We also share information through forums just like this. Also, our nurses are very active in their areas in conducting intervention and prevention programs when asked to. So we have a local outlet for the dissemination of this material, also. Also, we have been fortunate, I think, in that we have had a lot of media coverage. If you have dealt with the media a lot sometimes that can be good and bad but we do get a lot of media coverage so we feel like that is quite successful in disseminating the knowledge that we are gaining.

Right now we are occupied mostly with surveillance. We may shift our concentra-

tion to intervention and prevention as we accumulate more statistics. We have one good year of data which I think is a good sound data base for us at this point. In these 9 counties alone we have 610 injuries that required medical care.

What I am going to do next is present my first injury pyramid. See Figure 2.

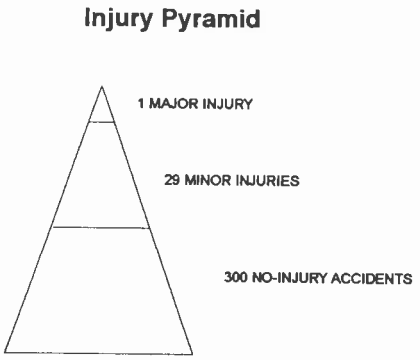


Figure 2. *Industrial Accident Prevention*

This is one that is the classical injury pyramid. This was proposed by a fellow named Hienrich about 40 years ago. He proposed that for every major injury there were 29 minor injuries and 300 accidents that really did not give rise to any injuries.

It is interesting that we are interested in agricultural injury and injury control. Hienrich, as a little bit of a background, was a Superintendent of Engineering and Loss Control for the Travelers Insurance Company. That is, the original interest in the injury pyramid was from an insurance company. That was about 40 years ago.

Before I go to the next injury pyramid I would like to dredge up a terrible memory for you. The reason this is a horrible memory is that it relates to something that you learned somewhere between the grades of 1 through 12. It was such a horrible memory for me I do not remember what grade I learned it in. Somewhere along there we learned the formula for the area of a triangle.

Yes, I see the expressions. See, I told you it was a horrible thought. You remember, I am sure, that the area is one half the base times the height. When I drew these charts today I tried to put them in perspective by maintaining the height as being about the same I am varying the base width, and therefore the area is in direct proportion to the ratios which they reflect. That was a mouthful. Try to keep the perspective in mind when we look at these.

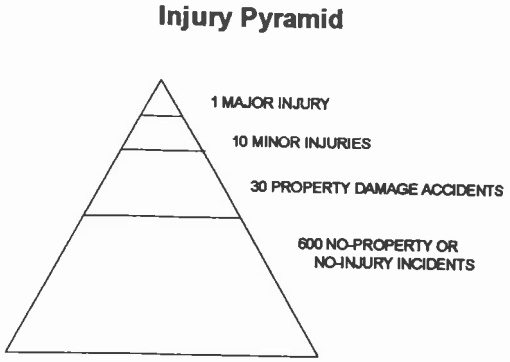


Figure 3. *Bird Accident Ratio*

This is called a Bird Accident Ratio because the fellow's name was Frank Bird. See Figure 3. People first see that and they do not understand what birds have to do with this. Frank Bird, in about 1969 came out with his injury triangle. He felt that this reflected things a little better than Hienrich. For every major injury there were 10 minor injuries and 30 property

accidents and then 600 no property or no injury accidents. He developed this about 1969.

Figure 4. *On the Practice of Safety*

Apparently he did not like what he did in 1969 because a little later he came out with a fellow named Loftus, and they modified it again. This is the injury pyramid they described of 1 major injury per 100 minor injuries to 500 no injury accidents. See Figure 4. I might add that Frank Bird also worked for the Insurance Company of America. So, up to this point, the interest was by insurance companies.

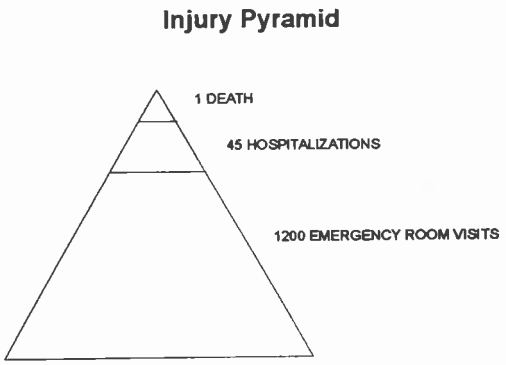


Figure 5. *American Medical Record Association*

The next one we see is a modern injury pyramid. See Figure 5. This is from the American Medical Record Association in a 1991 position statement. In their position statement, and I would think that the American Medical Records Association (now named American Health Information Management Association) has pretty good medical records, they state that for every death that hospitals had, there were 45 hospitalizations and about 1,200 emergency room visits. You can see that this is a very broad triangle with a very broad base for each death.

This is another study, a contemporary study, that is very similar. See Figure 6.

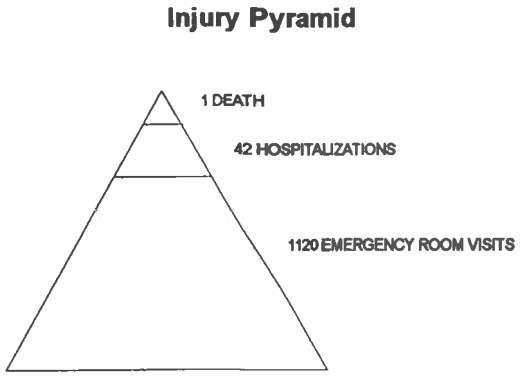


Figure 6. *A Data Book of Child and Adolescent Injury.*

This was done by Susan Gallagher in a Massachusetts study of 87,000 children and adolescents between 1980 and 1981.This has been reported in the American Journal of Public Health before. I find it a very credible report. This particular pyramid is one I drew but there is a very similar picture of it in *The Data Book of Child and*

Adolescent Injury. She describes one death for 42 hospitalizations for 1,120 emergency room visits which is very similar to the last one we saw by the American Medical Records Association.

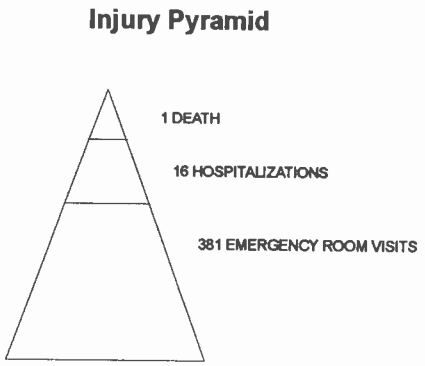


Figure 7. *Disability in America.*

This next pyramid is the one that probably made me think of this presentation because I learned it somewhere in an occupational medicine course that I took when I was getting my Masters in Public Health. See Figure 7. It is very familiar to a lot of you. I am not sure who actually developed this pyramid but this ratio can be found in the book *Disability in America* which is a 1991 publication put out by the Institute of Medicine. These numbers may be the most familiar because the numbers themselves stuck in my head when I was thinking about this. It is 1 death per 16 hospitalizations and 381 emergency room visits. I know that this particular triangle has been used to describe industrial accidents also.

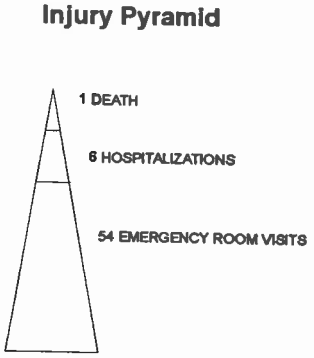


Figure 8. *Traumatic Farm Injury Surveillance in Kentucky.*

This is our injury pyramid. See Figure 8. This is the Traumatic Farm Injury Surveillance in Kentucky project; we had 610 injuries in our study of which 80 percent were actually farming activities. In that 610 injuries for every death we had only 6 hospitalizations and 54 emergency room visits so read it from the bottom up — for every 54 emergency room visits we had, we saw 6 hospitalizations and one death. Very different from the pyramids that I could find that have already been published. Very alarming also.

It gets scarier. This involves all of our 610 injuries. Like I said, 80 percent of them are due to farming injuries. That 20 percent includes other injuries on the farm such as recreational injuries which might be riding a horse or hunting and then there is a large proportion of that 20 percent that are household injuries such as cutting the grass, fixing the roof, falling down the stairs, that type of thing.

Of course, there is that ubiquitous category called "other" which I have learned in making instruments now that it does not

matter how many things you think of you still have to have "other." There is always something you did not think of. My classic "other" is that we had a woman who was coming out of an outhouse and tripped and broke her arm. That certainly was not a recreational injury. I do not know that it was a work related injury either, unless maybe she was overcome by organic pesticide poisoning and it was related to that.

If we look at just the 80 percent of these injuries that are really farm work related or production related, which I heard some people use, that bottom number drops to 47 injuries. So, for every 47 work related injuries we saw 6 hospitalizations and 1 fatality, which is even more alarming.

Just to review all the charts I have gone over, this is a composite of all the different aspect ratios. See Figure 9. We see these that list ratios of about 1 to 1,200; and then the insurance industry listed ratios of about 1 to 600 per injury severity; and then industrial accident 1 to 300; and or course we had the one from *Disability in America* that is about 1 to 400, 1 to 381; then we look at ours, 1 to 54 or even 1 to 47 if you consider farming related injuries only. I find it quite dramatic and feel like things that we have once learned may not be applicable to farming per se and it is a much more hazardous occupation than we may have ever anticipated.

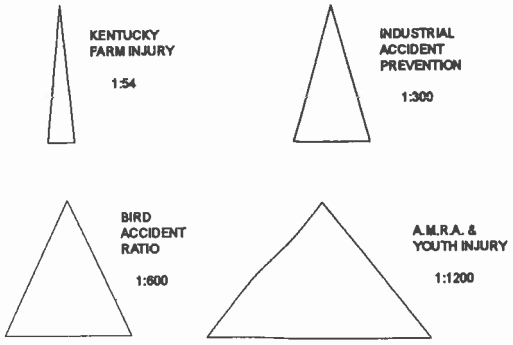


Figure 9. *Relative Aspect Ratios.*

Those of you who took a nap can wake up now for the next presentation. I appreciate your time.■

Mortality After Workers' Compensation Claims for Disease and Injury in Agriculture

By *James Beaumont, Ph.D.*
University of California at Davis

DR. HERRICK: Thanks, Mike. Our final presentation this afternoon is by Jay Beaumont. I have known Jay for a number of years. I met him first when he was an epidemiologist at NIOSH. He is now with the University of California-Davis where he seems to have made a full recovery. He is here today to present on the topic of Mortality After Workers' Compensation Claims for Disease and Injury in Agriculture. After Jay's presentation we will open the floor up for any comments or questions or discussion you would like to have.

DR. BEAUMONT: Thanks, Bob. I am going to tell you about a study we performed of Mortality After Agriculture Illness and Injury Claims, based on worker compensation claims in California. I would like to acknowledge my co-authors, David Goldsmith, Lynn Morrin, Pat Thorpe, and Joel Scwartz.

We had several purposes in doing this study; one was simply to assess the feasibility and the usefulness of the method. As far as we know, nobody has previously performed follow-up of mortality of worker's compensation claims in agriculture or elsewhere. We were not sure what we would be getting into and how useful the results might be.

Another purpose was to test several hypotheses. Our primary hypothesis was that respiratory disease mortality might be high, because there are many claims for lung disease in the compensation records, and because in a previous study called the California Occupational Mortality Study, we had seen a statistically significant excess of COPD or Chronic Obstructive Pulmonary Disease, after controlling for smoking.

Other hypotheses included suicide, based upon reports from the Midwest by Paul Gunderson and others showing elevated suicide rates in farming; injury mortality, because most of these workers continued to work in agriculture; and cancer, because of previous reports f high cancer rates in farmers. Finally, a ??? was hypothesis generation, because with the study design we could look at many different causes of death, and we did.

I will briefly go over the study design. The epidemiologic design was historical cohort. The health outcome was cause specific mortality. For comparison (control) group we used U.S. mortality rates. The study period for cohort entry, this is the period over which the claims occurred, was 1946 through 1975. We stopped in 1975 to allow a significant or substantial observation period after claims were filed. We looked at the deaths over the period 1946 through 1991.

Our data sources for claims was the California Worker's Compensation Appeals Board. There were some pros and cons of using this as a data source which I will get

to later. We ascertained our deaths through the California Departments of Vital Statistics and Motor Vehicles.

A few words about our sample selection — we did not cover the entire State of California; the Northern mountainous regions we left out. The regions have city names, which is a bit misleading. The offices are located in these cities but the offices actually represent very wide geographic areas. For example, the Northern California regions encompass most of the San Joaquin Valley of California.

We used all the respiratory claims, all the pesticide illness claims, and a random sample of other claims because there was a high number of other claims that was almost entirely injuries. We took a random sample that was approximately three times larger than the number of respiratory and pesticide claims. Using those methods we had a total number of claims of 1,077.

This is a distribution of claims and deaths by year. The green bars are the claims and the red bars are the deaths that we found, by decade. The number of claims did increase over time and leveled out in the 1970s. Because we stopped in 1975 we did not have any claims in 1980. The deaths steadily increased over time due both to having a larger study population and the age of the population.

We divided the study population into subcohorts in two different ways, two dimensions you might think of. In one dimension we divided the population on the type of claim that they had. This slide shows the different categories of claim types. The other dimension, I will tell you in advance, was by type of agricultural industry. In terms of type of claim, we had 168 persons with lung conditions, 765 with injuries, 81 with agricultural pesticide illnesses, and 67 with non-agricultural pesticide illnesses. One of our major study issues was whether we should include the non-agricultural pesticide illnesses. There are pros and cons to including them. A pro to including these people is that the pesticides that they use and their illnesses are relevant to agricultural exposures. On the other hand, they were not in agriculture, so our study is not strictly agricultural.

We have elected to include these non-agricultural pesticide claims at this point but I would appreciate any comments you might have on that issue..

This is a further description of those four different cohorts. First, the respiratory claims. For Valley Fever there were nine claims, (this is a coccidioidomycosis) allergic rhinitis was the largest category with 71; the other claim categories were silicosis, 9; other pneumoconiosis, 33; pesticide exposures, 22; other chemicals, 40; and 1 other.

In terms of the injury claims, by far the largest number was from traumatic injuries. We had quite a few musculoskeletal and hernia injuries, and a scattering of other types of injuries.

(Slide Shown). This table shows all of the pesticide illness claims combined. I have simply broken them down by whether they were systemic poisoning or dermatitis, and by far the largest number was systemic

poisoning. In scanning my computer print out there was a very large number of parathion poisonings.

(Slide Shown). This table divides the cohort by the other dimension which is agricultural industry. It also presents data on those cohorts. Let me first tell you a little bit about these industry classifications. Primary agriculture is both crop and livestock production; agriculture-related includes services and grain mills, irrigation services, that sort of thing; food processing includes canneries and bakeries; timber and lumber is self-explanatory.

Let me just run down the right hand column which is the total for all agricultural industries. By the way, since this is agricultural industry, this slide leaves out those non-agricultural pesticide illnesses, so the numbers are less here; 1,010 instead of 1,077.

These claims were: 90 percent male, mean birth year 1916, mean age of claim was 47, mean year of claim was 1963, the percent deceased was 43 percent, and the mean award amount was $2,324.

At this point I would like to bring up another issue that we are facing and that is the fact that about 20 percent of these awards were for $0.00, so the issue is whether we should include the claims where eventually no money was awarded. So far we have elected to include them because we have been told that a major reason for the zero awards is the subject not showing up at the hearing. With a very large migrant component to this agricultural population we felt that maybe these claims were real, but it is a quandary. By the way, there were no major differences between the industry cohorts with regard to these variables, so I will not get into those minor differences.

(Slide shown). This table shows mortality results for the Agricultural Lung Claims Cohort. Let me first explain the layout of this slide. The vertical scale is the standardized mortality ratio (SMR) which is the ratio of observed and expected deaths. If the SMR was statistically significant, we indicated that with and asterisk. We drew a white line at an SMR 1 which indicates normal, no excess or deficit, to give you a reference point. The computer program we used was programmed by Gary Marsh from the University of Pittsburgh. It generates 62 different causes of death routinely which is too much to present all at once. I presented here the major cause of death categories and the more interesting findings.

For all causes of death in this cohort the number of observed and expected death was almost equal so the SMR was 1.1. With regard to cancer, there were no significant findings. The all cancers SMR was 1.3. Let me point out the SMR for respiratory cancer which was 0.8, indicating that smoking was probably not excessive in this population. Prostate cancer was a little bit high but not significant; it was a small number of deaths (three). Lymphatic and hematopoietic cancers were most elevated at 2.2 but, again, based upon the small numbers, it was not significant.

With regard to circulatory system diseases (stroke and heart disease), both of those

occurred less often than expected (SMRs of 0.8 and 0.7 respectively) which is fairly typical of a working population.

Where things get interesting is with the non-malignant respiratory diseases. The darker yellow bar is for all non-malignant respiratory diseases combined, for which there were 24 such deaths. I believe there were 7.7 expected deaths, that gave a ratio of 3.1 and was statistically significant. Emphysema had the most deaths and had a very highly significant SMR of 5.7. Other respiratory diseases had an SMR of 2.6.

We looked at the respiratory deaths more closely, first of all in terms of exposures, i.e., what kinds of respiratory exposures they had that led to their claim. There were 24 such deaths. The largest category of exposure was to wood dust for which there were six deaths, of which half were from logging and half were from lumber mills. The next largest exposure categories were rice dust which had three deaths; coffee dust which had three deaths; and flour dust which was associated with three deaths. Then we have a scattering, one death each from a wide variety of exposures ranging from hot lime dust and sugar refining to bean meal dust.

(Slide shown). We also looked at the non-malignant respiratory disease deaths by the agricultural industry. The first row in the table is for all causes of death. The second row is for all non-malignant respiratory disease. Here we saw that there was no association with a particular industry; the excess risk was pretty well spread out, with all of the ratios being right around three.

With regard to emphysema and other causes of respiratory deaths, we did see some differences in risk. Timber and lumber had the highest risk for employees. Food processing, on the other had high risk from other non-malignant respiratory disease. I am not sure why these differences occurred. Some of these numbers were pretty small.

(Slide shown). This graph shows non-malignant respiratory disease mortality again, but this time by length of time since claim. Interestingly, we found that the peak mortality occurred five to nine years after claims were filed. I thought maybe the peak would occur right away and go down, but instead the deaths occurred at a peak level of almost 10 fold risk at 5 to 9 years and then went down from there. Both the 5 to 9 years category and the 10 to 14 years category were statistically significant.

Moving on to the other type-of-claim cohorts. This is the injury claims cohort where we had our most subjects. Here the all causes SMR based upon 313 deaths was just 0.7, so there was a significant deficit of deaths overall. In terms of specific cancers there were no significant excesses but, there was overall a significant deficit at 0.7. Cardiovascular diseases were low. With regard to our apriori hypotheses, suicide was normal. Only motor vehicle injury was elevated but was not significant. Cirrhosis of the liver deaths were excessive, but were not significant.

Finally, the pesticide illness cohort. Here the mortality was about normal, and there were no excesses of cancer. With the pesticides we were very interested in cancer

particularly the lymphatic and hematopoietic cancers, for which we only saw one death. Interestingly, the heart disease SMR was elevated. Remember heart disease in all of the other cohorts was low, so the fact that it was normal compared to the U.S. rates was actually interesting. There was no excess of respiratory disease mortality.

I mentioned earlier that one of the major issues of our study was the fact that we used Worker's Compensation Appeals Board claims. They are claims that went to the Appeals Board, the second level of the compensation system. Let me tell you the reasons that we did that. The primary reason was that when we started this study, our primary interest was respiratory disease, and we were told anecdotally from a number of sources that almost all respiratory disease claims go to the Appeals Board. Another consideration was logistics. Appeals Board claims go to a central warehouse in Sacramento, which was close to us, whereas the first level claims are all scattered around the regional offices, and it is much more difficult and expensive to get those claims.

Claims that go to the Appeals Board are claims where there is disagreement about decision or settlement. Claims that are represented by an attorney also routinely go to the Appeals Board. These include serious injuries, claimants who mistrust their worker's compensation system or mistrust their employer — by the way this is opinion of a worker's compensation attorney — and finally, as I said before, most lung disease claims do go to the Appeals Board, which calls into question the representativeness of the injury deaths because we know we do not have the majority of the injury claims. So there is some issue of representativeness there.

(Slide shown). Conclusions. We found significantly elevated mortality from nonmalignant respiratory disease in the lung claim cohort, the SMR was 3.14 and was highly significant. The excess respiratory mortality was associated with wood dust, rice dust, coffee dust, and flour dust. Those dusts accounted for 15 of the 24 deaths. There was no significant excess risk of cancer, suicide, or injury mortality.

We concluded that the surveillance of mortality after worker compensation claims appears to be a useful method for examining health risks in agriculture. I have one more point to make, just as a commentary, in a form of a question. Did these exposures to the dusts of wood, rice dust, etc., cause these excess deaths or did these deaths simply occur as a result of smoking? I have not told you anything about smoking. Our smoking data is incomplete. The records usually did not contain smoking information. So, we are in the position or the quandary of saying, "If the excess risk was just due to smoking, then these claims, the judges' decisions, and the compensation were all invalid. They should not have been compensated and they were invalid claims." We are not in a position to say that. On the other hand, if they were valid claims then the compensation was fair and it is likely that these dust exposures did cause those deaths. Therefore, we recommend that further research be done to look at workers with these exposures. I will stop there. Thank you.■

Questions and Answers

Plenary Session VII - Surveillance/Intervention

DR. HERRICK: Thanks, Jay. The floor is open for any comments or questions or if anyone wants to give Jay some recommendations for future funding sources to pursue those hypothesis he generated. If you have a question I just ask you to please use the microphone and identify yourself so we know what kind of an answer you would like to hear. Any questions? John? Come on up.

DR. MYERS: This is directed to Dr. Beaumont. I am John Myers with the Division of Safety Research. How consistent were the California worker's compensation laws over that period because it has been my impression that worker's compensation changes about every two to three months?

DR. BEAUMONT: That is about right. I did not mention that the compensation has changed considerably in terms of its coverage. First of all, it does not include self-employed persons so we do not have good representation of farmers who are self-employed, and there is also the issue of farm workers. That has changed considerably, and that is the every two to three months that you are referring to. Sometimes the law says it is in terms of payroll; sometimes it is in terms of length of employment (if they are employed more than six months they are covered) and sometimes it has been the number of employees. It has changed considerably over time.

Coverage is very good now but over the time period that we covered here it did change quite a bit so it is very true that we do not have all of the injuries that did occur; we only have those that were covered. That is a good point.

PARTICIPANT: (Inaudible.) — NIOSH. I have a question for Mike Auslander and Larry Shireley. It is more of a comment. Mike, thinking of your triangles, one thing that we have noticed with other forms of surveillance is that as our surveillance systems get more sensitive they pick up the less severe illness so in your first year it is possible that you got such a high aspect ratio, as you phrased it, simply because the surveillance system is reaching a point where it is getting more sensitive. It will be real interesting to see what your triangle for next year looks like and it would also be nice to take Larry's two years of data and divide it and see what those look like. The concept in that use was pretty intriguing to me, a nice way of looking at surveillance data for those kinds of things.

DR. AUSLANDER: Gene, I appreciate your concern and it is one of ours too, believe me. Looking at the data that we have collected in our second year already it looks very similar to the first year, surprisingly so. The other thing that really surprised me, if you think about those triangles you might ask, "How about an age adjustment?" because some of those triangles applied to children and adolescents, some were all injuries and that type of thing. If you adjust them for age, we put our subject in three different groups of children, anyone below 18, 18 to 54 and then 55 and older, it is amazingly similar.

There are very few exceptions between those age groups with a few exceptions. One of the exceptions that I have noticed is that there is a higher likelihood for older and younger people to be injured by animals. My hypothesis is that is one of the chores that they give grandpa or they give the kids is to feed the animals and take care of the animals. But other than that difference that we see in children's injuries it is amazingly consistent among age groups.

MR. LAWRENCE: Timothy Lawrence of Ohio State. Jay, where did you draw the line on agricultural injuries or agricultural exposure to pesticides? For instance, use of aluminum phosphide by a grower would be considered agricultural, but at a growers' exchange would be non-agricultural, despite being the same chemical on the same commodity?

DR. BEAUMONT: The example you gave of a growers' exchange would still be considered agricultural, agriculture related, actually.

MR. LAWRENCE: All food processing?

DR. BEAUMONT: All food processing, yes.

DR. HERRICK: Any other questions or comments for any of the other presenters today?

PARTICIPANT: (Inaudible.) — interesting the high number of deaths around the dinner hour, around five to six o'clock in the evening. I was wondering if that could be Sun Down Farming Syndrome, in the shorter days where between five and six o'clock the sun goes down?

MR. SHIRELEY: (Inaudible.) — look at that and see if that might be a possibility. It would have to be pretty much in the spring. In North Dakota in the summertime 11 o'clock is nighttime.

PARTICIPANT: I would like to make a comment on that. We have charted our injuries by time of day and we see a dramatic peak at the end of the morning and all during the afternoon but a dramatic drop at noon. People just do not miss lunch. I mean there is a dramatic drop at noon.

DR. HERRICK: Anything else? Any other questions?

MR. VEAZIE: Mark Veazie from Division of Safety Research at NIOSH. I have a question for you, Dr. Auslander. I found your presentation of the data really quite intriguing. Modern injury control people draw injury pyramids merely to illustrate the tip of the iceberg in fact, but in the early days of safety when Hienrich was doing it he felt that the severity of injury was fortuitous by chance and therefore that the triangle would always be the same shape over whatever circumstances. We have pretty much definitively rejected just about everything Hienrich has as the truth. Have you thought of what contributes to the severity, like maybe the magnitude of energy involved within injuries and whether or not we should be looking at the severity of injury as an outcome in research and not just the occurrence of injury?

DR. AUSLANDER: I really cannot give you a good answer. I have thought about it but I do not know that I have come to any conclusions. It's just a phenomenon that we have observed that is alarming.

MR. VEAZIE: I think we should start thinking of severity as an outcome because, at least in DSR, we are talking about human factors determinants of severity, I mean, whether you are under the influence, for example, it effects what body parts get injured in a fall and that effects severity. There are also basic energy issues. I think your research leads us to think about considering predictors for severity and not just the occurrence of things.

DR. AUSLANDER: I think it is part of the greater issue that we are all discussing with our projects in that farming really is a unique occupation. There is something about it that separates it from other occupations and other ways of life and there are certain intangibles that we cannot put our finger on at this point that make it different, that is part of it.

DR. HERRICK: Any other comments, questions? If not, I would like to close with the reminder that the Southeast Center for Agricultural Health and Injury Prevention from the University of Kentucky is hosting a reception this evening which will be at seven o'clock here in this room which you are certainly welcome to. Do not forget that tomorrow we are starting at 8:30 but it will be in a different location, the Regency Ballroom East on the lobby level. With that we will close the session and see you at 7:00. Thank you very much.■

(Whereupon, the meeting was recessed at 5:30 p.m. to reconvene at 8:30 a.m., the following day, August 27, 1993.)

A Study of Osteoarthritis of the Knee and Hip in Dairy Farmers

By *John J. May, M.D.*
Director, New York Center for Agricultural Medicine and Health

DR. MC KNIGHT: I am Dr. Robert McKnight, the director of the Southeast Center for Agricultural Health and Injury Prevention here at the University of Kentucky. On behalf of the College of Medicine and the Center, welcome to Kentucky and I hope you have a safe trip back. For those of you that are leaving today, make sure you try to get a window seat on the airplane so you can see the horse farms when the plane takes off. Because if you flew into Lexington, you probably thought you were landing in Calumet Farm as it came in. If you have a few hours before your plane leaves, in a period of one hour you can get a very quick horse farm tour by simply going out one of the roads, probably to the north of the town, and you can see some very beautiful horse farms, get a good amount of scenery in, really, less than an hour. Because it is literally three miles from where you are right now, are some of the most beautiful horse farms. Those of you who have an interest in equine mortality can visit the tomb of Man of War, which is located at the Kentucky Horse Park. Those of you wishing a NIOSH description of the significance of equine mortality may contact Steve Olenchock, who visited the tomb on behalf of the NIOSH the other night, and I was a witness to that effect. So, that is at the Kentucky Horse Park. I understand that when horses are buried, they only bury the heart, the hooves, and the head. Man o' War was an exception. He was completely and totally embalmed in toto and is in a large casket which is beneath a huge equine statue at the Kentucky Horse Park. For those of you interested in human mortality of significance to Kentucky, Colonel Sanders' grave is located in Louisville. We have five very interesting presentations in the first of our two morning sessions, this morning. Our first speaker will be John J. May, M.D.. Dr. May is director of the New York Center for Agricultural Medicine and Health at Bassett Hospital in Cooperstown, New York. He will present a paper on the study of osteoarthritis of the knee and hip in dairy farmers.

DR. MAY: Thank you, Bob. Good morning. I am going to present today, review with you, some preliminary findings from a survey that we have begun on dairy farmers in central New York, looking for evidence of osteoarthritis involving the hip and knee.

This is a list of my collaborators with this study. I would like to give credit for the design and execution of the visual aids that I am using today to somebody else, but I can't.

This is the American Rheumatism Association's official definition of osteoarthritis. You can see that they successfully managed to obscure the fact that this is simply a wear-and-tear phenomena, which results in injury of cartilage and underlying bone.

This increases in frequency with increasing age. Although some cases of osteoarthritis can be traced to one specific episode of injury, the vast majority cannot. And these likely represent the accumulated effects of repeated minor trauma to the joint surface.

The net effect of this is a gradual loss of cartilage as well as bony changes. Since cartilage is not seen on X-rays, the radiographic picture is one of narrowing of the joint space. In addition, there are bony changes, the development of these little spurs, or osteophytes, and changes in the bone that underlies the cartilage - structural changes.

Osteoarthritis is a common and significant public health problem. It is second only to ischemic heart disease, as a cause of disability in those over the age 50[1]. It results in more hospitalizations and longer hospital stays than rheumatoid arthritis. It is a major component of the $4 billion spent annually in the United States on total joint arthroplasties[2]. In view of this, it is surprising how little is available in the literature on the prevalence of this disorder.

The presence of disease can be documented either radiographically or symptomatically.

Radiographic prevalence is the cleanest and easiest to do, and obviously the most commonly employed approach. As might be expected, the results of purely radiographic surveys are widely divergent from the results of clinically-based surveys[3].

The radiographic surveys look mainly for the joint space narrowing that I mentioned before. Additionally, presence of bone spurs, or osteophytes, suggest osteoarthritis and structural changes are also important. Probably, structural changes in the underlying bone and joint space narrowing are the key findings. The bone spurs are not felt to be etiologically significant phenomena.

Symptomatically, individuals with osteoarthritis experience pain. Initially they experience pain with activity. As the disease progresses it is pain with activity and rest. They also suffer crepitus, which means a grinding or creaking sensation when the joint is moved. As the disease progresses, there is loss of range of motion of the joint, and eventually, loss of stability of the joint.

Let's talk about the prevalence of this disorder in the general population. Again, data is surprisingly sparse.

Hip:	RADIO-GRAPHIC	SYMPTO-MATIC
Forsberg	1.2	4.3%
Danielsson	1.2	1.6%
Croft	11%	28%
Knee:		
Felson	27%	40%
Gresham	70%	22%

Table VII. *Prevalence*

The data most commonly quoted are from Danielsson[4], who, for several decades, has periodically surveyed all of the bowel and

kidney films obtained on the citizenry of Malmo, Sweden. These films, incidentally, show both hips. About 1.2 to 1.6 percent of these films have narrowing of the joint space to less than four millimeters.

Using a similar approach, Forsberg looked at a more rural population and showed that age-adjusted rates were about twice those of the citizens of Malmo[5]. He speculated that this was due to the inclusion of farmers in his population.

In a radiographic survey in Britain, Croft[6] used a similar approach on a somewhat older population. Rates were higher in his study, though in subsequent studies Croft had rates that are more this high in this range. I think the notable thing about Croft's study is the fact that he also recorded symptoms. Only 29 percent of those with radiographic changes were actually symptomatic.

Studies done on the knees are less common, less well done, and they look at older patients. The mean age in one study, for example, was 81 years. The major thing I would like to note is that, once again, only a minority of those with radiographic changes in the knee actually have symptomatic disease.

There have been several studies of this problem in farmers. See Table II.

Knee:

Anderson - OR 4.3

Hip:

Axmacher - 13.4 - 16.9% (controls 1.2 - 1.6%)

Thelin - RR 3.2 (>10 years farming)

Croft - 13.8 - 23.6% (controls 2.7 - 5%)

Table VIII. *Osteoarthritis in Farming*

A study from Marshfield, WI looked at people who presented with knee pain. When they were compared to a referent group from the local HMO, farmers were found to have an odds ratio of 4.3 for degenerative disease of the knees[7].

Axmacher looked at bowel and kidney films from Swedish farmers and compared those to the Malmo rates. He found a ratio of 12 when comparing farmers to their general population[8].

Thelin compared a number of farmers-- he looked at the number of farmers in a cohort of individuals who had undergone hip surgery for degenerative disease and compared this to a control population and found a ratio of 3.2[9]. He also raised the possibility of tractor use as a possible etiologic factor.

Finally, Croft looked at rates of radiographic disease in survey respondents who had been employed in farming and compared these to office workers. He described an odds ratio of 9.3[10]. Other than simply working in farming for greater than

one year, he was unable to define any other clear risk factors.

We were interested in determining the prevalence of both hip and knee disease in a group of New York dairy farmers. We hoped to define the rates of both radiographic changes and of symptomatic disease, which has not been done with regard to the knee previously. We wanted to look more systematically for specific risk factors, ideally, ones that might be addressed in preventive efforts.

Finally, we hoped to evaluate a telephone questionnaire for hip disease that we planned on using in the New York Farm Family Health and Hazard Survey. Data from this part of the analysis is not available, and I won't address that particular issue today.

Using a list from a recently completed county-wide health census, we randomly selected dairy farmers aged 55 to 65. We called them and invited them to participate in the study. All those who were called responded to a brief telephone questionnaire on symptoms regardless of whether they eventually participated in the study or not.

Participants provided extensive information on their work history, especially regarding specific farming practices. Information on potential confounders, such as smoking, family history, sports participation, trauma, and others, were elicited. A standardized joint examination was then performed by one of the study physicians. This was followed by pelvis films and weight-bearing films of both knees, which were read blindly by the study radiologist. Data was double-entered into the Fox-Pro and transferred into SAS for statistical analysis. T-test was used for analysis of continuous variables and chi square for categorical data.

The study currently is about half done, and I am not reporting any data on controls. Sixty-one of the seventy-six farmers that we contacted consented to participate. All were male, age 58.7 ± 2.9 years. They had spent 40.4 ± 9.6 years in dairy farming. Average herd size was 109 ± 59 cows.

Radiographic Arthritis: First, I would like to review the findings regarding the prevalence of radiographic changes. For this, any change other than minor joint space narrowing was considered confirmatory of osteoarthritis. Isolated, minor joint space narrowing was not counted as diagnostic of osteoarthritis.

	Severity Grade		
	1	2	3
Knees:			
spurs	6	7	1
jt. space	21	16	8
structure	8	5	1
Hips:			
spurs	3	3	0
jt. space	19	2	3
structure	15	5	0

Table IX. *Risk Factors.*

We found that 23 percent of our farmers have radiographic evidence of hip arthritis. And of those affected, 57 percent had evidence of bilateral disease. There was a

higher proportion of farmers with knee disease (31%), but a fewer number of these (21%) had evidence of bilateral disease. I would point out that the rate in the hips is quite similar to that reported by Croft. It is a little bit higher than Axmacher's figures, which is not entirely surprising since his group was younger, ranging 40 to 64 years in age.

Briefly, I'll just go through some of the radiographic abnormalities. The figures noted above did not include those who had simply isolated, mild joint space narrowing. If those individuals had been included, Table III shows that we would have actually reported substantially higher rates.

Hip:	9/61	(14.8%)
Knee:	14/61	(22.9%)

* X-ray change plus (pain or crepitus or loss of range)

Table X. *Symptomatic Osteoarthritis**

Table IV shows the types of X-ray changes that were noted, and it includes that group I just mentioned with the minor joint space narrowing. The major findings noted with both hip and knee were those of joint space narrowing and structural changes in the bone - this includes bony spurs and cyst formation in the underlying bone. And these are the two changes that are felt to be most significant radiologic indicators of osteoarthritis.

Finally, there was a trend to more severe disease in the knees than there was in the hips.

Symptomatic Arthritis: Now let's look at symptomatic osteoarthritis. This refers to the combination of the radiographic changes (except minor joint space narrowing) plus either pain or crepitus or loss of range of motion.

As expected these rates are somewhat lower than the radiographic changes alone. These rates are still strikingly elevated. In addition, there are several more patients who are reported as being normal here, who, in fact, have either pain, crepitus or loss of range of motion and minor joint space changes. For the present time, we are calling those people normal.

Risk Factors: Table V summarizes a preliminary screening of some of the risk factor data that we have collected. As you can see it is not terribly revealing with regard to hip disease. Risk factors for knee disease are somewhat more interesting.

Since we selected a group of farmers, aged 55 to 65, we would not expect age or years in dairy farming to be significantly different. But, for that matter, we would not have expected years in milking to be different either. It seems that indicators of the intensity of their work, such as herd size, number of cows milked, as well as the absence of hired help, seemed to correlate with the presence of osteoarthritis of the knee.

	Hip	Knee
Age	-	-
Years dairy	-	-
Acres	+	-
Herd size	-	+
Hired help	-	+
Tractor	-	-
Weight - 20	-	+
- 40	-	±
- 50	-	-
- now	-	-
Milk hours	-	-
Cows milked	-	+
Years milking	-	+
Type milking	-	-
Milking position	-	-
Milking stool	-	-

Table XI. *Risk Factors.*

Interestingly, their weight at the age of twenty correlated and there is sort of a borderline correlation between their weight at the age of 40. Other details of farm work, specifically with regard to milking, whether they used a stanchion system or a parlor system, whether they milked kneeling or squatting, whether they used a stool were all examined. None of these, to our surprise, appeared to be significant factors, at least with our current sample size.

Likewise, tractor operation did not seem to enter into it. Although, this is just a very crude indicator, at this point, of tractor use, we have more detailed information regarding their use of tractors that remains to be analyzed.

Thus a preliminary look at our data suggests that osteoarthritis of both hip and knee are common problems for dairy farmers in the age range of 55 to 65. Disease of the knee appears to be more common and more severe than hip disease. It appears that osteoarthritis of the knee may relate to the intensity of work, the size of the work force, and possibly weight early in working years. Thank you. ■

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Filling the Gap: Recruiting Professionals for Careers in Agricultural Safety and Health

By Barbara Pies, M.S.
University of Iowa

MR. McKNIGHT: Thank you Dr. May. Our next speaker will be Barbara Pies from the Institute of Agricultural Medicine and Occupational Health at the University of Iowa. Her presentation will be Filling the Gap: Recruiting Professionals for Careers in Agricultural Safety and Health. Ms. Pies.

MS. PIES: Good Morning. My name is Barbara Pies. I work at the Institute of Agricultural Medicine and Occupational Health (IAMOH) at the University of Iowa. Part of my responsibility there involves coordinating the graduate program. My position requires me to answer many questions about the program and the University of Iowa and Iowa City.

One typical question that I am asked a lot by students from out-of-state and other countries is, "What is there to do in Iowa City?" I usually respond by saying, "Iowa City is a very nice city to live, and there are a lot of things to do, including theater, music, sports, and our newest activity is canoeing in the streets."

As you can see Iowa City suffered from the "Flood of 1993". Many of the streets were closed throughout a good part of the summer and some are still closed.

The title of my presentation is "Filling the Gap: Recruiting Professionals for Careers in Agricultural Safety and Health." I would also like to recognize my co-authors, Jim Merchant, who is the director of the IAMOH, and Burt Kross, director of training activities at the IAMOH.

Remember back when farming was done with horses? I feel fortunate to have been around when my dad still did some farming with horses.

This picture, taken back in 1968, shows my sisters, Sally and Melinda and myself getting a ride from Dixie. After the work was done for the day, my dad would unharness the horses by the garage. It was always a thrill when he would let us ride them to the barn.

Today agriculture has changed immensely. We have gone from horse power that ran on feed, hay, grass, and grain to horsepower that runs on diesel fuel. With these changes, farmers are able to farm more acres and feed many more people.

I think the following slogan does a good job depicting how much agriculture has changed. Back in 1968, farming equipment was pulled with two horsepower. Today, it is pulled with 150 horsepower. Agriculture, you've come a long way, baby!

But just how far have we come? Each year thousands of farmers are killed and injured in farm-related accidents. Today, agriculture has moved into the first place as being the most dangerous or hazardous occupation. Why is this the case? There are a lot of reasons for this, many of which have been discussed here at this symposium.

In my presentation I want to focus on the following important reason: there is a shortage of professionals with the knowledge of agriculture problems, their causes, and preventive mechanisms. Many professionals are unaware of the health and safety problems that exist in agriculture. It is our responsibility to train and educate people on the problem and preventive mechanisms.

The University of Iowa offers a graduate program in the area of agriculture safety and health; housed at the Institute of Agricultural Medicine and Occupational Health. It's goal is to educate and train researchers, educators, nurses, physicians, veterinarians, and other health care professionals for career development in the area of agricultural safety and health.

In the remainder of my presentation, I will give you a short description of the program and then discuss some of our recruiting efforts.

We are in the Occupational and Environmental Health (OEH) Division is in the Department of Preventive Medicine Environmental Health, which is a part of the College of Medicine. The department has two other divisions: biostatistics and epidemiology. The agricultural safety and health specialty is one of four specialty areas in a division of occupational and environmental health. Other areas include industrial hygiene, environmental health, and occupational health or occupational medicine.

One of the strengths of our program is that, besides students being able to take a number of courses, they are able to get some practical experience. Because, out at the institute, it houses four main centers, including the Center for Agriculture Disease and Injury, Research, Education, and Prevention, commonly called CADIREP, which is funded by NIOSH, the Injury Prevention Research Center, the Environmental Health Sciences Research Center, and Iowa's Center for Agricultural Safety and Health. These centers help give students that practical experience and give them an idea of the wide, the diverse areas in the whole arena of occupational and environmental health.

But, even though programs like the University of Iowa exist, they have limited value because even though it exists and it is very important, it is not useful unless professionals are aware of the problem and the program. Many people, including the general public, those in public institutions, and the government, are unaware and/or unconcerned of the problem facing agriculture. Many professionals interested in agricultural safety and health are unaware that programs like the University of Iowa's exist. These reasons demonstrate the need to make people aware of agricultural concerns and recruit them into programs.

Our recruiting efforts have focused on the following three main areas: a needs assessment, a recruitment plan, and training support for students.

First, I would like to talk about our needs assessments. This was a very important component of our recruiting efforts. It was important to first look at the program and evaluate it and to see if changes were needed and how it could be improved.

In the needs assessment the following two methods were used: focus groups and also questionnaires. Two focus groups were organized with approximately ten students in each group. There are approximately 30 students in our division.

The focus groups focused on the curriculum area only. Students were asked open-ended questions about everything, including the courses, the content of them, the instruction, and if the students felt they were being prepared for a career in the area.

Students provided a very good response. We received both positive and negative responses to our questions.

The second method used was a questionnaire. The questionnaire was distributed to all the OEH divisional students. It focused on all other aspects of our graduate program, such as orientation, admission, and communication.

After the two needs assessments were completed, the results were analyzed and compiled in a report. The next question that you are probably asking is, "How is this information being used?".

The results and the recommendations in the report are being used several ways. First, it was distributed to the faculty and the students. We felt it was really important that the students received a copy. They served as a type of checks and balance system to ensure that changes are being made. The report was also distributed to the curriculum committee and the training committee. These committees are responsible for implementing changes and improvements.

Many changes have already been made. For example, the curriculum committee has met many times throughout the spring semester and also the summer. Many of the courses have been changed and plans to add new courses are underway.

During the final part of my presentation, I will discuss recruitment plans. First of all, we are developing a recruitment package. Presently, we have program brochures but they are out of date. New information needs to be added. The recruitment package will be designed to be easily updated. The information will be kept in a specially designed folder for easy distribution.

We are also developing a recruitment display that can be used at Career Days at universities, and community colleges. We are also starting to focus on high school students in FFA and 4-H. We feel it is important to educate and create an awareness in younger audiences also.

Another component of recruitment efforts include distributing recruitment information

to targeted locations (community colleges and other universities). In addition to the recruitment package, a poster describing the program with return-for-more-information cards on the poster will be distributed to target locations.

We plan to continue to advertise through journals, magazines, and newspapers, about the program and about student support awards available.

Another area that is essential is maintaining a placement record. In the past, there has been no system for keeping a placement record. I get a lot of questions about where are your graduate students. I usually end up going and tracking down different faculty members and asking them where students went and what position they are in right now. So, if we have all this located in one area it is going to be very helpful.

Another area is to publish a yearly alumni newsletter. I think this is a real important area that we keep our alumni involved, because they are important also in the recruiting effort.

The third area of our recruitment plan is our training support for students, which is sponsored by NIOSH. During years one and two of our center's grant we were able to sponsor, or support, 10 students. During year three we were able also to support 10 students. And this has been essential to our program, with the way the economy is, it is essential that you have support money available for students.

In conclusion, a serious problem exists. Even though agriculture has seen tremendous changes, these technological changes have not eliminated farm accidents, deaths, or injuries. What will the future hold? It is my hope that with programs like the University of Iowa, and the dedication of individuals like the people in this room, death and injuries related to farm accidents will be dramatically reduced and even eliminated. Then we can say, "Agriculture, you truly have come a long way, baby." Thank you.■

Stimulating Interest in Pesticide Protection

By *Lori M. Vidlak*
Nebraska Department of Health

DR. McKNIGHT: Our next speaker is Lori Vidlak, the communications coordinator for the Cancer Control Farmer's Project with the Nebraska Department of Health. She will discuss "Stimulating Interest in Pesticide Protection." Ms. Vidlak.

MS. VIDLAK: Thank you. Well the first thing I want to say is that if I have some problems with this remote control it is because I never get to handle it at home, because I'm married.

The women out there understand, let me tell you. The first thing I'd like to do is introduce or recognize my project leader: Joleen Tenhulzen-Huneke from the Nebraska Department of Health. Our project is called Harvest for a Lifetime. Harvest for a Lifetime is a cancer control project for farm families. It is one of the five demonstration projects funded by NIOSH.

The project consists of three components. The first one is a barrier study, conducted in March 1992, that evaluated knowledge, attitudes, and behaviors related to the cancers that we were going to address. The second part of the program involves a variety of interventions - community-based - both adult education and youth education, media (which has been an extremely strong component), and professional education. The third part of the project is a post-intervention survey which is scheduled for March 1994.

We have targeted 10 counties in south-central Nebraska as intervention counties for the project. Eight counties in northeast Nebraska comprise our controls. We chose these counties to try to reduce media contamination. That proved easier said than done.

The 10 intervention counties have a strong media component that is pretty local. There are three local television stations in the area, three daily newspapers, about 20 weekly newspapers and about 12 radio stations. The media has been extremely interested in this project. This interest was generated not only by our activities, but also by activities going on nationally.

Our project focuses on three cancers and their related risk behaviors. We like to describe the project focusing on the risk behaviors rather than on the cancers, because it seems a bit more tenable for our target audience.

We are focusing on chewing tobacco use during the fall months. To make the project more manageable for staff, we try to spend a specific time of each year focused on one risk area. We focus on pesticide

protection in the winter months and into the spring. During the summer, we turn our attention to skin cancer and sun protection.

Harvest for a Lifetime is a strong community-based program involving a lot of cooperating organizations. Cooperating groups include the FFA the FHA, the Farm Bureau, the Farmer's Union, county extension, the Hospital Association, the Cancer Society, the Lung Association, health departments, community action agencies, and just about anybody we could lay our hands on in these 10 counties.

We put together an advisory committee that meets quarterly and helps us decide the kind of activities that we want to do and helps us to pre-test materials. We have also developed county committees, made up of local representatives from the various organizations that have gotten involved. The county committee concept has proven to be extremely helpful in not only generating local interest in the project, but also in carrying out some of the project activities.

We were warned pretty early not to get into the issue of pesticide protection because it is a touchy subject. People were worried about what the state health department was going to say about it. But we learned from doing focus groups and also from conducting our survey, that pesticide protection was an important issue to the farm population. They were concerned. They had heard about it. They were interested. They weren't real sure what they should do about it. But they were very interested.

What we decided to do, based upon our experience, was to focus on the family, and on ways that you can protect your family from pesticide exposure. We concentrated on two areas. One was in the use of protective clothing, personal protective equipment (PPE). Our barrier survey had shown us that nearly 100 percent of farmers said that wearing protective clothing was important. But only 47 percent of them always used it.

Another area we wanted to focus on is the proper laundering of pesticide contaminated clothing. We found in our barrier study that 28 percent of the population used no precautions at all. Only 55 percent of the population washed pesticide work clothes separately from the family laundry.

We did a lot of different interventions. We have often been told by our NIOSH support group that we are doing too much. We agree, we are. But we can't help it. We are kind of an energetic little crowd. And we are optimists - we are eternal optimists.

One thing that we did was we put together a display board. The display materials are all laminated and can be sent out separately and produced very cheaply. And this has been really helpful using the FFA and FHA's because they put up a lot of school bulletin boards. In some cases they built their own boards and sent them out this box of laminated materials with a little chart of how you put them up. And that has been real effective.

This display has been used at a variety of community events. It was designed from

an article that, luckily, appeared in Successful Farming magazine about a month before we needed the first display. They gave us permission to use the photographs that were in the publication. The article discussed the importance of wearing protective clothing and showed examples.

Again, that kind of reinforces what I said before about national publicity impacting our work. So we decided that rather than worry about the contamination that was going on, we would use it. We would try to use our message to reinforce the national messages and vice versa.

We took a lot of personal protective equipment out with the display. We believe that it is important to show-and-tell our message. The misinformation out there is incredible. The notion that farmers already use chemical-resistant gloves, was really not true. They used gloves, they used work gloves, leather gloves, and they thought that was just fine. And we had a lot of experience in trying to educate people even who were at the forefront, I mean, farmers who thought that they were way ahead of everybody else in what kind of protection they were using, even they weren't using the correct protection.

We also developed a laundry display and a laundry slide/tape show. The slide show is about 6½ minutes long and is really effective with home extension clubs. It comes with a pre- and post-test, which has been pretty valuable because once you give the pre-test, the women watch the show very closely to figure out what they got right and what they got wrong. And then they can discuss it during the post-test. We did some pre-testing and so we have an idea, now, what needed to be changed before we transfer it to videotape.

Another component was an interactive show-and-tell session for adult groups. At each presentation, we ask for a couple of volunteers. The volunteers dress up in the protective equipment in another room. When they come back, they walk around the room (kind of like a fashion show), and we help the audience point out what is right or wrong about their outfits. Some of the equipment was wrong for pesticide application. On this slide, the respirator he is wearing has ammonia filters on it. It doesn't have pesticide filters. We use these moments to make the point that it is very important to pay attention. But it's not as easy as we, as health educators, would like it to be. Pesticide protection is complicated. We have got to recognize that, for these farmers, it is not as simple as we think it is.

One of the big issues, the biggest issue, is accessibility. We went on little shopping missions around our 10 county areas looking for some of this material, looking for the gloves, looking for the aprons, looking for the respirators. They couldn't be found. We got sent all around a farm equipment store -from this guy to this guy to this guy - trying to find gloves. We never did find chemical-resistant gloves in that community. So you can preach all you want to these people that they need to wear this stuff, but if they can't find it locally, or if they **can** find it but it costs too much, it's just not going to happen.

Media was a big component in the project,

as I had mentioned before. We used news releases on personal protective equipment and laundering that were written pretty folksy tone. We sent these releases to the county extension agents and had them use their byline in the local newspapers to get the stories in. That really helped because local newspapers are a little bit more inclined to use something that comes from a local source than they are from something that comes from the state health department.

We also used radio public service announcements and radio interview programs. We got a lot of strong coverage from the dailies throughout this campaign. We got a lot of great publicity from TV. We had a five minute feature done Easter evening on the six and ten o'clock news on one of the local stations, about the issue of pesticide protection, featuring some local farmers who had been poisoned. Very effective story. We got lots of phone calls the next day from people who had seen it. So now we are using that video as a trigger film in educational presentations because it is so effective and so emotionally grabbing.

We developed a brochure for men on personal protective equipment. I have some of those with me. We also developed a brochure for women focusing on the laundry issue. We recognize that this is probably sex-stereotyping, but it is based on focus group and advisory team input, and we really felt we had to go with what the reality was in Nebraska.

Along with all this media and programming, we did a direct mailing to about 4,900 farm families in the region. We mailed a copy of each of the brochures, an introductory letter talking about the program, and a return card that they could send back for a free washing machine magnet and a set of chemical-resistant gloves. The response was a lot higher than we thought. We had ordered about 200 gloves in anticipation of that kind of response. We got more than 2,000 cards back. It was obvious that these people couldn't find these things in their communities so, we also sent out a resource list of the places where you can purchase personal protective equipment.

One of our local reporters wrote a story about our unique "glove offer" and the great response. Well, that generated even more cards coming back in, you should have seen us, we were just going crazy. And it went on the wire, we were getting calls from all across the state from people who were interested in getting these gloves. It really illustrates the importance, I think, of accessibility.

We have really learned three things from this project.

1) It is important to build relationships - with community groups, with the media, and with your target audience.

We have developed some trust now, I think, from the farmers who responded to this, who got their gloves as they requested. We made sure all the orders got filled. We have done a similar mailing, now, three months later on sun protection offering a sunscreen lip balm and some little pocket notebooks that the farmers can use. But, this time instead of just sending out a

little postcard, we sent kind of a long survey along with them. And we are getting a lot of those back. So, it kind of makes us think what can we ask for next?

2) It is also important to show and tell. Telling isn't good enough. You really have got to **show** these people what you want them to do.

3) it is extremely important to make the items, the equipment, whatever, accessible to your audience. If you have to **give** it away at first, to get them familiar with it, and comfortable with it, then I think it's a good investment. Farmers have given us so much, it is about time that we gave them something back. Thanks.■

Knowledge Gaps About Stress-Related Disorders Among Agricultural Workers

By *Larry Chapman, Ph.D.*
University of Wisconsin

DR. McKNIGHT: Thank you. The next speaker will be Larry Chapman, Ph.D. Dr. Chapman is with the Department of Agricultural Engineering and the Department of Neurology with the College of Medicine at the University of Wisconsin. Dr. Chapman's talk will be about Knowledge Gaps About Stress-Related Disorders Among Agricultural Workers. This is the first of three we will hear this morning related to the interesting topic of stress. The other two will occur after the break. Dr. Chapman.

DR. CHAPMAN: Good morning. I worked with Ted Scharf and others at NIOSH to review the existing literature on occupational stress as related to agricultural occupations. As Bob just said, later this morning, after the break, Pamela Kidd and Ted will be presenting more about occupational stress in agriculture.

The way we set out on the project that I worked on, was we divided it into four areas, four different types of disorders we were going to look at: cardiovascular disease, suicide, psychiatric illness, and psychological distress. Obviously, it is not possible to entirely attribute any of these disorders to occupational stress. They are disorders with a multi-factorial causation.

I don't want to try your patience and, I think as we approach the break it is more important to be merciful. But this is a project where I was faced with trying to review hundreds of studies and put them into some kind of order. And so what I would like to do is give you a broad brush treatment of some of the findings.

This is an example of what the report looked like. See Table I. This is a collection of cardiovascular disease studies from mortality statistics. Mortality statistics are what people die of. They are done by looking at death certificates from people who were in agricultural occupations.

Each study was done somewhat differently, but, for the most part, they attempted to collapse deaths of farmers over a number of years, say 10 years. They would define a farmer, often times from Census Bureau information. They would then like this with the information on the death certificate. For instance, the Wisconsin study covered 35,000 deaths. It covered the period 1968 to 1976. It used, from the U.S. census data, people who were owners, tenants, or laborers, those were what farmers were defined as.

That was the largest study, nearly 36,000 deaths, and you will see the different types of cardiovascular disease, specific types of cardiovascular disease that these people died of.

STUDY	Coronary artery disease	Athero-sclerotic heart disease	Circulatory System disease	Cerebro-vascular disease	Rheumatic heart disease
New York farmers (n=18,811)	-	-	-	-	-
Iowa farmers (n=5933)	-			-	
South Carolina white male farmers (n=2820)	-		-	+	
Wisconsin white male farmers (n=35,972)	-	-	-	+	+
California farm workers (n=6012)		-	-	-	-
California owner managers (n=6302)		-	-	-	+(?)
Washington farm laborers (n=3089)	-	-	-	-	-
Washington dairy farmers (n=1814)	-(?)	-	-	-	+
Finland male farmers (n=4361)	-	-	-	-	-
Finland female farmers (n=612)	-	-	-	-	-

+= increased compared to controls or normal rates
-= lower than or equal to control group or normal rates

Sources: New York - Stark A. Arch Env Health 1987;42:204-212
Iowa - Pomrehn PR JAMA 1982;248:1073-1076
South Carolina - Uni H. South Med J 1987;80:1137-1140
Wisconsin - Saflas AF. Am J Ind Med 1987;11:119-129
Finland - Notkola V. Scand J WEH1987;13:124-128 & 1988;16:187-191
California - Stubbs HA Am J Ind Med 1984;6:305-320
Washington - Milham S. NIOSH Research Report, 1976

Table I. *Cardiovascular Disease Mortality Studies of Agricultural Workers*

Age Range	Circulatory disease SMR	Cerebrovascular disease SMR
30-39	72.9	166.7
40-49	39.8*	129.5
50-59	53.5*	26.0*
60-69	63.4*	57.5*
70 +	79.5*	81.1
Total	67.5*	71.7*

* =p<0.005
SMR = age standardized mortality ratios
n = 18,811
Source: Stark A. Arch Env Health 1987;42:204-212

Table II. *Farmer Cardiovascular Disease Mortality by Age, New York 1973-1984.*

Underneath, I have got a minus if there was no difference or if rates were lower than normal. And there is a plus if it looked as though there were a significant difference for farmers. And for all of the cardiovascular diseases, the mortality studies fairly consistently showed lower rates. The next step beyond is to take a look at some of the detail within some of these studies. Not many of them attempted to break down the occupational titles, the operation sizes, or the ages of the people who died. One study that did was the New York study. See Table II.

They were able to show that for both circulatory disease and cerebrovascular disease there were significantly lower rates, or lower ratios, of mortality among farmers across an age range. This helps give one more confidence in the findings. They were also able to show the same for cerebrovascular disease. The top two age standardized mortality ratios,which are supposed to be compared to 100, if it is over 100 it is higher, if it is lower than 100 it is lower, were not significant. That is because the numbers were so low.

For example, in the top one, here, expected deaths were 1.3 and there were 2 people who died. That is how you get the 1.66, but the number is so small it doesn't obtain significance.

Breaking down the farmer group by operation size, is another item on the research wish list.

One study that has done that is from Finland. They did find significant effects for farm size, here we can see the farm size, greater than 50 acres all the way down to 2.5 to 12 acres. See Table III. And the rate ratio is significant at each of these sizes independent of victim age, type of operation, or geographic location, they also controlled for these factors. So it is the farmer who has the small holding that seems to be the farmer who experiences the greatest risk of death from cardiovascular disease.

Mortality studies track deaths. Morbidity studies attempt to give you an idea of how many people who are living actually have a diagnosed disease.

Farm size (acres)	n	Rate ratio
>50	305	100
38-49	267	114
25-37	536	121
15-24	965	132
2.5-12	418	152

Source: Notkola VJ. Scand JWEH 1987;13:124-128

Table III. *Farmer Cardiovascular Disease Mortality by Farm Size, Finland 1979-1983.*

A big problem in the United States is that we have kind of a fragmented health care system. And so health records are not available on people in large numbers. They are not available consistently, particularly for the agricultural work force. Many farmers don't have a health insurance

DISEASE	SMR	95% CI
All cardiovascular diseases	74	70-77
Ischemic heart disease	66	59-74
Myocardial infarction	64	58-71
Hypertension	70	57-86
Cerebrovascular disorders	103	92-118

SMR = age standardized mortality ratio
n = 60,515 farmers & 2,843,217 controls
Source: Thelin A. Soc Sci Med 1991;32:305-309

Table IV. *Farmer Cardiovascular Disease Morbidity, Sweden 1978-1983.*

provider. If you go to a country like Finland, or Sweden, and Scandinavia, where the health care system is better centralized, more farmers have health insurance coverage, it is easier to tell whether there are, in fact, differences between agricultural occupations and other occupations for having a diagnosis of cardiovascular disease.

Here is a table from a study done in Sweden. See Table IV. It attempted to compare farmer health records, 60,000 farmers, with the Swedish population at large, which was 2.8 million individuals. They showed that age-standardized morbidity ratios for farmers were consistently lower than or equal to average rates for other occupations.

Now, I would like to move to the next area of farm suicides. There are not very many studies available in this area. The picture for suicides in the agricultural work force is very mixed. A number of studies have been done that compare urban versus rural residents for suicide. And many of them have shown that the rates are nearly identical. As many of you probably know, the numbers of people in the agricultural work force in rural areas are a distinct minority. And so there is no guarantee that you are really saying anything about farmers if you say something about rural residents.

A few state level studies have been done. This is a table of a study that was done in Kentucky, and another in Colorado, two states with different types of agriculture, by a researcher who, I think, is here this morning, Dr. Loranne Stallones. I talked to her yesterday and she said that I wasn't entirely inaccurate in suggesting that these two studies were done with fairly similar, fairly comparable methods, although there were some differences - differences in time periods covered, differences in what the local economics or circumstances were in the two states. See Table V.

As you can see, farm suicide rate differences from U.S. white male rates were about 25 percent higher in Kentucky,

	Census code	n	Prevalence	Crude odds ratio	95% CI
Data entry keyers	385	63	13	3.30	1.47-7.42
Groundskeeper gardener (except farm)	486	52	6	1.13	0.34-3.75
Other farming, fishing & forestry	multiple	74	5	1.57	0.54-4.54
Farm workers	479	47	2	0.312	0.04-2.29
Source: Eaton WW. JOM 1990;32:1079-1087					

Table V. *Month Prevalence of Major Depressive Disorder by Occupation.*

OCCUPATIONAL TITLE	SMR
Full time farmer (n=913)	169.0
Dual occupation farmer (n=51)	27.0
Farm laborer (n=177)	24.0
Farm homemaker (n=71)	36.8
Source: Gunderson P. National Farm Medicine Center, Marshfield, WI.	

Table VI. *Agricultural Workforce Suicide Rates by Occupational Title, 1980-1988.*

whereas in Colorado they were about 35 percent lower. And the rule of thumb being, you have different rates, you have different states. In her discussion, Dr. Stallones suggested that this may be due to the fact that farm environments differ widely across the country, which, I think, is also something that has been emphasized again and again over the last two days.

And also that there may be other factors operating. I know, in Wisconsin, we have a program where we work with coroners. We find that some coroners, in particular, may be reluctant to attribute a death to suicide in a farm community because it can mean that the farm family then doesn't have that life insurance policy available to them.

Another major suicide study has been done by Dr. Paul Gunderson and others, a five state study of agricultural work force suicide in five north-central states. The study was done on suicides over the period of 1980 to 1988. This study attempted to dis-

criminate between different occupational groups within the agricultural work force - the full-time farmer, the dual-occupation farmer, the farm laborer, the farm homemaker. See Table VI. Dr. Gunderson is here, also, and hopefully I am doing his study justice by observing that the full-time male farmers were pretty clearly at greater risk here. Which was, in some sense, a surprising finding. Some of us may have thought that farmers with dual-occupations would be under more stress, would have more concerns, more time pressure.

Here is the third area, diagnosed psychiatric disease. A very difficult area. First, I would like to show you something about the mortality statistics. Not many people die of a psychiatric disease. They may have a psychiatric disease diagnosis at death, but, it doesn't, often times, lead directly to death. So it is difficult to use mortality statistics to get an idea of whether farming occupations, agricultural occupations, have higher rates of psychiatric disease.

Here we have four studies: California, Wisconsin, Washington state, and South Carolina. See Table VIII. You may remember these are four that were also in our first table on cardiovascular disease mortality. We have four types of psychiatric disease endpoints. Arguably, only the first one, the category of 'death due to mental and personality disorders' is probably stress-related, or is most likely to be stress-related. Diseases of the nervous system might more likely be considered to be related to agricultural chemicals, and neuro-degenerative diseases, sometimes.

Once again, it is a mixed picture. I think the important thing to note about this depiction is, the findings that are significant, that have the little stars next to them. For most of the numbers up there, whether they are PMR's or SMR's, proportional mortality ratios or standardized mortality ratios, there isn't any significance. They were not large enough numbers of psychiatric disease deaths to really say anything either way.

STATE	PERCENT
Kentucky	25%+
Colorado	35%

Sources:
Stallones L. Suicide & Life Threatening Behavior 1990;20:156-163
Stallones L. J Rural Health 1992;8:139-142

Table VII. *Farm Suicide Rate Differences from 1980 U.S. White Male Rates*

To try and pull something out of here, let's look at the suicide death rates, the suicide ratios. We can see that, for California white male farm workers, we have a significantly increased rate, but for Wisconsin white male farmers, a significantly decreased rate in suicides. Once again, different rates in different states. A second finding, looked at the Wisconsin white male farmers for senility and other disorders, other diseases of the nervous system, and sense organs. We have significantly elevated proportional mortality ratios for the senility category that are also found in Washington state farm laborers.

It is difficult to know what to make of this

STUDY	Mental & personality disorders	Senility & other	Suicide	Diseases of the nervous system
California white male farmworkers (n=4466) in SMRs	56.5**	102.1	51.2**	78.5
non-white male farmworkers (n=595)	92.3	-	68.9	113.1
white male farm owner/manager (n=4932)	130.6	131.0	105.2	119.4
Wisconsin white male farmers (n=35,972) in PMRs	0.92	1.63*	1.23*	1.30*
Washington farm laborers (n=3089) in PMRs	0.30	2.34*	0.88	0.58
Washington dairy farmers (n=1814) in PMRs	1.07	1.24	1.09	1.10
South Carolina white male farmers (n=2820) in PMRs	1.18		0.95	0.65

** = p<0.01 * = p<0.05

Sources: Stubbs HA Am J Ind Med 1984, Saflas AF. Am J Ind Med 1987, Milham S. NIOSH Research Report, 1976, Une H . South Med J 1987

Table VIII. *Psychiatric and Nervous System Disease Mortality Studies of Agricultural Workers.*

mixed picture. The authors in the Wisconsin study speculated that, perhaps, some of these elevations could be accounted for by agricultural chemical exposures. But they were primarily talking about cancers, that were also included in their study, and didn't refer directly to psychiatric disease endpoints.

Now, I would like to move, once more, to morbidity findings in psychiatric disease. See Table IX. Just as with mortality we had problems because most people don't die of a psychiatric disease, with morbidity, psychiatric disease morbidity you have a problem because most of the people with psychiatric diseases never see a physician, never get a diagnosis, and are never treated. There isn't any way to know what the base rate is of psychiatric disease in the agricultural population or any other population.

The National Institutes of Mental Health (NIMH) recognized this problem 10 or 15 years ago and began what they called the Epidemiologic Catchment Area program, where they did a community survey in a number of areas around the country. This National Institute of Mental Health Epidemiologic Catchment Area data can then be reanalyzed by occupation, and that is what we have here, a study that attempted to do that. When the NIMH data are evaluated, agricultural work doesn't seem to be significantly related to major depression or psychotic disorders.

This table just shows major depression, we have data entry keyboard workers from office work. See Table VII. Their odds ratio of 3.30 and the confidence interval show that they have significantly elevated rates of major depression. For other farming, fishing, forestry, a category that includes multiple census codes, and for the

census code farm workers, there are no elevations, at least no significant elevations, if you look at the confidence intervals.

And here, once again, we have morbidity information from Scandinavia, where health records are good. See Table IX. We have, in this case, diagnoses from health records collapse over a multi-year period. We show that, over all, psychiatric disease diagnoses among living farmers, in Sweden, anyway, are lower than normal.

The final area is psychological distress. That means self reports, what people think or say about how they feel, what they feel their mood is like, whether they have symptomatic complaints that are stress-related.

One study that is a fairly large study that has been done here is one that comes from Iowa. See Table X. And it asks Iowa farmers over the last 10 years, "What are major occupational health problems that you find?" Twenty percent of the individuals reported animal-related trauma. Serious occupational stress was reported by about half of the farmers. So it is obviously something that farmers perceive is an important issue.

	SMR	95% CI
Male farmers	68	64-72
Female farmers	92	85-100

SMR = age standardized morbidity ratio
n = 60,515 farmers & 2,843,217 controls
Source: Thelin A. Soc Sci Med 1991; 32:305-309

Table IX. *Mental Illness Morbidity in Farmers, Sweden 1978-1983.*

Robert Karasek is someone in stress literature who has gained a reputation for attempting to place all occupations on common scales. He has used decision latitude or control and physical exertion to put a scale together. I think urban university professors are somewhere over here, high decision latitude, high job control, very little physicalexertion, almost none at all in their jobs. Many of you may be able to appreciate that, that standing for your occupation.

The farmer, on the other hand, is considered as someone with slightly higher, or very high, compared to other occupations anyway, physical exertion, but still a significant amount of decision latitude and aspect of control. I guess the question I would like to leave you with is, "Do we actually think that farmers experience a great deal of decision latitude?" In fact, we have heard today about how the weather is one factor that farmers don't have under their control, government food policy and government regulations are another.

Recently, you may have read, over the summer, about how changes in U.S. pesticide policy is taking another decision out of the hands of farmers and placing it in the hands of policy makers for public health reasons.

INJURY / DISEASE	Experienced in last 10 yrs (%)
Serious occupational stress	47
Back problems	27
Breathing problems	27
Animal-related trauma	20
Source: Thu. Am J Ind Med 1990;18:427-431	

Table X. *Self-Reported 10 Year Prevalence of Injury or Disease, Iowa Farmers 1988.*

In summary, very little is known about occupational stress in the agricultural work force. Available information is fragmented and contradictory. There is no compelling evidence for a causal connection and linking mechanisms are uncertain. Finally, there is better evidence from the mortality statistics. But, once again, there isn't a clear picture there. Overall rates for all of these conditions don't appear to be elevated for agriculture. But, there are some preliminary indications that a few subgroups may be at higher risk. Thank you.[1]

REFERENCE

1. Chapman, L.J. Sources of Data and Information About Stress-Related Disorders in Agricultural Work. Report prepared for NIOSH is available form Dr. L. Murphy, U.S. National Institute for Occupational Safety and Health, Division of Biomedical & Behavioral Science, 4676 Columbia Parkway, Cincinnati, Ohio 45226.

Questions and Answers

Plenary Session VIII - Research/Intervention

DR. MC KNIGHT: Thanks to all of our presenters in the morning session. We have a few minutes for questions. As we have done before, I would like you to step to the microphone if you do have a question and tell us your name and your affiliation. We have five very excellent presenters up here with lots of information, and I am sure there are some questions. So we are open for questions.

MR. SCHULER: Ron Schuler from the University of Wisconsin for John. In terms of your study with the farmers, you talked milking parlors versus stall barns and so forth, did you take into consideration the fact of length of time? Because, those farmers being 55 to 65 years old, when they first started I am sure they were all in stall barns and some changed over at different times.

DR. MAY: Thank you. I think that is a very pertinent comment. What I presented is, at best, half-baked. There is a lot more baking that has to go on. We do have information about that. We have information about how long they milked before the pipeline was installed and we have a number of other things that we are going to look at. Actually, I had meant, while I was up there, to solicit the assistance of people in the audience who obviously know more about this than I do in terms of suggesting other potential factors that we should be looking at. Please, in the break, or at this point, if there are things that you have always wondered about, there are probably things I haven't thought to wonder about but would like to.

DR. MC KNIGHT: Any other questions?

MS. WILK: I am Valerie Wilk with Farmerworker Justice Fund. I have a question for Lori. In terms of looking at pesticide education, do you have plans to do things to help farmers know about least toxic alternatives in sustainable agriculture?

MS. VIDLAK: At this point, no. Our project is focusing only on protective clothing and laundering.

When we got those 2,000 cards returned, we had one where the farmer wrote on it, "What you should be doing is telling farmers not to use chemicals." We all have personal feelings about what should be used and what shouldn't be used. But we are trying not to let our personal feelings interfere with the reality of what actually is being done in that particular area of Nebraska.

I think sustainable agriculture will come around but it is being dealt with by other agencies and other organizations, and not ours.

MS. WILK: I know because one of the -- a lot of the work that we do we find out that that's one of the areas where even if a farmer is interested in getting information, and having at least an insert or something in mailings and say where you can get more information, it would be really useful.

MS. VIDLAK: There is a wonderful organization in Nebraska, up in the northeast area, actually in our control counties, called Center for Rural Affairs. And they do a wonderful job. And we are on their mailing list. But at this point we haven't incorporated that information into our literature. We are not real sure how it would go over, public relations wise, and they do a wonderful job themselves. At this point we haven't affiliated ourselves with them.

DR. MC KNIGHT: Any other questions before we break?

MS. GOLDENHAR: Linda Goldenhar from NIOSH, also for Lori. I know there would be a selection bias and some problems with who responded, but have you gone back to those 2,000 people that got the gloves to ask them if they have been using them.

MS. VIDLAK: No, but we plan on doing that. We put all those names on our database. We are going to be doing some more pesticide education again in winter. One of the first things we want to do is do a mailing out to those individuals and ask them if they did use their gloves, what they thought about them, and if they want another pair. They will get a regular newsletter from us as well and that really helps keep building the interest in the project.

DR. MC KNIGHT: Any other questions?

MS. MOREAU: Peggy Moreau with the UVM Extension System, University of Vermont. I just have a comment. I think it is really important to look at stress in agricultural workers. As a dairy farmer's wife and someone who works with dairy farmers in my split positions for extension, so I am concerned that that is going to be hard to measure. Because my experience with the farmers I work with is that they are very reluctant to go for help and they are very reluctant, for instance, to use our local mental health services, because they don't want anybody to know that they have been there, they can't afford private therapists. So I know many of them who are really struggling with a great deal of stress and depression, who just don't seek any professional help for that. And I hope there is some way of reaching those people.

PARTICIPANT: Part of the work that I do, I talk to people and farmers assistance hot line throughout a number of states. They reported to me that -- comments very similar to the ones you just suggested. They were also extremely interested in better support for farmer assistance hot lines because they link the farmers with resources in their community for things like mental health and for services that can intervene at an earlier point in time, advice about legal and financial help, disaster relief, things that can help prevent the stress later on down the line.

DR. MC KNIGHT: I think we should give all of our presenters this morning a round of applause. ■

Plenary Session IX - Research

Moderator:
Thomas R. Bender, M.D., M.P.H.

Secondary Analysis of Focus Group Data in Investigating Farm Stress

By *Pamela Kidd, Ph.D.*
University of Kentucky

and

The Stress in Farm Family Research: Validation, Hypothesis Testing, and other Methodological Issues

By *Frederick E. Scharf, M.A.*
National Institute for Occupational Safety and Health

DR. BENDER: And as was mentioned, Dr. Chapman drew us off this topic through his paper of the last part of the last session of stress-related disorders among agricultural workers. I am Tom Bender, the director of the Division of Safety Research for NIOSH. The last two papers will be presented in a conjoint manner. I am going to introduce both of the speakers to you now since they will be talking to you in rotation. The first speaker is Dr. Pamela Kidd, who is at the College of Nursing here at the University of Kentucky. And her role in this session is to tell us about secondary analysis of focus group data and investigating farm stress. The second speaker is Frederick E. Scharf, Ted Scharf, who is with the Division on Biomedical and Behavioral Sciences with NIOSH in Cincinnati. And his role will be to describe the stress farm family research validation hypothesis testing and other methodologic issues. So we have a half an hour for this and they have assured me that we are going to have time for a few questions. Let's start then with Dr. Pamela Kidd. Pam.

DR. KIDD: We are going to start collaboration early by sharing handouts. So I tried to make sure that everybody got a package of handouts or you are sitting next to someone that has them. We will be referring to those handouts throughout the presentation, but I'll try to get you oriented at the right place in time.

The way that we are going to break this session into components, it will be in three components. The first thing I am going to do is to talk a little bit about the original analysis and methodology that we used. Then I will break and let Ted describe to you some of the methodological issues in stress modeling research. Then I will come back to you and show you how we have applied this model by using a secondary analysis or how the model was derived, from a secondary analysis of focus group data. And I just want to, also, thank my other colleague, Carol Koetke, who is in the audience, who was part of this analysis team as well.

Alright, let me introduce you a little bit to the original study. The original data was collected as part of the first year of the sur-

veillance of behavioral risk factors in older farmers project. This project is part of the Kentucky Farm Family Health and Hazard surveillance cooperative agreement between the University of Kentucky and NIOSH. And Dr. Robert McKnight is the Principle Investigator (PI) of the overall project.

These were the original research questions that we used in structuring our focus groups. These questions served as the initial interview guide. We used an exploratory research design with structured group interviews serving as the method of data collection. That slide just gives you a little bit more details about the methodology.

The initial interview guide did just consist of the research questions. But after each interview, the guide was expanded and refined based on ongoing analysis of our data. Subsequent questions were integrated within the framework of these original research questions. So with each focus group, the interview guide itself becomes a more structured research data collection tool.

A series of six focus groups were conducted that purposely sampled male farmers, age 55 years and older, that were engaged in full-time farming. We also engaged wives of those farmers in separate groups and couple groups, both the farmer and their wife. I hate to say it like that, because in actuality many of their wives could've been classified as full-time farmers, if you know what I mean. This slide is a little busy, but it is just to let you know we had a total sample size of 48.

Let me briefly discuss focus group methodology. Most of us are familiar with the technique since we are using it more frequently in surveillance. Traditionally, it hasn't been used for surveillance but it does offer some advantages. First off it gives you one topic of conversation. So participants can really discuss the complexity of that issue.

A second very positive factor has been an intimacy that's created between the researcher and the participant. You can go back to them and you can work with them as a team in trying to disseminate information or testing interventions. A lot of times you will get individuals in the group that represent agencies and their roles in life. From participating in a group they end up working together outside of the group. So the community infrastructure can be helpful as well.

And the last reason to use focus groups is they are relatively cheap and you get a lot of data very quickly.

In terms of why using focus groups with farmers, first off, farmers have a rich oral tradition. Their safety rules have been communicated verbally many times in the field, watch that shaft, or, turn off that tractor, I told you to do that - that type of safety rule. As well as, risk taking, hazard recognition, safety decision making are relatively salient issues. The process of how a person makes safety decisions is difficult to assess sometimes using pure survey, written survey techniques.

Safety decision making may not be a conscious process, so once the group discussion starts rolling it can serve as a stimulus for individual expression.

And the last very good reason to use them is

that farm families value fellowship. That is not on the slide, but group meetings provide a way of communicating, it's informal functional support, it's a legitimate cultural function of that community. And if you are dealing with older farmers it may be they participate in a group rather than deal with the respondent burden that might be associated with other data collection techniques.

What do you get from focus groups, or what can you get? Several different uses of the data. But the one that we are really focusing on is generating hypotheses for quantitative designs. I use them in my own research, really, as a sounding board for moving into the quantitative realm. This leads then to Ted, who is going to start out with that.

MR. SCHARF: Thank you, Pam. Thank you, Dr. Bender. Thank all of you for coming. My purpose is to discuss the methodological issues of stress process modeling.

Now the plan originally, at the time of submitting the abstracts, was simply to put up a general outline of where we might go with farm stress modeling. But then in looking at the results of Pam's transcripts from the Kentucky farmers we found that we had some information to fill in that model. And so I would just like to point out that Pam is a coauthor on this presentation today. Also I would like to acknowledge Mark Veazie (DSR, NIOSH), who has been struggling valiantly to educate me in the research on injury and safety. He is in the Division of Safety Research. He has extended his best efforts and I'll just leave it at that. I don't know how successful he has been in my case.

We begin with what has become the NIOSH stress model. See Figure 1. This is published in Hurrell and Murphy[1], and that is in the References in your handout. We use this as a basis for developing a model of stress in agriculture. My purpose is not to focus on the contents of these models but rather the main components.

So the first main component is job stresses. These are the physical, psychosocial and organizational features of the environment in which people work -- in which farmers work -- and in which all of us work.

The second main component I want to focus on is acute stress reactions. These are the immediate stressful consequences of those stressful features of the environment.

The third main component is down the line in terms of time -- illness or chronic strain. That doesn't happen right away. It develops later.

If we had time we would talk about nonwork factors, buffer factors, individual factors. We are not going to do that today. I am excluding them only because of the shortage of time. It is not to imply, in any way, that they are not important.

The most important thing I want to point out here though is that this is a process, it is a process over time. We are going to be coming back to that implicitly throughout this entire talk, even though we use models that look as though they are simple correlational single time designs. I want to emphasize that.

The three key questions I want to address today are, first: "Is there something that we

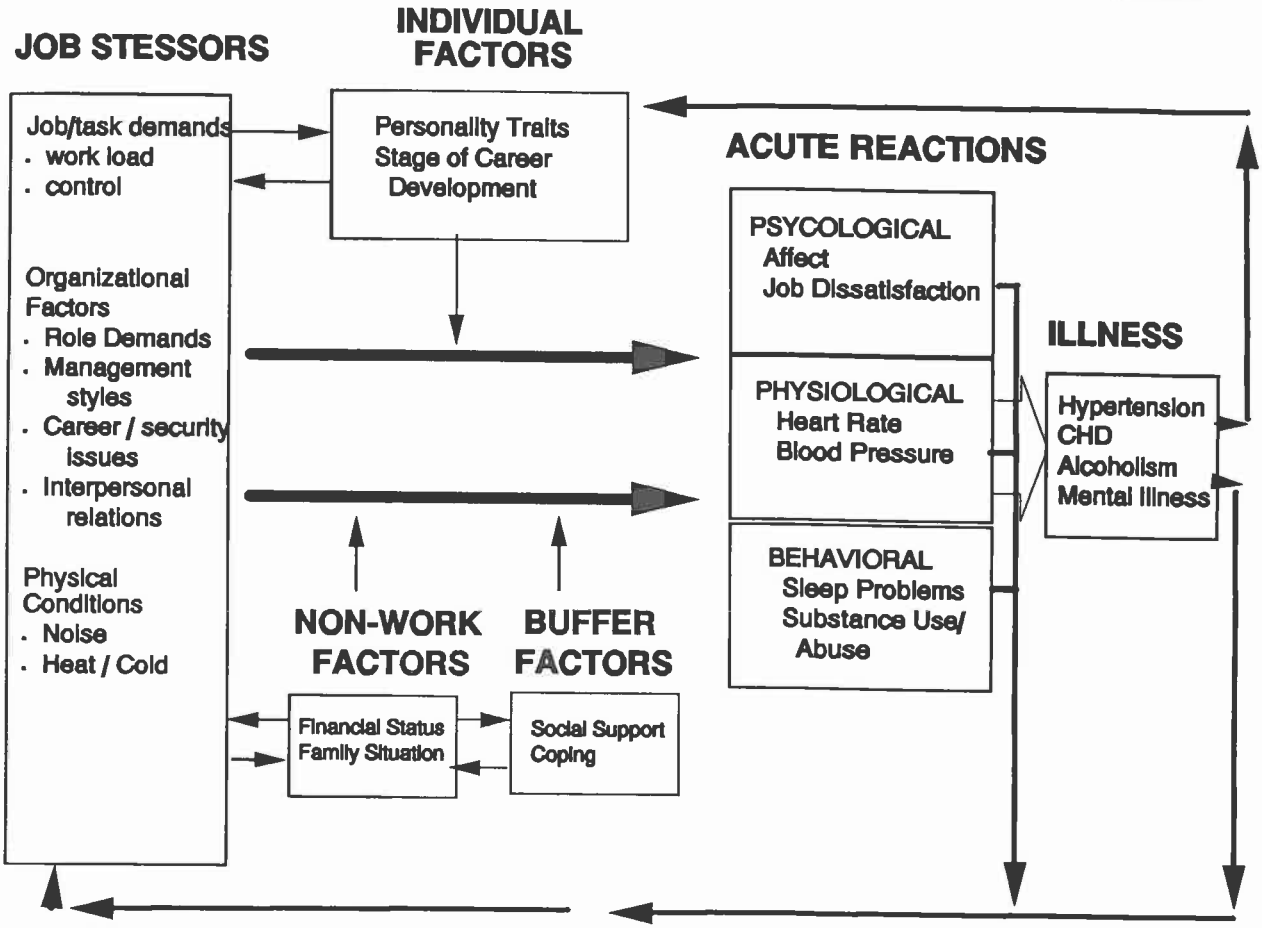

Figure 1. Model of job stress and health relationships.

might call a stress process?"

Listening to Dr. Larry Chapman you might wonder why are we here, what are we doing? We think there is some information but we need to work hard to be able to demonstrate that. So if there is a stress process, how can we show that what we are observing is reasonably attributable to stress and not to some other unobserved variable or process?

Second question, "How might we measure, and then demonstrate that this process, in fact, exists?"

Third, "How can such a demonstration serve as a basis for future research or prevention efforts?"

See Figure 2. The major components of the NIOSH stress model, from a methodological perspective, would be viewed this way. Components here -- when we talk about subject measures, we are talking about asking the workers what is going on in their lives at work. We also want to be concerned with cross validation, so that we have some idea that what we think we are measuring is, in fact, what we are measuring.

Model Components	Subject Measures	Cross-Validation
job stressors	independently verifiable judgement	research teams, independent investigators
acute reactions	reports of experiences e.g. frequency	physiological measures e.g. blood pressure, catecholamines, cortisol
illness / chronic strain	health / ill-health e.g. anxiety, depression	history of lost work time, physicians' reports, treatment

Figure 2. Major components of the Stress Model

When we talk about job stressors, these are the features of the environment. So we want an evaluation and assessment -- a dispassionate judgment about that feature in the environment. We want it to be independently verifiable, so that a co-worker can come in and make roughly the same kind of judgment, so that a research team member could come in, or some other independent investigator could come in and make roughly the same judgment of that stressor in the environment. The worker who is exposed to the stressor is in a very important position to evaluate it, because that person works with it every day. So that's, in a sense, the expert. But it is important to have the independent assessment as well -- that would be a measure that is independently verifiable.

Farm family studies are doing just that. The Ohio presentation, Phase Two -- Jay (Prof. J.R. Wilkins, III, OSU), you will have to correct me -- is modeling those components of looking at the farmers but also their own research team is going in. And I believe some of the other presentations at this symposium are also arguing for this multi-method kind of assessment.

When we talk about acute reactions, these are personal experiences. So there is no right or wrong. Whatever the person says, that is it. However, we will try to get some cross-validation in terms of physiological changes. Some of the common validation methods are blood pressure, catecholamines, and cortisol.

Finally, we move on to chronic strain, that is general health or ill-health measures, anxiety, depression. The CES-D (1980. Center for Epidemiological Studies - Depression., N.C.H.S. series 11, no 216.) scale is being used in some of the farm family studies. That is a good example of a measure of chronic strain of depression. We might look at a history of lost work time, on physicians'

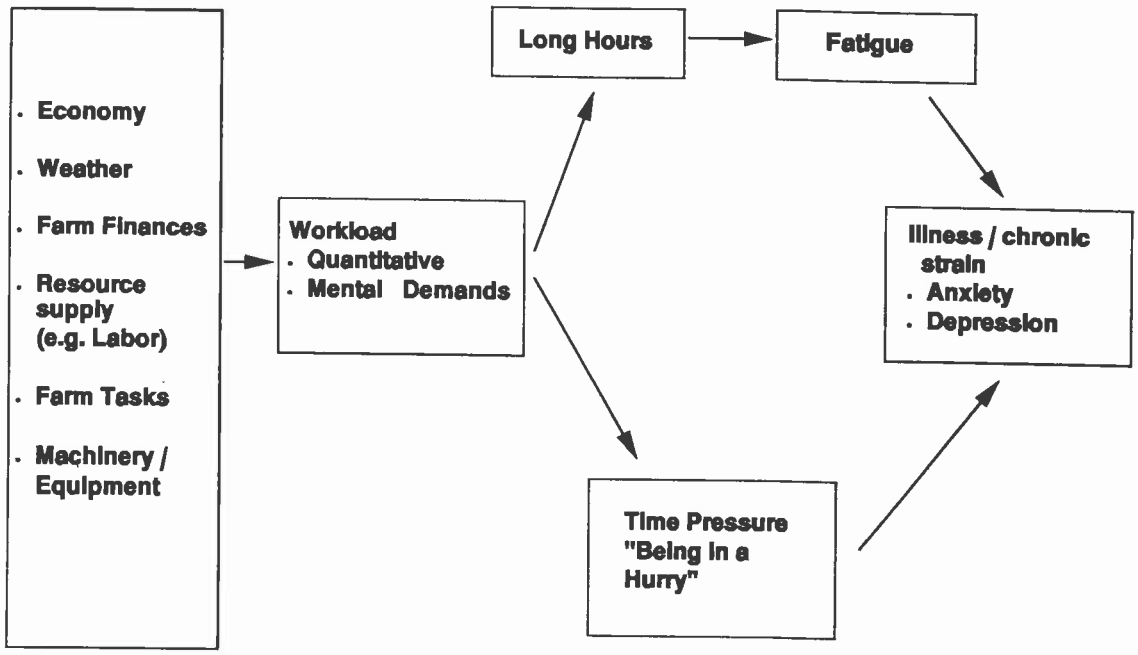

Figure 3. A preliminary model for understanding Farm Family Stress

reports of this sort of thing.

A couple of important things here. One is to emphasize multi-method. I think I left it out of the references but Campbell and Fiske's multi-trait multi-method matrix (Psycholological Bulletin, 1959. v.56 pp. 81-105.) is a very important reference here. Also Spector[2] and others have looked at some of the stress research and have noted that sometimes in studies you can't tell the difference between a measure of chronic strain and acute stress reactions. So when we measure these things we want to know which we are measuring. They point out that sometimes somebody who is depressed might, in fact, respond that they are having more problems at work. But the causal direction has been reversed. And so if we are going to show a stress process from job stressors through acute reaction to chronic strain, we have got to be able to show the whole process and validate it. That is some of the message coming from that research.

And then, once again, let me emphasize this is a cross-time issue.

See Figure 3. This is a very preliminary, very simple, overly simplified beginning model of how we might start to look at farm family stress. We have the job stressors on the left. Each box represents a concept, or set of concepts in this case, and each arrow represents a hypothesis. Where there are no arrows, that means we are hypothesizing no relationships, the null hypothesis. So we might imagine that some kind of farm task changed, or maybe equipment broke down, and that led to an increased work load. That meant the farmer might have felt he was under increased time pressure. Farmers say,

"I am in a hurry," it's "being in a hurry."

If that accumulates over a long term period of time, that might lead to anxiety. And this is how we are going about this kind of modeling process.

See Figure 4. We have talked, a bit, in this conference about the weather events in the Midwest and also in the southeast United States. This is -- I am almost embarrassed it's so simple but I made it extremely simple just on purpose, weather leads to no productivity, leads to poor farm family finances. So these are stressors that accumulated over the past few months and into the next few months, right now. That can lead to the build up of anxiety, possibly depression, and, as Paul Gunderson, who is in this audience, has been writing, in some cases to suicide. We are looking at an increased possibility of that in the coming months right now.

See Figure 5. As I said, this is very simple, it is not enough. What if we wanted to include pesticides. We would want to include multiple methods. So in the branch I am in, Applied Psychology and Ergonomics in DBBS, we have John Russo and others evaluating exposure to organophosphates in a multi-method fashion. And we would want to include their kinds of assessment tools along with looking at stress. So we are moving beyond just a simple stress model to a much more comprehensive approach.

See Figure 6. Similarly, Robert Dick, also in Applied Psychology and Ergonomics, is looking at new assessment methods for exposures to pesticides, solvents, and metals. Again a multi-method approach, and that is really important to emphasize.

See Figure 7. What we are talking about is much more than just this small little model. We are talking about moving to a broader physical, ergonomic, and bio-behavioral model, of which this stress process is just one small part. And I am going to turn it back over to Pam who is going to fill in these boxes with some really exciting findings.

DR. KIDD: Alright. At least you are not asleep. In terms of the secondary analysis that we did I am going to have you turn off the overhead now, thank you. We had two aims in doing the secondary analysis. Number one, to find out what job stressors do farm families share with other occupational workers and what job stressors are unique. We are really still in the process of analyzing this data.

The impetus for the secondary analysis arose from the initial analysis of the focus group data. The participants didn't discuss mental health, specifically. But, there was a trend in the data that worrying about finances and getting the help in terms of extra labor or machinery parts, for example, increased your injury risk indirectly by increasing their fatigue. And it is the stress injury relationship that I am going to elaborate further upon.

How did we go about analyzing this focus group data? We did several things. First off, when you deal with stress and coping, it has been examined extensively in the literature, we were obligated to start with definitions in the literature of words that might be important to look for in the transcripts. So we had a seven page extensive coding dictionary. The coding dictionary was structured from the beginning.

Problem: Evaluation of organophosphate-poisoned workers and methyl bromide-exposed fumigators.

Methods: Neurobehavioral Evaluation System (Cognitive, Motor, Affective)

Postural Sway

Eye-Hand Coordination

Figure 4. Neurobehavioral Assessment of Pesticide Applicators
(John Russo, Ph.D., David Chrislip, W. Stephen Brightwell, Robert Dick, Ph.D.)

However, those definitions were modified after analyzing each transcript, based on the farmers interpretation of those terms. There were about 31 stressors in the literature that were not discussed spontaneously by the farmers in our study.

The dictionary went through five iterations. It was revised by the team after each transcript analysis. We had a total of 145 key words and 908 data entries, or discourse segments from those transcripts. We were dealing with 240 pages of transcripts.

Originally, the focus groups were audiotaped and transcribed verbatim. Once we transcribed the data and we coded it independently by two investigators for each transcript, we entered the data into **FYI3000**, which is a qualitative software data program.

We displayed the data in printouts based on every key word in the dictionary. Then we later obtained secondary printouts by collapsing key words and concepts together based on coding definitions and hypotheses that were emerging in the analysis.

We looked at the consistency of our coding among raters, for each county, and what are our Kappa coefficient were. We had a moderate to excellent agreement, 0.69 to 0.87. We also looked at the content validity of what we were doing. We matched the definitions in terms of the meaning of the definition and how well the definition matched with a piece of data. We completed this task independently and calculated a mean across the panel of three expert judges. We had a mean of 86, which is good agreement, good validity between definitions and data.

We kept a diary of our coding decisions, relationships among key words, and questions that are not yet answered. It helps to clarify analysis techniques throughout, it also serves

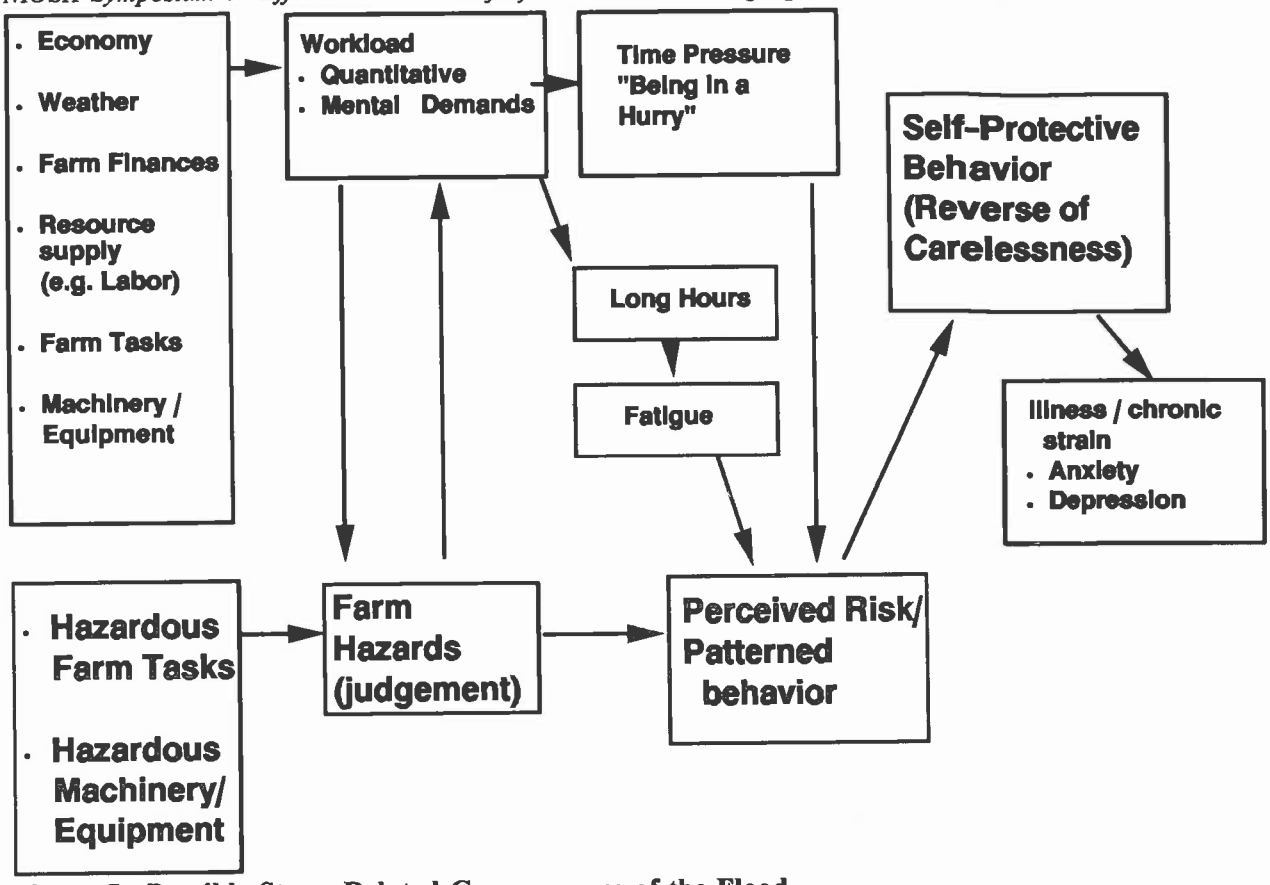

Figure 5. Possible Stress-Related Consequences of the Flood.

as an audit trail in case someone would like to look at the way you analyzed your data.

What did we find? Definitely, a greater clarification of the relationship between stress and injury. You saw the model that Ted put up, let's take that one box of farm stress. These were the most frequent stressors listed by farmers in our particular secondary analysis. This environment is very much a psychö-socio-physical environment. The important thing is that some farm tasks are viewed as hazardous and some are not, even though they will tell you that all farming is dangerous. When the farmers talk in the focus group, they give greater clarification regarding what types of equipment and tasks are more dangerous.

This is showing moving a piece of equipment down a public highway since it was one of the most significantly rated, or frequently encountered, hazardous tasks.

Judgments about their workload and hazards. Well, their workload perception does come from the demands placed upon trying to complete these tasks with limited labor supply and limited equipment sometimes. A lot of times it increased their workload because they physically had to do something they didn't feel quite safe in delegating. And a lot of times it also influenced their perception of what they were doing at the time as being

more hazardous than what it would have been at another point in time.

This is showing the multiple work roles of the wife on the farm. And also the male farmer in dealing with animals. Mental demands of the simultaneous tasks of farming was frequently listed as requiring judgment that influenced some of their safety decision making.

Acute reactions, what did we find in the secondary analysis? Time pressures, long hours, fatigue, and carelessness were frequently mentioned. I have to really focus in on carelessness because to me it says lack of self-protection, (how we are defining carelessness), is the key in injury control.

Several of these newspaper clippings show what farmers perceived increased their time pressures and long hours worked - weather, etcetera, were some of these stressors. So, again going back to the original column, these stressors impacted this stage in the process.

I am going to refer you now to your handouts. It is the page called "Relationship and Supporting Data." I want you to look at the very last entry on the handout which is bolded. I will read this, paraphrase it to you, because you can't read it on the slide. Basically, what they are saying here is that it is spring, it has rained and rained and rained. You can't get in the field and time to get the crop in order to have adequate growing time is getting so close and you have major breakdowns every day and your temper gets terrible. This represents anger as an acute strain. "I just don't say anything. I avoid contact with him, that is a coping strategy, but we are not getting into that here. I will argue with him later. But I worry about him when he gets in this particular state and I tell our son to watch him real close because I know he gets careless and something happens." This data depicts the relationship between stress and the acute reaction of carelessness.

Other strains that we encountered in our data were anxiety, injury productivity, and anger. We have a frequency listing in one of those handouts for you. In other words, once they are careless, they may sustain an injury that requires medical and nursing treatment or it may result in mortality.

Let's turn off the slide projector and we will go back to the transparencies and show you the application of the model.

Kentucky farmers definitely identified certain tasks as being more hazardous using certain equipment. For example, the bush-hog and mowing on a hillside. That comes into the judgment of farm hazards. At the same time they will tell you they will delegate certain tasks to certain people but a lot of times figuring out who is able to perform a certain task increases their stress and their mental demands. Or it may add more work on them because they can't delegate it.

That then leads to the time pressures, the long hours, and the fatigue. The column I am really concerned about, or I am interested in that I am still trying to figure out, is the perceived risk and pattern behavior column or cell. At this point, it seems that at a time when they have multiple stressors affecting their decision making, instead of paying more attention to the cues regarding the hazard, they know it is a dangerous task, perhaps

Development of assessment methods for quantifying the adverse motor and sensory effects of chemicals commonly used in farm work. Current neurobehavioral test batteries do not contain a sufficient number and diversity of sensory and motor tests to adequately assess neurotoxicity from exposure to agricultural pesticides, solvents, and metals.

Sensory Funtion:
- Olfaction
- Vision
- Cutaneous sensation
- Evoked sensory potentials

Motor Funtion:
- Tremor
- Manual Dexterity
- Postural Stability

Figure 6. Neurobehavioral Health Risks in Farm Workers
Robert Dick, Ph.D., Bobby Taylor, Paula Grubb, M.A.

they have already told someone of the danger. They may have cut themselves or before doing this task, the equipment is dangerous. However, they perceive or place greater attention on the other stressors that are in the box above that hazard box (e.g. economics, weather, labor, supply, etc.). Why? I don't know, except that they tell me it is related to productivity.

And a good example of trying to explain this to you is to go back to that very same handout that I just read from - the Relationship and Supporting Data handout. I believe that is number one, right at the top of your page. "Well, I am going to finish this task or this job because I have -- before I do anything about the tractor brakes, it is going to rain tomorrow, I have got to get this job done

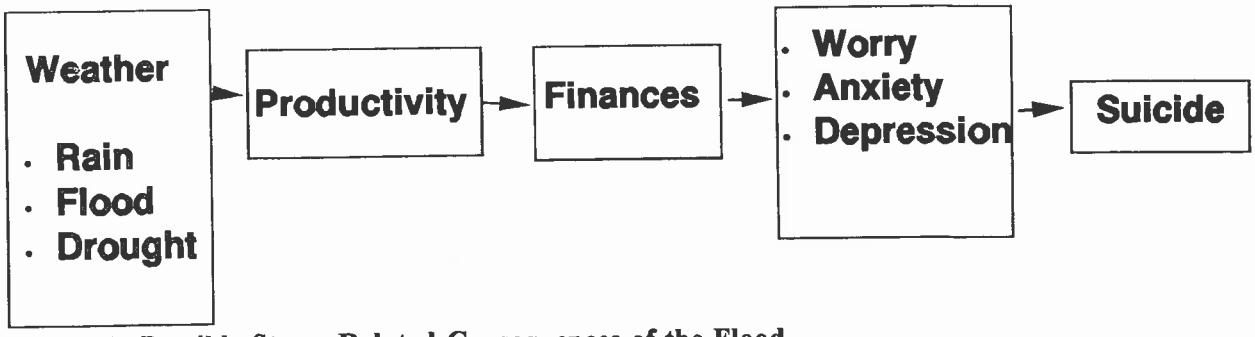

Figure 7. Possible Stress-Related Consequences of the Flood.

today. It is carelessness because you feel like you can complete the job without having an accident. But the carelessness is there because it is already a fact that it can cause an accident."

So at that point, they are paying a lot more attention on getting the task done and not necessarily the injury potential of the task.

The very next piece of data on that handout depicts how it leads from perceived risk to carelessness to injury. They say (this is related to productivity) why they may be paying more attention to the farm stressor cues in the top box than actually the hazardous task, (e.g. a piece that is torn off could be a protective item) is the cost of repair versus getting the job done without having to fix it at that time. The cost versus the amount of time and what you are going to save if you go on and get the job done. Especially if the needed repair doesn't hamper what you are doing. If you have a belt broken or a chain, that is a necessity, but a shield, probably, you could pick two or three acres of corn while you were getting the shield made. The cost of that shield will come out of the profit that is decreasing while you repair the equipment. They are making an actual decision to go for the productivity and take the injury risk.

So where do we go from here? Basically, for some reason, it appears they are paying attention to cues of farm stress but not necessarily to cues of the hazard at that time. Their focus is on maintaining productivity not preventing injury. But they are not making the link at that time by preventing injury you are maintaining productivity. And, perhaps, also familiarity with doing the task under less stressful conditions encourages their lack of self-protection.

I think the key thing that I have learned from this point in the analysis is that unsafe behavior needs to be discussed in relation to economics, and their lifestyle, and even their farming management strategies or implications, and not just in terms of preventing injury and promoting health. I think it may have more meaning and make sense to them in their decision making process.

I will turn it back to Ted for one last comment.

MR. SCHARF: See Figure 7. Thank you very much, Pam. I can't tell you how exciting it was to be sitting there with the model and have Pam pull out the transcripts to fill in these boxes and make the connections across the model. It was so exciting when it happened and it is still exciting now to see it happening. But, what have we got?

If we follow the modeling techniques we need to follow the methodological requirements of this type of stress process. We are forced to take a more comprehensive and inclusive approach to modeling, not stress alone but this whole idea of a bio-behavioral model of farm family issues.

Second, by following this process within the limits of our methods, this is testable. These hypotheses are testable and we can compare them to other possible hypotheses.

Also, Mark Veazie has done some work on the safety and injury component of this. We just have a few boxes in the model that relate to the kinds of work you are doing in Morgantown. What we need is to take these

small boxes and explode them out into what processes are going on. That is where we need to develop better collaboration.

Finally, one of the most exciting things is it forces us to shift our focus and emphasis from just the immediate experiences. We get away from just what has been happening before a potential injury happens. It says, look back to the precursors. Interrupt this stress process early in the model. What the farmers have said is that they need a labor supply that knows how to work on the farm, one that they can count on to get the job done, when it comes time. They need better — we need better economic conditions so the farmers are not under such tremendous pressure to try and just work a little more and just cut that extra acre because that is where their profit is. We need to alleviate some of the pressures here. Those are a couple of the issues that this kind of modeling allows us to do as well as suggesting a more comprehensive and ecological approach to looking at issues with respect to farm families. That is all I have for now. Thank you very much.

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Questions and Answers

Plenary Session IX - Research

DR. BENDER: Thank you both very much. We have, I think, a few minutes -- Dr. Lemen is coming up, come over here Dick -- a few minutes for questions because it is a very exciting topic. Of course, if it was simple we would have solved it all long ago. Dr. Deming says all models are wrong, some are useful.

And that is about where we are now. But there will be some potentially very helpful questions, I think, probably, from the group at this time. So let's take a few minutes to have that. When you come to the microphone would you, as before, give your name and affiliation? Maybe the stress of catching the plane has people mute now. Anything? Seriously, we will take a couple minutes if you would like to ask or follow up. Should I call on someone?

I have a few staff members here I could pin down.

DR. MC KNIGHT: Robert Mc Knight of the University of Kentucky. This is directed to Dr. Kidd. I know that we have also spent the past year doing focus groups of children and adolescents. Was there any information in the focus groups on children and adolescents that indicated that there might be a model of childhood stress, related to childhood injuries in agriculture?

DR. KIDD: Bob asked a great question. I did not look at the transcripts from that particular project, although, I think, that is the next step. And since you are part of that project team, you know that you are going to have some work too. There is definitely, has to be implications for the children. In this immediate model where I see it is the decision making, the judgment column, that the farmer decides, now who is going to be able to help us with this hazardous task. I don't necessarily want to put my oldest son on the hill doing this particular job since it just rained. The reality is I just got two other workers that never used this particular piece of machinery, they have been on a totally different tractor at my friend's farm yesterday, I have got to get them started, so I am going to put my son on this job to start out.

So it may be, at that point, in that column, that there could be some implications for other members of the family - injury beyond just the farmer injury, if that makes sense.

DR. BENDER: Anything else? Yes.

MS. MOREAU: Peggy Moreau, University of Vermont. (Comment off mike.)

MR. FREUND: Gene Freund with NIOSH. Not being an injury epidemiologist I am probably being a little bit careless myself in making comments. But, I think, one thing that really comes up in looking at your comments is that you have got this issue of carelessness and it makes me think that, as we have seen in many other occupational arenas at the time, to affect behavior is not when they are trying to get that production done. The practice that while they are in the field, trying to do that thing is not the time to do it. We really do need to be looking back, as Ted said, at the engineering controls that

protect people from the carelessness that the need to produce is doing, the barriers too, having ROPS on your tractors, power take off, shaft protection, and even the choices people make in terms of their overall plan for pesticide production to reduce the hazard when they get careless in the field, and all those kinds of things. I think that is a real important thing. And that is also behavioral because the farmer is the one who is deciding to do this, but at different times.

DR. KIDD: I really believe that, Gene. If anything that first box of the stressors, it gives much credibility to engineering techniques. Because, all of a sudden, what is down in that bottom box as a hazard, may not be perceived as a hazard and could reduce greater mental demands if we can make the equipment safer or if we can make that task completion safer. So, indeed, you may get less in that bottom box, which ultimately could influence that second box. So, good reason to work together.

DR. MAY: John May, Cooperstown, New York. I am wondering, the activities that are listed in the second box, did you make any effort to verify whether these, in fact, are hazardous activities or simply viewed as hazardous activities?

DR. KIDD: In terms of epidemiologic data and getting some incidence in prevalence rates in our state, we did try to do that in our first year of data collection. We got some information about use of ROPS and the number of tractors. We didn't have the data in at that time from our occupational health nurse study. Now we will have a stronger database to go back and add on those demographic variables as well as those injury variables and see if there is a correlation between those and the frequency within which a key word appeared in the transcripts. So to answer you, not at this time, but definitely, it is in the future plans.

MR. PEDERSEN: I'm Dave Pedersen, I'm with NIOSH, Cincinnati. My question relates to one of your conclusions where you were emphasizing, I think, as a semi-intervention technique, that one should emphasize economics over personal safety or injury prevention. Would you expand on that?

DR. KIDD: Yes, thank you. What I truly envision, and this has been through help of the analysis team, it is not my own deduction, it has been a real team approach working with extension and the farmers themselves too, is that if you can talk about disability prevention more, and remind them they have got a family they want to get back in from the field today to see, and even maybe PSAs at the time of harvest in planning to alert them to their increased injury susceptibility, perhaps those are ways. But it is really showing them that when they are injured, how many hours do they ultimately lose? Plus, if they are insured or not. And bringing back the ramifications, fiscally, of injury to them, which we have not really looked at in the degree that I think we could.

DR. BENDER: I think we had better stop now. Just sort of in closing, I would comment that stress and it's relationship to health, and stress and it's relationship to injury, are, of course, very, very important topics. And it is fitting that we close out the session, I think, with this topic. Keep in mind that stress may be an etiologic co-factor in leading to health and injury outcomes. But it,

also, is a result of outcomes. Nothing is more stressful than having an injury or even a fatality or a long-term disability from farm work. So on both sides of the equation, both the input and the output. Some things I am encouraged about, in terms of agriculture, came out in Dr. Chapman's presentation. And although injuries -- farming may be one of the most very, very hazardous occupations in the country, there does seem to be some long-term health effects that are quite low among farmers. Yes, farming has been proposed as a healthy occupation. In fact, if you look at some of the Standardized Mortality Ratios (SMR), and even considering the possibility that healthy farmers may stay at work and unhealthy farmers may get out and go into key punching or something like that, there is almost a protective effect from some long-term outcomes related, associated with farming. So I think the emphasis on injury and stress is one that is very, very important. We look forward to hearing more out of all of you regarding that topic.

Closing Comments

By *Richard A. Lemen, Ph.D.*
Acting Director, NIOSH

DR. BENDER: Well our closing remarks are going to be made by Richard A. Lemen, Ph. D.. Dr. Lemen is the acting director of the National Institute for Occupational Safety and Health. He has been in that position as acting director of NIOSH since just August 1, 1993. He was the deputy director of NIOSH since August, 1991. And prior to this he was the assistant director of NIOSH, Washington office and that was from October, 1988 to August, 1991. He was the director of the Division of Standards Development and Technology Transfer, which is known as DSDTT, from June, 1980 to September, 1988. He has served NIOSH in a variety of management positions over the last 25 years. He is the author of many scholarly publications including joint editorship of the book, *Dust and Disease*. He received his BA degree from Central Methodist College where he was named a distinguished alumni in 1987. He has a master's degree in epidemiology from the University of Missouri and a Ph.D. in epidemiology from the University of Cincinnati. Let's welcome to the podium, Dr. Lemen.

DR. LEMEN: It is truly a pleasure to be here. As I was coming in the room and talking to some of the people in the back of the room, they said, "You know, the amazing thing about this group of people is that they seem to be really willing and are working together." And I think that is one of the best compliments that anybody can make about a group of people like this.

I am sorry I could not be here for the whole conference. I am happy to be here to end the conference.

I would like to thank a few people that were very instrumental in putting this conference together - Mel Myers, who I am sure all of you had an opportunity to talk to, Tim Groza, and Betty Dryden in the back of the room, and also to Rosemary Cianfracco from the Division of Safety Research for helping with the audio-visual materials. And I would like to thank the Southeastern Center for Agricultural Health and Injury Prevention for all the support they have given throughout this conference in helping NIOSH put this conference on.

We have a strong commitment in the Institute to agricultural safety and health. These activities represent a major part of our budgetary process.

I, personally, have an interest in agricultural health because I grew up in an agricultural community in Missouri and spent many, many hours working on the farm as a child and as a teenager and as a college student. I haven't been back to work on a farm since then because I took another career channel. But I certainly remember all of those early years in my in a farming community, working with farmers.

Many of you are probably aware that September 19 - 25 has been designated as this

year's National Farm Safety and Health Week. This week we will observe the 50th anniversary of the health and safety concerns of American farmers.

The emphasis this year will be on the child, on tractor safety, and on chemical safety. I think that it is very appropriate to include the child and you have heard much about that during this conference. The theme they have chosen for this year's observance is Safety and Health - Agriculture's Future. This theme seems, to me, very appropriate considering the rapid approach of the year 2000.

It is difficult to judge, at this time, what is going to happen in the 21st century and what farming is going to be like in. But it is likely that the agricultural community will still be facing many of the hazards they face today. We will continue to need safety and health intervention and prevention programs well into the next century and probably for many centuries to come.

This conference has been an important forum, both on examining our progress and for looking ahead to the future needs of agriculture. If we are going to improve agricultural safety and health in the 21st century, it is crucial that we continue to plan for the future.

At NIOSH, we are doing this through a transformation process that we began about a year ago. We are trying to transform the Institute to make it a better science Institute, to make partnerships with people like you, to make the Institute more efficient, and to assure realization of our mandate which is to provide a safe and healthy workplace for all the workers in this country.

We are striving to enhance, the way we do business in NIOSH. Through conferences like this, we are building not only our internal structure but also those with partners outside of NIOSH.

Over the last year, we at NIOSH have developed a vision that we hope will direct our activities and research into the next century. That vision is "delivering on the nation's promise: safety and health at work for all people... through prevention."

We have also compiled a list of values that we, at NIOSH, hope to use in working with our partners and within the Institute. These values include honest communication, trust, mutual respect, humility, personal responsibility, caring, meaningful work, integrity, commitment and fairness. We hope that we can instill these values in all the individuals that work in our Institute so that we can perform better in the areas of excellence in science, excellence in service, advocacy, and in developing new partnerships.

In striving to develop these new partnerships, we want to include as many partners to NIOSH as we can. You are important partners to us and we want to work with you. We need your assistance to help us transform NIOSH into an organization that will go into the 21st century and provide the science, the advocacy, and the honest communication that is needed in presenting and preventing worker safety and health problems in this country.

This process is going to begin publicly on September 22 when the NIOSH Quality Counsel and the NIOSH Board of Scientific Counselors hold the first meeting. At this meeting we are going to invite partners of

NIOSH to come and tell us how they feel NIOSH should operate in the future. The NIOSH staff and I have been hearing from a number of people around the country expressing the needs of farmers and their families. We want to hear clearly what you need and we want to be able to address these needs in our research program, in our prevention program, and in our role as an advocate for you to the United States Congress, to the White House, and to other entities where change can be made.

We also want to continue our partnerships with people like Marilyn Adams, Kelley Donham, James Merchant and those of you that have participated in the NCASH. These people have specifically expressed concern about the health and the safety of children on farms. For this reason I am proud of NIOSH, I am proud that we play a role in funding a number of these programs dealing with children.

Children are still often neglected in the workplace - you have heard about this in this conference. Historically, NIOSH has tried to reach out to these workers and those people facing occupational hazards. I am proud of NIOSH that we have included children in these processes. It is crucial that all of us committed to agricultural safety and health continue to emphasize community participation. We also must continue to address the migrant health worker issues. We need to have more effective programs in this area.

It is our obligation, I think, as occupational safety and health researchers to actively involve the farm workers, and their families, in our efforts to prevent disease, injury and death in their working environment. So I hope you have all enjoyed this conference. I hope you have all gotten something out of it that you can take back home. But, most importantly, I hope that this conference has been an avenue where honest communication and active participation by all has occurred. We want to continue meeting with you on a periodic basis. With the help of the NIOSH staff, and participating Division Directors, we will continue our commitment to agricultural safety and health. We want to include you in helping us transform NIOSH and making it more responsive to your needs and to the needs of America's workers. So, thank you very much and have a safe trip home. I hope I have eliminated a little stress by not keeping you until 11:30 so you can catch your planes. Thank you all.

Comments

DR. BENDER: Thank you, Dr. Lemen. Any final things -- any final instructions, housekeeping, anything else?

MR. MELVIN L. MYERS: One is a hazard that we hadn't really recognized at NIOSH before and that is something mud. And mud was in two ways -- heard about two fatalities in turns of towing people out of the mud. Several people shared their own stories about being towed out of mud. Heard about one chain that broke and went back through a tractor window and caused a ruptured spleen. Mud is an issue that we just did not have on any of the information that you found -- that we had as a handout here. That was a new revelation in terms of a hazard.

Secondly, the mud issue is one that came across as something the farmers are not --

you can't get the crops out this year. You probably can't even get them in next year. Saturated soil means that we are going to go over the whole winter probably frozen. Soil, water in the soil next spring will be still saturated. A normal rainfall next year could lead to more flooding. So there is probably going to be two years of lost crops which I don't think people, the society has really recognized yet. So it is going to be a long term thing and the stress stuff we have been hearing about becomes very important.

I talked to Dave Baker who came in yesterday from Missouri and Dave said there are three things that are real important. One is to deal with the stress thing as soon as we can, because it is going to be there. Number two, are those strange problems that one sees after a flood, things that we at NIOSH have been working on in terms of indoor air, is just one aspect of that, is the fungal spores are going to be all over as this flood recedes. The third thing is for NIOSH to somehow connect through Federal Emergency Management Agency (FEMA) so that more NIOSH expertise is available at the local level when they make the call to FEMA. For those who want a report on those observations are very meaningful.

DR. BENDER: Alright, that is the end of this session and the end of the conference. I wish you bon voyage. Thanks for all your help and participation.

ACRONYMS

4-H	A youth organization; 4-H stands for head, heart, hands and health
AGI	All Glass Impinger
AHPS	Agricultural Health Promotion Systems
ATV	All Terrain Vehicle
AV	audio visual
CADIREP	Center for Agriculture Disease and Injury, Research, Education, and Prevention
CATI	computer assisted telephone interview
CAST	Cooperative Agricultural Surveillance Training
CFOI	Census of Fatal Occupational Injuries
COPD	chronic obstructive pulmonary disease
dBA	decibel
DBBS	Division of Biomedical and Behavioral Science
DSHEFS	Division of Surveillance, Hazard Evaluations, and Field Studies
DPSE	Division of Physical Sciences and Engineering
DSR	Division of Safety Research
DRDS	Division of Respiratory Disease Studies
DSDTT	Division of Standards Development and Technology Transfer
DTMD	Division of Training and Manpower Development
EMS	Emergency Medical Service
EPA	Environmental Protection Agency
FACE	Fatal Accident Circumstances and Epidemiology
FAIC	Farm and Agricultural Injury Classification
FEMA	Federal Emergency Management Agency
FFA	Future Farmers of America
FHA	Federal Housing Authority
FHADES	Farm Health and Demographic Enumeration Survey
HAZOP	hazard and operability study
HI-CAHS	High Plains Intermountain Center for Agricultural Health and Safety
IAMOH	Institute of Agricultural Medicine and Occupational Health
IBM	International Business Machines
ICD	International Classification of Disease
INASH	Illinois Network for Agricultural Safety and Health
MMRF	Marshfield Medical Research Foundation
MMWR	Morbidity and Mortality Weekly Report
MNCRASH	Minnesota Center for Research in Agricultural Safety and Health
NCASH	National Coalition for Agricultural Safety and Health
NHANES	National Health and Nutrition Examination Survey
NIMH	National Institute of Mental Health
NOHS	National Occupational Hazard Survey

NOMS	National Occupational Mortality Surveillance System
NTOF	National Traumatic Occupational Fatality
OARDC	Ohio Agricultural Research and Development Center
OASS	Ohio Agricultural Statistics Service
OATS	Olmstead Agricultural Trauma Study
OEM	original equipment manufacturer
OHNAC	Occupational Health Nurse's in Agricultural Communities
OMB	Office of Management and Budget
OVS	Office of Vital Statistics
PEL	Permissable Exposure Limit
PMR	Proportionate Mortality Ratios
PPE	personal protective equipment
PSA	Public Service Announcement
PTO	power take off
REL	Recommended Exposure Level
ROPS	roll-over protection structure (tractor)
RRIS	Regional Rural Injury Study
SAS	Statistical Analysis System
SENSOR	Sentinel Event Notification System for Occupational Risk
SIC	Standard Industrial Classification
SMR	Standardized Mortality Ratio

INDEX

agricultural health promotion 89, 161, 169, 172, 176, 178, 186, 198, 268
AHPS 103, 169, 177, 268
Alabama 86
alachlor 102
Alaska 13-15, 17, 116
Amish 49, 161-163, 185
anhydrous ammonia 97, 170
animal handling 27, 58
Arizona 6, 84, 172, 173, 175
ATV 94, 268
CADIREP 229, 268
California . . 16, 20-22, 24, 25, 43, 47, 51-53, 86-88, 123, 138, 141, 144, 149, 189, 213, 214, 218, 237, 242, 243

cancer
- brain 4, 19, 72-76, 98, 101, 121, 122, 127-131, 213, 215-217, 232, 233
- breast 4, 19, 72-76, 98, 101, 121, 122, 127-131, 213, 215-217, 232, 233
- colorectal 4, 19, 72-76, 98, 101, 121, 122, 127-131, 213, 215-217, 232, 233
- control 4, 19, 72-76, 98, 101, 121, 122, 127-131, 213, 215-217, 232, 233
- early detection of . 4, 19, 72-76, 98, 101, 121, 122, 127-131, 213, 215-217, 232, 233
- lymphoma 4, 19, 72-76, 98, 101, 121, 122, 127-131, 213, 215-217, 232, 233
- melanoma 4, 19, 72-76, 98, 101, 121, 122, 127-131, 213, 215-217, 232, 233

carcinogens
- monitoring biological markers & exposures 216, 239, 240

CAST 25, 26, 28, 176, 268
CD-ROM 200
CDC 9, 12, 187, 193
Chemicals
- safety compliance 4, 27, 43, 58, 75, 101, 111, 135, 136, 154, 174, 188, 214, 242, 246
- sampling & analysis . 4, 27, 43, 58, 75, 101, 111, 135, 136, 154, 174, 188, 214, 242, 246

child safety 58
Colorado 25, 38, 42, 54, 63, 64, 104, 150, 240-242
CPR 172
DBBS 254, 268
Delaware 178
DPSE 268
DRDS 110, 268
DSHEFS 29, 268
Exposures
- occupational . . . 17, 25, 28, 34, 36, 38, 40, 41, 60, 63-65, 73, 74, 101, 109, 112, 116,

118, 123, 128-131, 159, 189, 190, 214, 216, 217, 243, 254
to chemicals . . . 17, 25, 28, 34, 36, 38, 40, 41, 60, 63-65, 73, 74, 101, 109, 112, 116, 118, 123, 128-131, 159, 189, 190, 214, 216, 217, 243, 254
to herbicides . . . 17, 25, 28, 34, 36, 38, 40, 41, 60, 63-65, 73, 74, 101, 109, 112, 116, 118, 123, 128-131, 159, 189, 190, 214, 216, 217, 243, 254
to noise . . 17, 25, 28, 34, 36, 38, 40, 41, 60, 63-65, 73, 74, 101, 109, 112, 116, 118, 123, 128-131, 159, 189, 190, 214, 216, 217, 243, 254
to pesticides . . . 17, 25, 28, 34, 36, 38, 40, 41, 60, 63-65, 73, 74, 101, 109, 112, 116, 118, 123, 128-131, 159, 189, 190, 214, 216, 217, 243, 254
FFA 9, 18, 19, 171, 230, 233, 268
Florida 16, 17, 51, 52, 67, 78, 121, 201
FYI3000 255
GC 158
Georgia 52, 129
grain handling 26
Hawaii 86
Hazards
assessment of 11, 26-28, 38-42, 44, 135, 140, 141, 146, 147, 150, 162, 172, 175, 179, 181, 199, 205, 256, 257, 265, 266
disseminate info on . . . 11, 26-28, 38-42, 44, 135, 140, 141, 146, 147, 150, 162, 172, 175, 179, 181, 199, 205, 256, 257, 265, 266
engineering . . 11, 26-28, 38-42, 44, 135, 140, 141, 146, 147, 150, 162, 172, 175, 179, 181, 199, 205, 256, 257, 265, 266
grain handling 11, 26-28, 38-42, 44, 135, 140, 141, 146, 147, 150, 162, 172, 175, 179, 181, 199, 205, 256, 257, 265, 266
process analysis of 11, 26-28, 38-42, 44, 135, 140, 141, 146, 147, 150, 162, 172, 175, 179, 181, 199, 205, 256, 257, 265, 266
workplace or agricultural analysis 11, 26-28, 38-42, 44, 135, 140, 141, 146, 147, 150, 162, 172, 175, 179, 181, 199, 205, 256, 257, 265, 266
HAZOP 97, 98, 268
Herbicide
sampling 46, 128
HI-CAHS 44, 268
Hispanic 20
Hispanic workers 48, 79, 160
Idaho 9, 52
Illinois 86-88, 123, 160, 268
Indiana 9
Iowa . . 9-11, 25, 59, 60, 80-82, 84, 85, 87, 108, 129-131, 176-179, 182-184, 192, 228, 229, 231, 237, 244, 245
Kansas 128-130, 149, 169, 170
Kentucky . . 1, i, 3-8, 16, 25, 60, 67-70, 78, 79, 84, 85, 98, 132-134, 191-194, 196, 197, 207,

208, 211, 220, 221, 240, 242, 248-250, 257, 261
lung disease 40, 60, 213, 217
Maine 30, 31, 86
Massachusetts 210
Michigan 16, 45-47, 49, 52-54, 86, 125, 129
migrant workers 17, 45, 55, 79, 121, 130, 160
Minnesota 72-74, 86-88, 99, 107, 109, 112, 129, 268
Mississippi 10, 132, 133
Missouri 11, 86, 87, 202, 203, 206, 264, 267
MMRF 60, 268
Montana 86
National Migrant Resource Program 123
NCHS 121
Nebraska 10, 129, 232, 235, 246, 247
New Jersey 16, 17, 52, 129
New York 10, 11, 25, 52, 86, 97, 98, 117, 185, 221, 224, 237, 239, 250, 262
NHANES III 102
North Carolina 16, 17, 52, 67, 79, 86, 103, 105, 106, 125, 130-133
North Dakota 97, 187-190, 219
NTOF 13, 14, 115, 118, 269
NURSE 16, 20, 22, 30, 43, 45, 97, 98, 103, 162, 204, 208, 262, 269
nurses . . . 12, 21, 23, 24, 30, 32, 67, 71, 81, 87, 102, 107, 125, 169, 187, 188, 190, 204, 208, 229
OATS 112, 269
Occupational Health Nurse's in Agricultural Communities Projec 20
occupational health surveillance
    occupational health surveillance 120
Ohio 16, 20, 25, 82, 97, 99, 100, 102, 104, 125, 154, 161-163, 185, 219, 245, 252, 269
OHNAC 67, 68, 71, 107, 185, 187, 207, 269
Oklahoma 14, 15, 56, 58
OMB 100, 269
Oregon 52
OSHA 9, 11-13, 17, 21, 59, 60, 63, 65, 101, 104, 105, 154, 172, 174
OSU 102, 252
Pennsylvania 16, 52, 85, 116-118
PESTS 65, 66, 68
PI 249
Proportionate Mortality Ratios 122
Protective
    gloves 42, 233
    hearing (see hearing loss & conservation) 42, 233
PTO 16, 27, 42, 174, 178, 189, 269

ROPS 11, 16, 42, 84, 150-153, 174, 179, 186, 195, 199, 205, 262, 269
RRIS 112, 269
Safety programs
    model 31, 89, 172-175
    occupational 31, 89, 172-175
    pesticide 31, 89, 172-175
safety training 141, 172, 175, 198
SENSOR 103, 106, 124, 269
SIC 115, 116, 118, 126, 269
South Carolina 237, 242, 243
South Dakota 6
SPRAINS 23, 113, 189
Tennessee 9, 16, 132-134, 198-200
Texas 45, 51, 52, 54, 86, 121, 127
Traumatic
    carpal tunnel, tendinitis, etc. . . . . i, 113, 214
USDA 15
Utah 86, 88
Vermont 247, 261
video exposure monitoring 102
Virginia 56, 89, 127
Washington 52, 79, 86, 237, 242, 243, 264
West Virginia 56, 127
Wisconsin 15, 44, 60, 77, 97, 115, 164, 166, 237, 241-243, 246

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