

NORTH CAROLINA
OCCUPATIONAL SAFETY AND HEALTH EDUCATION AND RESEARCH CENTER

ANNUAL REPORT
July 1, 2006 – June 30, 2007

NIOSH Grant # T42OH008673-03

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CHAPEL HILL, NORTH CAROLINA

November 2007

North Carolina Occupational Safety and Health Education and Research Center
Centerwide Annual Report
July 1, 2006 – June 30, 2007

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II. INTRODUCTION and EXECUTIVE SUMMARY

The purpose of the North Carolina Occupational Safety and Health Education and Research Center (NC OSHERC) is to train practitioners and researchers in the academic disciplines of Industrial Hygiene (IH), Occupational Health Nursing (OHN), Occupational Medicine (OM), Occupational Safety and Ergonomics, Occupational Epidemiology (OE), and Health Services Research in Occupational Safety and Health (HSROSH). The program also provides continuing education for professionals in these areas who seek to maintain and update their skills. Program trainees will be well equipped to achieve the occupational safety and health objectives outlined in Healthy People 2010 and continue to develop skills as addressed in the IOM report: Safe Work in the 21st Century.

The NC OSHERC is administered by an Executive Committee consisting of Center Director (Bonnie Rogers, DrPH, COHN-S, LNCC, FAAN) who also serves as the Program Director for Occupational Health Nursing and the Health Services Research in Occupational Safety and Health Program; Deputy Director (Judy Ostendorf, MPH, COHN-S, CCM, FAAOHN); Leena Nylander-French, PhD, Industrial Hygiene Program Director; David Richardson, PhD, Occupational Epidemiology Program Director; David Kaber, PhD, Occupational Safety and Ergonomics Program Director and Kathleen Buckheit, MPH, Director of Continuing Education and Outreach Program. All programs are located at the University of North Carolina, Chapel Hill, except Occupational Medicine which is at Duke University and Occupational Safety and Ergonomics which is at North Carolina State University.

The NC OSHERC utilizes advisory boards for the overall Center and for each of the programs listed above. These committees consist of members from industry, government, and academia, and they provide the various programs with input regarding curricula; needs assessment; and regional, national, and global perspectives on occupational health and safety. Each program advisory board has a chair who serves as a representative to the Center Advisory Board. The Center Advisory Board contains an additional labor/community and government representative and it meets with the ERC Executive Committee to coordinate the advisory process, propose action items, and facilitate changes within the ERC.

This report describes major accomplishments, significant changes, and identifies the NC OSHERC website which includes links to programs and the faculty/staff directory. The period covered by this report is 7/1/06-6/30/07. During this period, the following major accomplishments have been achieved:

A. Major Accomplishments

1. The NC OSHERC completed and submitted a Non-competing Continuation Grant for 07-08.
2. Outreach efforts have been outstanding by all faculty with enormous amounts of participation with community and fostering translation of research to practice. Numerous publications, collaborative sponsorships of courses, presentations, and consultations have been provided as shown in faculty program reports that practitioners, businesses, and workers have all been impacted with practice changes noted. Also, our NORA Interdisciplinary Seminar Series was posted via electronic forums. During this

reporting period participation increased, with an average attendance of 100 per seminar. The May 2007 seminar on Universal Precautions had an attendance high of 212. All disciplines have been represented and the international audience includes participants from the United States, as well as 13 countries; for example, Canada, South Africa, India, Israel, Malaysia, United Arab Emirates, Qatar, and Singapore.

3. A letter requesting proposals for pilot research projects was distributed. Proposals were team reviewed and one was funded through the NC OSHERC. The award was made to a professor in epidemiology and a student in the Public Health Leadership Program for their proposal titled "TB Testing in South Africa".
4. Continuing education has developed several new courses based on needs assessments. The new courses include Environmental Risk Assessment, Disaster Preparedness: Safety Working with Security of Information Technology, and Risk Assessment for Insurance. In addition, 4,712 students were trained during this reporting period, which is almost 12 times the required number of 400 students trained per year (by NIOSH). Professional certification or continuing education contact hours are now awarded for all courses. Certification review courses are offered in Occupational Health Nursing (COHN), Industrial Hygiene (CIH), Safety (CSP), Case Management (CM), Hazardous Materials Management (CHMM), and Certified Safety Manager (COHN/SM). Examinations taken for courses indicate a pass rate of 80 – 100%, which is significantly higher than national rates of 34 – 76%. One distance learning continuing education course has been developed and one is under development. The Continuing Education Program has undertaken sole sponsorship of the North Carolina State Ventilation Conference with 9 participants earning certificates after completing the 2 week-long courses and passing the examinations.

5. Academic Programs

The Industrial Hygiene Program had a total of five trainees supported with NIOSH funds; three Master's students and two doctoral students. Two of the Master's graduates are continuing in the doctoral program, one doctoral graduate accepted a postdoctoral fellowship, and one Master's and one doctoral graduate accepted positions in industry. Six students received poster, scientific achievement, or service awards during this reporting period.

The Occupational Health Nursing (OHN) Program had 17 trainees supported with NIOSH funding. The OHN Program graduated 2 master's students. All graduates (100%) are employed. The Occupational Health Nursing Program has received approval and established an on-line Certificate in Occupational Health Nursing Program. The first group of students will begin class August 2007. The program of study is based on a total of 11 – 12 academic credits and will provide a recruitment groundfield for potential applicants to master's level degree program and/or for those needing additional knowledge related to the specialty field.

The OHN Program participated in the very successful Graduate School Review of the Public Health Leadership Program, where NC OSHERC and OHN reside. The self study was completed in March 2007

and the site visit was April 3 -5, 2007. Details of the program review are discussed in the Occupational Health Nursing Program Progress Report.

The Occupational and Environmental Medicine Residency (OEMR) Program has two residents enrolled in the program. Efforts to improve and expand resident rotation experiences have been successful. The Duke Employee Health and Wellness Center rotation has been revised to include more focused administrative and toxicological investigations in addition to workers comp injury care. A new rotation with Duke Sports Medicine has been implemented as well as a rotation in Louisiana which focuses on hyperbaric medicine and the delivery of occupational health services to the oil and gas industries headquartered on the gulf course.

The OEMR program was evaluated by the Duke Graduate Medical Internal Review Board during this reporting period and received full accreditation.

The Occupational Safety and Ergonomics Program (OS & E) supported four students with NIOSH funding. PhD level training was expanded, since it was approved in the previous program review, and one student was funded. Four Master's Theses and one dissertation were completed during this reporting period.

The OS & E program had a successful external review through the Graduate School.

Dr. Gary Mirka accepted a position at another university and Dr. David Kaber was appointed as the Program Area Director.

Occupational Epidemiology included two trainees supported with NIOSH funding. Dr. Dana Loomis accepted a position at another university and Dr. David Richardson was appointed as the Program Area Director.

The Health Services Research Program in Occupational Health and Safety supported three trainees with NIOSH funds. The program was phased out June 30, 2007.

For all programs, faculty have secured several grants and produced 240 publications, including 6 book chapters and 1 book; many with students. Numerous (228) presentations have been given nationally and internationally.

B. Significant Changes

The North Carolina Occupational Safety and Health Education and Research Center (NC OSHERC) continues to fulfill its mission by educating occupational health professionals and researchers at all levels. The following significant items are noted:

1. Dr. David Richardson replaced Dr. Dana Loomis as the Occupational Epidemiology Program Director.
2. Dr. David Kaber replaced Dr. Gary Mirka as Occupational Safety and Ergonomics Program Director at North Carolina State University.
3. Interdisciplinary efforts have increased substantially.
 - a. The NORA Interdisciplinary Seminar Series has continued to discuss research pertinent to NORA. Trainees are required to attend at all of the sessions, either in person or via the webcast. Topics and the discipline responsible for presenting the seminar are listed below:

Topic	Discipline Presenting Seminar
"Mercury and Chlorine Exposures: Residual Effects 4-20 Years After Exposure"	Occupational Medicine
"Firefighter Physical Fitness: An Inductive Inquiry into Firefighter Culture and Worksite Health Promotion"	Health Services Research in Occupational Safety and Health
"Educational Needs Assessment for Pediatric Health Care Providers on Pesticide Toxicity"	Occupational Health Nursing
"Standard/Universal Precautions: Compliance, Beliefs & Barriers"	Industrial Hygiene

The seminar is developed by NC OSHERC Program Directors on a rotating basis. The series is presented on campus and webcast so that the larger Occupational Safety and Health community can participate.

- b. All cognate courses are interdisciplinary and are offered online.
4. Minority recruitment efforts have increased. For example in the Occupational Health Nursing Program contact has been made to several minority professional associations and colleges including the Black Nurses Association, Hispanic Nurses Association, the Indian Tribe Education Organization, and the American Assembly for Men in Nursing. The Occupational Health Nursing Program developed and displayed a banner recruitment advertisement on the minoritynurse.com website. The Continuing Education Program has offered tuition waivers to minorities at historically black universities. Recruitment ambassadors have been secured representing nursing alumni across the country and they will actively recruit minorities. Encouraging minorities to apply is on all brochures and the NC OSHERC website. NC OSHERC was represented at the UNC Annual Minority Health Conference in February 2007 and the Unity Tribal Health Conference in Raleigh, March 2007.

C. ERC Website

The ERC Website address is: <http://osherc.sph.unc.edu>. This address links to all programs and faculty/staff directory.

III. PROGRAM PROGRESS REPORTS

A. Program Title: Center Administration

B. Program Director: Bonnie Rogers

C. Program Description: The NC OSHERC is located at the School of Public Health with collaborating units at Duke University and NC State University. All curricular programs are accredited by the Council on Education in Public Health. The purpose of the program is to train practitioners and researchers in the disciplines of industrial hygiene (IH), occupational health nursing (OHN), safety/ergonomics (S/E), occupational epidemiology (OE), and health services research in occupational safety and health (HSROSH). We also proposed adding occupational medicine at Duke University in the competing continuation grant submitted September 2005 and it was funded in June 2006 as a core program. In addition, this overall program responds to mandates in the OSHA Act, section 2(b)(5) “by providing research in the field of occupational safety and health (OSH)... and by developing innovative methods, techniques and approaches for dealing with occupational safety and health problems” and section 2(b)(6) of the OSHA Act – “by exploring ways to discover latent diseases, establishing causal connections between diseases and work in environmental conditions, and conducting other research related to health problems...” In so doing, the National Occupational Research Agenda (NORA) is well recognized in the context of research emphasis at the Center. Program trainees will be well equipped to achieve the OSH objectives outlined in Healthy People, 2010 and continue to develop skills as addressed in the Institute of Medicine (IOM) report: Safe Work in the 21st Century.

Industrial hygiene trainees typically obtain a master’s degree over a 2-year course of study which includes a minimum of 30 semester hours and a thesis or technical report. The IH program offers MSEE, MSPH, and MS degrees to engineers and scientists; as well as the PhD option for qualified applicants. PhD students spend an additional three to four years beyond the master’s degree to complete original research and write a dissertation. The training objectives for the Master’s program are the education of highly qualified professional industrial hygienists with strength in the areas of exposure assessment and control technology with a strong record of placement in professional positions. At the doctoral level, industrial hygiene training and research provide the foundation for the development of new methods for exposure assessment and control and prepare scientists for research and teaching careers in OSH. Our research program provides post-doctoral students a first-class research experience and a solid foundation that strengthens their ability to become leaders in the field.

The OHN program offers MPH and MS degrees fully accredited by the National League for Nursing Accreditation Commission. The MPH program is offered on-campus and by distance education format which has been very successful. The MPH program in OHN prepares occupational health nurse specialists for positions in leadership, program planning and evaluation, or management of occupational health programs. The program leading to the MS degree prepares graduates in program planning and evaluation with emphasis

on the development of research skills as beginning researchers. The program has a large enrollment of students with approximately 20 students per year. Final approval for the Certificate in Occupational Health Nursing Program was granted in April 2007. The program can be completed in 1 year or less with 11-12 academic credits awarded. These academic credits can be transferred into the MPH for those who wish to continue into the master's degree program. The first group of students will begin classes August 2007.

The major goal of the Occupational and Environmental Residency Program is to train ethical, board-certified, occupational and environmental physicians who possess the knowledge and skills necessary to provide occupational and environmental health professional services in a wide variety of settings, including academia, public health agencies, corporate occupational health, and community based clinical occupational medicine. The program is two years in length with the first year devoted to academic training leading to the completion of the Master in Public Health degree, which is completed at the University of North Carolina at Chapel Hill and the second "practicum" year involves supervised training in clinical occupational medicine, mentored research and interdisciplinary occupational health hazard assessment with other occupational health professionals.

The Occupational Safety and Ergonomics Training Program is designed to train practitioner and research engineers in the area of occupational safety and ergonomics. The focus in this particular training program is on engineering solutions to occupational safety and health and ergonomics problems. The training provided through this program is a combination of traditional classroom instruction, applied occupational safety fieldwork, and basic and applied research training. All students participate in sponsored research projects of the core faculty members (both laboratory and field research) as well as applied practicum experience in working in industry to recognize, evaluate and control workplace hazards.

The Occupational Epidemiology program trains scientists with a high level of intellectual and technical skill, who will develop and apply the theory, methods, and substance of epidemiology to engage with challenging occupational health problems and to prepare the occupational health workforce of the future. The course of study in Occupational Epidemiology is designed for trainees with a Master's degree in a related field and leads directly to the PhD. Training activities include required and elective courses, mentored research practica, a preliminary written examination, participation in faculty research, and the development and execution of the doctoral dissertation project.

The Health Services Research in Occupational Safety and Health is designed at the doctoral level to prepare researchers in this field of study. The PhD in Health Policy and Administration in this concentration is designed to provide both intensive and extensive training in research methods, subject matter, and theory appropriate to health services research with OSH integrated through coursework, seminars, research experiences, and a dissertation specific to HSROSH. This program was phased out June 30, 2007.

The Continuing Education (CE) Program provides education and training programs consistent with workforce needs to prepare workers for their job responsibilities and to avoid exposure to occupational hazards. The CE Program focuses on the interdisciplinary nature of the actual work roles and responsibilities

of the health and safety professionals and technical employees. It provides for a strong understanding of the competencies of professions that are necessary to provide comprehensive and effective occupational health and safety programs in the public and private sectors. Continuing education is provided through short courses offered onsite and at semi-annual Institutes within the southeast region. The Industrial Hygiene, Occupational Safety, and Environmental Technician Certificate Programs require 6 units each of non-academic credits that are taken at 3 Institute meetings and focus on interdisciplinary needs of the students in courses of 2.5 or 4.5 days in length. All courses are open to anyone and are attended by students in all disciplines.

All program areas participate in several required interdisciplinary activities that will continue as part of faculty and student opportunities. Students attend courses and collaborate on joint projects through interdisciplinary courses in OSH, the NORA seminar series, and orientation and update sessions. Students and faculty often work on research projects with an interdisciplinary focus. We have a strong recruitment effort including minority recruitment. Our outreach program is outstanding among our entire faculty with numerous ties to and partnerships with the community and southeast region.

Trainees: Candidates for the master's degrees typically have bachelor degrees in the health sciences physical or biological sciences, or engineering in the case of MSEE applicants. Prospective trainees for the Occupational Health Nursing Program are required to have a nursing degree, a minimum GPA of 3.0, and acceptable performance on the GRE exam. Applicants for the doctoral degree typically have master's degrees in the appropriate discipline although in some cases admission directly to the PhD is possible with a bachelor's degree. Selection is based on prior academic performance including grades and GRE scores, but also on written statements, references, and general work experience. Trainees tend to take positions with private industry, government, academia, or the military.

Training Facilities: The NC OSHERC is located about four miles from the UNC campus in a spacious environment of 8,000 square feet shared with the OHN Program and CE Program. There is great classroom space, conference room, audio-visual equipment, student office space, a library, and ample parking. In 2001, the School of Public Health received a full seven-year accreditation from the Council for Education in Public Health (CEPH). Exceptional training facilities are currently available at the McGavran-Greenberg-Rosenau Hall complex at the UNC School of Public Health in Chapel Hill. Modern teaching facilities and approximately 6,000 sq.ft. of laboratory space for industrial hygiene research is available. Special equipment and facilities are available for aerosol measurement, ventilation research, biological monitoring, exposure assessment and analytical chemistry. A separate engineering laboratory is located in the Baity building adjacent to the School of Public Health, which provides an excellent site for air engineering research. The School of Public Health Hooker Building was opened in 2005 and provides laboratory and classroom space. In addition, NCSU provides laboratory facilities for the Safety/Ergonomics students. The newly renovated Health Sciences Library is directly across the street from the School of Public Health and maintains many journals and other resources relevant to occupational health and safety, including the NIOSHTIC database. Computers for students and faculty are available and close collaboration with the North Carolina Supercomputer Center provides state of

the art computational resources. Duke University in Durham is 15-20 minutes away and NC State University in Raleigh is also very convenient. Local industries e.g., GlaxoSmithKline, Replacements, and Coty, Inc. provide additional resources, training sites, and opportunities for trainees.

D. Program Activities and Accomplishments: All of the established training programs are successful in that they have trained large numbers of practitioners throughout the existence of the NC OSHERC. Likewise, the continuing education/outreach program has grown as a vehicle for training practitioners at entry and midlevels in their careers. These independent training activities continue to be an important part of the center. However, major changes in the business and industrial environmental, both in the US and the world economy, continue to have profound implications for the field of occupational health. Technology, globalization, and downsizing are forces, which continue to shape our world and profession. Environmental and economic issues put pressure on the field to change in paradoxical ways. Not only are practitioners with a broad range of skills required, but highly specialized technical consultants are also in demand as industry out-sources many of the previous functions performed by the workplace staff. We believe our program, which offers a wide range of courses and also focuses on strong research experiences at both Master and Doctoral levels, is responsive to these market forces. In addition, we feel we are particularly well positioned to provide the highly skilled technical people needed in today's economy. Research activities by their nature cut across disciplinary boundaries and lead to collaborative projects, which are more likely to produce effective, economic solutions to occupational health problems.

E. Program Products for all individual programs are listed in the appendix.

F. Future Plans

As in the past, the Center will focus on its partnering with other institutions and agencies to provide the highest quality programs and faculty available. Therefore, seeking opportunities to increase this outreach will remain a high priority of the NC OSHERC activities. For example, collaboration with Public Health Response Surveillance teams, NC DHHS, and UNC's Center for Public Health Preparedness and Emergency Management, and professional organizations in order to develop new training modules in domestic preparedness. Also, collaborate with Sunshine and Deep south ERCs to develop a 5-year Partnership Plan for annual conferences and provide select courses for each other's ERCs.

Continue aggressive recruitment plan for all programs; emphasizing minority recruitment and including recruitment through alumni, recruitment ambassadors, and development of brochures for distribution.

Develop and distribute NC OSHERC newsletter, which will include information about each program area and pertinent information about safety and health, to the larger occupational safety and health community.

III. PROGRAM PROGRESS REPORTS

A. Program Title: Outreach

B. Program Director: Bonnie Rogers

C. Program Description

The NC OSHERC provides numerous outreach activities across program areas. We conducted a survey and needs assessment of program graduates in March 2005 and found high satisfaction with our program and also what respondents indicated about future needs and challenges for occupational safety and health (OSH) for the next 3-5 years. Faculty and trainees are engaged in numerous research, educational, service outreach activities to the broader occupational safety and health community. Duke faculty and residents participate in a number of educational outreach activities directed outward towards other institutions, business, government agencies and occupational health practitioners locally, nationally, and globally. The Duke Occupational and Environmental Medicine (DOEM) Electronic Forum is a unique resource in the field of occupational medicine. Founded in 1993 by former DOEM faculty member Dr. Gary Greenberg who is now with the UNC, OHN Program, the list reaches more than 3,500 current subscribers located in more than 60 countries. The list serves occupational health professionals including physicians, nurses, industrial hygienists, government public health officials, industry groups and university researchers to provide a forum for announcements, dissemination of text files and academic discussion and allow presentation of clinical vignettes, synopses of new regulatory issues and reports of interesting items from publications elsewhere.

Each year approximately 60-hours of seminars and journal club in occupational health are offered to occupational health professionals from central North Carolina. Lecturers and participants are invited from the research facilities at Research Triangle Institute, NIEHS, Chemical Industry Institute of Toxicology, and the EPA. Industrial hygienists, safety specialists, nurses and physicians also attend these seminars which directly impact their practice, particularly translating new and innovative approaches to occupational health problem solving. Duke faculty are also involved in consultation to industry, government, other universities, and hospitals. Presentations and seminars by faculty are made to medical societies, regional and national occupational medical association meetings, and university and industry trainee groups. Continuing education programs provided by DOEM faculty during this reporting period include the training of 2,695 occupational health professionals from medicine, nursing, safety, and industrial hygiene employed in industry, government and academia. The annual Carolinas Occupational Medicine Conference is sponsored by the NC OSHERC. Kathleen Buckheit, CE Director and Gary Greenberg, OHN faculty, are currently serving on the Board of Directors of the NC Occupational Health and Safety project (NCOSH), a worker and union worker education and health and safety advocacy group. Residents and faculty have provided seminars at the Annual Safety and Health Meeting and coordinated occupational health screening clinics for underserved workers that have an impact on worker education and empowerment when dealing with health and safety issues in the

workplace. DOEM Faculty have developed academic courses for Duke and UNC medical students and residents that may impact their career choice and provide a skill set that can translate into their primary care practice. During a two to four week rotation, students participate in clinical evaluations, lectures and seminars, learn to conduct computerized database searches about occupational hazards and industrial toxicology, and visit industrial sites. Students complete at least one project focused on an occupational hazard relevant to their experiences.

In the OHN Program, OHN and Case Management Certification Review Courses have consistently documented a 96% passing rate, elevating the status of the OHN professional and preparing the OHN for more critical and complex interdisciplinary responsibilities. The OHN: Introduction to Principles and Practice Course has been reported by OHNs and employers to prepare new and experienced nurses with an expanding scope of practice. All OHN faculty teach in the OHN: Introduction to Principles and Practice co-sponsored by the NC OSHERC and the NC State Health Department. During this course the Worksite Assessment Guide (WAG) developed by Dr. Rogers is discussed and has been distributed to more than 270 OHNs. The WAG has also been distributed to OHNs across the country, and several OHN academic programs (UAR, UCLA, UAB, UMD), and is published for use in at least two books. The new OHN/Safety Management Certification Review Course was developed for certified OHNs based on needs assessments conducted by the NC OSHERC and the American Board for Occupational Health Nurses (ABOHN). It was offered in October 2006. This is the newest course developed by the academic faculty, the CE Program, and the safety consultants collaborating together with other partners.

The textbook written by Dr. Bonnie Rogers, Occupational and Environmental Health Nursing: Concepts and Practice, 2nd Edition (2003) is in use throughout the world by OHNs in practice, faculty in other universities, and other ERCs as both a required textbook and to integrate OSH principles and concepts within existing curricula. This book has also been translated into Spanish. The book co-authored by Dr. Rogers, Susan Randolph, and Karen Mastroianni, Occupational Health Nursing Guidelines for Primary Clinical Conditions, 3rd Edition (2002) is widely used as a protocol guide for OHNs and physicians in clinical practice. Several businesses have adopted these guidelines "as their own" for practitioner use by thousands of nurses. Both the textbook, 3rd edition, written by Dr. Rogers and the guidelines book, (4th edition,) co-authored by Rogers, Randolph, and Mastroianni are in press. Requests for curriculum materials, such as the Worksite Assessment Guide and articles are frequently received and filled as well as reprints of the many articles authored by Dr. Rogers.

A partnership is in place with the National Council for Occupational Safety and Health (National COSH), an advocate for worker safety and health. The director, Tom O'Conner, is on the NC OSHERC Advisory Board, the Health Services Research in Occupation Safety and Health Advisory Board, Continuing Education Advisory Board, and also teaches a class on the Labor Perspective in PUBH 785, Interdisciplinary Approaches to Occupational Health. Allen McNeeley who is the Director of NC OSHA is a member of the NC OSHERC Advisory Board and also teaches a class on worker safety and health in PUBH 785. Also, Dr. Rogers

volunteers with the Orange County Literacy Council, is a literacy tutor, and has provided significant consultation to them on health literacy for workers. Dr. Rogers has also provided awareness information to St. Thomas More School on musculoskeletal injuries from students carrying heavy backpacks.

NORA related interdisciplinary seminars, described in the Interdisciplinary Section, are offered as outreach to the OSH community. Invitations are broadcast through the interdisciplinary environmental and OSH groups within the region for their members and colleagues to participate in the web casts that are presented quarterly. Continuing Education Units are available to those who request them through UNC.

OHN faculty are active and highly collaborative with professional associations, at national, state, and local levels. At the national level, Susan Randolph is the immediate past president of the AAOHN; Kathleen Buckheit served on the Board of Directors and several national committees; Bonnie Rogers and Judy Ostendorf serve on the AAOHN Foundation Board of Trustees and on the Eastern NC Legal Nurse Consultant's Board as past president and treasurer respectively; Judy Ostendorf also is on the AAOHN Journal Editorial Review Panel and represents AAOHN on the ANSI Z365 Committee. Bonnie Rogers serves on eight editorial boards; has participated on several IOM committees; serves as chair of the AOEC National Board and the Scientific Committee on Education and Training in Occupational Health, ICOH; and is on the Cross Sector Council, NORA, NIOSH. At the state level faculty serve on the Awards Committee and the NCAOHN, Education and Standards Committee members and at the local level on committees such as Communications Committee, Professional Affairs and Awards Committees, Newsletter (Editor), and (Co-Chairs of the) Research Committee. OHN faculty consults with Clemson University about developing OSH courses and CE courses and also have developed and taught at their summer Clemson Institute for more than 10 years. All OHN faculty work with NCAOHN to identify current topics, lecturers, and evaluations of educational programs for the NCAOHN state conference offered semiannually and attended by over 100 OHNs each time. The NC OSHERC co-sponsors this meeting semi-annually, providing technical and on-site operational assistance. These programs have received the honor of Best Educational Offering several times by the AAOHN. These academic and adjunct faculty members are frequently asked to present topics at the meetings.

OHN faculty teach twice a year at the UNC-CH School of Nursing to the undergraduate juniors and seniors to describe and discuss the role of the OHN. They also teach about Occupational Health Nursing and consult with faculty at North Carolina Central University, a historically Black University. The DOEM Program is active presenting classes in the OHN Program and the Interdisciplinary Approaches to Occupational Safety and Health. Dr. Gary Greenberg is one of the key contributors to the OHN Program as adjunct Assistant Professor and teaches in these classes as well.

The IH/EAC core faculty are involved in a number of educational and outreach activities at the national and international level including conference organization, grant and manuscript reviews, and consultation. Three of the core EAC faculty members are Certified Industrial Hygienists (CIHs) in Comprehensive Practice by the American Board of Industrial Hygiene. The core faculty in the EAC focus area has published more than 500

peer-reviewed articles in scientific journals, of which 35 scientific articles were published during this reporting period..

Dr. David Kaber, Safety/Ergonomics core, is a member of the Ergonomics Society, the Human Factors and Ergonomics Society, and the Institute of Electrical and Electronics engineers, the Institute of Industrial Engineers, the American Society for Engineering Education, and Sigma Xi. He received the Alcoa Foundation Engineering Research Achievement Award in 2006. Dr. Kaber has published over 35 refereed, archival journal publications on theoretical and empirical human-machine systems research.

The Safety/Ergonomics Program also has adjunct faculty, Dr. Samuel Moon and Dr. Hester Lipscomb, Associate Professors in the Department of Community and Family Medicine at Duke University, who participate on inter-institutional graduate committees for some of their NIOSH trainees. The Program also has international collaboration with Dr. Regina Stoll, the Director of the Institute for Preventive Medicine at the University of Rostock (Germany), who has participated on inter-institutional graduate committees of several students. Dr. Stoll has also collaborated with Dr. Kaber on NSF sponsored research for design of intelligent supervisory interfaces for error prevention in human control of biological and chemical compound screening processes.

The Safety and Ergonomics Program area has on-going interactions with the Ergonomics Center of North Carolina, a group of safety and ergonomics professionals that provide training, education, and consultative services to North Carolina Industry. These interactions have been primarily in the joint conduct of research projects. From the Safety/Ergonomics area much of the current funded research conducted in the laboratory is intervention effectiveness research, and NIOSH trainees have all been involved in these projects. For example, in the 2006-2007 academic year trainees conducted a research experiment related to a NIOSH sponsored project, directed by Dr. Gary Mirka, which was focused on the agriculture industry. The objective of this work was to evaluate the effectiveness of a novel ergonomic knee support for the prevention of lower back pain in pepper harvesters. The report of this research has been submitted to the *Journal of Applied Ergonomics* for publication and is currently under review. Faculty and students have been active in presenting their work at professional conferences, including the 50th Annual Meeting of the Human Factors and Ergonomics society, the 2006 IEEE Systems, Man & Cybernetics conference and the 2007 IEEE Conference on Automation Science & Engineering.

Several epidemiology faculty fill prominent roles in scientific communication: for example, Dr. Savitz is one of the editors responsible for occupational health content in the journal *Epidemiology*; Dr. Gammon is an Associate Editor of the *American Journal of Epidemiology*; and Dr. Peden is Associate Editor in charge of occupational diseases for the *Journal of Allergy and Clinical Immunology*. The faculty are also active in professional organizations. For example, Dr. Richardson advises on occupational and environmental research development via the International Society for Environmental Epidemiology's Committee on Capacity Building in Developing Countries and Dr. Poole has served on the board of the Society for Epidemiologic Research. Dr. Richardson advises citizens' groups across the nation on occupational and environmental research activities

related to US DOE nuclear sites as a member of the Board of Directors, Citizens' Monitoring and Technical Assessment Fund; Dr. Richardson and Dr. Wing have spoken at community workshops organized by the Institute for Energy and Environmental Research; and Dr. Dement, Duke TPG during this reporting period, serves on a committee at the Hanford nuclear site to investigate health concerns related to exposures occurring at the hazardous waste tank farms. Additionally, Dr. Chen consults with researchers at the Liberty Mutual Research Institute for Safety in connection with research evaluating whole-body vibration and its relation to lower back disorders, and analyses of a large survey on job dissatisfaction and injury risk perception in relation to contextual features of workplace and characteristics of individual workers.

Epidemiologic research on occupational safety and ergonomics sometimes provides more immediately visible practical benefits, however. For example, Dr. Marshall is Principal Investigator of a large cohort study of cadets in the US military service academies that is investigating tears and ruptures of the Anterior Cruciate Ligament, a disabling knee injury common among active-duty military personnel. The results of this study are of immediate interest to the armed services and are likely to affect the way personnel are trained. A second example is a study led by Dr. Loomis that investigated acute injuries and musculoskeletal disorders among commercial fishermen. Findings from that study are the basis for a project developed by Dr. Mirka which seeks to develop ergonomic interventions to prevent lower back disorders among these workers. Although both Dr. Loomis and Dr. Mirka have accepted positions at other universities, they plan to continue collaborating on research projects.

The NORA Interdisciplinary Seminars are now web cast so that distance education professionals are able to attend and actively participate. Electronic notices are listed in the School of Public Health activities of the week which goes to all faculty, students, local public health departments, and others. We are also including notification to the NC Department of Labor, Occupational Safety and Health Division, state public health department, and universities with an OSH program. This has proven successful in that we had several people attend the August 2007 seminar by Dr. Max Lum "live" and others attended using the web cast. One strategy to increase attendance was offering continuing education units through the UNC-Chapel Hill. This was used for the first time in May 2005 and several attendees received them. The web cast seminars have been very well received. When asked if the presentation increased their understanding of the subject and relationship to OSH, 94% of the attendees strongly agreed; and 100% of the attendees felt the topic was important and relevant to OSH. Attendees commented that they liked being able to watch without having to travel to Chapel Hill; use of real life examples; discussion of interventions; being able to view the lecture at another time. One attendee commented that she shared the web cast with her peers at work, which can be considered a "snowball" outreach approach.

From HSROSH, Dr. Thomas Ricketts is President of the North Carolina Health Council; and Carol Runyan is a member of a national working group on injury and violence prevention and control infrastructure enhancement. HSROSH faculty have also made over 45 presentations over the past year. Some key presentations are listed. Dr. Bonnie Rogers presented the keynote address "Environmental Health Threats:

How Ready Are We?" at the NASA 2006 Occupational Health Conference. Dr. Rogers has also provided consultation to Thailand University on health services research and OSH. Through this consultation, Yuwadee Wittayapun, a visiting doctoral student from Bangkok, Thailand worked with Dr. Rogers during the 2005-2006 academic year on Health Services Research in Occupational Safety and Health, increasing her knowledge base and defining her research.

The CE Director participates on the Advisory Board of the Occupational Safety Program at NC A&T State University, a historically black college, developing a partnership with a NIOSH TPG. She provides resources for equipment, contacts for faculty and students, advice on the curriculum, and free educational opportunities to help enhance the students' college experience. This Board participation also informs faculty and students about the CE Programs. Many students have taken advantage of free tuition for the CSP Review course and invitations to attend several other courses have been extended to complement their academic courses. As a board member of the NC Tarheel Association of Occupational Health Nurses, Ms. Buckheit develops, edits, and sends out a quarterly newsletter to NCTAOHN members and contributes articles to the state NCAOHN newsletter on regulatory and practice issues. She is also an advisory board member for the NCSU Ventilation Conference and the Central Carolina Safety School; providing equipment, faculty, and materials. Dr. Rogers has also provided a PowerPoint presentation on leadership to the Director of Occupational Health and Safety at Pitt Memorial Hospital. The course materials from the CHMM Review Course were given to the Piedmont Chapter of the ACHMM for use in training their members. Ergonomic training materials were used by safety and health professionals to develop their ergonomics programs.

F. Future outreach plans include:

- Continue all professional association partnerships as described;
- Continue to develop industry relationships to translate research to practice as described here;
- Continue to provide educational lectures and curricular materials to other academic institutions, government, and industry and professional services and practical information to practitioners;
- Use list serves to communicate information to the OSH and public health community;
- Distribute the NC OSHERC newsletter with OSH topics and NORA content to the larger OHS community;
- Continue to publish in journals, publish books, and provide editorial assistance to journals;
- Continue to provide consultation to universities on OSH programs and to industry on OSH issues;
- Participate on college Advisory Boards, such as East Carolina University's Environmental Health Department to review curriculum and make contacts with industries and professional organizations for donations of equipment and "in-kind" services to their programs, including guest lecturers, scholarships, intern experiences, and site visits;

- Expand collaborations to allied health and safety professional organizations and practitioners throughout the Southeast region.
- Invite three visiting scholars to the OSHERC each year to provide presentations and consultations on research and teaching projects and the NORA Seminar Services;
- Fund two small student projects related to NORA.

III. PROGRAM PROGRESS REPORTS

A. Program Title: Interdisciplinary Coordination

B. Program Director: Bonnie Rogers

C. Program Description, Activities, and Accomplishments

The administrative core of the NC OSHERC fosters the interdisciplinary interaction of all programs in the training programs. Several strategies are used to accomplish this: orientation for trainees; an interdisciplinary occupational health course; integrated disciplinary coursework including field projects and class projects; NORA seminar series; interdisciplinary CE courses, and research, all of which involve program trainees and faculty.

An annual orientation/update is held in August for all NIOSH-funded trainees. The Center director discusses the mission of the NC OSHERC and its relationship to NIOSH, new Center initiatives, and the trainees get to meet each other and faculty in the different disciplines. In conjunction with the orientation, one of the four (increased from three in 2005) NORA Interdisciplinary Seminars is held. All NIOSH funded trainees are required to attend and participate in each of the four NORA Interdisciplinary Seminars held each year. Each training program area (Industrial Hygiene, Occupational Health Nursing, Occupational Medicine, Safety and Ergonomics, Occupational Epidemiology, Health Services Research in Occupational Safety and Health) is responsible for developing the seminar and securing a speaker on a rotating basis. Trainees and others in the school or community can attend the series completely onsite or online, since 2004. Susan Randolph, seminar coordinator, arranges for all seminars once the session has been developed by OSHERC faculty. The seminar is presented at the School of Public Health in the Mayes Center (temporarily relocated to the new Hooker Building during renovation) for those who wish to attend the actual sessions on campus. Seminars are also web cast so distance education students, students from NCSU (Safety and Ergonomics Program), Duke University, and others in the larger occupational safety and health community can attend and actively participate. Students attending the web cast seminar are able to ask questions using a toll-free number. Detailed information about the seminar including the web link is emailed to students. After the seminar is web cast, it is archived so it can be viewed at a later time or viewed again. The seminar gives students an opportunity to learn about NORA related topics and research, network, and develop critical questions. Since the web cast is a new methodology, trainees are asked to complete an evaluation of the seminar. The web cast seminars have been very well received. One attendee commented that she shared the web cast with her peers at work. This series will continue.

All NIOSH-funded trainees are and will continue to be required to take PUBH 785, Interdisciplinary Approaches to Occupational Health. This course is taught online; interdisciplinary students attend interdisciplinary-based lectures, conduct a virtual walk-through of an animal facility laboratory, and select an industry or specific hazard of their interest, and research and present their findings discussing interdisciplinary

roles. The groups are assigned so that different disciplines are represented in each of the groups. For example, in 2006, Allison Anderson (Safety/Ergonomics), Jennifer Borst (OHN), Dee Dailey (other), and Kristen Meador (Safety/Ergo) selected "Health Hazards and Control Measures in the Trucking Industry." Also in 2006, Leigh McClure (Safety/Ergonomics), Jessica Mead (HSROSH), Kathy Dayvault (OHN), and Jason Tate (OHN) selected "Professional Firefighters: Understanding a Special worker Population." All papers and presentations were excellent! During this course, various faculty/professional disciplines including occupational medicine, labor, nursing, industrial hygiene, and safety and ergonomics provide lectures. For example, Tom O'Connor, MPH from the National Council for Occupational Safety and Health, discussed occupational health and labor perspectives; David Weber, MD discussed bioterrorist agents; Mike Jacobs, MD presented screening, surveillance, and biological monitoring; Karen Mastrianni, MPH, RN discussed levels of prevention, health promotion, and program design; and Carol Runyan, PhD presented evaluation. For spring 2006, the course was increased to 3 credit hours from 2 incorporating more occupational medicine-related content presented by Duke Occupational Medicine faculty (new core program) and more health promotion interjected with health protection. Allen McNeely, NC Department of Labor, Occupational Safety and Health Division will also be present to talk about government regulations and the role of OSHA for worker protection. The variety of speakers used makes the course more interesting and enhances student learning with real world examples. The course has been well received and is also open to non-trainees.

Trainee interaction occurs from attendance by industrial hygiene, occupational health nursing, and safety/ergonomics trainees in industrial hygiene, toxicology, and safety courses (PHNU 787 - Industrial Hygiene; ENVR 423 - Industrial Toxicology; ENVR 432 - Safety/Ergonomics (except safety students do not take this basic safety course); PUBH 785 - Interdisciplinary Approaches - previously described). Students from other disciplines (e.g., epidemiology, health behavior, and medicine) also take these courses. This coursework provides the student with the skills necessary to learn about and develop a good understanding of an interdisciplinary framework for service delivery and research. Students learn about interdisciplinary roles and collaboration necessary to improve the health and safety of the worker and work environment. Students from all core disciplines participate in field experiences, conduct joint walk-throughs, collaboratively work together to address problems in occupational health, and make joint presentations related to the problem. For example, in the safety/ergonomics course (ENVR 432) five groups of students worked in interdisciplinary teams and selected safety and also ergonomic work-related health issues, visited the work-site, conducted a job safety/task hazard analysis, and analyzed methods for prevention and control. For each project, students made a power point class presentation presenting all findings. The safety project was on a specific topic, such as Accident Investigation and Job Safety Analysis. The ergonomic project was selected by the team to identify and describe a musculoskeletal disorder (MSD) hazard at a specific worksite, describe possible hazard prevention and control methods, and explain the health care management protocol and education and training program. Project examples completed were at Rex Rehab and Nursing Care Center (keyboarding and lifting, Brazeal Stone Works (heavy lifting and dust), and Jiffy Lube (overhead reaching, awkward bending, squatting

computer workstation evaluation, and temperature control). Each group also participated in and reported on an ergonomic case study problem solving exercise. The topic of one of the case studies was back injuries occurring in a hospital laundry department. Students also jointly toured the Triangle Pharmaceutical Company in NC which was safety focused and was followed by an in-depth classroom discussion of safety problems identified and control and prevention measures. In the online version students have power point presentations and audio, work on joint projects, and write joint papers using a case study approach.

In the toxicology course taught jointly by Dr. Woodhall Stopford (Duke Occupational Medicine) and Susan Randolph (Occupational Health Nursing) and in the industrial hygiene course taught by Dr. Nelson Couch with guest lecturers, students attend interdisciplinary classes on-campus or online (with chat rooms). The courses are designed for occupational medicine residents, occupational health nurses, and environmental science / industrial hygiene students and stress the development of problem solving skills using a multidisciplinary approach that involves the integration of specialists in all of the core disciplines. Students develop a project, paper, and presentation (e.g., arsenic, naphthalene, and cadmium) on a selected chemical providing an in-depth analysis of the risk, exposure assessment approaches, and prevention and control measures. Examples of student papers and presentations in industrial toxicology are "Welding Fumes and disease", "Do Aircrew have a Higher Risk of Cancer?", "Environmental Exposure to Pesticides", "Formaldehyde in Industry", and "Fission of U-235".

Trainees from all disciplines are encouraged to attend CE courses sponsored by the NC OSHERC and registration fees are waived. Trainees attend courses such as, workers' compensation, basic industrial hygiene, advanced safety, toxicology, legal concerns, ergonomics, biohazard science, case management, hearing conservation, and respiratory protection. At both the Summer and Winter Institutes, the Fundamentals of Industrial Hygiene course uses an interdisciplinary approach with several disciplines attending. The class of about 30 students is made up of industrial hygienists, safety specialists, occupational health nurses, and periodically, physicians and virtual walk-throughs are done. A large number of nurses and safety professionals attend the industrial hygiene courses and a large number of industrial hygienists and nurses attend the safety courses, etc. This is due to the demands of employers requiring expertise in more than one area; i.e., industrial hygiene, safety, occupational health and environmental health nursing. The Duke Occupational Medicine program is unusual in that it incorporates several disciplines including occupational health nursing, industrial hygiene, occupational epidemiology, biohazards, occupational mental health, and occupational and environmental medicine within one division.

Faculty members from each program routinely lecture in courses and seminars in the other disciplines and serve on dissertation/thesis committees. For example, Dr. Bonnie Rogers and Susan Randolph (OHN) provide a lecture on health care worker hazards in the occupational epidemiology course; Pat Curran (IH), Tom Sluchak (Ergonomics), Carol Epling (OM), and Jon Wallace (Safety) provide interdisciplinary lectures in the OHN I course; and Judith Holder (OP) provides a lecture on employee assistance programs in the OHN II

class. Two Duke OM faculty/residents teach in the Interdisciplinary Approaches in Occupational Health course and Dr. Bonnie Rogers sits on the Duke OM Resident Advisory Committee.

Faculty and trainees from the disciplines interact on several research projects. Students have worked with other students and faculty from occupational medicine, epidemiology, occupational health nursing, and safety and ergonomics on research projects ranging from commercial fishing, construction, healthcare, to traditional manufacturing industry. These opportunities have helped to broaden the trainees' perspectives on occupational safety and health issues. **Examples of recent projects that include both faculty and trainees:**

1. Low Back Injury Prevention in the Homebuilding Industry

Participants: Dr. Gary Mirka (Safety and Ergonomics, NCSU), Dr. Hester Lipscomb, Dr. John Dement, Dr. Samuel Moon (Occupational Medicine, Duke University), Dr. Leonard Bernard (Construction Engineering, NCSU)

2. Ergonomic Interventions for the Furniture Manufacturing Industry

Participants: Dr. Gary Mirka (Safety and Ergonomics, NCSU), Dr. Hester Lipscomb (Epidemiology, Duke University)

3. Learning Curve Analysis of a Patient Lift Assist Device

Participants: Stephanie Reid, Dr. Gary Mirka (Safety and Ergonomics, NCSU), Dr. Hester Lipscomb (Epidemiology, Duke University)

4. Occupational Injuries Among Commercial Fishers

Participants: Dr. Dana Loomis, Kristen Kucera (Epidemiology, UNC-CH), Dr. Gary Mirka (Safety and Ergonomics, NCSU), Mary Anne MacDonald (Ethnographer, Duke University)

5. Musculoskeletal Injuries to Nurses in Hospitals

Participants: Dr. Bonnie Rogers, Judy Ostendorf, Kathleen Buckheit, Courtney Stanion (HSROSH, UNC) A large number of nurses and safety professionals attend the industrial health courses, a large number of industrial health and nurses attend the safety courses, etc. This is due to the demands of employers requiring expertise in more than one area; i.e., industrial health, safety, environmental and occupational health nursing., Katie Slavin (OHN, UNC); Dr. Gary Mirka (Safety and Ergonomics, NCSU), plus safety graduate students.

These projects were completed during this reporting period.

Future Plans:

- Continue annual orientation/update
- Continue NORA Interdisciplinary Seminar Series
- Continue cognate interdisciplinary course (toxicology, IH, safety/ergonomics) with joint trainee projects
- Expand and continue to offer new interdisciplinary courses at the CE institutes based on needs assessment data and other courses i.e., OSHA Update and online as appropriate
- Involve trainees in interdisciplinary faculty research, publications, and presentations.

III. PROGRAM PROGRESS REPORTS

D. Program Title: NORA Research Support

E. Program Director: Bonnie Rogers

F. Program Description, Activities, and Accomplishments

The goal of the NORA Research Support Program is to provide a focused effort to support NORA related research training, interdisciplinary research discussion and collaboration, when feasible, and dissemination and applications of research through continuing education. Research training received by trainees is based on the curriculum of study in each department (e.g. industrial hygiene, occupational health nursing, occupational medicine, safety and ergonomics, and epidemiology).

Interdisciplinary research interaction is accomplished in several ways: collaborative research projects among faculty and students where like interests exist, which is already being done; participation of students and faculty in the interdisciplinary seminar series and continuing education/outreach events which has a focus on NORA research; and discussion at OSHERC executive Committee (Program Directors) meetings to identify opportunities for students to engage in research projects. The interdisciplinary seminar series has been described previously in this document in the interdisciplinary coordination section. The dates, presenters, coordinating discipline, and number of attendees for each NORA Seminar held during the annual reporting period are listed below:

August 23, 2006: Sandy Stopford, MD (Occupational Medicine) presented “Mercury and Chlorine Exposures: Residual Effects 4-20 Years After Exposure”. 77 attendees.
November 14, 2006: John Staley (HSROSH Doctoral Student) presented “Firefighter Physical Fitness: An Inductive Inquiry into Firefighter Culture and Worksite Health Promotion”. 67 attendees.
February 19, 2007: Lyla McCurd (Nursing) presented “Educational Needs Assessment for Pediatric Health Care Providers on Pesticide Toxicity”. 52 attendees.
May 16, 2007: Kathy Kirkland (Industrial Hygiene) presented “Standard/Universal Precautions: Compliance, Beliefs, & Barriers”. 212 attendees.

Although no NORA Research Support funding was received, several research projects included NORA related topics. During the reporting period, trainees conducted a research experiment related to a NIOSH-sponsored project, directed by Dr. Mirka, which was focused on the agriculture industry (NIOSH U50 OH07551-01). The objective of this work was to evaluate the effectiveness of a novel ergonomic knee support for the prevention of lower back pain in pepper harvesters. Nine subjects performed simulated pepper harvesting tasks, including both static and dynamic trials. The student trainees working on the project collected EMG, Motion Tracking, and Lumbar Motion Monitor data. Two combinations of simulated pepper plant height

and distance were evaluated for four different harvester posture positions, including: full kneeling, knee support, squatting and stooping. The students administered subjective surveys of discomfort and productivity measures were also collected on participants. They found three postures, knee support, squatting and stooping, required high flexion of the low back during dynamic trials (more than 60°). They also found squatting and stooping postures to produce significantly higher passive tissue moments compared with two kneeling postures. The report of this research has been submitted to the *Journal of Applied Ergonomics* for publication and is currently under review.

Also, NIOSH r2p activities include two ongoing projects in the field. Both are funded by the Center to Protect Workers Rights in a NIOSH cooperative agreement: prevention of nail gun injuries in residential carpenters and evaluation of minimal manual lift policy supported with left equipment.

Pilot/Small Projects

A letter requesting proposals for pilot research projects was distributed. Proposals were team reviewed and funded through the NC OSHERC. The award was made to a professor in epidemiology and a student in the Public Health Leadership Program for their proposal titled "TB Testing in South Africa".

**Industrial Hygiene Program
Progress Report
July 1, 2006 – June 30, 2007**

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III. Program Progress Reports

A. Program Title: Industrial Hygiene

B. Program Director: Leena A. Nylander-French, PhD., CIH

C. Program Description:

The training objectives for the Masters program remain the education of highly qualified professional industrial hygienists and scientists with strength in the discipline of industrial hygiene, i.e., the fundamental principles involved in the anticipation, recognition, evaluation, and control of factors arising in the workplace that adversely impact human health and well-being. The Program encompasses a full range of applications in occupational hygiene, including sample collection, analysis, statistical modeling, and interpretation of exposure data in order to investigate the relationships between exposure and development of disease. At the doctoral level, industrial hygiene training and research provide the foundation for the development of new methods for exposure assessment and control and prepare scientists for research and teaching careers in occupational health and safety. These individuals will contribute significant knowledge to the field and be prepared to conduct original ongoing research at academic institutions, government agencies, corporations, or serve as specialized consultants. The NIOSH traineeships supported three Masters students and two doctoral students during the 2006-2007 academic year. NIOSH support has been invaluable for the industrial hygiene focus area to be able to support first rate doctoral and Master's students. Furthermore, NIOSH support has allowed the students and faculty to design more individually appropriate study and research program as well as more possibilities for collaboration between the different disciplines in the Department and the School of Public Health.

The industrial hygiene faculty identifies itself as the Exposure Assessment and Control (EAC) focus group, which includes industrial hygiene, exposure assessment, and air pollution control. EAC faculty has been actively collaborating in joint research projects and educating and training our Master's and doctoral students. There are five full-time faculty members in the industrial hygiene program and ten adjunct faculty members. Dr. David Richardson, director of the ERC Epidemiology program area at UNC-CH SPH, joined the EAC focus group this past year and is actively participating in the activities of EAC focus group as well as training our students. Dr. Dana Loomis accepted a faculty and chair position at the Department of Environmental and Occupational Health, School of Public Health, University of Nevada. However, he is an adjunct faculty member at the DESE and continues to advise students and collaborate with faculty in the DESE. Dr. Stephen Rappaport is on off campus assignment/leave at the School of Public Health, University of California, Berkeley, July 2006 – June 2008. He is assisting in the development of statewide biomarker program assessing chemical exposures and biomarker levels in children and their parents as part of an ongoing investigation of childhood leukemia in California.

No changes have occurred in the program or curriculum during the reporting period. Our program focuses on the assessment and control of workplace and environmental exposures due to inhalation and dermal routes as its distinctive core contribution. We also encourage our students to enroll in continuing education courses offered through the ERC that cover materials related to professional practice not presented through our regular academic courses.

D. Program Activities and Accomplishments:

EAC focus area graduated 3 Master's and 2 doctoral students during the reporting period July 2006 – June 2007. Two of the Master's graduates are continuing in our doctoral program, one doctoral graduate accepted a postdoctoral fellowship, and one Master's and one doctoral graduate accepted positions in industry.

Six EAC focus area students received poster, scientific achievement, or service awards during the reporting period July 2006 – June 2007.

We are actively recruiting students from underrepresented groups and currently support one minority student with NIOSH-ERC funding.

E. Program Products:

EAC core faculty and students published a total of 35 scientific articles, of which 13 were partially supported by the UNC-CH IH ERC during the reporting period July 2006 – June 2007. Three of the NIOSH-ERC funded students presented their research findings in national scientific meetings while a total of 11 EAC student presentations (oral or poster) were given in both national and international meetings. The EAC faculty gave 14 invited presentations in national or international scientific meetings during the this reporting period.

F. Future Plans:

The future training objectives for the Master's and doctoral program remain the education of highly qualified professional industrial hygienists and scientists with strength in the discipline of industrial hygiene. We will continue to provide trainees with research experience in conducting field studies to develop exposure assessment methods, to investigate exposure-dose-response relationships, and to calibrate models for the optimal control of exposure.

**Occupational Health Nursing Program
Progress Report
July 1, 2006 – June 30, 2007**

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III. PROGRAM PROGRESS REPORT

A. Program Title: Occupational Health Nursing Program

B. Program Director: Bonnie Rogers, DrPH

C. Program Description: The Master of Public Health (MPH) and Master of Science (MS) degrees with specialization in Occupational Health Nursing are offered in the Public Health Leadership Program. The MPH program requires a minimum of 42 credits of which 20% may be transfer-in credits as is permitted for all students by the Graduate School. The program is taken on-campus and through distance education. The MPH program in Occupational Health Nursing prepares occupational health nurse specialists for positions in leadership, program planning and evaluation, or management of occupational health nursing programs. The program leading to the MS degree prepares graduates in program planning and evaluation; however, emphasis is on the development of research skills as beginning researchers. The on-campus MPH student can complete the degree in 1 ½ years, the distance learning MPH student in 2 ½ years, and the MS degree can be completed in 2 years; however, students have up to five years to complete the program.

i. **Goals and Objectives:** The goal of the Occupational Health Nursing (OHN) Program is to provide education, training, and research experiences as appropriate to occupational health nursing professionals, so as to transfer learned knowledge to protect and promote the health of the workforce. Program objectives include:

- Provide OHN education both on-campus and via distance education (for the MPH degree).
- Provide MS degree education (thesis required) on-campus.
- Provide OHN education for RNs via distance education (for the Certificate Program).
- Provide interdisciplinary learning opportunities and experiences with a public health foundation (5 core) and occupational health cognate courses.
- Provide integrated/applied learning through practicum experiences.
- Provide trainees with opportunities for scholarly demonstration of knowledge learned (e.g., master's paper, publications, presentations).
- Admit 4-6 trainees/year, encouraging diversity in enrollment.
- Offer continuing education/outreach to the occupational safety and health community.

ii. **Responsible Conduct of Science Training:** This training is achieved through both Informal and formal instruction in responsible conduct of research. It is discussed in PHNU 781: Occupational Health Nursing I, PHNU 782: Occupational Health Nursing II, and PUBH 785: Interdisciplinary Approaches to Occupation Health, PUBH 992: Master's Paper, and OHN Program students are required to complete The Collaborative Institutional Training Initiative (CITI Program) titled Instruction in The Protection of Human Research Subjects. Instruction on the scientific integrity and ethical principles in research is provided at five separate times during the curriculum. All trainees and faculty participate.

iii. **Faculty Participation:** The Program Director, Dr. Bonnie Rogers, and OHN faculty Judy Ostendorf and Susan Randolph continue to provide primary faculty support to the program. Ms. Ostendorf coordinates the Distance Education OHN option and co-directs the Occupational Health Nursing Certificate Program. Ms. Randolph helps coordinate the Health Services Research PhD program. All faculty continue to advise, mentor, serve as readers on master's papers, and collaborate with students to arrange meaningful practicum experiences and on publications. A table showing core, contributing, and adjunct faculty follows.

Core Faculty	Competence Area
Bonnie Rogers, DrPH, COHN-S, LNCC, FAAN	OHNsg, Epidemiology, Ethics, Health Care Worker Hazards, Legal
Judy Ostendorf, MPH, COHN-S, CCM, FAAOHN	OHNsg, Ergonomics & Case Management
Susan Randolph, MSN, COHN-S, FAAOHN	Occupational Health Nursing, Agriculture
CONTRIBUTING FACULTY	
Kathleen Buckheit, MPH, COHN-S/CM/SM, FAAOHN	Occupational Health Nursing, Ergonomics, Safety
Gary Greenberg, MD, MPH	Occupational and Environmental Medicine; support and repository for OHDEN, OccHealthNews, and Occ-Env-Med-L websites

ADJUNCT FACULTY	AFFILIATION	Competence Area
Elise Handleman, MEd, COHN-S	Director, Office of Occupational Health Nursing, Federal OSHA	OHNsg, BBP, Ergonomics
Judith Holder, PhD	Director, Occupational Mental Health Program, Duke University	Occupational Mental Health
Karen Mastroianni, MPH, COHN-S, FAAOHN	President, Dimensions in Occupational Safety and Health	OHNsg, Health Education
Kay Campbell, EdD, COHN-S, FAAOHN	Director, Health Promotion, GSK	OHNsg, Health Promotion
Elizabeth Lawhorn, MSN, COHN-S, CCM	Manager, Occupational Health Services, Exxon Mobil	OHNsg, Health Promotion, Surveillance
Ruth Barlow, MS, COHN-S, CCM	President, Optimal Outcomes	OHNsg, Case Management
Sheila Higgins, MPH, COHN-S	OHN Consultant, State of NC	OHNsg, Military
Jon Wallace, MBA, CSP	President, Workplace Safety	Occupational Safety

iv. **Curricula:** The OHN specialty is broad and dynamic and the curriculum requires a sound foundation in the sciences of public health, occupational health, and nursing within an interdisciplinary framework which is an essential integrated building block. The master's curriculum content in OHN contains three components: the public health sciences; the occupational health nursing core studies and OHN functional role courses, and practica; and the occupational health sciences interdisciplinary cognates. All students in the MPH or the MS degree program take the same core courses in the public health sciences, excepting coursework in health services administration and behavioral sciences, which is only for the MPH students. All OHN students take the occupational health nursing core studies, functional role, and occupational health cognates. MS students are required to take research methods/statistics coursework for research skills development.

Specialization in occupational health nursing requires foundational courses from the public health sciences, specifically epidemiology (EPID 600), biostatistics (BIOS 600), health administration (HPAA 600), environmental sciences (ENVR 600), and behavioral sciences (HBHE 600). Coursework in epidemiology provides a foundation for epidemiological inquiry; biostatistics provides for application of statistics in the planning, coordination and analysis of projects, research, and data; environmental sciences coursework introduces the student to basic concepts in environmental health, e.g., air and water pollution, food safety, hazardous substance exposure, and environmental policy and management; behavioral sciences addresses social and behavioral theories applied to health motivating; and coursework in health policy/administration focuses on organizational and human resources management.

Through a theoretical and conceptual framework, the OHN Program prepares the student as a specialist in occupational health nursing. OHN course content uses an occupational health nursing model based on system's theory developed by Dr. Bonnie Rogers to emphasize OHN roles, worksite assessment, interdisciplinary functioning, health promotion and prevention, management, program planning and administration including cost-benefit/effectiveness in occupational settings. The OHN courses (PHNU 781, PHNU 782) and practica (PHNU 783, PHNU 784, and PHNU 886) are sequenced so that students begin by learning theories, concepts, and principles in occupational health nursing and then applying these at the worksite, i.e., assess work-related health problems, and plan, implement, and evaluate occupational health programs/projects. Students have a variety of applied learning experiences e.g. walkthroughs, health promotion projects, and seminar leadership and teaching opportunities including a presentation and discussion of each student's individual philosophy of occupational health nursing and a jointly prepared and published research topic of occupational health nursing interest. For example, students this year published a continuing education article in the AAOHN Journal on the topic of heat stress. Students also conduct joint walk-throughs in the context of a system's analysis approach making joint presentations and providing an individually written paper.

D. Program Activities and Accomplishments:

i. **Progress Toward Goals and Objectives:**

- Provide OHN education both on-campus and via distance education (for the MPH degree).

Both the on-campus and distance education formats are offered for the MPH degree. During the reporting period we had 2 on-campus students and 12 distance education students. In addition 2 students graduated during this time frame.

- Provide MS degree education (thesis required) on-campus.
We currently have one student pursuing the MS degree; she is completing her thesis.
- Provide Certificate in Occupational Health Nursing Program.
Program approved April 2007. Thirty-six applications received; 12 students offered admissions, and 8 students accepted. Classes will begin August 2007.
- The OHN Program participated in the Graduate School Review of the Public Health Leadership Program. The self study was completed in March 2007 and the site visit was April 3 -5, 2007. In the Graduate School Program Review Team Report, the OHN curriculum was described as being "well designed to prepare students for a high level of performance in their profession". They further stated that "the students are well mentored, not only by the full time faculty but by practicing professional OHN nurses in worksite settings". The team commented that "the performance of students appears to be thoroughly evaluated through a broad set of performance measures that include course grades, quality of master's papers, conduct in the worksite practicum, successful completion of a comprehensive examination, and achievement of specified OHN competencies". The program review team met with current students and graduates of the OHN Program and documented that during those meetings "a high degree of satisfaction and praise was expressed for the quality of teaching and mentoring and for the practical and relevant experiences students had throughout the program". "Distance education students in particular expressed their appreciation for being able to continue their employment while going through the master's curriculum."
- Provide interdisciplinary learning opportunities and experiences with a public health foundation (5 core) and occupational health cognate courses.

Occupational health nursing students are highly engaged in numerous interdisciplinary activities. Selected required coursework in safety/ergonomics (ENVR 432), toxicology (ENVR 423), industrial hygiene (PHNU 787), and Interdisciplinary Approaches in Occupational Health (PUBH 785) provides the student with the skills necessary for the further development of the role of the OHN within an interdisciplinary framework. Students learn about interdisciplinary roles and collaboration necessary to improve the health and safety of the worker and work environment. Students from all core disciplines, participate in field experiences, conduct joint walk-throughs, collaboratively work together to address problems in occupational health, and make joint presentations related to the problem. For example, in the safety/ergonomics course (ENVR 432) five groups of students worked in interdisciplinary teams and selected a work-related health issue, visited the work-site, conducted a job safety/task hazard analysis, identified particular MSDS and health and safety hazards and analyzed methods for prevention and control. For each project, students made a power point class presentation presenting all findings and explained the health care management protocol and education and training program. Project examples include Rex Rehab and Nursing Care Center (keyboarding and lifting), Brazeal Stone Works (heavy lifting and dust), and Jiffy Lube (overhead reaching, awkward bending, squatting, computer workstation evaluation, and temperature control).

In the toxicology course (ENVR 423) students attend interdisciplinary classes on-campus or online and online chat rooms, and develop a project, paper, and presentation on a selected chemical (e.g., arsenic, naphthalene, and cadmium) providing an in-depth analysis of the risk, exposure assessment approaches, and prevention and control measures. Examples of student papers and presentations in industrial toxicology are "Welding Fumes and Disease", "Do Aircrew Have a Higher Risk of Cancer?", "Environmental Exposure to Pesticides", "Formaldehyde in Industry", and "Fission of U-235".

In the interdisciplinary approaches course (PUBH 785), interdisciplinary students attend interdisciplinary-based lectures, on-line including a virtual walk-through of the animal facility labs at UNC medical school, and select an industry and specific hazard based on their interest to research and formally present their findings to the class, discussing interdisciplinary roles. For example, Allison Anderson (Safety and Ergonomics), Jennifer Borst (OHN), Dee Daley (other), and Kristen Meador (Safety and Ergonomics) selected Health Hazards and Control Measures in the Trucking Industry. Kathy Dayvault (OHN), Leigh McClure (Safety and Ergonomics), Jessica Meed (HSROSH), and Jason

Tate (OHN) selected Professional Firefighters: Understanding a Special Worker Population. Both papers and presentations were excellent. During this course, occupational medicine was well represented with three physicians providing different lectures and discussions and a good interactive opportunity. In addition, industrial hygiene, safety/ergonomics, and nursing presented information. Injury prevention and labor issues were of significant interest to the students and a lively debate on ethical issues in occupational health was superb!

NORA Interdisciplinary Seminars also provide interdisciplinary learning opportunities and experiences through web casts. The topics and discipline responsible for the seminars are listed below:

August 23, 2006--"Mercury and Chlorine Exposures: Residual Effects 4-20 Years After Exposure" by Dr. Sandy Stopford (Occupational Medicine)

November 14, 2006--"Firefighter Physical Fitness: An Inductive Inquiry into Firefighter Culture and Worksite Health Promotion" by John Staley (Health Services Research in Occupational Safety & Health))

February 19, 2007--"Educational Needs Assessment for Pediatric Health Care Providers on Pesticide Toxicity" by Lyla McCurdy (Occupational Health Nursing)

May 16, 2007--"Standard/Universal Precautions: Compliance, Beliefs & Barriers" by Kathy Kirkland (Industrial Hygiene)

- Provide integrated/applied learning through practicum experiences.

PHNU 783/784 practica are concurrent during the academic semesters and are required for students without OHN experience. The concentrated field practicum, PHNU 886 (5-8 weeks), is required of all students, and enables them to develop and implement advanced OHN practice projects and synthesize the practice within their functional roles. Field practica or training is a planned and supervised experiential component of the academic program which provides learning opportunities not available in the classroom. The purpose and potential benefits of the field practicum are to relate theoretical classroom learning to practice situations; gain experience, skills and confidence in dealing with administrative, and/or service problems; explore and increase understanding of the structure and dynamics (e.g., agency objectives, goals, values, resources, constraints, etc.) of the setting in which he/she is working and the influence of occupational health/safety; and identify work-related health problems for intervention, prevention, and control. This is perhaps one of the best learning experiences offered and is not only completed in traditional industry settings but also in government, professional associations, agricultural, and hospital employee health settings.

- Provide trainees with opportunities for scholarly demonstration of knowledge learned.

During this reporting period 2 students graduated; they wrote master's papers.

- Admit 4-6 trainees/year, encouraging diversity in enrollment.

Five trainees were admitted during this reporting period. One of these trainees was a minority, a male. Three started the Program in the Fall 2006 semester and two admitted in May 2007 will begin classes in Fall 2007.

- Offer continuing education/outreach to the occupational safety and health community.

The OHN Program continues to actively participate in the NC OSHERC continuing education/outreach efforts. We offer the "OHN Certification Review and the Occupational Health Nursing: Introduction to Principles and Practice" courses every year. Three OHN faculty are on the Education and Standards Committee of NCAOHN, which plans the continuing education programs offered semi-annually, for occupational health nurses throughout the state. The NORA Interdisciplinary Seminars are offered to the occupational safety and health community throughout the United States and internationally and has been well received.

- ii **Trainee Honors, Awards, and Scholarships:** Two trainees received Public Health Scholarship Awards; the Klingenfus and Blee Hay Awards, in recognition of their leadership in occupational health nursing. A residential MS student received the AAOHN Foundation Academic Scholarship to support research for her master's thesis. One trainee received 1st place for her outstanding poster based on her master's paper, "Gender Differences in the Long-Haul Trucking Industry Related to Worker Health Perception: A Pilot Study" at the AAOHN Symposium in Orlando, FL. One trainee was inducted into Delta Omega-Theta Chapter, the honor society in public health and two trainees were inducted into Sigma Theta Tau, the

national nursing honor society. Four students published their first article as a course assignment. It was submitted to the AAOHN Journal and accepted for publication; the Journal asked to publish it as a continuing education article because it was so good.

- iii **Faculty Honors, Awards, and Appointments:** Faculty appointments include Chairperson, Scientific Committee on Education and Training in Occupational Health, ICOH; Cross Sector Council, NORA, NIOSH; Institute of Medicine, Standing Committee on Personal Protective Equipment Compliance and Committee on Personal Protective Equipment for Healthcare Workers During an Influenza Epidemic; Advisory Board, National Environmental Education and Training Foundation; and member of AAOHN Foundation Board of Trustees.
 - iv **Trainee Theses:** One MS student has been working on her thesis and expects to graduate December 2007.
 - v **New Faculty Positions:** There have been no new faculty positions during this reporting period.
 - vi **New Courses:** There have been no new courses developed during this reporting period.
 - vii **Trainee Recruitment Including Diversity Efforts:** Recruitment and marketing efforts have been extensive for the past year. During the reporting period there were 30 inquiries, with contacts returned or initiated by OHN faculty, with 4 of those making application. We have advertised extensively in the AAOHN News during the months of May and November; NCAOHN Connection, four times per year; AOEC News, annually; NC OSHERC Institute advertising semi annually; discussed program and provided application materials at the NC OSHERC Institutes, OHN Certification Review Courses 3-4 times per year, and Occupational Health Nursing: Introduction to Principles and Practice Course, annually; and provided information on the PHLP website and FAQs. A specific brochure targeting OHN distance education was developed and has been used in meetings with nurses in the Black Nurses Association. The brochure states that "Minorities are encouraged to apply". A banner announcement was developed and is currently being displayed on the minoritynurse.com recruitment website. We currently have three minority students enrolled. When inquiries are made by prospective applicants, an application packet is emailed or mailed and telephone or email contact follow-ups are made with every inquirer. A running list of inquiries is kept and, for those who are serious applicants, continued follow-up is done throughout the application process.
- E. Program Products:** Program faculty and trainees have produced publications (n=18) and presentations (n=66). The 3rd edition of the textbook written by Dr. Rogers, *Occupational and Environmental Health Nursing*, is in press. Several chapters from Dr. Rogers' textbook will be published in the Japanese Occupational Health Nursing Newsletter over a 12 month period in 2008. The 4th edition of the textbook co-authored by Dr. Rogers, Ms. Randolph, and Ms. Mastroianni, *Occupational Health Nursing Guidelines for Primary Clinical Conditions* is also in press. Publications are listed in Appendix B. The NCAOHN Spring and Fall Conferences were co-sponsored by the OHN Program. CE courses presented were the Occupational Health Nursing Certification Review Course and the Occupational Health Nursing: Introduction to Principles and Practice Course. Research projects that are continuing and have had significant trainee involvement included a NIOSH and University of Maryland funded grant titled "Antineoplastic Agent Exposure Study" and NEETF's Environmental Health Research Project.
- F. Future Plans:**
- Implement the on-line certificate in Occupational Health Nursing Program, which was approved April 2007. The first group of certificate students will begin classes August 2007. This will provide a recruitment groundfield for potential applicants to master's level degree program and/or for those needing additional knowledge related to the specialty field.
 - Develop self-study for NLNAC reaccreditation and organize site visit for January 2008.
 - Continue to provide graduate level education and training for master's students in occupational health nursing in both residential and distance learning formats.
 - Continue the aggressive recruitment plan for the master's programs, emphasizing minority recruitment. This will include advertising, both traditional and web-based, recruitment through our alumni and recruitment ambassadors, and development of brochures for distribution.
 - Continue to provide continuing education/outreach course offerings in Occupational Health Nursing Certification Review, Occupational Health Nursing: An Introduction to Principles and Practice, Case Management Certification Review, and offsite courses as requested.
 - Continue interdisciplinary interaction through overview course, seminars, orientation session, and research experiences as appropriate.

**Occupational and Environmental Medicine Program
Progress Report
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III. Program Progress Reports

A. Program Title: Occupational and Environmental Medicine

B. Program Director: Dennis Darcey, MD, MSPH, FACOEM

C. Program Description

The major goal of the Duke Occupational and Environmental Medicine Residency (OEMR) program is to train ethical, board-certified, occupational and environmental physicians who possess the knowledge and skills necessary to provide occupational and environmental health professional services in a wide variety of settings, including academia, public health agencies, corporate occupational health, and community based clinical occupational medicine.

OEMR is based in the Division of Occupational and Environmental Medicine within the Department of Community and Family Medicine (CFM) at Duke University Medical Center. The program is fully accredited by the Accreditation Council for Graduate Medical Education (ACGME) and is as a core program in the North Carolina Occupational Safety and Health Education and Research Center. The School of Public Health at the University of North Carolina at Chapel Hill (UNC) provides academic programs to fulfill the Master's in Public Health degree.

The program is two-years in length with the first year devoted to academic training leading to the completion of the Master in Public Health degree including coursework in biostatistics, epidemiology, environmental science, toxicology, industrial hygiene, safety, health and behavioral science and health administration. The second "practicum" year practicum involves supervised training in clinical occupational medicine, mentored research and interdisciplinary occupational health hazard assessment with other occupational health professionals. During the practicum year residents participate in rotations at an industrial occupational health service, a comprehensive university hospital based employee health clinic at Duke Medical Center, a regional community based occupational health clinic, the NC State Department of Health, and government agencies including OSHA and NIOSH. Since the knowledge and skills necessary to practice preventive medicine and occupational environmental medicine are acquired over the course of a career, lifelong learning skills are emphasized.

D. Program Activities and Accomplishments

The OEMR Program currently has two residents enrolled in the program. John Paul Longphre MD, MPH completed the MPH degree at the UNC School of Public Health and is now in the practicum year of training. Dr. Longphre, MD is a recipient of the prestigious OPSF Scholarship. Hassan Zakaria, MD, MPH is also completing the practicum year of study. Both will graduate from the program in June 2008. A third resident, Anand Joshi, MD will be starting the academic year of study in January 2008. The program is currently interviewing new resident candidates and it is anticipated that an additional two residents can be funded bringing the total enrollment to three by July 2008. The OEMR program continues to attract excellent candidates for training and has been fortunate to enroll a high percentage of minority trainees. Over the last five years the OEMR program has admitted residents who represent minorities in the field including 3 women (37.5%), two of whom are African American (25%), and an Asian male (12.5%). All but one of Duke's resident graduates (in the past five years) passed the American Board of Preventive Medicine examination on the first attempt.

Additionally two PhD graduate students at UNC were supervised by Duke OEM Epidemiology faculty: 1) Rodriguez-Acosta - Epidemiology doctoral student supported through minority supplement to patient handling grant; completed Ph.D. August 2007. Topic: Occupational injury and physical assault experience of nurses' aides employed at Duke University Health System. Dr Rodriguez-Acosta remains as a post doc in the Duke Epidemiology research group. 2) Clare Lutgendorf - Epidemiology masters' student. Topic: Health-related quality of life among women in low wage jobs in northeast NC. Degree expected 2008.

As outlined in the Future Plans Section of the previous progress report, efforts to improve and expand resident rotation experiences have been successful. The Duke Employee Health and Wellness Center rotation has been revised to accommodate more focused administrative and toxicological investigations in addition to workers comp injury care. A new rotation with Duke Sports Medicine has been implemented and both of the current residents are taking the rotation. A new off site practicum rotation has been approved with Tony Alleman, MD, MPH (a former Duke OEM resident) who directs a network of occupational medicine clinics in Louisiana that focus on hyperbaric medicine and delivery of occupational health services to the oil and gas

industries headquartered on the Gulf Coast. Another practicum rotation is now in place for residents to work with Schering Plough Pharmaceuticals. Dr. Darcey serves as their corporate global occupational health consultant and a number of projects are available for resident learning opportunities.

The OEMR program was evaluated by the Duke Graduate Medical Internal Review Board this past year and received full accreditation. This internal review is scheduled 2 years prior to the ACGME five year review to assist program directors with compliance. Based on the review, the resident evaluation process will be expanded and the competencies matrix will be reorganized using the six core competencies.

There have been no changes in program leadership since 1998 when Dennis Darcey, MD, MSPH was appointed Program Director. The faculty has been stable and in the last year former Duke OEMR resident and now faculty member, Brian Caveney, MD, MPH was elected President of the ACOEM Carolinas Occupational Medicine Professional Organization. The program director Dr. Darcey serves on the Board of the NIOSH North Carolina OSHERC and the North Carolina State Department of Health Advisory Panel for an ATSDR funded study of TDI Exposed Communities. The associate program director Carol Epling, MD, MPH has been recently appointed Associate Director of the Duke Employee Occupational Health and Wellness Center that services over 26,000 employees employed by Duke University and the Duke Health system. Dr. Lipscomb serves on the Board of Scientific Counselors, National Institute for Occupational Safety and Health (2007-2010) and the NIOSH NORA Construction Sector Research Council. Dr. Lipscomb was the keynote speaker at the prestigious Sixth International Scientific Conference on Prevention of Work-Related Musculoskeletal Disorders held in Boston during the Summer 2007. Dr. Thomann, Director of Occupational and Environmental Safety Office for Duke University and Medical Center was reappointed as Chairman of the North Carolina Radiation Protection Commission. He was also appointed to the Environmental Health Committee of the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE). The epidemiology faculty headed by Dr. Dement continues to be very productive and a list of publications and select presentations are listed in Appendix B.

E. Program Products

Each year approximately 60-hours of seminar / journal club CME in occupational health are offered to occupational health professionals from central North Carolina. Duke faculty is also involved in consultation activities to industry, government, other universities and hospitals. Presentations and seminars by faculty have been made to medical societies, regional and national occupational medical association meetings, university and industry trainee groups, and regional and national symposia. Continuing Education Programs provided by OEM faculty over the last year include the training of 2,695 occupational health professionals from medicine, nursing, safety, and industrial hygiene employed in industry, government and academia. The Annual Carolinas Occupational Medicine Conference is sponsored by the NC OSHERC. A listing of publications is included in Appendix B and Continuing Education activities are included in Table 12A.

Duke OEMR residents participated in a number of research projects and presentations.

John Longphre, MD, MPH

Master's in Public Health Thesis: *The science and economics behind the practice of Critical Care Hyperbaric Medicine*. The world of clinical hyperbaric medicine is undergoing large changes, both in regard to reimbursement and evidence-based care. This paper discusses the both the science of hyperbaric medicine and these administrative changes.

Other Projects: U.S. Patent Application for Cooling Garment intended for wear underneath (protective) clothing in hot/dangerous environments.

Textbook Chapter: Clinical Practice of Biological Monitoring, *Tetrachloroethylene Chapter* (co-authored with Brian Caveney MD, JD, MPH, OEM Press, submitted)

Textbook Chapter: Civetta, Taylor, and Kirby's Critical Care 4th Ed., *Hyperbaric Medicine Chapter* (submitted)

Academic Paper (First Author): *First Aid Oxygen in Recreational Diving Injuries*. Longphre JM, Denoble PJ, Moon RE, Vann RD, Freiburger JJ. *Journal of Undersea and Hyperbaric Medicine*, 2007 34(1):43-9.

Academic Paper: *Predictors of Increased PaCO₂ During Immersed Prone Exercise at 4.7 ATA*. Cherry AD, Forkner IF, Frederick HJ, Natoli MJ, Schinazi EA, Conard JL, Longphre JP, White W, Frieberger JJ, Stolp BW, Pollock N, Doar PO, Boso AE, Alford EL, Walker AJ, Ma A, Rhodes MA, Moon RE. *Journal of Applied Physiology* (in press)

Abstract: Longphre KM, Yeh CC, Longphre JM, Sim WS, Huh BK. *Evaluation of Interlaminar versus Transforaminal Epidural Steroids for Radicular Low Back Pain*. American Society of Anesthesiology Annual Meeting. 10/15/2007

Abstract: Pollock NW, Cherry AD, Forkner IF, Natoli MJ, Frieberger JJ, Stolp BW, Longphre JP, Conard JL, Rhodes MA, Schinazi EA, Doar PO, Boso AE, Alford EL, Walker AJ, Frederick HJ, Moon RE. *Comparison of end-tidal versus arterial measures of CO₂ during immersed exercise at surface and depth*. Undersea and Hyperbaric Medical Society (UHMS) Annual Meeting, 2007

Magazine Article: *First Aid Oxygen Update and the DAN[®] Oxygen Card*, Alert Diver Magazine, November/December 2006 issue

Hassan Zakaria, MD, MPH

Master's in Public Health Thesis: Analgesic Use in U.S. Emergency Departments for Patients Reporting Moderate to Severe Pain: Select Patient Characteristics Influencing Narcotic Analgesic Prescribing Practices.
Other Reports / Papers:

1. Evaluation of Sensitizers Amongst Employees in Pharmaceutical Manufacturing Industry – current
2. Frequency of occupational injuries and illnesses amongst employees at Duke University Medical Center – descriptive study
3. Blood and body fluid exposures at Duke University – descriptive study
4. Risk / Benefit Analysis of Pre-Employment Fitness Screening at Duke University
5. Patient Drug Information Pamphlet for acetaminophen

Presentations:

1. Hard Metal Disease –Bosch Employee Union Employees, Greenville, NC
2. Risk / Benefit Analysis of Pre-Employment Fitness Screening at Duke University – Journal Club 06/26/2007
3. Pre-Employment Fitness Screening at Duke University – Presentation to Duke University Doctorate of Physical Therapy training program. And Duke OEM Seminar.
4. Occupational cardiopulmonary diseases. ENVR 246, Duke University Survey of Occupational Health and Safety: 10/18/2007.

NIOSH r2p: Dr. Lipscomb has two ongoing projects in the field both funded by the Center to Protect Workers Rights in a NIOSH cooperative agreement: 1) prevention of nail gun injuries in residential carpenters; 2) prevention of patient handling injuries, evaluation of minimal manual lift policy supported with lift equipment.

F. Future Plans

The OEMR program plans to continue training up to four residents. Efforts to improve and expand resident rotation experiences are ongoing with focus on revising the resident rotation with the IBM Corporate Program. IBM has had a change in personnel and discussions have begun to make some adjustments to the rotation which will now focus more on disability management. Based on the interest of an incoming resident another off site practicum rotation is being developed with the Savannah River Department of Defense facility in South Carolina. This rotation will focus on hazard assessments led by a team of industrial hygienists and health physicists as well as clinical experiences at the on site occupational medicine clinic. In addition, a revision of the OEM competencies is planned to reflect changes in the ACGME residency requirements noted during the recent Duke internal GME review.

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III. Program Progress Reports

A. Program Title: OCCUPATIONAL SAFETY AND ERGONOMICS PROGRAM

B. Program Director: David B. Kaber, PhD

C. Program Description

1. Goals and Objectives

The goals and objectives for the Occupational Safety and Ergonomics (OS&E) Program Area are to provide education, training, and support to master's and doctoral level graduate students seeking advanced engineering degrees with an emphasis in OS&E. The regional need for practitioner engineers trained in safety and ergonomics is evidenced by injury and illness statistics for the agriculture, fishing and home construction industries (among others) in North Carolina. These industries all have injury/illness rates higher than those for private industry, as a whole, and they are of significant economic importance to our State. Training engineers in the prevention of occupational injuries and illnesses can have a significant impact on these industries and worker health.

The OS&E training grant is housed in the Department of Industrial & Systems Engineering (ISE) at NCSU. The rationale for this is that engineering controls are generally recognized as the most effective methods for reducing the incidence and severity of occupational injuries. The main thrust of our program is teaching students how to recognize, evaluate and control occupational safety and ergonomics hazards. The training provided through this program has been a combination of traditional classroom instruction, basic and applied research training, and occupational safety field experiences.

2. Responsible Conduct of Science Training

The focus of our student training in the responsible conduct of science occurs in three areas: (1) the ethical treatment of human subjects; (2) responsible data collection and analysis; and (3) responsible authorship. Training in each of these areas has been provided by ergonomics faculty (Hsiang, Kaber and Mirka) through structured presentations, or consultation with students working on research projects. Each faculty member has developed a structured approach to introduce NIOSH trainees to the research environment.

In their first semester, students typically participate in a laboratory-based research project by assisting other senior students working in our Ergonomics Lab. In their second semester, the trainees may participate in a research study as part of a funded project or a basic research practicum course. Finally, in the summer between the first and second years, the students begin development of their thesis topic. They typically conduct their thesis research in the second year of the program. With this particular structure in place, there are logical points in time when various research ethics related topics can be addressed in the context of project work.

Beyond this, students are exposed to research ethics topics through a sequence of presentations as part of our ISE Department Graduate Seminar Series. These include: (1) a seminar on the use of human subjects in research, typically presented by an ergonomics faculty member; (2) a seminar on the ethics of publication and peer review, typically presented by the ISE Department head; and (3) a seminar on data integrity and research recordkeeping, presented by NCSU's Associate Vice Chancellor For Research Administration. These seminars are offered each fall semester.

In addition to these sources of information, PUBH 785 (a required course for all OS&E students) provides a formal presentation of issues in the ethical conduct of research. Students are evaluated on their retention of these critically important issues as part of the course.

3. Faculty Participation

i. Program Director

This year, Dr. Gary Mirka left the NCSU ISE Department for a position at another university. Dr. David Kaber has assumed the role of Program Area Director. Dr. Kaber is a full professor and has been a member of the faculty of the ISE Department since 2000. He has provided leadership and expertise to the ergonomics program and laboratory at NCSU over the past 7 years.

Dr. Kaber has been a co-PI on the NCSU/UNC ERC component grants since 2004 and he was a co-PI on the NIOSH Safety TPG (Training Program Grants) from 2001-2003. He began his service as the Program Director of the Safety and Ergonomics Program Area in August of 2007. Dr. Kaber will serve as the administrator of the Safety and Ergonomics Program Area. He and Dr. Simon Hsiang are currently responsible for coordinating all safety and ergonomics course offerings and recruiting students to the program. Dr. Kaber assigns students to program area advisors and assures that program area students follow the required curriculum and gain the necessary research training.

Dr. Kaber's area of specialization is in cognitive ergonomics and systems safety. He has primarily conducted research on human-automation interaction in complex systems, including aircraft and air traffic control. Dr. Kaber received the Sigma Xi Research Award in 2005 and the Alcoa Foundation Engineering Research Achievement Award in 2006. He has published over 35 refereed, archival journal publications on theoretical and empirical human-machine systems research. He has focused on assessment of the impact of types and levels of automation on human performance, situation awareness and workload in piloting advanced commercial aircraft, teleoperation of robotic manipulator systems, air traffic management in terminal radar approach control, etc.

In terms of curriculum development, Dr. Kaber has developed several new courses during his tenure, including: (1) ISE 740 – "Engineering Psychology of Human-Computer Interaction"; (2) ISE 741 – "Systems Safety Engineering"; and (3) ISE 745 – "Human Performance Modeling". He has previously taught ISE 541 – "Occupational Safety Engineering" through NCSU's Engineering On-line Program.

Dr. Kaber has a strong record of research funding from federal agencies, including NASA, the NSF, the ONR (Office of Naval Research) and the ARI (Army Research Institute), as well as industry sources. In addition to his academic work experience, Dr. Kaber has consulted with several human factors consulting companies, including Aptima, Inc., Charles River Analytics, Inc. and SA Technologies, Inc. Projects have ranged from designing and developing new measures of situation awareness for infantry squad training to the development of models of commercial aircraft pilot behavior. He is a member of the Ergonomics Society, the Human Factors and Ergonomics Society, the Institute of Electrical and Electronics Engineers, the Institute of Industrial Engineers, the American Society for Engineering Education, and Sigma Xi. Dr. Kaber is committed to allocate approximately 15% FTE to the direction of the ERC component program.

ii. Program Faculty

Dr. Simon Hsiang is an Associate Professor in the ISE Department. He began his employment at NCSU in August 2005. He is a core member of the Safety and Ergonomics group and participates fully in the ERC component program in terms of: interacting with students through courses; advising students; chairing student committees; and involving students in his active research program. Dr. Hsiang's expertise and research are focused on human motor control, optimization of manual control performance, and human-machine system stability. Much of his work in these areas has focused on slips, trips and falls in industrial workplaces, and the interaction between cognitive and physical workload in complex task performance. Dr. Hsiang has taught a breadth of courses in safety, ergonomics, statistics and more general industrial engineering courses. While at NCSU, Dr. Hsiang has taught ergonomics and biomechanics (ISE 544) courses. He has also developed two special topics classes on "Human Causality and Survival Function Analysis" (ISE 794C) and "Human Causality and Bayesian Decision Analysis" (ISE 794D). In the future, Dr. Hsiang will also be teaching the "Research Practicum" (ISE 796B) for the Safety and Ergonomics Area. Dr. Hsiang and Dr. Kaber have a history of collaboration, including joint funding from NASA and industry as well as co-authored technical reports

and conference proceeding publications. Over the last two years, Drs. Hsiang and Kaber have served together on several graduate student committees.

Dr. Nelson Couch is an Adjunct Assistant Professor of ISE and is also a core faculty member in the Safety and Ergonomics Program. While Dr. Couch has broad expertise in occupational safety applications, his particular area of emphasis is in radiation safety. Dr. Couch has been active in teaching our Occupational Safety (ISE 541) and Systems Safety (ISE 741) courses since 2001. Dr. Couch has also contributed to our program through his participation on NIOSH trainee thesis committees, as his adjunct faculty status permits this activity. Dr. Couch has received numerous forms of recognition for his work in the area of occupational safety and health, including being made a Fellow of the American Industrial Hygiene Association in 2004.

From other near-by universities, Dr. Samuel Moon and Dr. Hester Lipscomb, Associate Professors in the Department of Community and Family Medicine at Duke University, have also participated on inter-institutional graduate committees for some of our NIOSH trainees, as well as interdisciplinary ergonomics research projects. Both Moon and Lipscomb have been adjunct faculty in our department. They have each served on two graduate student committees.

With respect to international collaboration, Dr. Regina Stoll, the Director of the Institute for Preventive Medicine at the University of Rostock (Germany), has participated on inter-institutional graduate committees of several students studying in our Safety and Ergonomics Program Area. Dr. Stoll is an Adjunct Associate Professor of ISE and she has served as a member of Noa Segall and Rebecca Green's Ph.D. dissertation committees. Dr. Stoll has also collaborated with Dr. Kaber on NSF sponsored research for design of intelligent supervisory interfaces for error prevention in human control of biological and chemical compound screening processes.

4. Curricula

During this reporting period, the Safety and Ergonomics Program Area has expanded student training from the master's level to master's and Ph.D. levels. In addition to the traditional coursework, our program places emphasis on research training for all students. The students who participate in the NIOSH trainee program also participate in our on-going funded research projects. This has been our approach throughout the existence of the program. Publications of our current and recently-graduated trainees (see Appendix B) provide evidence of this. In general, traditional coursework and research training will continue to be our approach for future trainees.

As described above, we engage all students in a laboratory research project in their first semester of training. This familiarizes the students with the tools of ergonomics research. The second semester research study is typically related to a funded project or conducted through our basic research practicum course (ISE 796B). The ergonomics area faculty work with the trainees at the close of their first year to identify a thesis topic. The students then conduct their thesis research in the second year of training. Using this structured approach, trainees receive exposure to basic experimental methods, advanced ergonomics research techniques, as well as the process of conducting independent research. This approach also formalizes the research ethics training received by the students.

In terms of traditional coursework, our training of master's-level students is focused on producing high-quality practitioners with a good understanding of research methods. Training of Ph.D. level students is focused on producing researchers trained in cognitive and physical ergonomics methods with excellent measurement, modeling and systems analysis skills. All master's students supported by the training program are full time students pursuing theses. They enter our program having already completed a baccalaureate degree. Ph.D. students enter our program with either a bachelor's or master's degree. The former students ("direct-track Ph.D.") must complete a master's degree on their way to the Ph.D.

All master's and Ph.D. level trainees take a specific set of courses to satisfy the Safety and Ergonomics Program Area requirements and they participate in on-going, sponsored research in our Ergonomics Laboratory. The master's students are required to take a total of 30 credit hours for graduation (17 of these credit hours have a safety or ergonomics focus). The Ph.D. students are required to take a total of 72 credit hours for graduation. The majority of these credit hours have a safety or ergonomics focus. All trainees are also required to enroll in our Applied Research Practicum

(in OS&E) (IE 796A) as part of their coursework, to demonstrate application of research skills to a real-world ergonomics problem.

All master's-level trainees graduate with the skills necessary to recognize, assess, develop and implement engineering and administrative controls for general occupational safety and ergonomics hazards. The Ph.D. level students graduate with the skills necessary to: use existing ergonomics measurement methods to identify engineering problems; integrate ergonomics analysis and modeling methods (create meta-methods) as a basis for proposing problem solutions; and analyze results and make appropriate system design recommendations.

The safety and ergonomics training provided through this program comes from both required and elective courses. To satisfy the safety concentration requirements, students can select from the courses (or equivalents) listed in Appendix A. ("Safety concentration" courses appearing in italic typeface are required for the trainees.) In total, there are 17 credit hours of required safety and ergonomics coursework and an additional 2-3 credit hours of safety and ergonomics electives.

Required Applied Research Practicum in Occupational Safety & Ergonomics: All trainees are required to enroll in the applied research practicum (IE 796A). The practicum is included in our program for the purpose of providing trainees with an introduction to field research in occupational safety and ergonomics. Trainees perform a specific, defined research project through a local employer. Each trainee keeps a research notebook that tracks project milestones, problems, solutions, etc. The trainee's advisor reviews the notebook on a regular basis, to monitor the trainee's progress. Each trainee (or team) prepares a technical report summarizing the field research experience and prepares and presents a seminar at the work site. The sponsor and the ergonomics faculty evaluate the product of the research. Some previous students have noted in their reports that the breadth of hazards identified in employer facilities was representative of the content of courses required as part of the training curriculum. In particular, students found the industrial toxicology course (ENVR 432 "Industrial Toxicology") to be highly relevant to their completion of the applied research practicum. As such, the toxicology course has since been recommended for all trainees.

D. Program Activities and Accomplishments

During this reporting period, 26 students were enrolled in the safety and ergonomics area within the NCSU ISE Department. Of these, four students received some financial support through the NIOSH NC OSHERC. The majority of the trainees that were not supported by NIOSH funding were Ph.D. students (10). Previously, this was a group that was not eligible for support, as our program was limited to master's level training. This changed during the 2006-2007 academic year, as our Ph.D. training was approved in the previous program review. Currently, 1 Ph.D. student is supported through the NIOSH program and another Ph.D. will join the training program in spring 2008. All of the four students supported during 2006-2007 academic year were women (a minority group in engineering), and one was African-American. Three of these students graduated in spring term 2007 and the remaining student will graduate in spring 2008.

Dissertations completed in the period

1. Sheik-Nainar, M. A., "Situation Awareness and Gait Control in Mixed Cognitive and Physical Task Performance under Perturbations."

Theses completed in the period

1. Li, Y., "Modeling the effects of time lag in virtual reality (VR)-based haptic surgical simulator."
2. Marks, A., "Learning curve analysis for alternative keyboards."
3. McClure, L., "Effects of time of day and warm up on lifting kinematics."
4. Meador, K., "Ergonomic interventions for sonographers."

E. Program Products

During the present reporting period, the Safety and Ergonomics Program Area faculty and students published (in-print) 10 archival journal articles. Ten more papers have been accepted and are "in

press". Seven additional papers have been submitted for review (see Appendix B for the full listing of manuscripts generated by faculty and students conducting research in the Safety and Ergonomics Program Area). Faculty and students have also been active in presenting their work at professional conferences, including the 50th Annual Meeting of the Human Factors and Ergonomics Society, the 2006 IEEE Systems, Man & Cybernetics Conference, and the 2007 IEEE Conference on Automation Science & Engineering.

During the reporting period, trainees also conducted a research experiment related to a NIOSH-sponsored project, directed by Dr. Mirka, which was focused on the agriculture industry (NIOSH U50 OH07551-01). The objective of this work was to evaluate the effectiveness of a novel ergonomic knee support for the prevention of lower back pain in pepper harvesters. Nine subjects performed simulated pepper harvesting tasks, including both static and dynamic trials. The student trainees working on the project collected EMG, Motion Tracking, and Lumbar Motion Monitor data. Two combinations of simulated pepper plant height and distance were evaluated for four different harvester posture positions, including: full kneeling, knee support, squatting and stooping. The students administered subjective surveys of discomfort and productivity measures were also collected on participants. They found three postures, knee support, squatting and stooping, required high flexion of the low back during dynamic trials (more than 60°). They also found squatting and stooping postures to produce significantly higher passive tissue moments compared with two kneeling postures. The report of this research has been submitted to the *Journal of Applied Ergonomics* for publication and is currently under review.

F. Future Plans

In the current academic year, we plan to further expand our training program on the Ph.D.-level. Our current funding is being used to support two master's students and we have recruited two new Ph.D. students for NIOSH traineeships to begin in spring term 2008. One of these students is a woman engineer. As our current master's students graduate in spring 2008 and 2009, this will open-up opportunities to support additional Ph.D. students with the ERC support. This move to Ph.D. student support is expected to have a significant impact on our future graduate student recruiting in the Safety and Ergonomics Program Area. In expanding our Ph.D. student training, we will continue to attempt to recruit under-represented minorities (in both gender and race).

**Occupational Epidemiology Program
Progress Report
July 1, 2006 – June 30, 2007**

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III. Program Progress Report

A. Program Title: Occupational Epidemiology

B. Program Director: David Richardson, PhD

C. Program Description

Goals and Objectives

Occupational Epidemiology is an allied research program that has been part of the UNC ERC since 2001. The mission of the occupational epidemiology program is to train highly-qualified scientists who will develop and apply the theory, methods and substance of epidemiology to protect workers' safety and health. With the program now in its sixth year, we are emphasizing engaging trainees in high-quality research on occupational health and safety, supporting trainees in contributing scholarly publications, and ensuring that they successfully complete the program.

Program Leadership and Faculty

Core and adjunct faculty members for the program are shown in the following table. Dr. David Richardson has taken over program leadership. One of the program's prominent faculty members, Dr. Loomis, accepted a faculty and chair position at the Department of Environmental and Occupational Health, School of Public Health, University of Nevada, but will continue as an adjunct faculty member.

Table of Program Faculty

Core Faculty	Research and Competency Areas
David Richardson (Program Director)	Injuries, exposure assessment, methods, radiation
Jiu-Chiuan Chen	Respiratory diseases; musculoskeletal disorders; exposure assessment
Marilie Gammon	Breast cancer, gastric cancer, esophageal cancer
Stephen Marshall	Injuries; quantitative methods
Andrew Olshan	Parental occupation, pregnancy outcome and childhood cancer; exposure assessment methods
Charles Poole	Quantitative methods
Jane Schroeder	non-Hodgkin's lymphoma, renal cell cancer, uterine fibroids, pesticides and other agricultural exposures.
Steve Wing	Ionizing radiation, social justice and health; philosophy of epidemiology
Adjunct Faculty	
John Dement	Exposure assessment, construction
Hester Lipscomb	Musculoskeletal disorders, injuries, construction
Kenneth Mundt	Surveillance, methods, injury and disability, historical exposure reconstruction, science policy
David Peden	Respiratory diseases, asthma, allergy, biomarkers
Bonnie Rogers	Occupational health nursing, hazards to health workers, ethics
Carol Runyan	Injuries, violence, young workers, agriculture
Vilma Santana	Mental health; women; work organization
David Savitz	Pregnancy outcome; electromagnetic fields; pesticides & cancer
Dana Loomis	Injuries, exposure assessment, methods
Timothy Wilcosky	Exposure assessment, methods, cancer

Curricula

The course of study leads to the PhD and is designed for students with a Master's degree in epidemiology or a related field. Training activities include required and elective courses, mentored research practica, interdisciplinary seminars, preliminary written and oral examinations, participation in research, and the development and execution of the doctoral dissertation project. There were no significant changes in the program or curriculum in the past year. Support from NIOSH provides valuable enhancements to the occupational epidemiology program through courses, seminars and opportunities to be exposed to other occupational health disciplines. Some of the most valuable training takes place as students work with professors to conduct research and publish the findings.

Responsible Conduct of Science Training

All occupational epidemiology trainees are required to complete both formal coursework on research ethics and training in the responsible conduct of research with human subjects required by the Public Health Institutional Review Board. This training is documented and assessed at the Intra-Departmental Review required of all doctoral students, and again before undertaking the dissertation research. All current trainees have completed the required training.

D. Program Activities and Accomplishments

Progress Toward Goals & Objectives

Three criteria have been established for evaluation of the program's success: 1) timely completion of degrees by trainees; 2) number and quality of publications contributed by trainees to the peer-reviewed literature; 3) placement of graduates in appropriate positions.

Because the occupational epidemiology program is small, typically supporting only two trainees at any one time, and still relatively young, with the first trainees appointed in August, 2001, there were no new program graduates in the past year.

Two of the trainees who were in the program one year ago have moved out of the training program and are in good academic standing. Myduc Ta has not yet graduated, but is working actively on her dissertation on community-level structural determinants of workplace violence under. Zewditu Demissie is in the early stages of developing a dissertation proposal with input from several of the program faculty. She is expected to graduate in 2008.

Trainee Recruitment

Two new trainees have been enrolled, Ghassan Hamra, who is in the early stages of developing a dissertation proposal with input from several of the program faculty and has a strong interest in occupational radiation epidemiology, and Steven Lippman, who is developing a dissertation in the area of occupational injury epidemiology. In addition, trainees and faculty members are engaged in research that has generated papers that are in preparation, undergoing review, or accepted for publication, as described in the next section.

Other Accomplishments

Faculty Honors and Awards

Faculty Appointments

Stephen Marshall, Promoted to Associate Professor of Epidemiology and Orthopaedics, 2005; Appointed Adjunct Associate Professor of Exercise and Sports Science, 2006; Member of National Academy of Science's Committee on Medical, Physical, and Mental Standards for Military Recruitment.

New Courses

"Analyses of case-control data," David Richardson, Instructor, 17th International Summer School of Epidemiology, University of Ulm, Germany. 2006.

Trainee Honors and Awards

None

E. Program Products

Program trainees were the lead author of one original scientific paper that was submitted during the past year. In addition, one trainee made a research presentation at International Society for Exposure Assessment. A complete list of trainee publications appears in the Appendix.

Other students benefited indirectly from the presence of the training program, although they were not appointed as trainees. Student publications that were enhanced by program support are also listed in the Appendix.

F. Future Plans

Recruiting promising individuals to the program and working with trainees to guide them through the development of appropriate doctoral research projects, encourage them to generate scholarly publications and to mentor them to successful completion of the PhD will continue to be key objectives for the program and its faculty. In addition, the faculty will continue to seek extramural funds that will provide a strong research base for the program.

Specific plans for the requested budget period include:

1. Recruiting highly qualified individuals as trainees;
2. Working with current trainees to emphasize scholarly publication;
3. Ensuring that individuals who have received program support continue to progress toward graduation;
4. Continuing research collaborations with faculty from the Safety/Ergonomics program and the Occupational Medicine program;
5. Enhancing interdisciplinary interaction through trainee participate in research;
6. Contributing to Dr. Rogers's interdisciplinary occupational health course and the NORA seminar series.

Beyond addressing the preceding programmatic goals, we hope to recruit a new faculty member in occupational epidemiology to replace Dr. Loomis, perhaps at the assistant or associate professor level. A long-term goal is to expand the size of the program from two trainees to five, as recommended in the review of our most recent application for competing renewal. With programs and departments competing for the best applicants—particularly outstanding minorities—training grant support is often a critical factor in applicants' decisions about which institution to attend. In the past year, however, we did not have the resources to recruit any new trainees. In addition, although ERC support is of great value to the trainees, a training program that is too small is ultimately difficult to sustain with new courses, continuing education, outreach and other activities that require a significant amount of faculty time.

**Health Services Research in Occupational Safety and Health Program
Progress Report
July 1, 2006 – June 30, 2007**

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Health Services Research in Occupational Safety and Health (HSROSH) Progress Report

July 1, 2006 – June 30, 2007

F. Program Title: Health Services Research in Occupational Safety and Health

B. Program Director/s: Dr. Bonnie Rogers and Dr. Morris Weinberger

C. Program Description: The Collaborative PhD Program in Health Services Research in Occupational Safety and Health (HSROSH) is located within the Department of Health Policy and Administration. Students are full-time and on-campus. A minimum of 44 credit hours of graduate coursework, excluding dissertation hours, is required for the degree. Students take required courses in HPA core seminars, methods, a minor area, occupational safety and health area, and health services. Students select a minor area of expertise which may be disciplinary (i.e., economics, epidemiology, financial management, sociology/organizational studies, political science, public policy development) or interdisciplinary (i.e., decision sciences, quality and access). They must pass a written comprehensive examination upon completion of coursework, then present and defend a dissertation proposal and a final dissertation defense based on original research.

The objectives of the training program are to provide education, experiences, and a professional environment for trainees to:

- 1) Develop knowledge and skills in order to conduct independent research in health services research in the field of occupational safety and health.
- 2) Develop knowledge of the literature, important findings, methodological problems, data availability, and research issues related to the organization, financing, and management of occupational health services and delivery options including an examination of quality, cost-benefit, and cost-effectiveness analyses and evaluation.
- 3) Learn how to apply currently acceptable statistical analysis techniques to research issues in health services research in occupational safety and health.
- 4) Develop teaching skills by designing and teaching a course in the area of specialization.
- 5) Develop a minor or collateral area to bring additional perspectives to problems in health services research.

The program normally takes four years to complete and requires a minimum of two years in residence. All requirements for the degree must be completed within eight years from the date of first registration in the Graduate School. At least two semesters of full-time residency equivalency (nine or more hours) must be taken in continuous registration on this campus with a minimum of four semesters of residency required overall.

1. Goals and Objectives. The goal of the HSROSH program is to provide both intensive and extensive training in research methods, subject matter, and theory appropriate to health services research with occupational safety and health integrated through coursework, seminars, research experiences, and a dissertation specific to HSROSH. Interdisciplinary interaction is emphasized in PUBH 785, Interdisciplinary Approaches to Occupational Safety and Health; the NORA Interdisciplinary Seminars which are held quarterly; and group activities. Since the HSROSH Program received phase-out money, the objective is to phase out the program by June 30, 2007.

2. Responsible Conduct of Science Training.

The responsible conduct of research, one of the core competencies of the HPAA Doctoral Program, is addressed in several courses, including HPAA 885, HPAA 886, HPAA 872, HPAA 873, HPAA 874, and some of the minor courses. For example, EPID 780, Occupational Epidemiology, includes a required module on ethics in occupational health research. All students and faculty are required to complete CITI Program, Instruction in the Protection of Human Research Subjects. This web-based course should be completed during the first 2 semesters of the student's program. The required modules

address ethical principles, use of human subjects, assessing risk, informed consent, privacy and confidentiality, use of records in research, protected populations, conflicts of interest, HIPPA and research, etc.

- 3. Faculty Participation.** The faculty of the HSROSH Program remained unchanged. Dr. Bonnie Rogers continued as NC OSHERC PI/Program Director and Director for the HSROSH Program. Dr. Morris Weinberger continued as Co-Director for the HSROSH Program grant. Susan Randolph continued as Program Coordinator and supporting faculty. The faculty for the program represent researchers and practitioners from a wide variety of disciplines including professionals in health services research, occupational health and safety, economics, epidemiology, injury prevention and control, management systems, and statistics. Exposure to these faculty and disciplines, as well as linkages with external agencies including the NC State Public Health Department, various industry segments, and labor groups, will enhance the students' experiences. The table below shows core, supporting, and adjunct faculty along with their area of interest and/or competence.

Core Faculty	Interest/Competence Area/s
Tom Ricketts	Rural health care, primary care, regionalization of services, political philosophy, policy implementation and development, and global and comparative national health policies
Bonnie Rogers (PI; Director)	Occupational hazards to health care workers (antineoplastic agent exposure), ergonomic and work practice interventions, and ethical problems in occupational health
Carol Runyan	Injury prevention and control, adolescent workers, and workplace violence
Morris Weinberger (Co-Director)	Health services research, primary care, patient-centered outcomes research, pharmaceutical care, and quality care

Supporting Faculty	Interest/Competence Area/s
Marisa Domino	Economics of mental health, agency relationships among physicians, patients, and insurers; diffusion of new technologies, and public provision of health care and health insurance to low income populations
Shoou-Yih Daniel (Daniel) Lee	Health care organizations
Edward Norton	Health economics, long-term care and aging, mental health, managed care, and econometrics
Susan Randolph	Occupational health and hazard surveillance
William Sollecito	Management systems
Sally Stearns	Health economics, applied statistical methods, health services reimbursement systems, cost-effectiveness analysis, and use of health services at end of life
Bryan Weiner	Organizational change, adoption, and implementation of innovations, patient safety, and inter-organizational relationships

Adjunct Faculty	Interest/Competence Area/s
Kay Campbell	Occupational health promotion, disability management
David Coble	Safety in occupational health
Carol Epling	Occupational medicine education
Arnold Kaluzny	Assessment, program evaluation, development and operations of strategic alliances in health services
Kerry Kilpatrick	Operations research

Dana Loomis	Occupational epidemiology, health risks to vulnerable groups
Judith Ostendorf	Ergonomics in occupational health

4. **Curricula.** The curriculum is divided into categories reflecting health services research/research methods (9 credit hours); analytical methods (9 credit hours); minor area/health policy elective (18 credit hours); occupational safety & health requirements (11 credit hours); professional development (8 credit hours); and dissertation (minimum of 6 credit hours). Relevant coursework in occupational safety and health is taken but may be interchanged to some degree with minor area coursework to the extent that minor coursework requirements are met. HPAA 873 and HPAA 874 are integrative seminars with occupational safety and health content. For example, Dr. Gary Greenberg from UNC presented “Workforce Administrative Plans for Pandemic Flu” on November 7, 2006; Dr. Brian Caveney from Duke University, Occupational and Environmental Medicine presented “Return on Investment from Lifestyle Restriction” on April 17, 2007. Comprehensive examinations and dissertation requirements in the specialty must be met.

An example of a typical curricula schedule is presented below using Epidemiology as the minor area of study.

Course Type	Fall Year 1	Spring, Year 1	Fall, Year 2	Spring, Year 2
HSR/Research Methods	HPAA 870 HPAA 881	HPAA 885 HPAA 882	HPAA 886 HPAA 883	HPAA 872 Elective
Analytical Methods	HPAA 496 (math module) HPAA 496 (Stata software)			
Seminars	HPAA 873 HPAA 874 HPAA 871	HPAA 873 HPAA 874	HPAA 873 HPAA 874	HPAA 873 HPAA 874
Minor (Epidemiology/OSH)	EPID 710	PUBH 785 EPID 715	EPID 695	EPID 780

Students are expected to attend the NORA Interdisciplinary Seminars held quarterly each year. The seminars are also webcast to accommodate distance education students and varying class schedules, and to promote outreach to the larger occupational safety and health community. Each training area within the NC OSHERC is responsible for securing a speaker to address a topic in the respective area on a rotating basis. John Staley, a doctoral student in the HSROSH Program, presented “Firefighter Physical Fitness: An Inductive Inquiry into Firefighter Culture and Worksite Health Promotion,” an aspect of his doctoral research.

D. Program Activities and Accomplishments

1. Progress Toward Goals and Objectives

The primary objective was to phase out the HSROSH Program. Students were told that the HSROSH Program was being phased out and to explore other means of funding for the future. They have been encouraged to complete their course of study. The integration of occupational health content into HPAA research seminars (HPAA 873 and HPAA 874) has continued.

2. Trainee Honors, Awards, & Scholarships: Nothing new to report.

3. Faculty Honors, Awards, Appointments:

- Shoou-Yih Daniel Lee was recognized for his service as an advisor to the 2006-2007 Hubert H. Humphrey Fellowship Program.

4. Trainee Theses and Dissertations

- *Julie Seibert* is doing an integrated dissertation entitled “The Impact of Social Policy and Social Networks on the Employment Status of Persons with Disabilities.” She plans to defend her proposal before the end of the Fall 2007 semester once some final issues are resolved.

- *John Staley* is working on his dissertation entitled “Determinants of Firefighter Physical Fitness: An Inductive Inquiry into Firefighting Culture and Coronary Risk Salience.” His dissertation examines the cultural barriers and meaning of physical fitness in firefighter culture, so as to improve physical fitness, coronary health, and worksite health promotion through multi-level intervention design. A mixed methods design is used, including qualitative ethnographic interviews, focus group discussions, and quantitative survey. He plans to defend his dissertation this fall and graduate in December 2007.
- *Courtney Stanion* worked on her dissertation proposal this past year but found a problem with the data. She is considering other topics. She is taking a leave of absence for one year, effective August 2007.
- *Jessica Meed* is developing her dissertation proposal on what interventions will help Operation Enduring Freedom (OEF) and Operation Iraqi Freedom (OIF) combat veterans who have suffered cognitive injuries in the combat zone, remain part of the workforce after returning to the United States.

5. New Faculty Positions: None.

6. New Courses: None.

7. Trainee Recruitment Including Diversity Efforts: Not applicable (program being phased out).

E. Program Products

1. Publications and Presentations of Program Faculty and Trainees: Faculty and students published or have in press at least 71 books, book chapters, and refereed articles. They also gave over 46 presentations. See Appendix B.

2. Conferences/Symposia Sponsored: Not applicable.

3. CE Courses Presented: Not applicable.

4. Successful R2P Projects: Not applicable.

5. Research Projects Completed Having Significant Trainee Involvement

- *Julie Seibert* has served as a Teaching Assistant with Dr. Jim Porto in the Community Preparedness and Disaster Management (CPDM) certificate program, and has done some contract work with University of Florida resulting in technical reports for state agencies.
- *Jessica Meed* is working with Jim Porto, PhD on a project to access how the readiness of hospitals and medical workers is measured. She completed an independent study with Dr. Jim Porto on military and first responder mental health. She also spent this past summer on active duty as an ENSIGN in the U.S. Public Health Service working on mental health policy for responders to disasters; and worked with the DHHS Office of the Assistant Secretary for Preparedness and Response (ASPR), and Dr. Dori Reissman (CDC/NIOSH).

• **Unique Training Courses Presented:** Not applicable.

F. Future Plans: Not applicable.

**Continuing Education Program
Progress Report
July 1, 2006 – June 30, 2007**

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- B. Program Director**
- C. Program Description**
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PROGRESS REPORT for 7-1-06 to 6-30-07

- A. **PROGRAM TITLE:** Continuing Education Program (CE)
- B. **PROGRAM DIRECTOR:** Kathleen Buckheit, MPH
- C. **PROGRAM DESCRIPTION:** Since 1976, the NC OSHERC has been committed to providing quality CE opportunities for occupational safety and health professionals. Based on the continual evaluations of needs assessments, course evaluations, outreach, and recruitment activities, a substantial need for this service is evident. This need is due in part to the ever-changing needs of practitioners and an interdisciplinary approach to CE. The CE Program is responsible for developing, coordinating, and implementing courses that provide information to the various disciplines to enhance their work productivity, and provide professional development. It includes education and hands-on training required to earn and maintain professional certifications, licensure, and regulatory requirements. This is accomplished by identifying these requirements through various forms of needs assessments, collaborating with qualified faculty and academic advisors, and developing and delivering appropriate courses to meet these needs. Course evaluations serve as quality assurance that courses are effectively and efficiently delivering the NC OSHERC programs and services.
- **Goals and Objectives:** The **goals** of the CE Program remain to provide top quality education and training to health and safety practitioners in the southeast region through Institutes, contract courses, and onsite short offerings. As in the past, the CE Program will focus on collaborating with other organizations and agencies to provide the highest quality programs and faculty available. Therefore, seeking opportunities to increase outreach is a priority for the marketing strategy.
 - **Major objectives are:**
 1. Analyze needs assessment data annually to develop one online course within the next three years and develop two new short courses every three years;
 2. Train at least 800 people per year - twice the NIOSH ERC grant requirement;
 3. Increase diversity enrollment by 5% based on data from CE registration forms through outreach to identified historically black colleges, Native American tribes, and professional minority groups;
 4. Provide educational collaborations with two additional chapters of professional associations;
 5. Increase union attendees in CE courses by 5% over next two years through outreach to the local unions with the assistance of Mr. Tom O'Connor, Advisory Board member and NCOSH;
 6. Increase outreach to local health departments through offers of tuition waivers for two staff; and
 7. Increase physician attendance by 10% through collaboration with Duke OM, COEMA, and new partnerships with VA COEMA and American Academy of Family Physicians.
 - **Faculty participation** comes from commitment of both the academic and non-academic faculty. Academic faculty have a university affiliation; non-academic faculty are practitioners and consultants. Both continue to engage in outreach with professional associations on behalf of the NC OSHERC and participate as course directors, planners, presenters, evaluators, and technical advisors from the various disciplines offering a unique blend of theoretical and practical experience.
 - **CE Program Director**, Kathleen Buckheit, has been Director for four years and is responsible for overseeing the administration of all program development and activities, including: selecting courses and faculty; facilitating development of online courses, ensuring quality of courses, faculty, presentations, and customer satisfaction; providing sound fiscal management; marketing programs and services; developing and conducting outreach and diversity activities. She works closely with the Advisory Boards on these responsibilities. Ms. Buckheit has over 20 years experience in Occupational Health in a variety of settings that include: OHS Program Manager in industry; Research Collaborator; State OHN Consultant; Supervisor of exposure surveillance grants as Hazardous Substances Emergency Events Surveillance (HSEES) Program and Adult Blood Lead Exposure Surveillance (ABLES) Program; and PI on the NC Occupational Surveillance Grant on which she remains an advisor. She is also an advisor for the Pesticide-Related Illness and Injury Surveillance grant headed by the current State Consultant. She has taught several courses on Bioterrorism and worked for NC DHHS on SARS and Anthrax teams. She previously demonstrated her leadership in organizing training in the handling, managing, and evaluation of environmental exposure to toxic algae for NC. She developed the *Medical Management Guidelines* for the NC Department of Environment and Natural

Resources (DENR), Division of Water Quality, and NCSU Aquatic Botany Lab workers, which were later adopted by the NC Public Health Preparedness Teams for bioterrorism. As the NC State OHN Consultant, she worked with industry and health and safety professionals to develop disaster preparedness systems at the worksite. She was part of the NC DHHS task force developing *Safe Re-entry Guidelines* for local health departments faced with new public health concerns of unknown hazardous materials. She worked with the State Emergency Response Team as a 4-county coordinator after the NC flooding of Hurricane Floyd and has been appointed facilitator for the NC DHHS, Occupational and Environmental Epidemiology Branch, for a series of community meetings and panel discussions for an ATSDR grant addressing Toluene Diisocyanate (TDI) exposures in NC. Ms. Buckheit has been UNC adjunct faculty for over 12 years in the Public Health Leadership Program. She has networked to identify new faculty and courses recommended from needs assessment data. She participates on several state and national organizations and university boards, demonstrating leadership expertise. She devotes 75% of her time to CE and Outreach.

- **CE Program Assistant Director**, Vicki Smith, serves as Assistant Director (AD) of CE, she devotes 80% time to CE and is responsible for the day-to-day administrative activities of the Center. With over 25 years with the CE Program, she supervises the administrative staff, manages off-site classroom contracts and travel, conducts marketing through five listservs, schedules courses, and submits CE course contract proposals. She coordinates faculty and course locations and oversees data management systems.
- **CE Program Specialists (2)** have worked for over 17 and 20 years with the NC OSHERC CE Program and have administrative responsibilities for individual CE courses assigned to them; maintaining student tracking, daily office administrative duties, registrations, daily receipts, and website contacts. They work with the instructors on preparing course materials and equipment, applying for contact hours, and producing certificates of attendance. Both are responsible for customer service and course evaluation data collection and analysis. They devote 80% commitment to CE.
- **CE Program Faculty** are both academic faculty, who are occupational health and safety professionals with either fulltime or adjunct university appointments, and non-academic faculty, such as consultants and practitioners. Both groups serve as course directors, instructors, technical advisors, curriculum and evaluation reviewers, and planning committee and advisory board members for CE Program offerings. The CE faculty have many years of experience and technical expertise to develop interdisciplinary curriculum and provide quality training. Some faculty include:
 - **Industrial Hygiene (IH)**: More than 20 faculty teach over 20 classes and serve as course directors, instructors, technical advisors, and advisory and planning committee members. As a consultant with a wide variety of health and safety experiences in the public and private sector, Nelson Couch, PhD, CIH, CSP, Chair of the Technician Certificate Program Advisory Board and lead academic faculty member for CE Programs, represents academic faculty from UNC IH and NCSU Safety Programs. His expertise in both the IH and Safety disciplines supports his interdisciplinary understanding of the needs of the CE Program. He is course director for CIH and CSP Review Courses, and FIH online course. Other faculty include: Salvatore DiNardi, PhD, CIH, U of MA at Amherst and editor of the AIHA text: *The Industrial Environment, Its Evaluation, Control, and Management*; Dennis George, PhD, Western Kentucky University (WKU); Craig Scholl, CSP, Firecon, Inc.; Rod Handy, PhD, CIH, Purdue University; Michael May, PhD, WKU; Scott Harris, PhD, US EPA; and Rich Cravener, CIH, CSP.
 - **Occupational Health Nursing (OHN)**: Academic faculty serve as course directors, instructors, and advisory and planning committee members for the CE Program, presenting: *OHN: Introduction to Principles and Practice*; and *OHN, OHN Safety Management*, and *Case Management Certification Review Courses*. CE collaborates with the NC Association of Occupational Health Nurses (NCAOHN) and NC Tarheel Association of Occupational Health Nurses (NCTAOHN) with four OHN academic faculty, Bonnie Rogers, DrPH, Judy Ostendorf, MPH, Susan Randolph, MS, and Kathleen Buckheit, MPH, planning, developing, and presenting at semi-annual NCAOHN State Conferences, and local chapter meetings and provide all AV equipment and on-site technical support. The OHN Program Director is a certified legal nurse consultant in occupational health and safety and Past President of the local chapter, Eastern NC Association of Legal Nurse Consultants (ENC-AALNC) and Ms. Ostendorf is Treasurer. They worked on four educational offerings this reporting period with CEUs from UNC.

- **Occupational Medicine (OM):** Faculty at UNC-CH, Duke University Medical Center, and private practitioners serve as course directors and faculty in CE OM courses. Dennis Darcey, MD, MSPH and Brian Caveney, JD, MD, MPH from Duke, participate on the CE Advisory Board and develop and present *Workplace Ergonomics* at the Institutes. Brian Boehlecke, MD, UNC, teaches the *Pulmonary Function Testing Technician* course. With OM as a new component of NC OSHERC, the collaboration and opportunities involve more physicians and OM courses and has expanded CE to the hospital setting.
- **Occupational Safety and Ergonomics (OS):** Academic faculty from NCSU School of Engineering and consultants from their Ergonomics Center plan, develop, and conduct Ergonomics courses with Tamara James, MS, Ergonomics Director for Duke, Tim McGlothlin, MS, Director of NCSU's Ergonomics Center. Dr. Nelson Couch, a NCSU faculty member, chairs the Technician Certificate Programs Advisory Board and teaches for CE. Ray Boylston, (first head of NC OSHA and a wealth of experience and knowledge), David Coble, Bill Taylor, and Jim Jones provide a unique team of safety instructors blending their years of varied experiences from OSHA, industry, military and city government. Jon Wallace, co-instructor for the academic Safety and Ergonomics course with Judy Ostendorf (OHN), is course director for the Safety and Health Systems Auditing CE course and is developing the Fundamentals of Safety online course.
- **Occupational Epidemiology (OE):** *Occupational Epidemiology* course was first conducted August 2002. Although CE is not a requirement of this allied Program, courses in Epidemiology will continue to be offered and David Richardson, PhD, will oversee and advise on planning and presentation.
- **Curricula - Needs Assessments** are vital to supplying appropriate education and training for the health and safety professionals. A variety of methods were used to identify these needs and were used to determine courses to be offered and developed. Following the needs assessments data, more environmental courses are being developed. We have contacted environmental health and food service organizations through outreach to offer assistance and collaborate with their educational programs to involve them in the Environmental Technician Certificate Program. Several new courses are offered every year through the various programs presented in collaboration with the professional associations, such as the Carolinas Occupational and Environmental Medicine Association (COEMA) Annual Symposium and the NC Association of Occupational Health Nurses (NCAOHN) Semi-annual Conferences. Recent needs assessments conducted during 2004-2006 through the following include:
 1. **Survey of students attending current NC OSHERC CE programs:** A random survey of 150 student evaluations attending 20 CE courses during 2004-2006 requested Certification Review courses; Ergonomics; Safety; Industrial Hygiene Sampling; Lab/Biosafety; and Indoor Air/Mold.
 2. **Information gathered at NC OSHERC exhibit booth at professional conferences and via the NC OSHERC website for 30 participants:** Data indicated the top five courses requested are: Certification Review Courses; Complying with OSHA; Health Promotion; Industrial Hygiene; and Safety.
 3. **Information gathered by NIOSH ERC exhibit booth at professional conferences in 2005-2006:** The ERC data indicates the top courses requested are: Risk Assessment; Respiratory Protection; Safety; Hearing Loss/Conservation Programs; and Ventilation.
 4. **Results of Needs Assessments conducted by professional associations:** AAOHN 2005-2006 assessment data indicate the top five topics are: Worksite Health Promotion/Wellness; Legal Liability/Scope of Practice Issues; Case Management; Safety/Injury Prevention; and Stress Management. Data from local AIHA and ASSE chapters indicate courses NC OSHERC already offers.
 5. **Centerwide needs assessment** of March 2005 was sent to 2,834 people on the Center's Email list. The Centerwide needs assessment survey listed **56** topics from which survey respondents could choose. The top five CE topics are identified by discipline listed in the proposal under Proposed Training section. Tracking of the effectiveness and impact of professional Certification Review Courses is conducted for CIH, CSP, CHMM, COHN, and COHN/CM. Questionnaire results and Pass/Fail Rates from course attendees are being tracked and indicate highly successful offerings.

D. PROGRAM ACTIVITIES AND ACCOMPLISHMENTS

- **Progress toward goals and objectives** are measured and reassessed annually. All were met in 2006-2007.
 1. Needs assessments are conducted and analyzed annually. Based on the results, one online course is developed and another being developed. Three new courses were presented in the last two years.
 2. 4,712 students were trained this past year;
 3. Diversity enrollment increased by 5% based on data from CE registration;
 4. Educational collaborations were increased to Carolinas AIHA and NC ASSE chapters;
 5. Union attendees in CE courses were increased by 3% this year and looking to meet another 2 % next year to meet the objective of 5% over 2 years.
 6. Free attendance was provided to four health department staff members, and;
 7. Physician attendance increased exponentially with the addition of OM to NC OSHERC and other outreach.
- **New courses** include: Environmental Risk Assessment; Disaster Preparedness: Safety Working with Security of Information Technology; Risk Assessment for Insurance;
- **Trainee recruitment including diversity efforts** meets the training needs of the region. The **geographic** statistics indicated that **85%** of the trainees were from the southeast region. For the past year, this was an increase from the previous five years of **64%** reported from the region. For 2006-2007, the diversity breakdown of attendees reporting their ethnic background was: White - 70%; Black - 20%; Hispanic - 6%; Asian - 2%; American Indian - 1%; Other - 1%. With diversity plans, we seek to enroll more Hispanic and American Indian populations. Every Hispanic and Black Chamber of Commerce in the southeast region was contacted and provided marketing information. If individual Chamber members were listed with contact information, marketing information was also provided at that level. Every American Indian tribe with a website in the southeast region was contacted with marketing information.

E. PROGRAM PRODUCTS include course manuals from all courses offered and a CD game that teaches about asbestos awareness and hazards that is for sale.

- **Conferences/symposia sponsored** include: two semi-annual educational conferences for NC Association of Occupational Health Nurses; annual symposium for the Carolinas Occupational and Environmental Medicine Association; annual NC State Ventilation Conference; annual Occupational Safety and Health Update Series; NC Tarheel Association of Occupational Health Educational Meetings; Piedmont Chapter of ACHMM for Certification Review; Central Carolina Safety School Conference; NC Statewide Safety Conference; semi-annual conferences of Carolinas Section of AIHA, and Piedmont, Western Carolina and NC Chapters of ASSE.
- i. **CE courses presented 7/1/06 to 6/30/07 are listed on Tables 12 previously requested by NIOSH.** The NC OSHERC is recognized for the quality and variety of continuing education courses offered that continue to meet local, regional and national needs and all courses have contact hours for CEUs or professional certification units. **Table 12A** illustrates the breakdown of students and courses by core and documents the interdisciplinary attendance at what used to be traditionally distinct core courses, demonstrating that the roles and responsibilities of the health and safety professionals is crossing into other disciplines. Many courses are interdisciplinary in nature and are attended by nurses, occupational physicians, industrial hygienists and safety professionals even though the course is not listed in that particular discipline. Therefore, although a course is offered in a specific discipline, attendance by other professionals very frequently crosses over disciplines. This year the CE Program trained **4,712** of students in **135** courses. This is over **eleven times** the NIOSH grant requirement to train 400 students per year in CE. All courses have CEUs through UNC, Duke and/or professional organizations (AAOHN, ABIH, BCSP). The addition of Duke OM Program has resulted in a significant increase in physician CE attendance.
 - **Program Evaluations** are conducted for each course to identify deficiencies and weaknesses to modify and improve CE courses. Methods used are:
 1. **Outcomes Measurements** conducted for all certification review courses request exam results six months after course. Passing rates are significantly higher than national passing rates for all courses.

2. **Student evaluations** indicate high satisfaction. Of the random survey of 2004-2005 CE courses (n=75), a composite summary evaluation showed a 4.73 Likert scale satisfaction rating (5 is the highest).
 3. **Evaluations of course materials** are frequently done by UNC faculty members to assist course directors and faculty in the development of course curriculum and materials.
 4. **Exam results** for courses requiring testing, uses the passing rate of 85% of students to indicate that the material was adequately covered. All Certificate Program students take exams earning non-academic credit or units. First time passing rate is 90% for the three Certificate Program courses. After re-test, passing rates are 100%. Exams are also used for revisions in question design and content.
 5. **Workplace effects** are requested by follow-up contact to determine what effects can be attributed to the CE Programs by asking students to share their success stories.
- **Unique training courses presented** include the **Certified Occupational Health Nurses Safety Management Certification Review Course**. It was the first offered in response to a new Board certification credential and has been recruited by the American Board of Occupational Health Nurses to provide information on the types and levels of expertise of participants. Two courses addressing Insurance issues of **Risk Management** were added this last year. The **Occupational Safety and Health Update Series** is presented annually.
 1. **Technician Certificate Programs** were initiated with IH in 1996 after careful analysis of many methods of surveying students to identify job responsibilities and in what ways they felt the knowledge and skills were deficient. Safety followed in 1999 with Environmental offered in 2002. From the input of the health and safety professionals in the workforce and the many methods of conducting needs assessments, it was apparent that the scope of practice of the specialty profession has changed and enlarged to cover non-standardized responsibilities that cross over into other disciplines. Now all Certificate Programs require two week-long courses (4 units or non-academic credits) in the base discipline and two remaining units chosen from a list of about **25** electives every year, applicable to all of the Technician Certificate Programs to best fit the role of the technician. Exams are outcome measurements of acquired skill and knowledge. Since 1996, there have been **678** Certificate Program students, **334** graduated.

Individual interdisciplinary and departmental components have provided for the interdisciplinary focus of the CE and HST Programs. Although offered as elective courses, they are not exclusive to the Technician Certificate Programs and, therefore, all trainees are encouraged to participate. Frequently, students enroll in the Certificate Programs after taking one of the interdisciplinary electives. These interdisciplinary courses have been very successful and, because of student requests and various forms of Needs Assessments, the Technician Certificate Program Advisory Board approved all electives for use in any of the Certificate Programs allowing the student to choose as the courses best applied to their own scope of practice. Sample courses are: Respiratory Protection; Industrial Ventilation for Practitioners; Applied Industrial Toxicology; Ergonomics in the Workplace; Indoor Air Quality; Non-Ionizing Fields Radiation; Industrial Noise Management; Safety and Health Audit Management; and many more.
 2. **Professional Certification Review Courses** prepare professionals to pass their relative certification exams, required by many employers for advancement and higher compensation. These courses are interdisciplinary using faculty from all program areas. Comprehensive Industrial Hygiene (CIH); Certified Safety Professional (CSP and ASP); Certified Hazardous Materials Manager (CHMM); Certified Occupational Health Nurse (COHN and COHN-S), Certified Occupational Health Nurse/Case Manager (COHN/CM and COHN-S/CM) are offered. Developed by Safety and OHN faculty for a new OHN certification offered this year, Certified Occupational Health Nurse Safety Manager (COHN/SM and COHN-S/SM) Review Course was offered last Fall and Spring.
 3. **Distance Education** was initiated three years ago to incorporate distance-learning opportunities into the total CE Program based on needs assessments and student requests, beginning with **Fundamentals of Industrial Hygiene (FIH)**. Although most who inquired have taken the course in person, five have completed the course. **FIH** was the first course developed in a web-based format, modeled after the FIH course produced by the UNC OHN and IH Programs for distance learning

students. This 4.5-day course, earning 36 contact hours for CEUs, is also offered in the traditional CE format at both semi-annual Institutes. The online format awards the same 4.5 ABIH or 2.9 BCSP points or CEU contact hours and the student has up to 15 weeks to complete the course and earn two units for the Technician Certificate Program. There have been many inquiries from individuals and industries to use this format since January 2005; however, five have registered and three have begun the course Fall 2006. We have had meetings with AIHA to collaborate on a marketing effort to promote the online course together. **Fundamentals of Occupational Safety (FOS)** is the second online course mirrored after FIH and has been delayed until more interest is shown. The target is for 2008 after evaluating the success of the FIH course and develop the best approach for the FOS course. **Other Online Courses** are being discussed. **Toxicology** is being evaluated to see if there is a market for this course online. This decision will be made in Fall 2008 after the FIH online course is evaluated for actual need and FOS is marketed.

4. **North Carolina State Ventilation Conference Certificate Program**, drawing faculty from nationally-recognized universities and industries, started at the NC OSHERC in May 2005 with 30 students completing the Certificate. This Certificate offers higher-level courses geared for engineers in design, installation and maintenance of building-appropriate ventilation systems. Several states are interested in collaborating with NC.
5. **NORA Interdisciplinary Series** coordinated through the NC OSHERC Director's office with all core and allied programs participating, presented web casts on a quarterly basis. All disciplines are responsible for developing a seminar on a rotational basis to ensure the interdisciplinary content and is available to all for CE credit.
6. **Offsite CE Programs** as contract courses for private and government agencies satisfy the organizational needs of the customer. All types include from asbestos training to professional certification review.

E. FUTURE PLANS FOR THE NEXT BUDGET PERIOD: July 1, 2007 to June 30, 2008

- a. **Proposed Activity** is increasing collaborations with 7 Public Health Response Surveillance teams (PHRST), NC DHHS and UNC's Center for Public Health Preparedness and Emergency Management, and professional organizations. Plans include: 1) Developing new training modules on domestic preparedness with an increase in courses and students on a variety of chemical, biological, radiological, and nuclear (CBRN) topics, including two online modules; 2) Soliciting more contract courses, providing off-site group education and training; and 3) Increasing the scope of the CE program with a more regional focus by increasing the collaboration with the Sunshine and Deep South ERCs through the development of a 5-year Partnership Plan for annual conferences and providing select courses for each other's ERCs.
- **Marketing, Outreach, and Diversity:** Providing the highest quality CE education has been the draw for those familiar with the NC OSHERC, especially from EPA Region IV. Networking remains important in marketing to professional organizations, members, employers, and employees. Attendance at interdisciplinary meetings provides recognition of the CE Program and opportunities to promote the NC OSHERC. Professional association meetings continue to be targets for marketing and outreach. Outreach includes participating on advisory boards, presenting courses, providing equipment and tuition waivers, and promotion of CE and academic programs as future education and training options to strengthen the skills and knowledge of the workers and those responsible for workforce health and safety. Plans include: expanding marketing and outreach throughout the region, visiting historically black colleges, American Indian Education Centers, and union and Hispanic workers' outreach; and targeting Chambers of Commerce and professional associations to continue working with their educational planning committees.

IV. Specific Improvements in OS&H Resulting from ERC Programs

The major impact of any academic institution is obviously in the success and contributions of its students. UNC-OSHERC alumni continue to be major contributors to the occupational safety and health field at all levels, in all programs, as the individual program area trainee lists indicate.

Several examples of specific improvements in occupational safety and health resulting from ERC programs include:

- A faculty/resident investigation of a cluster of dermatitis cases at a large steel mill led to improvements in administrative procedures and personal protective equipment that has significantly reduced the incidence rate of cases of dermatitis.
- OEM Resident John Longphre, MD, MPH is participating in a Federal Advisory Committee to the U.S. Coastguard to develop revised medical fitness for duty standards for merchant mariners. The committee was formed at the request of the NTSB following several water transportation accidents to improve the shipboard safety for workers, passengers and public safety.
- Duke faculty Epidemiologic Research projects investigating nail gun injuries discovered that the most significant safety risk was due to the rapid fire automatic feature. This led the manufacturers association, The International Staple and Nail Tool Association (ISANTA) to sponsor a change in the ANSI standard for pneumatic tools. The new standard adds tool safety labels and changes in the actuation system of the majority of framing nail guns to include sequential actuation systems that prevent the nail gun from discharging automatically. The device requires contact with the nail surface and pulling the trigger to actuate the release of the nail. Follow up epidemiologic studies with a carpenter apprentices in St. Louis led to a 20% reduction in nail gun related injuries.
- Clinical observations of an increasing rate of musculoskeletal disorders among ultrasonographers at Duke Hospital led to multiple interventions by the Duke ergonomic team including pannus supports, breast supports and a unique prototype mechanical arm support with attachments for multiple probes. In addition, educational programs were instituted highlighting better staff postures and patient positioning. These interventions led to significant reductions in MSD's in this population of workers.
- The Duke Ergonomic Program was also responsible for Duke Hospital adopting a hospital wide lift equipment program which has been successful in reducing MSD disorders among nurses, nursing assistants, and radiology technicians.
- In partial fulfillment of the thesis requirement for her degree, Kristen Meador worked with sonographers at Duke University Medical Center (UMC) to assess the impact of three different ergonomics transducer interventions in a simulated ultrasound-scanning task. The transducer grip sizes were modified to allow for improved hand posture position and gripping force, as measured using EMG sensors. Kristen also studied the effect of simulated patient size (obese vs. non-obese) and scanning angle on sonographer muscle exertion levels. The results of the study were reported in Kristen's thesis and were shared with Duke UMC to help address potential design problems and ergonomics injuries for sonographers.

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APPENDIX A

PROGRAM CURRICULA, COURSE REQUIREMENTS & SAMPLE CURRICULA

Industrial Hygiene Program Curricula

The Master's Program

All three MS-degree programs require 2 years of course work and submission of a master's technical report or thesis, which describes a relevant research project, and an oral defense/presentation of the work before a faculty committee. Appropriate projects involve laboratory research, development of theory, and/or fieldwork. The offered core courses (Table A) and advanced courses (Table B) for Master's students are given below. The Department of Environmental Sciences and Engineering requires a seminar (ENVR400) and a Unifying Concepts course (ENVR401) designed to expose all ENVR students to the fundamental principles common to the field. Students in the EAC focus also take industrial hygiene core courses specified in Table A. In addition, students take enough elective courses selected from the advanced courses listed in Table C to bring the total number of credits earned to a minimum of thirty semester hours.

We also encourage our students to enroll in continuing education courses offered through the ERC that cover materials related to professional practice not presented through our regular academic courses. In order to take better advantage of the excellent collection of CE courses in industrial hygiene, which are offered by our ERC, the faculty recently made it possible for students to receive academic credit, a maximum of 3 credit hours, for attending CE courses. A formula of one credit hour per 15 contact hours was agreed upon in keeping with university guidelines. Students in the industrial-hygiene track can also take courses at Duke University (e.g., occupational diseases, biohazards) or at North Carolina State University (e.g., noise, ergonomics and safety) through a reciprocity agreement we have with those schools.

Industrial Hygiene Program Curricula (continued)

Table A. Core Courses:

Number	Title	Credit	Semester	Faculty
ENVR 400	Seminar Series	1	Both	ENVR Faculty
ENVR 401	Unifying Concepts	3	Both	Miller
BIOS 545	Principles of Experimental Analysis	3	Both	Biostatistics faculty
EPID 600	Principles of Epidemiology	4	Both	Epidemiology faculty
ENVR 411	Laboratory Techniques and Field Measurements	3	Fall	Nylander-French, Weinberg, Whalen
ENVR 416	Introduction to Aerosol Science	4	Fall	Leith
ENVR 516	Aerosol Science Laboratory (alternate years)	2	Fall	Leith
ENVR 430	Health Effects of Environmental Agents, OR	3	Fall	Ball, Nylander-French
ENVR 423	Industrial Toxicology, OR	2	Spring	Stopford
ENVR 470	Environmental Risk Assessment, OR	3	Spring	Crawford-Brown
ENVR 732	Health Effects of Outdoor and Indoor Air Pollution	3	Fall	Hazucha
ENVR 422	Air and Industrial Hygiene	3	Fall	Fox
ENVR 432	Occupational Safety and Ergonomics	3	Fall	Faculty
ENVR 433	Health Hazards of Industrial Operations	3	Spring	Flynn
ENVR 750	Principles of Industrial Ventilation	3	Fall	Flynn
ENVR 992	Master's Technical Report, OR	3	Both	Core Faculty
ENVR 993	Master's Thesis			

Table C. Advanced Courses:

Number	Title	Credit	Semester	Faculty
ENVR 770	Biological Monitoring	2	Spring	Nylander-French
ENVR 751	Ventilation Design Problems	1	Fall	Flynn
ENVR 754	Air Pollution Control	3	Spring	Leith
ENVR 768	Micro-Environmental Air Flow Modeling (odd years)	3	Fall	Flynn
ENVR 769	Advanced Methods of Exposure Assessment (even years)	3	Spring	Rappaport
ENVR 784	Environmental Law	3	Fall	Heath
ENVR 468	Advanced Functions of Temporal GIS	3	Fall	Serre
ENVR 765	Model-Based Exposure Mapping and Risk Assessment	3	Spring	Serre

Industrial Hygiene Program Curricula (continued)

Students in the MSEE program must take ENVR750 Principles of Industrial Ventilation, ENVR751 Ventilation Design Problem, and ENVR754 Air Pollution Control. Students in the MSPH program must take two general public health courses, one from the Department of Health Behavior and Health Education (HBHE600 or alternative) and one from the Department of Health Policy and Administration (HPAA600 or alternative). In addition to the core courses listed below, most students take several advanced courses (listed below the core courses). Students are encouraged to take courses taught by faculty outside the EAC focus area faculty after consultation with their faculty advisor.

All NIOSH funded students are required to take PUBH785: Interdisciplinary Approaches in Occupational Health, attend a minimum number of interdisciplinary seminars, and attend an NC OSHERC orientation meeting. Other interdisciplinary activities noted in industrial hygiene include students taking courses with occupational health nursing students, safety students, and physicians in toxicology, industrial hygiene, and safety/ergonomics courses and working on projects together. Students also engage in joint collaborative research.

The Doctoral Program

The goal of our doctoral program is to educate highly qualified Ph.D.'s who will contribute significant knowledge to the field, and be prepared to conduct original ongoing research at academic institutions, government agencies, corporations, or serve as specialized consultants. There are few formal course requirements for the Ph.D. degree; the actual courses required are determined by the doctoral committee. Students in this program typically spend between one and two years in course-work prior to taking their qualifying examinations. The examinations include both written and oral components and cover basic knowledge of the principles of industrial hygiene as well as a proposal for a research project. The student is then responsible for conducting an independent research project, which contains sufficient new information for a minimum of three peer-reviewed publications. The doctoral program is usually completed within four to five years.

MPH Occupational Health Nursing Program

Sample Guide for Distance Learning Education Format**

Year 1 (See Note:)

Summer (Fall Registration)	Fall	Spring
PHNU 781 (3) ²	EPID 600 (3) ¹ HPAA 600 (3) ¹ PHNU 783 (2)*	ENVR 600 (3) ¹ ENVR 423 (3) ¹ PUBH 785 (3) ¹ PHNU 784 (2)*

Year 2

Summer (Fall Registration)	Fall	Spring
PHNU 782 (3) ²	BIOS 600 (3) ¹ PHNU 787 (2) ¹ PUBH 748 (2) ¹	PUBH 746 (3) ¹ HBHE 600 (3) ¹

Year 3

Summer (Fall Registration)	Fall	Spring
PHNU 886 (3) PUBH 992 (3)	ENVR 432 (3) ¹	

1 = internet-based

2 = on campus course (1 week)

* PHNU 783/784 required for students without occupational health nursing experience.

** With the continued development of the online format, changes in curriculum may occur.

Certifications

- CITI Course in Protection of Human Research Subjects (**first year**)
- CPR, AED, & First Aid (anytime)
- Spirometry (anytime)
- Hearing Conservation (anytime)

Note:

- This format is fluid and is constructed as a guide to which course offerings may vary in the semester in which they are offered.
- This program of study can be completed in approximately 2-2½ years as outlined above. However, you have five years from admission within which the program must be completed.
- Independent study/transfer in credit (20% of total program credits may be transferred in with approval).

Number	Hours	Title
BIOS 600	3hr.	Principles of Statistical Inference
ENVR 600	3hr.	Environmental Health
ENVR 423	3hr.	Industrial Toxicology
ENVR 432	3hr.	Occupational Safety and Ergonomics
EPID 600	3hr.	Principles of Epidemiology
HBHE 600	3hr.	Social and Behavioral Sciences in Public Health
HPAA 600	3hr.	Introduction to Health Policy and Administration
PHNU 744	3hr.	Roles and Functions of Public Health Nursing
PHNU 781	3hr.	Occupational Health Nursing I
PHNU 782	3hr.	Occupational Health Nursing II
PHNU 783*	2hr.	Occupational Health Nursing Field Practicum I
PHNU 784*	2hr.	Occupational Health Nursing Field Practicum II
PHNU 787	2hr.	Fundamentals of Industrial Hygiene
PHNU 886	3hr.	Field Practice in Public Health
PUBH 740	1-3hr.	Special Issues in Public Health Practice
PUBH 746	3hr.	Program Planning and Evaluation
PUBH 748	2hr.	Policy Development
PUBH 785	3hr.	Interdisciplinary Approaches to Occupational Health
PUBH 992	3hr.	Master's Paper

**MPH Occupational Health Nursing Program
Sample Guide for On Campus Education Format**

Year 1

Summer (Fall Registration)	Fall	Spring
PHNU 781 (3) ²	EPID 600 (3) ¹ HPAA 600 (3) PHNU 783 (2)*	ENVR 600 (3) ¹ ENVR 423 (3) ¹ PUBH 785 (3) ¹ PHNU 784 (2)*

Year 2

Summer (Fall Registration)	Fall	Spring
PHNU 782 (3) ²	BIOS 600 (3) ¹ PHNU 787 (2) ¹ PUBH 748 (2) ¹	PUBH 746 (3) ¹ HBHE 600 (3) ¹

Year 3

Summer (Fall Registration)	Fall	Spring
PHNU 866 (3) PUBH 992 (3)	ENVR 432 (3) ¹	

1 = Internet based

2 = On-campus course (1 week; however course completion extends throughout semester)

* PHNU 783/784 required for students without occupational health nursing experience

Note:

- This format is fluid and is constructed as a guide to which course offerings may vary in the semester in which they are offered.
- The program of study can be completed in 2-2½ years as outlined above. However, you have 5 years from admission within which the program must be completed.
- Independent study/transfer in credit (20% of total program credits may be transferred in with approval)

Certifications

- CITI Course in Protection of Human Research Subjects (**first year**)
- CPR, AED, & First Aid (anytime)
- Spirometry (anytime)
- Hearing Conservation (anytime)

Minimum credits required for graduation = 42

Number	Hours	Title
BIOS 600	3hr.	Fundamentals of Biostatistics/Principles of Statistical Inference
ENVR 600	3hr.	Environmental Health
ENVR 422	3hr.	Air and Industrial Hygiene
ENVR 423	3hr.	Industrial Toxicology
ENVR 432	3hr.	Occupational Safety and Ergonomics
EPID 600	3hr.	Principles of Epidemiology
HBHE 600	3hr.	Social and Behavioral Sciences in Public Health
HPAA 600	3hr.	Introduction to Health Policy and Administration
PHNU 744	3hr.	Roles and Functions of Public Health Nursing
PHNU 781	3hr.	Occupational Health Nursing I
PHNU 782	3hr.	Occupational Health Nursing II
PHNU 783*	2hr.	Occupational Health Nursing Field Practicum I
PHNU 784*	2hr.	Occupational Health Nursing Field Practicum II
PHNU 787	2hr.	Fundamentals of Industrial Hygiene
PHNU 886	3hr.	Field Practice in Public Health
PUBH 740	1-3hr.	Special Issues in Public Health Practice
PUBH 746	3hr.	Program Planning and Evaluation
PUBH 748	2hr.	Policy Development
PUBH 785	3hr.	Interdisciplinary Approaches to Occupational Health
PUBH 992	3hr.	Master's Paper

**MS Occupational Health Nursing Program
Sample Guide for On Campus Education Format**

Year 1

Summer (Fall Registration)	Fall	Spring
PHNU 781 (3)	EPID 600 (3) BIOS 600 (3) PHNU 783 (2)* HBHE 750 (4)	ENVR 600 (3) ENVR 423 (3) PHNU 784 (2)* PUBH 785 (3)

Year 2

Summer (Fall Registration)	Fall	Spring
PHNU 782 (3) PHNU 886 (3)	PUBH 748 (2) ENVR 422 or PHNU 787 (2) ENVR 432 (3) Elective (3)	BIOS 545 (3) PUBH 993 (3) Elective 1

Certifications

CITI Course in The Protection of Human Research Subjects (**first year**)
Spirometry
Hearing Conservation
CPR, AED, & First Aid

Minimum credits required for graduation = 45

Number	Hours	Title
BIOS 600	3hr.	Fundamentals of Biostatistics/Principles of Statistical Inference
BIOS 545	3hr.	Principles of Experimental Analysis
ENVR 600	3hr.	Environmental Health
ENVR 422	3hr.	Air and Industrial Hygiene
ENVR 423	3hr.	Industrial Toxicology
ENVR 432	3hr.	Occupational Safety and Ergonomics
EPID 600	3hr.	Principles of Epidemiology
HBHE 750	4hr.	Applied Research Methods in Health Behavior and Health Education
PHNU 744	3hr.	Roles and Functions of Public Health Nursing
PHNU 781	3hr.	Occupational Health Nursing I
PHNU 782	3hr.	Occupational Health Nursing II
PHNU 783*	2hr.	Occupational Health Nursing Field Practicum I
PHNU 784*	2hr.	Occupational Health Nursing Field Practicum II
PHNU 787	2hr.	Fundamentals of Industrial Hygiene
PHNU 886	3hr.	Field Practice in Public Health
PUBH 740	1-3hr.	Special Issues in Public Health Practice
PUBH 746	3hr.	Program Planning and Evaluation
PUBH 748	2hr.	Policy Development
PUBH 785	2hr.	Interdisciplinary Approaches to Occupational Health
PUBH 993	3hr.	Master's Thesis

* PHNU 783/784 required for students without occupational health nursing experience.

Note: Students are required to complete the 45 credit minimum through elective courses. While PHNU 744 (Roles and Functions of Public Health Nursing) and PUBH 746 (Program Planning and Evaluation) are recommended as electives, students are encouraged to select courses that meet specific learning needs.

**Occupational and Environmental Medicine Residency Program
Curricula**

Date	#	Topic	Preceptor	Learning Objectives
08/13/04	1	Ethics in Occupational Medicine	Dennis Darcey, MD, MSPH	<ol style="list-style-type: none"> 1. Recognize the conflicts of interest and ethical dilemmas which arise in the practice of Occupational Medicine 2. Be familiar with professional standards (ACOEM and others) regarding ethical conduct.
08/18/04 and 08/20/04	2	Mercury exposure in the laboratory setting	Woodhall Stopford, MD, MSPH Geria Furtuna, MD	<ol style="list-style-type: none"> 1. Describe the acute and chronic health effects associated with exposure to lead, mercury, cadmium, uranium and arsenic. 2. Develop an occupational medical monitoring program for exposures to any of these metals. 3. Devise an epidemiologic monitoring program for detecting adverse chronic effects associated with exposures to any one of these metals.
08/27/04	3	Regulatory Issues	George Jackson, MD	<ol style="list-style-type: none"> 1. Be able to explain the FMLA and its interpretation 2. Understand the interface with health benefit plans 3. Become familiar with FAA and DOT regulations, as well as their interpretation and enforcement, to employers and employees. 4. Interpret routine visual and audiometric screening results in establishing fitness for duty with regard to FAA and DOT regulations. 5. Review FAA and DOT regulations regarding substance abuse.
09/17/04	4	Occupational Health Nurses and Doctors: Roles, Teamwork, and Patient-related Communications	Bonnie Rogers, DrPH Sam Moon, MD, MPH	Define the role of the occupational health nurse in the corporate health setting and delineate standards of physician supervision of onsite nurses

Date	#	Topic	Preceptor	Learning Objectives
09/17/04	5	Controversies in asbestos-related health effects	John Dement, PhD	<ol style="list-style-type: none"> 1. Review industrial hygiene aspects of occupational asbestos exposures including sampling and analysis methods and their historical development. Also, characteristics of airborne asbestos fibers are reviewed including issues of fiber type, respirability and airborne size distributions. 2. Review diseases caused by asbestos as well as the historical development of knowledge concerning the health effects of asbestos. Diseases discussed include asbestosis, lung cancer, mesothelioma, gastrointestinal cancers, and cancers at other sites. Asbestos fiber types and disease risks also are reviewed. 3. Review risk assessments for asbestos exposures and current regulatory exposure limit of 0.1 fibers/cc established by OSHA. This review also includes development of exposure guidelines by the ACGIH and the epidemiological basis for these guidelines.
09/24/04	6	OSHA Recording Standard	Gary Tencer	<ol style="list-style-type: none"> 1. Be knowledgeable regarding the current requirements of the OSHA recording standard 2. Highlight the recent changes in the standard
10/01/04	7	NC Workers Comp conference		See attached conference curriculum
10/08/04 – 10/10/04	8	Carolinas Occupational Medicine Association Annual Meeting		See attached conference curriculum
10/15/04	9	Case Scenarios: Violence in the workplace	Judith Holder, PhD	<ol style="list-style-type: none"> 1. To enhance problem-solving skills relative to dealing with and handling at risk employees. 2. Discuss what types of information they would need to know to intervene. 3. Describe the value of having a risk assessment team. <p>Be able to:</p> <ol style="list-style-type: none"> 1. Determine the signs and symptoms of a troubled employee 2. Identify risk factors for violence 3. Examine the impact of work culture on employee behavior
10/22/04	10	Worksite visit in Wilmington, NC	Dennis Darcey, MD, MSPH John Kromer, MD, MPH	<ol style="list-style-type: none"> 1. Evaluate health hazards of cobalt production facility 2. Evaluate health and safety issues at a nuclear fuel rod assembly plant 3. Evaluate health and safety issues at an aircraft turbine production facility
10/29/04	11	Faculty Meeting and Case Conference	All	Present Toxicology consulting cases

Date	#	Topic	Preceptor	Learning Objectives
11/05/04	12	ACOEM meeting San Antonio, TX	ACOEM faculty	See attached conference curriculum
11/12/04	13	Health Effects of Cobalt Exposure	Tom Brock, PhD	<ol style="list-style-type: none"> 1. Discuss health effects known to be associated with exposure to cobalt or cobalt compounds. 2. Discuss health effects possibly associated with exposure to cobalt or cobalt compounds. 3. Review potential health effects of exposure to hard metal and missed-cobalt compounds. 4. Gain awareness of data gaps in knowledge of health effects.
11/19/04	14	Occupational Dermatitis	Carol Epling, MD, MSPH	<ol style="list-style-type: none"> 1. Differentiate occupational skin disorders by history, exam and diagnostic evaluation, and distinguish irritant and allergic dermatoses. 2. Be able to write appropriate work restrictions for occupational dermatitis.
11/16/04	NA	Thanksgiving Holiday	N/A	N/A
12/03/04	15	Faculty Meeting and Case Conference	All	Present Toxicology consulting cases
12/10/04	16	Carbon Monoxide Exposure	Woodhall Stopford, MD, MSPH	<p>This tutorial will be an advanced segment to ENVR 144, Industrial Toxicology. There will be both focused readings and clinical examples. For this section it is expected that residents/learners will be able to:</p> <ol style="list-style-type: none"> 1. Describe the range of acute and chronic sequelae associated with acute CO poisoning. 2. List guidelines for the use of hyperbaric oxygen therapy in CO poisoning. 3. Discuss the controversy of adverse effects associated with chronic exposures to excessive levels of CO.
01/07/05	17	Faculty Meeting and Case Conference	All	Present toxicology consulting cases
01/11/05 – 01/12/05	18	Conference of Research on Health Disparities at NIEHS	Hester Lipscomb PhD Carol Epling MD, MSPH	See attached curriculum
01/14/05	19	Advocacy for Worker Safety	Amy Kaufman NCOSH	<ol style="list-style-type: none"> 1. Understand Workers Compensation process from the worker's perspective. 2. Be familiar with current local worker advocacy projects. 3. Review ongoing union health and safety programs
01/19/05	20	Professionalism	Sam Moon, MD, MPH	Review case studies in ethical conduct of physicians

Date	#	Topic	Preceptor	Learning Objectives
01/21/05	21	Media Training	DUMC media office	Discuss: How to handle an interview and become a source for reporters; how to write an op-ed article; how to balance media outreach with other academic priorities; how to be effective on radio and TV; and how to communicate scientific research
01/28/05	22	MRO Update	Dennis, Darcey, MD, MSPH	Understand and discuss the: <ul style="list-style-type: none"> • components of a drug free workplace program • purpose of drug testing • types of drug testing • standards of practice • MRO responsibilities • lab testing and toxicology of substances of abuse Reference: ACOEM MRO Drug and Alcohol Testing Course Manual (there is a copy to the left of my computer, black plastic binder blue color, but I'll reproduce key pages for our discussion.
02/04/05	23	Faculty Meeting and Case Conference	All	Present Toxicology consulting cases
02/07/05	24	Lead Screening	Alex Kemper, MD, MPH (Integrated Toxicology Program)	<ol style="list-style-type: none"> 1. Be knowledgeable about the history of research on lead toxicity. 2. List potential health effects of lead toxicity. 3. Be able to design lead exposure surveillance program.
02/11/05	NA	Residents Out-of-Town Rotation	N/A	N/A
02/18/05	NA	Residents Out-of-Town Rotation	N/A	N/A
03/04/05	25	Faculty Meeting and Case Conference	All	Present Toxicology consulting cases
03/18/05	26	Benzene	John Dement, PhD	<ol style="list-style-type: none"> 1. To review the physical and chemical characteristics of benzene and the routes of occupational exposure. Also reviewed are industrial hygiene sampling methods (charcoal tube sampling and passive dosimeters) for the evaluation of inhalation exposures. 2. To review the toxicology of benzene including the target organs and metabolic pathways leading to effects of benzene on the hematopoietic system.
04/01/05	27	Faculty Meeting and Case Conference	All	Present Toxicology consulting cases
04/08/05	28	Methodological Issues in Study of Occupational Injury	Hester Lipscomb, PhD	<ol style="list-style-type: none"> 1. Describe 3 different approaches to work-related injury surveillance and be able to describe possible indications and limitations of each. 2. To be aware of alternative research designs used for analytical occupational injury epidemiology.

Date	#	Topic	Preceptor	Learning Objectives
04/15/05	29	Integrated Toxicology Program (ITP): Seminar on Genetics and Environmental Law	ITP faculty	Review latest developments in the interface of genetic testing and environmental law.
05/06/05	30	Faculty Meeting and Case Conference	All	Present Toxicology consulting cases
05/13/05	31	ACOEM National Meeting	ACOEM faculty	See attached curriculum

Occupational Safety and Ergonomics Program Curricula

Master's and Ph.D. Level Training. The training of M.S. students is focused on producing high-quality practitioners with a good understanding of research methods. Training of Ph.D. level students is focused on producing researchers competent in cognitive and physical ergonomics methods with excellent measurement, modeling and systems analysis skills. All master's students supported by the training program are full time students pursuing theses. They enter our program having already completed a baccalaureate degree. The master's is typically a two-year degree program. Ph.D. students enter our program with either a bachelor's or master's degree. The former students ("direct-track Ph.D.") must complete a master's degree on their way to the Ph.D. The Ph.D. degree is typically a three-year degree program.

All master's and Ph.D. level trainees take a specific set of courses to satisfy the Safety and Ergonomics Program Area requirements and they participate in on-going, sponsored research in our Ergonomics Laboratory. The master's students are required to take a total of 30 credit hours for graduation (17 of these credit hours have a safety or ergonomics focus). The Ph.D. students are required to take a total of 72 credit hours for graduation. The majority of these credit hours have a safety or ergonomics focus (including 12-15 hours of dissertation work). All trainees also enroll in our Applied Research Practicum (in OS&E) as part of their coursework, to demonstrate research skills applied to a real-world problem.

The safety and ergonomics training provided through this program comes from both required and elective courses. Short descriptions of each of the required courses and the most often selected electives are provided below to provide a sense of the breadth of our program coursework. The syllabi for many of these courses can be accessed on-line (<http://courses.ncsu.edu/ie.html>) for a more complete review of the topics covered in each course.

ISE 540: Human Factors in Systems Design

Basic concepts of ergonomics and their application to design of human-machine systems and products. Consideration of human behavioral and biological capabilities and limitations in design for human efficiency, safety and comfort. Systems development cycle; human-machine function allocation; task and skill analysis; systems evaluation; anthropometry. Design of control and display systems, instrument panels, workplaces, seating and tools.

ISE 541: Occupational Safety Engineering

Occupational accident-injury study; morbidity, mortality; investigation and analysis. Hazard control; energy countermeasure strategies; control technology. Impact biomechanics, trauma and survivability. Risk assessment; systems safety analysis. Product design, manufacturing defects, system failures and human error as causative factors. Safety program development. Near-accident reporting. OSHA compliance; standards. Accident, trauma and forensic case studies from manufacturing, motor carrier and construction industries.

ISE 544: Occupational Biomechanics

Anatomical, physiological, and biomechanical bases of physical ergonomics. Strength of biomaterials, human motor capabilities, body mechanics, kinematics and anthropometry. Use of bioinstrumentation, active and passive industrial surveillance techniques and the NIOSH lifting guide. Acute injury and cumulative trauma disorders. Static and dynamic biomechanical modeling. Emphasis on low back, shoulder and hand/wrist biomechanics.

ISE 741: Systems Safety

The process of system safety combines management decision-making, engineering analyses and risk assessment into a comprehensive, systematic approach for managing safety issues. This course will familiarize the student with techniques for identifying and recognizing potential safety hazards and the concept of risk assessment. Various system safety techniques (listed below) will be explored together with their application to hazard analysis and control. Use of situations in the industrial environment and case studies will help to illustrate the usefulness of various system safety techniques.

ISE 796: Applied Research Practicum (in Occupational Safety & Ergonomics)

Field research course for those students participating in the Occupational Safety and Ergonomics Training Program. Application of the skills and techniques learned in classroom and lab to develop novel methods for recognition, evaluation, and control of occupational safety hazards in the workplace. Students work with faculty and a local company to provide “ergonomics research services” to facilitate novel approaches to occupational safety.

PUBH 785: Occupational Health: Interdisciplinary Approaches

Overview course on occupational health focusing on interdisciplinary approaches to address complexities of workplace exposures, impact of work-related hazards, and interactions on health. Here students attend lectures conducted by an interdisciplinary team of faculty, participate in joint interdisciplinary workplace walk-throughs, and develop and present joint research-based projects (described further in the Interdisciplinary section of the Administrative Core proposal section of this application).

ENV 432: Industrial Toxicology

Toxicological assessment of and a case presentation of related exposure is given. A conceptual approach is utilized to design appropriate programs to prevent worker ill health due to industrial toxicant exposure. In this course students attend interdisciplinary classes either on-campus or on-line, participate in “live” chat sessions, and jointly prepare and present a paper on a chemically-related issue e.g. radon exposures, danger in dry cleaning, or cyanide in gold processing – all student projects.

In terms of the sequence of coursework, a sample curricula for the master’s degree is shown below. Required safety/ergonomics courses are shown in **bold**. All courses are three credit hours unless otherwise specified. Although the ENV 135 course was not previously identified as a “required” course in the training program curriculum, the positive response of recent graduates to this course has changed its status from an elective to a required course in the curricula.

Sample M.S. curriculum:

- Semester 1: IE 514 Manufacturing Product Engineering
IE 544 Occupational Biomechanics
IE 723 Production Planning, Scheduling and Inventory Control
IE 601 Industrial Engineering Seminar (1 credit hour)
- Semester 2 IE 601 Industrial Engineering Seminar (1 credit hour)
IE 540 Human Factors in Systems Design
IE 541 Occupational Safety Engineering
ST 516 Experimental Statistics For Engineers II
- Semester 3 ENV 135 Industrial Toxicology (2 credit hours)
IE 741 Systems Safety Engineering
- IE 695 Master's Thesis Research
- Semester 4 **IE 796A Applied Research Practicum (in Occupational Safety)**

PSY 745 Human Performance Modeling

PUB 785 Occupational Health: Interdisciplinary Approaches (2 credit hours)

IE 695 Master's Thesis Research

Safety Concentration: The above sample curriculum shows one set of course options available to the students. To satisfy the safety concentration requirements, students can select from the courses (or equivalents) listed below. Courses in italic typeface are required for the trainees. In total there are 17 credit hours of required safety and ergonomics coursework and an additional 2 credit hours of safety and ergonomics electives.

ISE 540: Human Factors in Systems Design

ISE 541: Occupational Safety Engineering

ISE 544: Occupational Biomechanics

ISE 741: Systems Safety

ISE 796A: Applied Research Practicum (in Occupational Safety & Ergonomics)

PUBH 285: Occupational Health: Interdisciplinary Approaches – offered at UNC-CH

ENVR 432: Industrial Toxicology – offered at UNC-CH

ISE 796B: Research Practicum (in Occupational Safety & Ergonomics)

ENVR 422: Air and Industrial Hygiene – offered at UNC-CH

ENVR 432: Occupational Safety and Ergonomics – offered at UNC-CH

ENVR 433: Health Hazards of Industrial Operations – offered at UNC-CH

MAE 510: Effects of Noise and Vibration

MAE 514: Industrial Noise Control

EPID 125: Injury and Violence as Public Health Problems – offered at UNC-CH

EPID 600: Principles of Epidemiology – offered at UNC-CH

EPID 168: Fundamentals of Epidemiology – offered at UNC-CH

EPID 268: Theory and Quantitative Methods in Epidemiology – offered at UNC-CH

EPID 276: Occupational Epidemiology – offered at UNC-CH

Required Applied Research Practicum (in Occupational Safety & Ergonomics): All trainees are required to enroll in our applied research practicum (IE 796A). The practicum is included in the program for the purpose of providing trainees with an introduction to field research in occupational safety and ergonomics. Trainees perform a specific, defined research project through a local employer. Each trainee keeps a research notebook that tracks project milestones, problems, solutions, etc. The trainee's advisor reviews the notebook on a regular basis, to monitor the trainee's progress. Each trainee (or team of trainees) prepares a technical report summarizing the field research experience and prepares and presents a seminar at the work site. The sponsor and the ergonomics faculty evaluate the product of the research. Some previous students have noted in their reports that the breadth of hazards identified in employer facilities was representative of the content of courses required as part of the training curriculum. Related to this, students found the industrial toxicology course (ENV 135 "Industrial Toxicology") to be invaluable to them as a basis for the research practicum. As such, the toxicology course has since been recommended for all trainees. A formal evaluation of the previous research projects by the students indicated the projects were challenging and, for those who have since graduated and found employment, were representative of the kinds of tasks they experience in their current position.

EPIDEMIOLOGY PROGRAM SCHEDULE

Epidemiology

PI: Rogers, Bonnie

EPID 271 Class Schedule Spring 2005

Date	Week	Day	Lecture Topic	Speaker	Required Readings	Homeworks
January						
13	1	Thursday	1 Rates Analysis and Survival Analysis	Marshall		
18	2	Tuesday	2 Hazard and Survival	Marshall	Bull 1997 pages 1041-58	
20	2	Thursday	3 Kaplan-Meier, Log-Rank, Effect Measures	Marshall	Bull 1997 pp 1041-58 and 1062-63	
25	3	Tuesday	4 Lab: Stratified Analysis Tools	TA		
27	3	Thursday	5 Proportional Hazards Regression	Marshall	Tibshrani 1982	
February						
1	4	Tuesday	6 Risk Sets, Partial Likelihoods, Logistic & PHReg, Ties	Marshall	Alison 1995 pp 111-37	HMWK 1 due
3	4	Thursday	7 Assessing the PH Assumption (Goodness of Fit)	Marshall	Alison 1995 pp 173-181	
8	5	Tuesday	8 Relaxing the PHA; Extended Model; Time Interactions	Marshall	Alison 1995 pp 154-157	
10	5	Thursday	9 Lab: Assessing PHA and Time Interactions (Survivor)	Marshall		
15	6	Tuesday	10 Stratified Proportional Hazards Model	Marshall	Alison 1995 pp 158-161	HMWK 2 due
17	6	Thursday	11 Lab: Stratified Model; Relaxing the PHA (Dust)	Marshall		
22	7	Tuesday	12 Left Truncation, Interval Censoring	Marshall	Alison 1995 pp 161-165; Falk 94	
24	7	Thursday	13 Time-Dependent Variables: Counting Process	Marshall		
March						
1	8	Tuesday	14 Recurrent Events	Marshall		
3	8	Thursday	15 Sensitivity Analysis	Marshall	R&G Chap 19; Taubes 1995	
8	9	Tuesday	16 Sensitivity Analysis	Marshall	R&G Chap 19; Taubes 1995	HMWK 3 due
10	9	Thursday	17 Computer-Intensive Methods: Exact and Bootstrap	Marshall	Zhu 1997	
15	--	Tuesday	-- Break	--		
17	--	Thursday	-- Break	--		
22	10	Tuesday	18 Analysis of person-time incidence rates	Loomis	R&G Chap 3	HMWK 4 due
24	10	Thursday	19 Stratified Analysis of Rates and Standardization	Loomis	R&G Chap 3	
29	11	Tuesday	20 Categorizing Exposures	Richardson	Wing 1991; Greenland 1995	
31	11	Thursday	21 Poisson Regression I	Loomis	Kleinbaum 1998; Alison 1999	
April						
5	12	Tuesday	22 Poisson Regression II	Loomis	Kleinbaum 1998; Alison 1999	
7	12	Thursday	23 Lab: Poisson Regression	Marshall	Kleinbaum 1998; Alison 1999	
12	13	Tuesday	24 Poisson Regression III	Loomis	Richardson 2004; Loomis in press	HMWK 5 due
14	13	Thursday	25 Exposure Response Models	Loomis	Steenland 2004	
19	14	Tuesday	26 Multiple Imputation	Marshall	Yuan 2001; Heitjan 1997	
21	14	Thursday	27 Binomial Regression	Miller	McNutt 2003; Zou 2004	
26	15	Tuesday	28 Multiple Imputation	Marshall	Yuan 2001; Heitjan 1997	HMWK 6 due
28	15	Thursday	29 Final Exam	None		

This version: Jan 13

Health Services Research in Occupational Safety and Health Program Curricula

Course Title	Credits
Health Services Research/Research Methods (9 credit hours)	

*HPAA 870	Seminar on Health Services and Policy Research	3
*HPAA 885	Methods in Health Services Research	3
*HPAA 886	Qualitative Research Methods	3

Analytical Methods (9 credit hours)

*HPAA 881	Linear Regression Models	3
*HPAA 882	Analysis of Panel Data	3
*HPAA 883	Analysis of Categorical Data	3

Minor Area/Health Policy Elective (18 credit hours)†

Specific courses are determined by minor area of study:
*Epidemiology, Economics, Political Science, Sociology,
Financial Management, Decision Science, & Quality and Access*

Occupational Safety & Health Requirements (11 credit hours)†

*PUBH 785	Interdisciplinary Approaches to Occupational Health	3
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Select 8 other credits of electives in Occupational Safety and Health from an approved list or approval from the Program Director.

Professional Development (8 credit hours)

*HPAA 871	Seminar in Teaching Health Policy & Administration	1
*HPAA 872	Developing Proposals for Health Services and Policy Research	3
*#HPAA 873	Policy Seminar in HPAA	1
*#HPAA 874	Advanced Research Seminar in HPAA	1

Other

*HPAA 994	Doctoral Dissertation	6 (minimum)
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* Required course

HPAA 873—1 credit per semester for 1st year students

HPAA 874—1 credit per semester for 2nd year students

(Both HPAA 873 and 874 are core department seminars. While credit is given for 1st and 2nd year students, all students are expected to attend.)

† While a student must complete 11 credits to fulfill the Occupational Safety and Health (OS&H) requirement, courses taken to fulfill the Health Services Research and Minor Area of Study requirements may also count toward the OS&H credits if they are relevant.

APPENDIX B
PUBLICATIONS

INDUSTRIAL HYGIENE PROGRAM PUBLICATIONS

1. Anthony TR, Flynn MR. CFD Model for a 3-D inhaling mannequin: verification and validation. *Ann Occup Hyg* 50:149-156, 2006
2. Anthony TR, Flynn MR. CFD investigation of particle inhalation. *J Aerosol Sci* 37:750-765, 2006.
3. Boundy M, Leith D, Polton T. Method to evaluate the dustiness of pharmaceutical powders. *Ann Occup Hyg* 50(5):453-458, 2006.
4. Chao YC, Kupper LL, Serdar B, Egeghy PP, Rappaport SM, Nylander-French LA. Dermal exposure to jet fuel JP-8 significantly contributes to the production of urinary naphthols in fuel-cell maintenance workers. *Environ Health Perspect* 114(2):182-185, 2006.
5. Flynn MR, Koto Y, Fent K, Nylander-French LA. Modeling dermal exposure--an illustration for spray painting applications. *J Occup Environ Hyg* 3(9):475-480, 2006.
6. Fent KW, Jayaraj K, Gold A, Ball LM, Nylander-French LA. Tape-strip sampling for measuring dermal exposure to 1,6-hexamethylene diisocyanate. *Scand J Work Environ Health* 32(3):225-240, 2006.
7. Kim D, Andersen ME, Nylander-French LA. Dermal absorption and penetration of jet fuel components in humans. *Toxicol Lett* 165(1):11-21, 2006.
8. Kim D, Andersen ME, Nylander-French LA. A dermatotoxicokinetic model of human exposures to jet fuel. *Toxicol Sci* 93(1):22-33, 2006.
9. Kim D, Andersen ME, Pleil J, Nylander-French LA. Refined PBPK model of aggregate exposure to methyl tertiary-butyl ether. *Tox Lett* 169(3):222-235, 2007.
10. Kim D, Andersen ME, Chao Y-CE, Egeghy PP, Rappaport SM, Nylander-French LA. Prediction of human dermal and inhalation exposures to jet fuel by analysis of a PBTK model. *Environ Health Perspect* 115(6):894-901, 2007.
11. Leith D, Sommerlatt D, Boundy MG. Passive Sampler for PM10-2.5 Aerosol. *J Air Waste Management Assoc* 57:332-336, 2007.
12. Serdar B, Tornero-Velez R, Echeverria D, Nylander-French LA, Kupper LL, Rappaport SM. Predictors of occupational exposure to styrene and styrene-7,8-oxide in the reinforced plastics industry. *Occup Environ Med* 63(10):707-712, 2006.
13. Richmond-Bryant J, Eisner AD, Flynn MR. Considerations for modeling particle entrainment into the wake of a circular cylinder. *Aerosol Sci Tech* 40:17-26, 2006.

OCCUPATIONAL HEALTH NURSING PROGRAM PUBLICATIONS

BOOKS

1. Personal Protective Equipment for Healthcare Workers During an Influenza Pandemic. Report of the Institute of Medical Academy of Sciences, 2007.
2. Rogers, B. (In Press). Occupational Health Nursing: Concepts and Practice. 3rd edition. Philadelphia: Saunders.
3. Rogers, B., Randolph, S.A., and Mastroianni, K. (In Press). Occupational Health Nursing Guidelines for Primary Clinical Conditions (4th ed.). Beverly, MA: OEM Press, Inc.

BOOK CHAPTERS

1. Randolph, S.A. (2007). Taking Action—The American Association of Occupational Health Nurses: Policy Initiatives to Address Workplace Violence. In D. Mason, J. Leavitt, & M. Chaffee, Policy and Politics in Nursing and Health Care (5th ed., pp. 873-875). Philadelphia: Saunders.
2. Rogers, B. (2007). Ethical Issues in Occupational Health. Chapter in D. Dyck, Disability management: Theory, strategy, and industry practice.
3. Rogers, B. and Travers, P. (2007). Occupational Health. Chapter in Nies, M. and McEwen, M. Community Health Nursing. Elsevier.
4. Rogers, B. (2006). Community Health Nursing in Occupational Health. Chapter in Stanhope, B. and Lancaster, J. Community and Public Health Nursing. Elsevier.

PUBLICATIONS

1. Greenberg, G.N. (2006). Avian Flu's first US victims; Poultry workers shouldn't serve as canaries, editorial. International Journal of Occupational and Environmental Health. 12(3).
2. Randolph, S.A. (2006). Developing policies and procedures. AAOHN Journal, 54(11), 501.
3. Rogers, B. Stiehl, K., Borst, J., Hutchins, S. and Hess, A. (2007). Heat related illnesses: Role of the occupational and environmental health nurse. AAOHN Journal, 55(7), 279-287.
4. Rogers, B., Lawhorn, E. (2007). The role of the occupational and environmental health professional in response to hurricanes Katrina and Rita, AAOHN Journal, 55(5), 197-208.
5. Rogers, B. (2006). Worksite health promotion: Skills and functions of professional staff, North Carolina Medical Journal, 67: 442-444, 2006.

WEB-BASED, CURRENTLY ONLINE AND UPDATED

- Greenberg, G.N. Consultant resources in Occupational & Environmental Medicine (updates: quarterly). <http://Links.OccHealthNews.net>

- Greenberg, G.N. Information resources regarding clinical and organizational aspects of the Open Door Clinic. <http://OpenDoorDocs.org>
- Greenberg, G.N. "The Ectopic Cortex", Palm-OS / PDA resources for Clinical and Occupational & Environmental Medicine (updates: quarterly). <http://Palm.OccHealthNews.net>
- Greenberg, G.N. Resource repository for pandemic planning for employers and workforces (updates: quarterly). <http://pandemic.OHDEN.net> or <http://www.OHDEN.net/pandemic>
- Greenberg, G.N. Introductory site for Occupational Health Disaster Expert Network (updates: quarterly). <http://www.OHDEN.net>
- Greenberg, G.N. Support for *Occ-Env-Med-L* electronic forum. <http://Archives.OccHealthNews.net>, <http://Survey.OccHealthNews.net>, <http://Disclaimer.OccHealthNews.net>, <http://Rules.OccHealthNews.net>

OCCUPATIONAL AND ENVIRONMENTAL MEDICINE PROGRAM PUBLICATIONS

Resident publications

1. Caveney BJ, Longphre, J. Tetrachloroethylene. In Clinical Practice of Biological Monitoring, Hoffman H and Phillips S, eds. OEM Press (submitted)
2. Darcey, D, Chimonas, M. N- Hexane. In Clinical Practice of Biological Monitoring, Hoffman H & Phillips S, eds., OEM Press (submitted)
3. Darcey D, Paliwal, A. Xylene. In Clinical Practice of Biological Monitoring, Hoffman H & Phillips S, eds., OEM Press (submitted)
4. Darcey D, Zakaria, H. Cobalt. In Clinical Practice of Biological Monitoring, Hoffman H & Phillips S, eds., OEM Press (submitted)
5. Moon RE and Longphre JM: Chapter 61 Diving Medicine. In Murray and Nadel Textbook of Respiratory Medicine, 4th Edition, Elsevier, 2006.
6. Longphre JM. *First Aid Oxygen Update and the DAN[®] Oxygen Card*, Alert Diver Magazine, November/December 2006.
7. Longphre JM, Denoble PJ, Moon RE, Vann RD, Freiburger JJ: *First Aid Normobaric Oxygen for the Treatment of Recreational Diving Injuries*. Journal of Undersea and Hyperbaric Medicine, Jan-Feb, 2007.
8. Chimonas MA. Frank A. Gessner, BD. Airborne particulate matter from primarily geologic, non-industrial sources at levels below National Ambient Quality Standards is associated with outpatient visits for asthma and quick relief medication prescriptions among children less than 20 years old enrolled in Medicaid in Anchorage Alaska. Environmental Research, October, 2006.
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Selected Faculty Publications:

PUBLISHED PEER REVIEWED ARTICLES:

1. Welch LS, Haile EH, Dement J, Michaels DM. Change in Prevalence of Asbestos-Related Disease among Sheet Metal Workers 1988-2004, Chest, 131:863–869, 2007.
2. Østbye T, Dement JM, Krause KM. Obesity and Workers' Compensation: Results from the Duke Health and Safety Surveillance System, Arch Int Med, 167:766-773, 2007.
3. Hein MJ, Stayner LT, Lehman E and Dement JM. (2007). Follow-up study of chrysotile asbestos textile workers: Cohort mortality and exposure-responses. Occup Env. Med., Published online April 20, 2007.
4. Lipscomb HJ, Dement JM, Epling CA, McDonald MA, Schoenfisch AL. Are we failing vulnerable workers? The case of black women in poultry processing in rural North Carolina. New Solution 17(1-2):17-40,2007.
5. Lipscomb HJ, Lackson L. Nailgun injuries treated in U.S emergency departments, 1998-2005. Morbidity and Mortality Weekly Report 56(14); April 13, 2007.
6. Lipscomb HJ, Epling CA, Pompeii LA, Dement JM. Musculoskeletal symptoms among poultry processing workers and a community comparing group: black women in low-wage jobs in the rural South. American Journal of Industrial Medicine 50:327-338, 2007.

7. Lipscomb HJ, Dement JM, Epling CA, Gaynes BN, McDonald MA, Schoenfisch AL. Depressive symptoms among working women in rural North Carolina: A comparison of women in poultry processing and other low-wage jobs. *International Journal of Law and Psychiatry* (special edition on work and mental health). In press, April 2007.
8. Myers DJ, Kriebel D, Karasek R, Punnett L, Wegman DH. The social distribution of risk at work: acute injuries and physical assaults among healthcare workers working in a long-term care facility. *Soc Sci Med.* 2007 Feb;64(4):794-806.
9. Runyan CW, DeSanto J, Schulman M, Lipscomb H, Harris T. Work hazards and workplace safety violations experienced by adolescent construction workers. *Archives of Pediatric and Adolescent Medicine.* 2006;160:1-7.
10. Bunn WB III, Stave GM, Downs KE, Alvir JMJ, Dirani R. Effect of Smoking Status on Productivity Loss. *Journal of Occupational and Environmental Medicine.* 2006 October;48(10):1099-1108.
11. Lipscomb HJ, Dement JM, Nolan J, Patterson D. Nail gun injuries in apprentice carpenters: risk factors and control measures. *American Journal of Industrial Medicine.* 2006;49:505-513.
12. Bingham E, Ringen K, Dement JM, Cameron W, McGowan W, Welch L, Quinn P. Frequency and Quality of Radiation Monitoring at Two Gaseous Diffusion Plants. *Annals New York Academy of Sciences.* 2006;1076:394-404.
13. Caveney, B. J.. Nickel and its compounds. In H. Hoffman & S. Phillips (Eds.), *Clinical Practice of Biological Monitoring.* OEM Press (Submitted).
14. Caveney, B. J.. (Submitted 2006). Carbaryl. In H. Hoffman & S. Phillips (Eds.), *Clinical Practice of Biological Monitoring.* Location: Publisher.
Fleming, D., & Hunt, D. (Eds). (2006). *Biological Safety: Principles and Practices, 4th edition.* Washington, D.C.: ASM Press.
15. Hunt, D. (2006). Standard (Universal) Precautions for Handling Human Specimens. In D. Fleming & D. Hunt (Eds.), *Principles and Practices, 4th edition* (pp. 341-360). Washinton, D.C.: ASM press.
16. Rauscher, KJ and Myers DJ. Socioeconomic Disparities in the Prevalence of Work-related Injuries among Adolescents in the United States. *Journal of Adolescent Health.* 2007.
17. McDonald MA, Kucera KL. Understanding non-industrialized workers' approaches to safety: How do fishermen "stay safe"? *Journal of Safety Research.* 2006; in press.

OCCUPATIONAL SAFETY AND ERGONOMICS PROGRAM PUBLICATIONS

Refereed Journal Articles In Print

- (1) Endsley, M. R., Hoffman, R., Kaber, D. B. & Roth, E. (2007). Cognitive engineering and decision making: An overview and future course. *J. of Cognitive Engr. & Decision Making*, 1(1), 1-21.
- (2) Jiang, ZL, Y Shu, JE Drum, S Reid, & GA Mirka (2006) "Effects of Age on Muscle Activity and Upper Body Kinematics during a Repetitive Forearm Supination Task", *International Journal of Industrial Ergonomics*, 36(11): 951-957.
- (3) Kaber, D. B., Segall, N., Green, R. S., Entzian, K. & Junginger, S. (2006). Using multiple cognitive task analysis methods for supervisory control interface design in high-throughput biological screening processes. *International Journal of Cognitive Technology & Work*, 8, 237-252.
- (4) Karakostas T, Hsiang S.M, Sarantopoulos C & Krause J. (2007) "Dynamic loading performance of fasciocutaneous flaps and implications for gait." *Clinical Biomechanics* (Bristol, Avon). 22(4):478-85.
- (5) Ma, R. & Kaber, D. B. (2007). Effects of in-vehicle navigation assistance and reliability on driver trust. *Int. J. of Indus. Ergo.*, 37: 665-673.
- (6) Ma, R. & Kaber, D. B. (2007). Situation awareness and driving performance in a simulated navigation task. *Ergonomics*, 50(8), 1351-1364.
- (7) Sheik-Nainar, M. A. & Kaber, D. B. (2007). The utility of a virtual reality locomotion interface for studying gait behavior. *Human Factors*, 49(4), 696-709.
- (8) Shin, G, M Nance & GA Mirka (2006) "Differences in Trunk Kinematics and Ground Reaction Forces between Older and Younger Adults during Lifting," *Int. J. of Indus. Ergo.* 36(9): 767-772.
- (9) Shu, Y & G.A. Mirka (2006) "A Laboratory Study of the Effects of Wrist Splint Orthoses on Forearm Muscle Activity and Upper Extremity Posture", *Human Factors*, 48(3): 499-510.
- (10) Southard, SA, JH Freeman, JE Drum & GA Mirka (2007). "Ergonomic Interventions for the Reduction of Back and Shoulder Biomechanical Loading when Weighing Calves", *International Journal of Industrial Ergonomics*, 37(2): 103-110.

Refereed Journal Articles Accepted for Publication

1. Anderson, AP, KA Meador, LR McClure, D Makrozahopoulos, DJ Brooks & GA Mirka (Accepted) "A Biomechanical Analysis of Anterior Load Carriage", To Appear in *Ergonomics*.
2. Hsiang, S.M. & Ekwaro-Osire, S. (Accepted) "Crashworthiness tradeoff between head and neck injuries" To Appear in *Journal of Integrated Design and Process Science*.
3. Perry, C. M., Sheik-Nainar, M. A., Segall, N., Ma, R., Kaber, D.B. & Mirka, G.A. (Accepted). The effects of physical workload on situation awareness and cognitive task performance in multitasking. To Appear in *Theo. Issues in Ergo. Sci*.
4. Kaber, D. B., Perry, C. M., Segall, N. & Sheik-Nainar. M. A. (Accepted). Workload State Classification with Automation During Simulated Air Traffic Control. To Appear in *Int. J. of Avia. Psych.*

5. Kaber, D. B., Segall, N. & Green, R. (Accepted). Metaphor-based design of high-throughput screening process interfaces. To Appear in *Int. J. of Usability Studies*.
6. Noack, K, CM Sommerich and GA Mirka (Accepted) "College students and computers: Profile of use and musculoskeletal discomfort and their comparison with those of professional computer users", To Appear in *International Journal of Industrial Ergonomics*.
7. Reid, S & GA Mirka (Accepted) "Learning Curve Analysis of a Patient Lift Assist Device", To Appear in *Applied Ergonomics*.
8. Shu, Y, Z Jiang, X Xu & GA Mirka (Accepted) "The Effect of a Knee Support on the Biomechanical Response of the Low Back", To Appear in *Applied Biomechanics*.
9. Southard, S, GA Mirka (Accepted) "An Evaluation of Backpack Harness Systems in Non-Neutral Torso Postures", To Appear in *Applied Ergonomics*.
10. Xu, X, GA Mirka & SM Hsiang (Accepted) "The Effects of Obesity on Lifting Performance", To Appear in *Applied Ergonomics*.

Refereed Journal Articles In Review

1. Anderson, A., Mirka, G. A., Joines, S. & Kaber, D. B. (In Review). Analysis of alternative keyboards using learning curves. Submitted to *Applied Ergonomics*.
2. (1) Glasscock, NF GA Mirka, CM Sommerich, and KW Klein (In Review) "Effects of Personality Type and Task Stress on Biomechanical Indicators of Task Performance" Submitted to *Human Factors*.
3. Kaber, D. B., Green, R. S., Kim, S-H. & Segall, N. (In Review). Assessing usability of human-machine interfaces for life science automation through computational cognitive models. Submitted to *Int. J. of Human-computer Interaction*.
4. Kaber, D. B., Riley, J. M., Sheik-Nainar, M. A., Endsley, M. R. & Lampton, D. R. (In Review). Measurement of infantry soldier situation awareness in virtual environment-based training research. Submitted to *Journal of Cognitive Engineering & Decision Making*.
5. Kucera, K, GA Mirka, D Loomis, S Marshall, H Lipscomb, and J Daniels (In Review) "Quantifying Ergonomic Stresses in North Carolina Commercial Crab Pot and Gill Net Fishermen", Submitted to the *Journal of Occupational & Environmental Hygiene*.
6. Li, Y., Kaber, D. B. & Lee, Y-S. (In Revision). Surgical simulator fidelity and the effects of time lag on human performance. Submitted to the *Journal of Cognitive Engineering & Decision Making*.
7. Shin, G, and GA Mirka (In Review) "An In-Vivo Assessment of the Low Back Response to Prolonged Stooping: Interplay Between Active and Passive Tissues", Submitted to *Clinical Biomechanics*.

OCCUPATIONAL EPIDEMIOLOGY PROGRAM PUBLICATIONS

1. Abrahamson PE, Gammon MD, Lund MJ, Britton JA, **Marshall SW**, Flagg EW, Porter PL, Brinton LA, Eley JM, Coates RJ. Recreational physical activity and survival among young women with breast cancer. *Cancer* 2006; 107(8):1777-1785.
2. Agel J, Dick R, Nelson B, **Marshall SW**, Dompier TP. Descriptive Epidemiology of Collegiate Women's Ice Hockey Injuries: National Collegiate Athletic Association Injury Surveillance System, 2000–2001 Through 2003–2004. *Journal of Athletic Training* 2007;42(2):255-260.
3. Agel J, Dompier TP, Dick R, **Marshall SW**. Descriptive Epidemiology of Collegiate Men's Ice Hockey Injuries: National Collegiate Athletic Association Injury Surveillance System, 1988–1989 Through 2003–2004. *Journal of Athletic Training* 2007;42(2):247-254.
4. Agel J, Evans TA, Dick R, Putukian M, **Marshall SW**. Descriptive Epidemiology of Collegiate Men's Soccer Injuries: National Collegiate Athletic Association Injury Surveillance System, 1988–1989 Through 2002–2003. *Journal of Athletic Training* 2007;42(2):276-283.
5. Agel J, Olson D, Dick R, Arendt EA, **Marshall SW**, Sikka RS Descriptive Epidemiology of Collegiate Women's Basketball Injuries: National Collegiate Athletic Association Injury Surveillance System, 1988–1989 Through 2003–2004. *Journal of Athletic Training* 2007;42(2):208-216.
6. Agel J, Palmieri-Smith RM, Dick R, Wojtys EM, **Marshall SW**. Descriptive Epidemiology of Collegiate Women's Volleyball Injuries: National Collegiate Athletic Association Injury Surveillance System, 1988–1989 Through 2003–2004. *Journal of Athletic Training* 2007;42(2):292-299.
7. Agel J, Ransone J, Dick R, Oppliger R, **Marshall SW**. Descriptive Epidemiology of Collegiate Men's Wrestling Injuries: National Collegiate Athletic Association Injury Surveillance System, 1988–1989 Through 2003–2004. *Journal of Athletic Training* 2007;42(2):300-307.
8. Cardis E., Vrijheid M., Blettner M., Gilbert E., Hakama M, Hill C., Howe G, Kaldor J, Muirhead C, Schubauer-Berigan M, Yoshimura T, Bermann F, Cowper G, Fix JJ, Hacker C, Heimiller B, Marshall M, Oshima S, Thierry-Chef I, Utterback D, Ahn Y-O, Amoros E, Ashmore P, Auvinen A, Bae J-M, Bernar Solano J, Biau A, Combalot E, Deboodt P, Diez Sacristan A, Eklof M, Engels H, Engholm G, Green LM, Gulis G, Habib R, Holan K, Hyvonen H, Kerekes A, Kurtinaitis J, Malke H, Martuzzi M, Mastauskas A, Monnet A, Moser M, Murata M, Pearce MS, **Richardson DB**, Rodriguez-Artalejo F, Rogel A, Tardy H, Telle-Lamberton M, Turai I, Usel M, Veress K. "The 15-Country Collaborative Study of Cancer Risk Among Radiation Workers in the Nuclear Industry: Estimates of Radiation-Related Cancer Risks." *Radiation Research* (2007) 167: 396-416.
9. Cavallari JM, Eisen EA, **Chen JC**, Fang SC, Dobson CB, Schwartz J, Christiani DC. Night Heart Rate Variability and Particulate Exposures Among Boilermaker Construction Workers. *Environ Health Perspect.* 2007, 115(7):1046-1051.
10. Cavanaugh JT, Guskiewicz K, Giuliani C, **Marshall SW**, Mercer VS, Stergiou N. Recovery of postural control after cerebral concussion: new insights using Approximate Entropy. *Clinical Journal of Sport Medicine. Journal of Athletic Training* 2006: 41(3):305-313.
11. **Chen JC**, Stone PH, Verrier RL, Nearing BD, MacCallum G, Kim JY, Herrick RF, Christiani DC. Personal coronary risk profiles modify the autonomic nervous system activities in acute human response to particulate exposures. *J Occup Environ Med.* 2006, 48(11):1133-1142.

12. **Chen JC**, Cavallari JM, Stone PH, Christiani DC. Obesity Is A Modifier of Autonomic Cardiac Responses to Fine Metal Particulates. *Environ Health Perspect.* 2007, 115(7):1002-1006.
13. **Chen JC**, Linnan L, Callahan LF, Yelin EH, Renner JB, Jordan JM. Workplace policies and prevalence of knee pain and osteoarthritis: The Johnston County Osteoarthritis Project. *Occup Environ Med.* [Online 13 June 2007. doi:10.1136/oem.2006.030148]
14. Dick R, Agel J, **Marshall SW**. National Collegiate Athletic Association Injury Surveillance System Commentaries: Introduction and Methods. *Journal of Athletic Training* 2007:42(2):173-179.
15. Dick R, Ferrara MS, Agel J, Courson R, **Marshall SW**, Hanley MJ, Reifsteck F. Descriptive Epidemiology of Collegiate Men's Football Injuries: National Collegiate Athletic Association Injury Surveillance System, 1988–1989 Through 2003–2004. *Journal of Athletic Training* 2007:42(2):227-239.
16. Dick R, Hertel J, Agel J, Grossman J, **Marshall SW**. Descriptive Epidemiology of Collegiate Men's Basketball Injuries: National Collegiate Athletic Association Injury Surveillance System, 1988–1989 Through 2003–2004. *Journal of Athletic Training* 2007:42(2):200-207.
17. Dick R, Hootman JM, Agel J, Vela L, **Marshall SW**, Messina R. Descriptive Epidemiology of Collegiate Women's Field Hockey Injuries: National Collegiate Athletic Association Injury Surveillance System, 1988–1989 Through 2002–2003. *Journal of Athletic Training* 2007:42(2):217-226.
18. Dick R, Lincoln AE, Agel J, Carter EA, **Marshall SW**, Hinton RY. Descriptive Epidemiology of Collegiate Women's Lacrosse Injuries: National Collegiate Athletic Association Injury Surveillance System, 1988–1989 Through 2003–2004. *Journal of Athletic Training* 2007:42(2):268-275.
19. Dick R, Putukian M, Agel J, Evans TA, **Marshall SW**. Descriptive Epidemiology of Collegiate Women's Soccer Injuries: National Collegiate Athletic Association Injury Surveillance System, 1988–1989 Through 2002–2003. *Journal of Athletic Training* 2007:42(2):284-291.
20. Dick R, Romani WA, Agel J, Case JG, **Marshall SW**. Descriptive Epidemiology of Collegiate Men's Lacrosse Injuries: National Collegiate Athletic Association Injury Surveillance System, 1988–1989 Through 2003–2004. *Journal of Athletic Training* 2007:42(2):261-267.
21. Dick R, Sauers EL, Agel J, Keuter G, **Marshall SW**, McCarty K, McFarland E. Descriptive Epidemiology of Collegiate Men's Baseball Injuries: National Collegiate Athletic Association Injury Surveillance System, 1988–1989 Through 2003–2004. *Journal of Athletic Training* 2007:42(2):180-190.
22. Griffin LY, Albohm MJ, Arendt EA, Bahr R, Beynon BD, DeMaio M, Dick RW, Engebretsen L, Garrett WE, Gilchrist J, Hannafin JA, Hewett TE, Huston LJ, Johnson RJ, Lephart S, Ireland ML, Mandelbaum BR, Mann B, Marks PH, **Marshall SW**, Myklebust G, Noyes FR, Powers C, Shields C, Shultz S, Silvers H, Slauterbeck J, Taylor D, Teitz C, Wojtyk EM, Yu B. Understanding and preventing non-contact ACL injuries: a review of the Hunt Valley II meeting, January 2005. *American Journal of Sports Medicine* 2006:34(9):1512-1532.
23. Guskiewicz KM, **Marshall SW**, Bailes J, McCrea M, Harding HP, Matthews A, Mihalik JR, Cantu RC. Recurrent concussion and risk of depression in retired professional football players. *Medicine and Science in Sport and Exercise* 2007: 39(6):903-909.

24. Huang YH, **Chen JC**, Dearmond S, Cingular K, Peter Y. Work shift, safety climate, company injury frequency and individual work injury risk: a multilevel modeling approach. *Accid Anal Prev.* 2007 (in press).
25. Hoffmann W, Terschueren C, **Richardson DB**. "Childhood leukemia in the vicinity of the Geesthacht nuclear establishments near Hamburg, Germany." *Environmental Health Perspectives* (2007) 115: 947-952.
26. Hopkins W, **Marshall SW**, Quarrie K, Hume P. Risk Factors and Risk Statistics for Sports Injuries. *Clinical Journal of Sports Medicine.* 2007: 17(3):208-210.
27. Knapik J, **Marshall SW**, Lee R, Darakjy S, Jones SB, dela Cruz GC, Mitchner TA, Jones BH. Injury prevention effectiveness and physical properties of mouthguards in sports and recreational exercise. *Sports Medicine* 2007:37(2):117-144.
28. Knowles SB, **Marshall SW**, **Loomis DP**, Weaver N, Yang J, Bowling JM, Kalsbeek W, Mueller FO. Risk factors for high school sports injury. *American Journal of Epidemiology* 2006:164(12):1209-1221.
29. Koshiol JE, Schroeder JC, Jamieson DJ, **Marshall SW**, Duerr A, Heilig CM, Shah KV, Klein RS, Cu-Uvin S, Schuman P, Celentano D, Smith JS. Smoking and time to clearance of human papillomavirus infection in HIV-seropositive and HIV-seronegative women. *American Journal of Epidemiology* 2006:164(2):176-83.
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31. Linet MS, Schubauer-Berigan MK, Weisenburger DD, **Richardson DB**, Landgren O, Blair A, Silver S, Field RW, Caldwell G, Hatch M, Dores GM. "Chronic Lymphocytic Leukemia: An Overview of Etiology in Light of Recent Developments in Classification and Pathogenesis." *British Journal of Haematology* (20 pages, accepted August 22, 2007).
32. **Marshall SW**, Covassin T, Dick R, Nassar LG, Agel J. Descriptive Epidemiology of Collegiate Women's Gymnastics Injuries: National Collegiate Athletic Association Injury Surveillance System, 1988–1989 Through 2003–2004. *Journal of Athletic Training* 2007:42(2):240-246.
33. **Marshall SW**, Hamstra-Wright K, Dick R, Grove KA, Agel J. Descriptive Epidemiology of Collegiate Women's Softball Injuries: National Collegiate Athletic Association Injury Surveillance System, 1988–1989 Through 2003–2004. *Journal of Athletic Training* 2007:42(2):191-199.
34. **Marshall SW**. Power for tests of interaction: Effect of raising the Type I error rate. *Epidemiologic Perspectives and Innovation* 2007:4:4.
35. Rentz D, **Marshall SW**, **Loomis D**, Martin SL, Casteel C, Gibbs D. Effect of deployment on the occurrence of child maltreatment in military and non-military families. *American Journal of Epidemiology* 2007:165(10):1199-1206.
36. **Richardson DB**, Rzehak P, Klenk J, Weiland SK. "Analyses of case-control data for additional outcomes." *Epidemiology* (2007) 18: 441-445.
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Industrial Medicine (2007 25 pages, accepted July 10, 2007).

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39. **Richardson DB**, **Wing S**, Daniels RD. "Evaluation of external radiation dosimetry records at the Savannah River Site, 1951-1989." *Journal of Exposure Science and Environmental Epidemiology* (2007) 17:13-24.
40. **Richardson DB**, Wing S, Wolf S. "Mortality among workers at the Savannah River Site." *American Journal of Industrial Medicine* (2007 20 pages, accepted July 9, 2007).
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42. **Richardson DB**, Wing S. "Lung cancer mortality among workers at a nuclear materials plant." *American Journal of Industrial Medicine* (2006) 49:102-111.
43. **Richardson DB**. "The Impact on Relative Risk Estimates of Inconsistencies Between ICD-9 and ICD-10." *Occupational & Environmental Medicine* (2006) 63:734-740.
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45. Sanford K, **Marshall SW**, Martin SL, Cook P, Coyne-Beasley T, Demissie Z. Deaths from violence in North Carolina 2004: How deaths differ between women and men. *Injury Prevention*. 2006;12(Suppl II):ii10–ii16.
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HEALTH SERVICES RESEARCH IN OCCUPATIONAL SAFETY AND HEALTH PROGRAM PUBLICATIONS

Books/Book Chapters

- Freire, K., & **Runyan, C.W.** (2006). Planning Models: PRECEDE/PROCEED and Haddon Matrix. In Gielen, A.C., Sleet, D., & DiClemente, R.J. (Eds.), *Injury Prevention: Behavior Change Theories, Methods and Applications*. San Francisco: Jossey-Bass.
- Grabowski, D.C., & **Norton, E.C.** (2006). Nursing Home Quality of Care. In A.M. Jones (Ed.), *Elgar Companion to Health Economics* (pp. 296-305).
- Lee, S.Y.D.**, Alexander, J.A., & Wang, V. (2007). A Taxonomy of Hospital Governing Boards. *Academy of Management 2007 Annual Meeting Best Papers Proceedings*.
- Norton, E.C., & Stearns, S.C.** (2006). Logistic Regression. In E.C. Chumney, & K.N. Simpson (Eds.), *Methods and Designs for Outcomes Research* (pp. 105-113), American Society for Health –Systems Pharmacists.
- Randolph, S.A.** (2007). Taking Action—The American Association of Occupational Health Nurses: Policy Initiatives to Address Workplace Violence. In D. Mason, J. Leavitt, & M. Chaffee, *Policy and Politics in Nursing and Health Care* (5th ed., pp. 873-875). Philadelphia: Saunders.
- Randolph, S.A.** (In press). Roles of the occupational and environmental health nurse. In B. Rogers, *Occupational and Environmental Health Nursing: Concepts and Practice* (3rd ed.). Philadelphia: Saunders.
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- Rogers, B.**, & Travers, P. (2007). Occupational Health. In M. Nies and M. McEwen, *Community Health Nursing*.
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- Villaveces, A., & **Runyan, C.W.** (In press). Safety. *World Book Encyclopedia*.
- Weiner, B.J.**, Helfrich, C., & Hernandez, S.R. (2006). Learning, Innovation, and Change. In S.M. Shortell & A.D. Kaluzny (Eds.), *Health Care Management: Organization Design and Behavior* (5th ed., pp. 382-414). Albany, NY: Delmar Publishing.

Refereed Papers/Articles

- Akazawa, M., Biddle, A., & **Stearns, S.C.** (2007). Impact of Early Initiation of Inhaled Corticosteroids on Resource Utilization and Costs in Patients with COPD: A Propensity Score Matching Approach. *Value in Health*.
- Arozullah, A.M., Yarnold, P.R., Bennett, C.L., Soltysik, R.C., Wolf, M.S., Ferreira, M.R., **Lee, S.Y.D.**, Heckinger, E., Costello, S., Khan, T., Shakir, A., & Davis, T. (Accepted for publication). Development and Validation of a Short-Form Rapid Estimate of Adult Literacy in Medicine. *Medical Care*.
- Alexander, J.A., Young, G.J., **Weiner, B.J.**, & Hearld, L.A. (In press). Governance and Community Benefit: Are Nonprofit Hospitals Good Candidates for Sarbanes-Oxley Type Reforms? *Journal of Health Politics, Policy and Law*.
- Beskow, L.M., Sandler, R.S., & **Weinberger, M.** (2006). Research Recruitment through US Central Cancer Registries: Balancing Privacy and Scientific Issues. *American Journal of Public Health*, 96(11), 1920-1926.
- Carpenter, W.R., **Weiner, B.J.**, **Kalunzny, A.D.**, **Domino, M.E.**, & **Lee, S.Y.D.** (2006). The Effects of Managed Care and Competition on Community-Based Clinical Research. *Medical Care*, 44(7), 671-679.
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