Research to Practice in Occupational Health Nursing

by Linda A. McCauley, RN, PhD, FAAN, FAAOHN

ABSTRACT
Occupational health nursing research has gained a significant place in national and international nursing programs and has advanced occupational health nurses’ understanding of the most effective ways to prevent occupational illness and injury, provide access to quality care for workers, and manage occupational injuries and return to work. This article describes the history of nursing research in general and highlights the current national shortages that must be addressed to ensure that nurses continue to impact the field. Occupational health nursing priorities are described and examples are given of nurse scientists who have established the foundation of occupational health nursing research and who illustrate varied expertise and the interdisciplinary context in which the work is conducted.

O ccupational health nursing research has gained a significant place in national and international nursing programs and has advanced occupational health nurses’ understanding of the most effective ways to prevent occupational illness and injury, provide access to quality care for workers, and manage occupational injuries and return to work. Advances in occupational health nursing research parallel advances in the recognition of nursing research overall. The National Institute for Occupational Safety and Health (NIOSH) and the National Institutes of Health (NIH), including the National Institute of Nursing Research (NINR), have provided continued support for nurses engaged in research aimed at promoting worker health. This article describes the history of nursing research in general and highlights the current national shortages that must be addressed to ensure that nurses continue to impact the field. The author also describes the role nurses play on interdisciplinary research teams. Examples are given of programs that have established the foundation of occupational health nursing research and that illustrate the varied expertise of occupational health nursing researchers. These examples span issues that have been identified as priorities by both the American Association of Occupational Health Nurses, Inc. (AAOHN) and the National Occupational Research Agenda (NORA), including preventive health measures, health disparities, and the value of nursing care for working populations. In the past four decades, AAOHN has recognized the contributions of talented and dedicated nurse researchers who have built and developed occupational health science. The programs of research highlighted in this report demonstrate the versatility of occupational health
nurse researchers, the interdisciplinary context in which the work is conducted, and the attributes nurse researchers continue to bring to the field.

**NURSING SCIENCE WORK FORCE**

Occupational health nurses practice in many settings, including worksites, health care systems, community and retail health clinics, battlefields, and academic environments. They have varying levels of education and competencies—from licensed practical nurses, who may contribute to direct client care in clinics and worksites, to nurse scientists who research and evaluate effective ways to promote the health of workers and their families. Only a small proportion of occupational health nurses have doctoral research degrees, not unlike all other fields of nursing. The Figure displays the percentages of occupational health nurses with specific degrees. The largest proportion of occupational health nurses in 2008 held 2-year associate degrees. Less than 20% of all occupational health nurses held graduate degrees, and the large majority of these nurses were nurse practitioners or clinical nurse specialists providing direct care to workers. A critical shortage of doctorally prepared nurses exists in general (Berlin & Sechrist, 2002) and also in occupational health—less than 5% of all nurses in the United States hold doctoral degrees (National Research Council, 2005). The NIOSH-funded Education and Research Centers (ERCs) have been the major training sites for occupational health nurses to pursue the doctor of philosophy (PhD) degree. It was only in the 1990s that the ERCs received NIOSH funding to educate nurse scientists. Today, 17 universities offer interdisciplinary PhD program opportunities for occupational health nurses. These statistics point to extreme nursing work force needs, but also illuminate the outstanding contributions of nurse scientists considering their small numbers.

According to a recent landmark Institute of Medicine (IOM, 2010) report, “The Future of Nursing: Leading Change, Advancing Health,” the nursing work force has few incentives to pursue further education, and faces active disincentives to advanced education. This fact has resulted in a scarcity of nurse scientists and faculty to educate the increased numbers of nurses that will be needed in the next two decades. The IOM report also pointed out that all health professionals should receive more of their education in concert with students from other disciplines. “Interprofessional team training of nurses, physicians, and other health care providers should begin when they are students and proceed throughout their careers. Successful interprofessional education can be achieved only through committed partnerships across professions” (IOM, 2010, p. 32).

The NIOSH-supported ERCs have historically integrated interdisciplinary training into their core expectations. Therefore, the nurse scientists associated with or trained in ERCs overwhelmingly conduct their research using an interdisciplinary format, as exemplified in many of the research programs highlighted in this article.

Occupational health nurses remain the largest group of health providers caring for the U.S. working population. They design and manage the full spectrum of occupational health services provided to workers in the United States. It is critical that nurse scientists who understand the delivery of occupational health nursing services be available to design and conduct studies examining the effectiveness of these programs.

**RESEARCH PRIORITIES IN OCCUPATIONAL HEALTH NURSING**

The identification of research priorities is critical in building the body of knowledge in occupational health; this body of knowledge is the foundation of practice improvement. In 1990, the first Occupational Health Nursing Research Priorities were identified and published in the **AAOHN Journal**. Recently, an update on the priorities was disseminated, providing a guide to prioritize research and target funding (Sidebar) (Rogers, 2011).

These priorities reflect areas of consensus in terms of the need to develop evidence and historical and current importance among programs of research in occupational health nursing. In the following section, examples are given of nurse scientists who have made or are making significant contributions to the field of occupational health nursing research and who also play an active role in educating and mentoring future scientists in the field.

**Effectiveness of Health Promotion Nursing Intervention Strategies, and Strategies for Increasing Compliance With or Motivating Workers to Use Personal Protective Equipment**

In the 1980s at the University of Michigan, Dr. Sally Lusk, Professor Emeritus, began a program of research that tested an innovative behavioral approach to increasing workers’ use of hearing protection. This program served as a basis for mentoring other nurse scientists who have continued to excel in advancing science in this field. Dr. Lusk’s contributions to the field were in recognizing that, in addition to efficacy studies of hearing protection, worker behavior is also a major determinant of personal protective equipment use. Dr. Lusk conducted the country’s—and potentially the world’s—first large-scale, randomized clinical trials of interventions to promote the use of hearing protection (Lusk et al., 1999; Lusk, Ronis, & Baer, 1997; Lusk, Ronis, & Hogan, 1997; Lusk, Ronis, & Kerr, 1995).
During her career, she received more than $6.5 million in total funding from federal and foundation sources to support research and training projects, including funding from the United Auto Workers-GM to assess the effects of noise on blood pressure and heart rate while controlling for other influences on these biological indicators. This landmark study was the first involving ambulatory measurements of blood pressure and heart rate among factory workers while working; a significant positive relationship was found between acute noise exposure and both diastolic and systolic blood pressure and heart rate (Lusk, Eakin, Kazanis, & McCullagh, 2004; Lusk, Hagerty, Gillespie, & Caruso, 2002; Lusk, Hagerty, Gillespie, & Ziemba, 2004). In assessing the effect of chronic noise exposure, Dr. Lusk and her colleagues found that those workers who used hearing protection had lower blood pressure and heart rate than workers without hearing protection.

Dr. Lusk was also appointed to federal review panels, coordinating committees, and task forces and was an American Academy of Nursing Senior Scholar at the Agency for Healthcare Research and Quality. She published nine book chapters and more than 80 articles in refereed journals, and was a natural mentor to her younger colleagues, five of whom secured their own research funding. Dr. Lusk combined her research program with strong teaching engagement, teaching courses and advising students at all program levels and guiding numerous master’s theses and projects and doctoral dissertations. She directed the University of Michigan’s ERC program in occupational health nursing. Her protégés continue to make significant contributions to health promotion and the prevention of hearing loss, including the current director of the occupational health nursing program at the University of Michigan, Dr. Marjorie McCullagh, who is studying hearing loss among agricultural workers (McCullagh, Lusk, & Ronis, 2002); the director of the occupational health nursing program at the University of California at San Francisco, Dr. OiSaeng Hong, who is conducting research studies on the prevention of hearing loss and other adverse health problems caused by chemical and noise exposures (Hong, Ronis, Lusk, & Kee, 2006); and Dr. Madeleine Kerr, University of Minnesota, who studies hearing loss prevention among roofers and laborers (Kerr, McCullagh, Savik, & Dvorak, 2003).

### The Nature and Effects of Stress and Workplace Stressors on Worker Health, Occupational Hazards of Health Care Workers, and Emergency/Pandemic Preparedness in the Workplace

Dr. Jane Lipscomb, Professor, University of Maryland Schools of Nursing and Medicine, and Director of the School of Nursing’s Work and Health Research Center, has had a strong program of research focused on the prevention of occupational injuries and illness in health care and social service workplaces for more than 20 years. Prior to joining the faculty, Dr. Lipscomb spent 3 years as a senior scientist in the Office of the Director of NIOSH and also directed the occupational health nursing program at the University of California at San Francisco. In the past decade, Dr. Lipscomb’s work has focused on the effects of extended work schedules and work organization on health among health care providers (Lipscomb, Trinkoff, Trinkoff,}

### Research Priorities in Occupational Health Nursing

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<th>Priority</th>
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<td>Effectiveness of primary health care delivery at the worksite.</td>
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<td>Effectiveness of health promotion nursing intervention strategies.</td>
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<td>Strategies that minimize work-related adverse health outcomes (e.g., respiratory disease).</td>
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<td>Health effects resulting from chemical exposure in the workplace.</td>
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<td>Occupational hazards of health care workers (e.g., latex allergy, bloodborne pathogens).</td>
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<td>Factors that influence worker rehabilitation and return to work.</td>
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<td>Effectiveness of ergonomic strategies to reduce worker injury and illness.</td>
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<td>The nature and effects of stress and workplace stressors on worker health.</td>
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<td>Health effects resulting from the interaction between aging and workplace hazards.</td>
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<td>Evaluation of critical pathways to effectively improve worker health and safety and to enhance maximum recovery and safe return to work.</td>
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<td>Evaluation of intervention strategies to improve worker health and safety.</td>
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<td>Strategies for increasing compliance with or motivating workers to use personal protective equipment.</td>
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<td>Emergency/pandemic preparedness in the workplace.</td>
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<td>Impact of occupational health nursing interventions on workers’ compensation claims.</td>
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Dr. McCauley has also led occupational health research that has contributed to understanding the effects of occupational exposures on DNA (Kisby et al., 2009; Robbins et al., 2008). The results of this work demonstrate that both personal care attendants’ and nurses’ rates of exposure to sharp objects, blood, and body fluids in the home setting warrant additional training, prevention, and protection.

Health Effects Resulting From Chemical Exposure in the Workplace

At the University of California at Los Angeles, Dr. Wendie Robbins evaluates human sperm cells for chromosomal abnormalities resulting from environmental, occupational, or lifestyle exposures, developing biomarkers that can be used in epidemiologic studies of male reproductive toxicity. She has accomplished this work in a global health context using a community-based participatory research model to study male reproductive effects in Chinese workers exposed to boron (Robbins et al., 2008, 2010). Dr. Robbins and her colleagues demonstrated the effects of occupational boron exposure on sperm parameters and sex ratios of offspring. Her work exemplifies the critical link among genes, the environment, and reproductive health. As is expected, her work is executed within an interdisciplinary context with colleagues from public health. Dr. Robbins also heads the occupational health nursing program at the University of California at Los Angeles, part of the School of Public Health-based Southern California ERC, and holds a faculty appointment in the University of California at Los Angeles’ Interdepartmental Program in Molecular Toxicology.

Dr. Linda McCauley, Dean of the School of Nursing, Emory University, has also focused on chemical exposures among agricultural workers and their families. She uses community-based participatory research methods to work with vulnerable, difficult to access working populations. Her research has documented the effects of low levels of pesticide exposures on neurobehavioral performance in adults and children of agricultural workers (Rohlfman et al., 2007; Rothlein et al., 2006). In more recent years, she and her interdisciplinary colleagues have integrated biomarkers of pesticide exposure, pathways of oxidative stress and effects on DNA (Kisby et al., 2009; McCauley, Lasarev, Muniz, Nazar Stewart, & Kisby, 2008). Dr. McCauley has also led occupational health nursing programs at both the University of Cincinnati and the University of Pennsylvania.

Occupational Hazards of Health Care Workers, and Emergency/Pandemic Preparedness in the Workplace

Working within an interdisciplinary framework, Dr. Bonnie Rogers has conducted significant research in the area of hazards to health care workers, with a particular focus on exposure assessment for antineoplastic agents and related health impacts (Connor et al., 2010; McDairmid, Oliver, Roth, Rogers, & Escalelante, 2010; Rogers & Brookshire, 1987; Rogers & Emmett, 1987). Her research has led to government, professional society, and nongovernment organization guidance publications for safer handling of these substances. This research has also led to policy changes in hospital and ambulatory care facilities regarding the handling of these toxic substances. Her work has also included a focus on other occupational health hazards for health care workers, including needlestick injuries and respiratory protection against influenza pandemics (Liverman, Harris, Rogers, & Shine, 2009; Rogers & Goodno, 2000; Rogers & Haynes, 1991; Rogers & Lawhorn, 2007; Shine, Rogers, & Goldfrank, 2009). Dr. Rogers has recently conducted an evaluation of North Carolina hospitals’ respiratory protection policies and procedures for at-risk health care workers. This study included an assessment of each facility’s written policies and procedures for respiratory protection; the proper use of and adherence to the Occupational Safety and Health Administration’s (OSHA) respiratory protection standards; the use of respiratory protection among health care workers, including an observational component in a sample of participants; and health care workers’ and hospital administration’s knowledge and beliefs about respiratory protection. The results will be used to improve work practices and safeguard health care workers at risk for airborne infections.

A national and international leader in the field of occupational safety and health and a nurse ethicist, Dr. Rogers was recently named the chair of the NIOSH Board of Scientific Counselors. During the past decade, she has played leadership roles in the development of a national occupational research agenda and has led the development and updates of the AAOHN research priorities. Her research has also included examining ethical dilemmas facing occupational health nurses and ways to resolve difficult ethical issues (e.g., confidentiality of health information, right-to-know, and conflict of interest) (Rogers & Goodno, 2000). Dr. Rogers is also engaged in mentoring future leaders in occupational health nursing by serving as the director of the North Carolina ERC and leader of the public health leadership program.

Effectiveness of Ergonomic Strategies to Reduce Worker Injury and Illness, and Evaluation of Critical Pathways to Effectively Improve Worker Health and Safety and to Enhance Maximum Recovery and Safe Return to Work

Dr. Hester J. Lipscomb is an occupational epidemiologist with earlier training in nursing and health behavior. Currently a professor in the Department of Community and Family Medicine, Duke University, her research interests have centered around injury and musculoskeletal outcomes among a variety of workers employed in construction trades, health care, commercial fishing, and poultry processing. Recent work has led to
an interest in the complex relationships between work and health disparities. In the past 15 years, she has published more than 80 scientific papers focused on studies of occupational injury. She also uses community-based research methods to access vulnerable worker populations (McPhee & Lipscomb, 2009), and has recently documented the need to study mental health as well as occupational health problems among poultry workers (Horton & Lipscomb, 2011). Her work covers the spectrum of occupational injury prevention, determinants of injury, and return to work. For example, she has studied nail gun injuries and the experiences of construction apprentices (Lipscomb, Cameron, & Silverstein, 2008b; Lipscomb, Nolan, Patterson, & Dement, 2010), back injuries in this population (Lipscomb, Cameron, & Silverstein, 2008a), and the extent of U.S. emergency department visits among construction workers and the compensation costs of work-related injuries among carpenters (Lipscomb, Schoenfisch, Shishlov, & Myers, 2010). Dr. Lipscomb has also engaged in occupational health policy development and previously served on the NIOSH Board of Scientific Counselors.

Dr. Lipscomb has also been influential in mentoring young nurse scientists. Lisa Pompeii at the University of Texas studied with Dr. Lipscomb and has developed her own program of research, including studies of musculoskeletal injuries among health care workers (Pompeii, Lipscomb, & Dement, 2008, 2010; Pompeii, Lipscomb, Schoenfisch, & Dement, 2009).

**Factors That Influence Worker Rehabilitation and Return to Work, and Evaluation of Critical Pathways to Effectively Improve Worker Health and Safety and to Enhance Maximum Recovery and Safe Return to Work**

Dr. Mary Salazar, Professor Emeritus, University of Washington School of Nursing, also conducted a sustained program of interdisciplinary research while she served as director of the occupational health nursing program at the Northwest Center for Occupational Health and Safety ERC. Her research focused on health behavior and health protection among working populations, including large evaluation studies for the Washington State Department of Labor and Industries and another within the nuclear weapons complex for the U.S. Department of Energy. In the latter study, she evaluated factors that influenced worker rehabilitation and return to work. She and her colleagues found that services for some worker groups (e.g., subcontractors) were limited and that a mismatch existed between hazards and types of services provided (Salazar, Takaro, Gochfeld, & Barnhart, 2003). Dr. Salazar and her colleagues have published some of the most detailed research studies of workers’ compensation systems (Brines, Salazar, Graham, & Pergola, 1999; Salazar, 2000; Salazar & Graham, 1999; Salazar, Graham, & Lantz, 1999). Her work has demonstrated the importance of structural factors (i.e., psychosocial variables, including job satisfaction and relationship with employer and coworkers, financial pressures, and system issues such as securing benefits) and process factors (i.e., interaction with service providers and the workers’ compensation system) to satisfaction with services.

**Health Effects Resulting From the Interaction Between Aging and Workplace Hazards**

According to the U.S. Bureau of Labor Statistics (2008), the American work force is aging. As a result, health problems associated with the aging process (e.g., coronary heart disease) present new health and safety challenges. Dr. Victoria Dickson is investigating how aging workers with coronary heart disease practice self-care (i.e., adherence to medication and treatment, symptom monitoring and symptom management) on a daily basis within the context of employment or the consequences of poor self-care behaviors for aging worker health and safety (Dickson, McCauley, & Riegel, 2008). Her research also examines the effect of work organization, defined as the work process (e.g., the way jobs are designed and performed) and organizational practices (e.g., management and production methods and human resource policies), on self-care behavior and worker productivity in this population. Her current study of the aging work force and chronic disease will be one of the first conducted by a nurse scientist and will explore the relationship of work organization and job-level characteristics to self-care, health status, quality of life, and work-related (i.e., absenteeism, presenteeism) outcomes. Study results may potentially lead to recommendations for workplace policies and generate novel job accommodations that facilitate self-care within the context of work.

**Effectiveness of Primary Health Care Delivery at the Worksite**

Although identified as a high priority for occupational health nursing research, it is difficult to find singular programs of research focused on the delivery of primary care services in the workplace. Occupational health nurse scientists at the University of Cincinnati have studied the role of the occupational health nurse in screening workers for domestic violence. Drs. Donna Gates and Dianne Felblinger found that although nurses consider it part of their role, they do not believe they have adequate training to competently care for workers who have experienced domestic violence (Felblinger & Gates, 2008). Dr. Pat McGovern at the University of Minnesota has focused her program of research on issues of women’s health in the workplace, including mother’s health and work-related factors during the postpartum period (McGovern et al., 2007). Recently, Karen Griffith and Dr. Patricia B. Strasser reported on a successful demonstration project integrating primary care services into occupational health services (Griffith & Strasser, 2010). The pilot initiative included constructing two on-site health center facilities staffed with primary care physicians, nurse practitioners, physical therapists, and other health care professionals. Analysis of the program delivery included a thorough financial analysis of return on investment. Although these investigators have demonstrated the capacity to study service delivery, additional work is needed on evaluating mod-
IN SUMMARY

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1 Occupational health nursing research has been limited by the scarcity of nurse scientists in the workforce.

2 Occupational health nursing scientists often conduct their work within interdisciplinary teams.

3 The American Association of Occupational Health Nurses, Inc., and the National Occupational Research Agenda set priorities to advance the science of occupational health nursing.

4 More research is needed to demonstrate the effectiveness of primary care, screening, and tertiary care models in the workplace.

eels of health promotion and disease prevention services, including screening, early diagnosis, and uncomplicated illness treatment in work settings.

CONCLUSION

In the same way nursing science in general is under-resourced, occupational health nursing research has been limited by the few doctorally prepared nurse scientists. However, in the past three decades, nurses scientist leaders have emerged, most frequently associated with NIOSH-funded ERCs. The journals in which occupational health nursing research is published are broad and reflect the interdisciplinary context in which many nurse scientists conduct their work. Several nurse scientists are using community-based participatory research methods to access vulnerable working populations. The research priorities for occupational health nurses have recently been updated, and it is clear that nurse scientists are making significant impact in most, if not all, of the priority areas. Health care reform has pointed to the critical need for empirical studies to demonstrate access to and quality of health services; a critical need exists to demonstrate the effectiveness of primary care, screening, and tertiary prevention care models in the workplace. Occupational health nursing researchers must continue to play an instrumental role in designing and implementing research studies that measure the impact of occupational health nursing services and interventions on the promotion and protection of workers’ health.

REFERENCES


Academies Press.


