



## Professional article

ACTA FAC. MED. NAISS. 2004; 21 (3): 171-178

Mirjana Aran|elovi}, Jovica  
Jovanovi}, Sa{a Borisov,  
Sonja Stankovi}

Institute of Occupational  
Health-Niš

## THE HAZARD OF HEALTH CARE WORK

### SUMMARY

Characterized as people committed to promoting health through treatment and care for the sick and injured, health care workers, ironically, confront perhaps a greater range of significant workplace hazards than workers in any other sector. Hazards facing health care workers include: biologic hazards associated with airborne and bloodborne exposures to infectious agents; chemicals hazards especially those found in hospitals, including waste anesthetic and sterilant gases, antineoplastic drugs and other therapeutic agents, mercury, and industrial-strength disinfectants and cleaning compounds; physical hazards including ionizing and non-ionizing radiation, safety and ergonomic hazards that can lead to a variety of acute and chronic musculoskeletal problems, violence; psychosocial and organizational factors including psychologic stress and shift work and many health consequences associated with changes in the organization and financing of health care. Yet despite high injury and illness rates, health care workers have received relatively little attention from occupational health and safety professionals compared with workers in industries traditionally viewed as hazardous. Legislation, regulations, and even voluntary guidelines to protect health care workers have been formulated and adopted slowly and they have been inadequate in their scope. From a public health perspective doctors represent an interesting index population. In this perspective, the health of the doctors can be seen as an indicator of the burden of disease of the culture in which they practice.

*Key words:* health care workers, hazards.

### INTRODUCTION

Characterized as people committed to promoting health through treatment and care for the sick and injured, health care workers, ironically, confront perhaps a greater range of significant workplace hazards than workers in any other sector. In addition to exposure to airborne and bloodborne infectious agents, typical exposures include workplace assault, ergonomic hazards, toxic drugs and other chemicals, radiation, and work stress, often

caused or exacerbated by inadequate staffing. For these reasons, health care workers (e.g., physicians, nurses, emergency medical personnel, dental professionals and students, medical and nursing students, laboratory technicians, hospital volunteers) often struggle to provide quality and compassionate care in an inherently dangerous work environment. Furthermore, in the health care work environment, unlike the situation in many other industries, workers are not the only ones who are affected when occupational safety and health threats are not ade-

quately identified and addressed: patient care also deteriorates.

Yet despite high injury and illness rates, health care workers have received relatively little attention from occupational health and safety professionals compared with workers in industries traditionally viewed as hazardous.

The health care industry has been slow to recognize and respond to the epidemic of injuries and illnesses facing its own work-force. Explanations given for this lack of attention or concern include the following:

1. A false perception that the industry is self-regulated: Accreditation is primarily directed at assessing the quality of patient services. As a consequence, inspectors are poorly trained in occupational health and safety and pay insufficient attention toward work-place exposures and hazards during inspections.
2. Focus on curative rather than preventive medicine: health care institutions are more concerned and better prepared to respond to the more dramatic aspects of curative medicine rather than to preventive medicine and public health, including occupational health and safety.
3. Lack of attention by governmental agencies responsible: little research has been conducted and few governmental standards have been issued for the hazards causing most injuries to health care workers.
4. The notion that "an industry that employs mainly females must be a safe industry": Seventy-six percent of hospital workers, 83% of nursing home workers, and 93% of home care workers are female.
5. A low unionization rate within the health care sector: Health care workers, compared with workers in more heavily unionized industries, have little voice and power to effectively negotiate for and improve workplace health and safety conditions (1-4).

#### HAZARD OF HEALTH CARE WORK

Hazards facing health care workers include;

Biologic hazards associated with airborne and bloodborne exposures to infectious agents;

Chemical hazards especially those found in hospitals, including waste anesthetic and sterilant gases, antineoplastic drugs and other therapeutic agents, mercury, and industrial-strength disinfectants and cleaning compounds;

Physical hazards including ionizing and non-ionizing radiation, safety and ergonomic haz-

ards that can lead to a variety of acute and chronic musculoskeletal problems, violence.

Psychosocial and organizational factors including psychologic stress and shift work and many health consequences associated with changes in the organization and financing of health care (Table 1)(1).

#### BIOLOGICAL HAZARDS

Biological hazards are infectious agents such as bacteria, viruses, fungi or parasites which may be transmitted via the contact with infected patients or contaminated objects, body secretions, tissue, or fluids. Health care workers, particularly those in hospital settings, are regularly exposed to biological or infectious agents (Table 2).

At the workplace, both Hepatitis B (HBV) and Human Immunodeficiency Virus (HIV), can be transmitted by infected blood and body fluids when they are in direct contact with the inside of the mouth, the eye, or with broken, scraped, chapped or inflamed skin. The exposure of greatest concern, however, is when the skin is broken by a contaminated object such as a needle or a scalpel. Neither HBV nor HIV can be transmitted by casual contact. The risk of HBV infection far exceeds the risk of HIV infection.

"Universal Precautions" should be established in any care setting where exposure to blood and body fluids is possible. Their purpose is to eliminate or reduce the risk of transmission of blood-borne pathogens. Since patients infected with HBV or HIV cannot always be reliably identified, blood and body fluid precautions should be used with all patients. In other words, the precautions should be applied universally.

Immunization against HBV is recommended for health care workers at the greatest risk of exposure. In addition, depending on a person's immune status, HBV vaccine or hepatitis B immune globulin or both may be recommended after accidental exposure to blood or body fluids. There is no vaccine against HIV.

Despite the success of the bloodborne pathogen standard and related guidance from the Centers for Disease Control and Prevention (CDC) and professional associations, a very significant health problem has emerged that can be attributed, in part, to the increased use of examination and surgical gloves required by this standard. An epidemic of latex allergy is now affecting health care workers and others exposed. The prevalence of latex allergy among health care workers is estimated to be between 5% and 12%, with atopic workers at even greater risk(5). Manifestations of this exposure range from type IV

*Table 1. Selected hazards, health effects, and control strategies in health care*

<i>Hazards</i>	Health effects	Control strategies
<b>Biological</b>		
Viral (Hepatitis B, Hepatitis C virus)	Acute febrile illness, liver disease, death	Safer needle devices, hepatitis B vaccine
Bacteria (Mycobacterium tuberculosis)	TB infection, TB illness, multiple drug resistance, death	Isolation of suspect patients, respirators, UV light, negative pressure rooms
Natural rubber latex proteins (and rubber chemical additives)	Range from type IV delayed hypersensitivity to rubber additives to type I immunologic response, anaphylactic shock, death	Substitution with low latex protein powderless gloves or nonlatex gloves and supplies
<b>Chemical</b>		
Ethylene oxide	Peripheral neuropathy, cancer, reproductive effects	Substitution, enclosed systems, aeration rooms
Formaldehyde	Allergy, nasal cancer	Substitution, local ventilation
Glutaraldehyde	Mucous membrane irritation, sensitization, reproductive effects	Substitution, local ventilation
Antineoplastic drugs	Cancer, mutagenicity, reproductive effects	Class I ventilation hoods, isolation of patient excreta
Waste anesthetic gases	Hepatic toxicity, neurologic effects, reproductive effects	Scavenging systems, isolation of off-gassing patients
Mercury	Neurological effects, birth defects	Substitution with electronic thermometers
<b>Physical</b>		
Patient handling	Back pain, injury	Patient handling devices, lifting teams, training
Static postures	Musculoskeletal pain and injury	Rest breaks, exercise, support hose and shoes
Ionizing radiation	Cancer, reproductive effects	Isolation of patients, shielding and maintenance of equipment
Lasers	Eye and skin burns, inhalation of toxic chemical and pathogens, fires	Local exhaust ventilation, equipment maintenance, respirators and face shield
Physical assault	Traumatic injuries, death	Alarm systems, security personnel, training
<b>Psychosocial/Organizational</b>		
Violence threat and physical assault	Traumatic injuries, death, posttraumatic stress disorders	Training, post assault debriefing
Restructuring	Mental health disorders, exacerbation of musculoskeletal injuries, burn out	Acuity-based staffing, employee involvement in restructuring activities
Work stress (other than above)	Mental health disorders, burn out	Stress prevention and management programs
Shift work	Gastrointestinal disorders, Sleep disorders	Forward, stable and predictable shift rotation

**Table 2. Blood-borne pathogens and other infectious agents and diseases**

<b>Mode of Transmission</b>	<b>Infectious Agent/Disease</b>
Blood and body fluids	Hepatitis B, Non-A, Non-B Hepatitis, Hepatitis C, Acquired Immuno-deficiency Syndrome (AIDS), Cytomegalovirus (CMV).
Feces	Hepatitis A, Salmonella, Shigella, Campylobacter.
Virus shedding in urine and stool	Rubella (German measles)
Respiratory secretions	Rubella (German measles), Rubeola (measles), Mumps, influenza, Respiratory syncytial virus (RSV).
Contact with infected skin lesions	Scabies
Airborne droplet nuclei	Pulmonary tuberculosis, Varicella zoster virus (VZV) (chicken pox only)
Saliva	Mumps, Herpes simplex virus (HSV) - Type I, Type II, Herpetic whitlow, VZC (chicken pox & shingles)
Secretions of lesions	HSV - Type I, Type II, Herpetic whitlow, VZV (chicken pox and shingles)

delayed hypersensitivity to rubber additives, which manifests as contact dermatitis, to type I immunologic responses to residual proteins in gloves and other medical devices. The National Institute for Occupational Safety and Health (NIOSH) made recommendations for prevention of allergic reactions to natural rubber latex in the work-place and for controlling exposure (available at:<http://www.cdc.gov/niosh>) (6 – 11).

#### CHEMICAL HAZARDS

Health care workers are exposed to a wide range of chemical disinfectant, anesthetic waste gases, and chemotherapeutic drugs that are known to cause human health effects, as well as others for which no or inadequate testing has been conducted. Numerous chemicals found in hospitals may be toxic or irritating to body systems. Chemicals can enter the body through contaminated food or cigarettes, absorption through the skin, inhalation or by accidental needle stick. The major routes of entry are by inhalation or skin absorption (Tabl 3).

Exposure does not always produce adverse health effects. Chemicals for which there is little or conflicting information about potential toxic effects, should be treated as toxic. Toxic chemicals are best dealt with by preventing worker exposure. This can be done by identifying the chemicals, considering their toxic properties and potential health effects and implementing control measures (2,3).

#### PHYSICAL HAZARDS

Ionizing and non-ionizing radiation, electricity, noise and heat are examples of physical hazards found in hospitals. Ionizing radiation is used in diagnostic procedures such as x-ray, fluoroscopy, and angiography, and in treatments using radioactive implantations or injections. Cumulative and long-term health effects include genetic damage and adverse reproductive outcomes. The risks of long-term low-level exposure to ionizing radiation are not fully known. Measures to minimize exposure include maximizing distance between the radiation source and the worker, using appropriate shielding and minimizing exposure time. Special attention should be given to the maintenance of portable fluoroscopy and x-ray equipment which may scatter radiation during procedures.

Non-ionizing radiation includes microwaves, magnetic fields, and lasers. The intensity of the light beam of lasers poses a risk especially to the eyes and skin. Procedures for the safe use of lasers should include training, warning signs, using appropriate safety eyewear, and non-reflective tools.

Excessive noise and heat are commonly found in kitchens, laundries, and boiler rooms. Cold, heat and sunlight are hazards for grounds and building maintenance personnel. Permanent hearing loss can result from long term exposure to noise in excess of 80 decibels (a measure of sound intensity). At lower levels, noise from equipment, alarms, conversation and other sources can impede communication and interfere with concentration. Comprehensive hear-

*Table 3. Chemical agents commonly found in the hospital environment*

Employees potentially exposed	Selected chemical agents
Central supply workers	Cleaning and sterilizing agents
Dietary & Housekeeping staff	Insecticides, detergents, disinfectants, solvents
Laboratory technicians	Tissue fixatives and reagents
Maintenance & facilities workers	Solvents, insecticides
Nurses	Medications, disinfectants, solvents, anti-cancer agents
Operating room staff	Anesthetic agents
Pharmacists	Medications and anticancer agents
Physicians	Anticancer agents, disinfectants
Workers in specialty procedure rooms	Disinfectants, sterilants

ing conservation programs should reduce noise through engineering controls, detect hearing loss early, provide worker education, and provide hearing protection devices.

Skin burns can result from exposure to hot surfaces or liquids or from exposure to excessive sunlight. Cold temperatures can produce frostbite or dangerous generalized cooling of the body (hypothermia). Engineering controls to prevent contact with hot surfaces or to reduce hot indoor temperature, protective clothing such as hats and long sleeved shirts to reduce sun exposure, and administrative guidelines for working in hot and cold environments are important measures to reduce the risk of injury (1,2,10,11).

#### ERGONOMIC AND SAFETY HAZARDS

Ergonomic and safety hazards cause or worsen accidents, injuries, strain or discomfort. Ergonomics is the application of scientific knowledge to the design of environments, tools, workstations and the content of work to suit the mental and physical limitations and capabilities. Work environments and procedures that incorporate ergonomic principles can anticipate accidents and avert injury and error. Health care safety hazards include: slippery floors, cluttered hallways or blocked exits, explosive gases used in laboratories and operating rooms, various power tools and other maintenance equipment, sharp utensils and instruments, and materials handling.

One of the most common and most severe hospital injuries is musculoskeletal injury, particularly

of the lower back. The most frequent time-loss injury was to the back resulting from overexertion while moving objects or handling patients. Approaches to reducing back injury and disability must be comprehensive and involve ergonomic strategies, education, early and aggressive injury treatment and appropriate rehabilitation programs.

Injuries also frequently experienced by health care workers include cuts, bruises and needle sticks.

Another problem is repetitive strain injuries (RSIs) of the upper limbs related to improper workstation and task design. RSI risk factors include: high rates of manual repetition, use of excessive manual force, and awkward postures of the wrists and shoulders. Workers in dietary and laundry departments and clerical positions, such as data entry operators and medical transcriptionists, may be at increased risk.

Violence against health care workers is an emerging occupational hazard. Preventing injury from aggressive acts starts when the employer acknowledges that the potential for violence exists. There must be strong management commitment to violence prevention programs. Strategies should encompass workplace design; patient care approaches to reduce anger, frustration, and agitation; staff training on recognition and interventions for potentially violent situations; and support systems for workers who do experience a violent event.

#### NEEDLESTICK INJURIES

The most prevalent, least reported, and largely preventable serious risk health care workers face co-

mes from the continuing use of inherently dangerous conventional needles. Such unsafe needles transmit bloodborne infections to health care workers employed in a wide variety of occupations. Elimination of unnecessary sharps and the use of safer needles can dramatically reduce needlestick injuries. Safer needle devices have integrated safety features built into the product that prevent needlestick injuries. The term safer needle device is broad and includes many different devices, from those that have a protective shield over the needle to those that do not use needles at all. Needles with integrated safety features are categorized as passive or active. Passive devices offer the greatest protection because the safety feature is automatically triggered after use, without the need for health care workers to take any additional steps. An example of a passive device is a spring-loaded. An example of an active safety mechanism is an employee-activated self-sheathing needle. Use of conventional needles in the health care environment today has been compared with the use unguarded machinery decades ago in the industrial workplace.

Once stuck, not only health care workers run the risk of acquiring a number of serious infectious diseases, but they and their families must deal with the emotional stress of waiting a minimum of 6 months to find out, through antibody testing, whether a particular needlestick injury will cause a potentially life-threatening disease. Health care workers must also avoid exposing others to their body fluids, including practicing "safe sex" during this period. In addition, those who take prophylactic drugs in hope of preventing human immunodeficiency virus (HIV) infection, may have serious side effects.

After a needlestick injury, the risk of developing occupationally acquired hepatitis B virus (HBV) infection for the nonimmune health care worker ranges from 2% to 40% depending on the hepatitis B antigen status of the source patient (12). The risk of transmission from a positive source for hepatitis C is between 3% and 10% (12), and the average risk of transmission of HIV is 0,3% (13). However, the risk of transmission increases if the injury is caused by a device visibly contaminated with blood, if the device is used to puncture the vascular system, or if the stick causes a deep injury. All of these diseases are associated with significant morbidity and mortality and only hepatitis B can be prevented by vaccine. Health care workers, laundry workers, and house-keeping workers are all too often engaged in duties that create an environment for these high-risk needlestick injuries. It is thought that one health care worker per week will eventually die from occupational exposure to HIV(6).

## ORGANIZATION OF WORK

Organization of work refers to management and supervisory practices as well as production processes and their influence on the way work is performed. Perhaps no other single factor influences worker injury and illness rates more than the manner in which work is organized and staffing decisions are made. Many factors in the hospital environment can affect the psychological and social well-being of workers. Examples of work organization which can have an adverse impact on workers include: little decision-making latitude, excessive job demands, role ambiguity, poor management ability, inadequate resources, and shiftwork. Rotating shifts and night work can have a negative impact on general well-being and performance because of the constant disruption of an individual's biological clock. Shiftwork can also negatively affect workers' social roles. Combative patients, terminally-ill patients, and coworkers or managers are also stressors. The current economic climate in health care can create excessive workload demands and a sense of insecurity at work.

Health care organizations should maximize worker participation in decisions affecting their daily work and the organization as a whole. Employers can also effectively resolve conflicts, help staff to respond positively to change and provide social support systems.(12-14).

## PSYCHO-SOCIAL HAZARDS

Many factors in the hospital environment can affect the psychological and social well-being of workers. Examples of work organization which can have an adverse impact on workers include: little decision-making latitude, excessive job demands, role ambiguity, poor management ability, inadequate resources, and shiftwork. Rotating shifts and night work can have a negative impact on general well-being and performance because of the constant disruption of an individual's biological clock. Shiftwork can also negatively affect workers' social roles.

Combative patients, terminally-ill patients, and coworkers or managers are also stressors. The current economic climate in health care can create excessive workload demands and a sense of insecurity at work.

Health care organizations should maximize worker participation in decisions affecting their daily work and the organization as a whole. Employers can also effectively resolve conflicts, help staff to respond positively to change and provide social support system.

In a public health perspective doctors represent an interesting index population. Most cultures recruit doctors from socioeconomically privileged groups, a clear asset in terms of health capital. Doctors also possess the available knowledge about how to avoid, prevent and treat disease, and how to act in emergency situations. Hence doctors, as a group should have the lowest risk possible. In this perspective, the health of the doctors can be seen as an indicator of the burden of disease of the culture in which

they practice. The more sick doctors, the higher the cultural risk of disease. On the other hand, doctors deliberately expose themselves to medical hazards by being surrounded by sick people and risky situations, so it may well be that at the end of the day, the life expectancy may be higher than in the general population, at least for certain groups or in special situations. (15–18).

## REFERENCES

1. Lipscomb J, Borwegen B. Health Care Workers In: Occupational, Environmental Medicine ed. Joseph LaDou. Stamford 1997:76–78
2. Mc Kinlay JB, Marceau LD. The end of the golden age of doctoring. *Int J Health Serv* 2002; 32: 379–416.
3. Barbara J. Fahey, BSN, CIC, David K. Henderson, MD, National Institutes of Health, Bethesda, Md. Reducing Occupational Risks in the Health Care Workplace. *Infect Med* 1999; 16:269–279.
4. Mechanic D. Physician discontent challenges and opportunities. *JAMA* 2003;290:941–946.
5. Kund JJ, Johanes M, Eva SH. Mortality and causes of death among Danish medical doctors 1973–1992. *International of Epidemiology* 1999; 28: 456–460
6. Ippolito G, Pura V, Petrosillo N, et al. Prevention, management and chemoprophylaxis of occupational exposure to HIV. Charlottesville, VA: International Health Care Workers Safety Center, University of Virginia, 1977.
7. Sania A, Mary E. Bollinger Latex Allergy and Occupational Asthma in Health Care Workers: Adverse Outcomes. *Environ Health Perspect* 2004; 112 : 378–381.
8. Bollinger ME, Mudd K, Keible LA, Hess BL, Bascom R, Hamilton RG. A hospital-based screening program for natural rubber latex allergy. *Ann Allergy Asthma Immunol* 2002; 88:560–567.
9. Swanson MC, Ramalingam M. Starch and natural rubber allergen interaction in the production of latex gloves: a hand-held aerosol. *J Allergy Clin Immunol* 2002;110(suppl 2):S15–S20.
10. Arellano R Bradley J, Sussman G. prevalence of latex sensitization among hospital physicians occupationally exposed to latex gloves. *Anesthesiology* 1992;77:905–908.
11. Liss GM, Sussman GL. Latex sensitization: occupational versus general population prevalence ratio. *Am J Ind Med* 1999;905–908.
12. Hendin H, Maltzberger JT, Haas AP. A physician's suicide. *Am J Psychiatry* 2003;160:2094–2097.
13. Rosvold ED, Bjertness E. Physicians who do not take sick leave: Hazardous heroes? *Scand J Public Health* 2001;29–75.
14. Smith R. Why are doctors so unhappy? Medical profession must unite to address problems. *BMJ* 2001;322:1363.
15. Tyssen R, Vaglum P. Mental health problems among young doctors: an update revives of prospective studies. *Harv Rev psychiatry* 2002;10:154–165.
16. Landon BE, Reschovsky J, Blumenthal D. Changes in career satisfaction among primary care and specialist physicians, 1977–2001. *JAMA* 2003; 289: 442–449.
17. Ingestad B, Christie VM. Encounters with illness: The perspective of the sick doctors. *Anthropology & medicine* 2001;8:201–210.
18. Olaf G Aasland. Doctors' health – better than their patients? Madrid: Publicado en Diariomedico. Com el 28/01/2004.

## ZDRAVSTVENI RADNICI – RIZIK PO ZDRAVLJE

Mirjana Aran | elovi}, Jovica Jovanovi}, Sa{a Borisov, Sonja Stankovi}

*Institut za medicinu rada – Niš*

SA@ETAK

Zdravstvene radnike karakteri{e posve}enost promovisanju zdravlja kroz le-enje i brigu o bolesnim i povre|enim. Ipak, ironi-na je ~injenica da se ba{ oni suo-avaju sa najraznovrsnijim rizicima na radnom mestu, vi{e nego radnici na bilo kom drugom radnom mestu. Rizici sa kojima se suo-avaju zdravstveni radnici mogu se klasifikovati na: bilo{ke rizike povezane sa izlo`eno{}u zaraznim agensima koji se prenose vazduhom (npr tuberkuloza) ili krvlju (npr. hepatitis i sida) fizi-ke rizike koji uklju-uju joniziraju}u i nejoniziraju}u radijaciju; hemijske rizike posebno u bolni-kim okru`enjima, koji uklju-uju otpadne anestetiki-ke i sterilizatorske gasove, antineoplasti-ne lekove i druge terapijske agense, `ivu, jake dezinficijense i sredstva za ~i{}enje; psihosocijalne i organizacione rizike koji uklju-uju psiholo{ki stres, rad u smenama kao i zdravstvene posledice povezane sa promenama u organizaciji i finansiranju zdravstvene za{tite. Ovde spadaju i nasilne pretnje i fizi-ki napadi; sigurnosne i ergonomske rizike koji mogu dovesti do raznih akutnih i hroni-nih mi{i}no-skeletnih problema. I pored visoke stope povreda i bolesti, zdravstveni radnici do sada nisu dobili dovoljno pa`nje od strane stru-njaka koji se bave profesionalnim oboljenjima u pore|enju sa zaposlenima u industrijama koje se tradicionalno smatraju rizi-nim. Zakoni, regulative i povremene smernice koje se odnose na za{titu zdravstvenih radnika sporo se usvajaju i ~esto su neadekvatne. U viziji op{teg zdravlja jedne sredine lekari predstavljaju interesantnu indeksnu grupu. U budu}nosti zdravlje lekara mo`e da poslu`i kao indikator te`ine oboljevanja stanovni{tva u sredini gde oni obavljaju svoj rad.

klju-ne re-i: zdravstveni radnici, nokse.