Hazards of the Health Care Sector: Looking Beyond Infectious Disease

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ABSTRACT

Background: Possessing every hazard class, the health care sector poses significant health threats to its workforce in both high-resource settings and low- and middle-income countries (LMICs).

Objectives: The aim of this paper was to examine the applicability of the classical hierarchy of hazard control technologies in resource-constrained health care settings.

Methods: Using a biologic and chemical hazard example, the hazard control hierarchy was applied for risk mitigation.

Findings: Even when resource constraints force a reordered selection of hazard control elements, risk reduction can be achieved across a variety of hazard classes.

Conclusion: For LMICs with limited resources, the hazard control hierarchy can be effectively employed, although the selection of methods may be reordered, to achieve significant hazard control. Such prevention strategies can thereby strengthen and sustain a critical pillar of the health system, its workforce.

Key Words: global health care sector, health and safety, occupational health

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INTRODUCTION

It is counter-intuitive that the health care industry, whose mission is the care of the sick, is itself a "high-hazard" industry for the workers it employs. This industry sector consistently demonstrates poor workforce injury and illness statistics, among the highest in the United States[1] and in the European Union (EU), about 30% higher than the average work-related accident rate.[2]

In both the United States and the EU, about 10% of all workers are employed in the health care sector. This workforce is overwhelmingly female, even in some low- and middle-income countries (LMICs), with about 70% of the total being women workers.[3] With such a large portion of the global workforce being employed in this high-hazard sector and with forecasts for the increasing need for health workers in the future, the magnitude of the health threat is considerable and demands address.

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Unique Hazards and Challenges of the Sector

A significant array of hazards is posed by the sector, with biologic agents and infectious diseases the most widely recognized. Indeed, such "health care—acquired" infections in patients, other unintended errors, such as medication overdoses, and the known side effects of hazardous treatments have recently spawned the highly visible "patient safety movement."[4] Less apparent, however, has been the risk to health that those same hazards and this same environment impose on the men and women who work there.[5]

Although preventing exposure to infectious agents and musculoskeletal injuries resulting from patient lifting have been the primary focus of employee safety programs, the chemical hazards in health care have been more slowly recognized. These include novel agents, some of which are unique to health care such as sterilants, germicidal agents, and pharmaceuticals including the highly toxic anticancer drugs. Many of these drugs are themselves cancer-causing or toxic to human reproduction and have been the subject of environmental monitoring campaigns in recent years, showing widespread work-area contamination.[6]

In the context of this highly complex and hazardous work environment, particular challenges arise in pursuing protections for health care workers in this unique

employment sector. Biases within the health care industry and the safety and health community itself collude to limit both the awareness of hazards that do exist and the successful application of classical approaches used to assure safe jobs.[7] This occurs for several reasons.

Because health care is a nontraditional employment setting, imagined by the public to be clean and safe, hazard awareness often is lacking. Also, due to its unique mission of caring for the sick, self-preservation behaviors, which normally aid in protecting workers, are suspended in a culture of self-less commitment to patient care. There is an erroneous "either/or" mentality historically present that sometimes forces a false choice to be made by a worker between providing good care or protecting oneself.

Importantly, these threats to caregiver health have been named as critical factors in the US nursing shortage according to the American Nurses Association (ANA), which published in a recent study that health and safety of the work environment impacts nurses' decision to stay in the profession.[8] Internationally as well, conditions of work and health threats have been found to contribute to the current global shortage of health workers.[9]

In a recent document from the World Health Organization (WHO), "Monitoring the Building Blocks of Health Systems," the health workforce is described as one of the essential 6 pillars of a strong and sustainable health system.[10] Although enlarging capacity through skills building and training is emphasized to bolster the health workforce, also discussed in the prevention of workforce shortages is mitigation of "losses caused by death, retirement, career change or out-migration."

Clearly, failing to address health threats in the work environment will be a barrier to retaining and sustaining caregiver ranks, which in turn, threaten the delivery of health care globally.

Hazard Classes

Workers in the health care sector, which possesses every hazard class, may encounter health threats both common to other workers, such as those related to large facility operations and maintenance, including asbestos, heavy metals, and solvents, and those hazards unique to the provision of care to ill patients. Table 1 presents a select summary of hazards organized by class including physical, chemical, biologic, mechanical and psychosocial hazard examples.

A number of excellent reviews of hazard management in the healthcare sector have been published[5,11-13] and the reader is directed to these resources. However, several overarching hazards require specific address, due both to their strategic threat to the global health workforce and because they are eminently preventable.

Table 1. Summary of Hazards Found in the Health Care Sector

Hazard Category	Examples	Health Effects
Physical Agents or physical forms of energy	Radiation, lasers, noise, extreme temperatures, electrical energy	Thermal or chemical burns, hearing loss, cancer, physical and psychological trauma
Chemical Chemical substances that are potentially toxic, including medications, solutions, and gases	Disinfectants, cleaning products and sterilants such as ethylene oxide, formaldehyde, and glutaraldehyde; drugs, waste anesthetic gases; hazardous anticancer drugs	Eye and skin irritation, asthma, allergy, dermatitis, other end-organ damage, cancer, spontaneous abortion and other reproductive effects
Biological Infectious agents, such as bacteria, viruses, fungi, or parasites, which may be transmitted by bloodborne contacts, contaminated body secretions/fluids, needle-stick injuries, or via airborne spread	HIV, hepatitis B and C, influenza, VRE, MRSA; SARS, and MERS	HIV and AIDS, TB, hepatitis, liver cancer, and other diseases
Mechanical/Biomechanical Factors in the work environment that cause or lead to musculoskeletal injuries, strain, or discomfort. Awkward postures, lifting excessive weight, and other factors causing musculoskeletal strains	Lifting and moving patients, tripping/slipping and fall hazards	Musculoskeletal disorders, back and upper extremity injuries, repetitive strain injury
Psychosocial Stressors Stressful work climates, threats of physical violence, work organization, shift work	Unsafe staffing, workplace threats, bullying, physical violence, unsafe unit design	Physical injury, psychological stress

MERS, Middle Eastern respiratory syndrome; MRSA, methicillin-resistant *Staphylococcus Aureus;* SARS, severe acute respiratory syndrome; TB, tuberculosis; VRE, vancomycin-resistant *Enterococcus*

Adapted from NIOSH NORA Health Care and Social Assistance "State of the Sector." 2009 and HealthWise, ILO, 2014.

Biologic Hazards, Airborne, and Bloodborne Pathogen Exposure

Biologic hazards are encountered in all health care settings and include airborne and bloodborne pathogens. Certainly the best-known airborne hazard is tuberculosis (TB), but other agents are also acquired by the airborne route, such as measles and severe acute respiratory syndrome and most recently, Middle East respiratory syndrome. Critical elements of an airborne hazard prevention plan are the early identification and isolation of patients as well as administrative and work practice controls to minimize exposure and disease transmission.[14]

In the long arc of the unfolding of the HIV pandemic, one little-known development has been the unintended effect experienced by health care workers in some settings in southern Africa. Due to the endemicity of HIV infection in these regions, including among health care workers, and the often fatal collusion of TB infection in the already HIV infected, there have been alarmingly high TB infection rates and losses of life among nurses and other health workers.[15]

Often, the typical TB prevention and treatment services afforded HIV patients may not be sought by HIV-infected health workers, due to the stigma they would experience with public knowledge of their HIV condition, which can occur when they line up for TB preventive treatment at the same clinics where they worked, for example. Because of this, the morbidity and mortality among workers was substantial, even as many of the countries in the region were already hobbled by a health worker shortage.

Against this backdrop, in 2011, a new initiative was launched jointly by the WHO, International Labor Organization (ILO), and UNAIDS to protect health workers. Joint WHO-ILO-UNAIDS policy guidelines were issued for improving health worker access to HIV and TB prevention, treatment, care, and support[16] to curb this alarming, preventable loss of life among health workers. This initiative promotes worker education regarding TB exposure risk and urges that prevention and treatment services be provided at points of care, while maintaining the privacy of health workers. Such occupational health services currently are not widely available in these affected areas, but could be provided by building upon some existing clinical and infection control resources.

As well, awareness must be brought to local and regional health ministers that threats to the health care workforce also threaten the viability of health systems with the loss of caregivers to preventable disease and death. Indeed, the WHO identifies the health care workforce as 1 of 6 essential pillars of its health system strengthening initiative.[10]

Bloodborne pathogens, which include viruses capable of causing hepatitis or HIV infections continue to threaten health workers in both high-resource areas and in LMICs.[17] In developing countries, 40% to 65% of hepatitis B (HBV) and C virus (HCV) infections in health care workers were attributed to percutaneous occupational exposure. In industrialized countries, such infections rates are lower, with 8% to 27% of infections for HCV attributable to occupation and around 10% for HBV. These lower rates are due to immunization and post-exposure prophylaxis (PEP). The range of HIV infections related to occupational exposure is estimated at 0.5% to 11%.[18]

The likelihood of infection occurring after a percutaneous exposure has been observed to occur in a specific order with HBV infections (18%-30%) > HCV (1.8%) > HIV infections (0.3%) displaying generally a 10-fold difference in infection likelihood between each of these agents.[18-21]

Health workers are at risk for exposure to bloodborne pathogens while performing routine duties involving the use of "sharps" such as injection needles and from unsafe sharps disposal. The WHO has many resource guides to protect health workers from exposure to bloodborne viruses, the elements of which include: 1) the use of "universal or standard" precautions—a system of work practices and behaviors that minimizes exposure such as prohibition of manual needle recapping after use and safe sharps disposal; 2) availability of hepatitis B immunization for health workers; 3) use of personal protective equipment (PPE) and apparel such as use of gloves; and 4) post-exposure management (including prophylaxis, where appropriate) counseling, and support.[22]

Noninfectious Hazards

Although health threat interventions in LMICs have largely targeted infectious disease risks, the WHO recently has enlarged its focus to include chronic disease prevention. This is in acknowledgment that nearly 80% of noncommunicable disease deaths— 29 million annually—occur in LMICs.[23] Chronic disease includes heart and respiratory disease, cancer, and diabetes. Therefore, widening the focus of attention given to occupational health threats related to the treatment of chronic disease must become a part of a comprehensive safety and health plan for the sector.

Chemical Hazards: The Special Case of Hazardous Drugs

"Exposure to potentially hazardous chemicals is a fact of life for health care workers," according to Stellman in her overview article on chemical hazards in health care.[24] Examples include laboratory reagents and chemicals required in diagnostic or therapeutic procedures. Pharmaceuticals are of increasing concerning, especially the hazardous anticancer chemotherapy drugs, which are highly toxic and require vigilance in their use and handling.

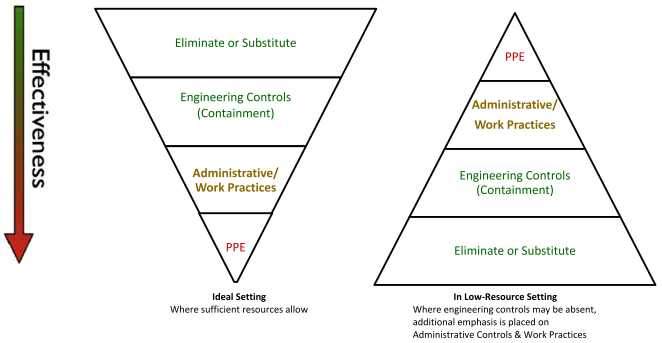

Figure 1. Hierarchy of workplace hazard controls. Abbreviation: PPE, personal protective equipment.

The term *hazardous drug* was first applied to most anticancer and some other limited classes of drugs by the American Society of Health-System Pharmacists[25] and was adopted by the Occupational Safety and Health Administration[26] and the National Institute for Occupational Safety and Health[27] in their publications promoting safe handling practices.

Drugs are classified as hazardous if studies indicate that exposures to them have the potential for causing cancer in animals or humans, or if they cause developmental or reproductive toxicity, or other organ-system damage. Most hazardous drugs are those used to treat cancer but also include HIV therapies and other antiviral agents.[27]

Occupational exposures to hazardous drugs can lead to acute effects such as skin disorders, allergic reactions, and hair loss; and chronic effects, including adverse reproductive events and possibly cancer.[6]

In the Pan American Health Organization (PAHO) monograph, "Safe Handling of Hazardous Chemotherapy Drugs in Low Resource Settings,"[28] a safer approach to handling these highly toxic, but lifesaving drugs is described when resource limitations might mitigate against "state-of-the-art" practices, but the hazard, nonetheless, requires address. Because these drugs require extensive manual manipulation during formulation (compounding) of the patient dose, there is opportunity for worker exposure. A heavy reliance on worker training, PPE use, and scrupulous work practices must be applied to minimize worker exposure. The PAHO document provides a detailed approach to safe handling of hazardous drugs in resource-constrained settings.

Safety Program Response to Health Care Hazards

In its 2004 document "Recommendations for Protecting Healthcare Workers' Health," International Commission on Occupational Health called for a "systematic occupational risk prevention program" for health care workers to include training regarding work risks and the provision of protective measures, as an integral part of an administrative process addressing health care quality.[29]

The basic occupational health approach to minimizing exposure to any workplace hazard uses a combination of protective industrial hygiene control methods that are applied in a specified order or hierarchy. This approach has achieved success across many industrial settings.[30] In most cases, the elements of this hierarchy can be applied to the health care setting (Fig. 1).

The hierarchy of hazard control technologies relies on engineering controls, such as a biological safety cabinet, a glove box, or other type of hazard barrier or containment, as the first technology applied. However, engineering solutions often are the most costly type of hazard control. In resource-limited settings where engineering controls are unaffordable or otherwise not feasible, scrupulous use of work practices that minimize aerosol and dust generation along with administrative controls that limit personnel access to areas where hazards are encountered can minimize exposure.

Figure 1 displays this upside-down hierarchy approach. Importantly, the lack of resources for the more costly elements of a hazard control approach does not relieve the facility from responsibility from applying some of the control measures that are available to make the work setting the most safe it can be, even in the setting of resource constraints.

The hierarchy of hazard control technologies relies first on engineering controls, as just described. For the airborne hazard example of TB, early identification and isolation of potentially infectious patients, in a negative pressure room, is the ideal "engineering" intervention to minimize exposure to airborne mycobacterium. However, in settings where such negative pressure isolation rooms are not available, other administrative and work practice controls of the airborne hazard can be applied, such as placing the infectious patient in a single room away from others. In some locations, a cough-inducing procedure, such as obtaining a sputum specimen, may occur outside, away from other patients.

In situations where "engineered" sharps with safety features are not available, careful work practice controls, such as refraining from manual recapping of needles, can mitigate needle-stick injuries.

For preparation of hazardous, anticancer drugs when the engineering control containment of a biologic safety cabinet is not available, applying a work practice of preparing drugs in low-traffic and clean preparation areas, and controlling personnel access to this area can minimize the number of workers potentially exposed to fugitive drug aerosol, as described in the PAHO document.[28]

Although only 2 hazard types (biologic and chemical) are discussed in detail here, the "hierarchy of hazard control" approach can effectively be employed to limit exposure to other hazard classes and sources of risk to health workers including musculoskeletal risks of patient lifting[31,32] and workplace violence.[33]

CONCLUSION

In both well-resource settings and in LMICs, the health care workforce is threatened daily with harm from exposure to agents encountered in this unique and complex workplace. Even here, however, the classical hierarchy of hazard control technologies can still be effectively applied to mitigate risk. Importantly, the selection of hazard control methods may be reordered in low-resource settings to provide some, albeit not ideal, hazard control. As LMICs enlarge their prevention services beyond infectious disease control, other health care hazards related to chronic disease care, such as cancer will require programmatic address by occupational health staff to protect and retain the vital health workforce, which is a fundamental pillar of all health systems.

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