African Newsletter

ON OCCUPATIONAL HEALTH AND SAFETY

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Editor in Chief
Suvi Lehtinen
E-mail: suvi.lehtinen@ttl.fi

Editor
Marianne Joronen
E-mail: marianne.joronen@ttl.fi

Linguistic Editor
Alice Lehtinen

Layout
Kirjapaino Uusimaa, Studio

The Editorial Board is listed (as of July 2014) on the back page.
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Ebola outbreak control measures in Nigeria at the Murtala Muhammed International Airport, Lagos

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Finnish Institute of Occupational Health

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Editorial

The ILO's primary goal is to promote opportunities for women and men to obtain decent and productive work in conditions of freedom, equity, security and dignity. In this formulation of decent work in the context of ILO action, the protection of workers against work-related sickness, disease and injury, as embodied in the Preamble to the Constitution of the ILO, is an essential element of security and continues to be a high priority for the ILO.

The health and safety of the world's workforce periodically attracts the attention of the national and international media. Industrial disasters, especially those resulting in multiple fatalities, make global headlines. But the reality is that throughout the world, many thousands of people die from their work activities every day, and numerous fatalities are unreported or ignored. Globally, an estimated 2.3 million workers die every year from occupational accidents and work-related diseases. In addition, many millions of workers suffer non-fatal injuries and illnesses.

Over the years, the ILO has multiplied the number of tools and activities in the area of occupational safety and health (OSH) in which it is engaged in order to carry out its mission. The promotion of standards in the field of OSH is thus a fundamental task, and an indispensable complement to the process of developing them.

At the First Session of the International Labour Conference in 1919, the ILO adopted the White Phosphorous Recommendation 1919 (No. 6). This instrument invited ILO member States to ratify the Berne Convention of 1906. This is one of the earliest international conventions on occupational safety and health and it was aimed at banning the use of white phosphorous. Since the mid-nineteenth century white phosphorous was widely used in the match-making industry, however it caused matchmakers – mostly children – to contract the dreaded, disfiguring "phossy jaw".

What compounded the tragedies caused by this occupational hazard was that they were avoidable. Another non-hazardous form of phosphorus, red phosphorus, worked just as well for making matches. However, the abundance of cheap labour and the absence of industrial health regulations made a shift in production patterns slow. It took legal compulsion, along with international action, to eventually eliminate the problem. This example illustrates the issues that are still today at the heart of ILO work and of the decent work paradigm in terms of worker protection, economic constraints and the role of regulatory mechanisms in maintaining compliance with ethical principles, rights and obligations.

Since the turn of the twentieth century when the first legal relationships between exposure to hazards and the world of work were being established, OSH has grown into a multifaceted discipline. This discipline has implications not only for human lives, enterprise development and national efforts to increase productivity and alleviate poverty, but also for the human environment. It is also recognized today as an essential component in the global efforts to develop production and consumption patterns which are sustainable and which respect the global environment in the face of increasing demographic pressures.

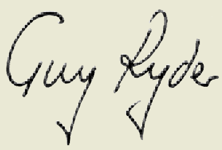
Taking this into account, and to further reinforce the work undertaken by the Labour Administration, Labour Inspection and Occupational Safety and Health Branch (LABADMIN/OSH), the ILOs focal point for OSH, I am pleased to announce that one of the new five ILO "flagship programmes" will be focussed to tackle the challenges in this field. The flagship programme "OSH Global Action for Prevention" is built on numerous ILO instruments in the field of OSH and responds to an urgent need to step up action in this area of work at country level. Complementing the work of LABADMIN/OSH, the flagship programme will design and deliver country-specific strategic interventions to:

- improve national regulatory frameworks on OSH and strengthen capacity to develop and implement compliance strategies and inspection practices;
- enhance national institutional capacities to acquire and use OSH knowledge and information to develop effective prevention policies, strategies, systems and programmes;
- encourage and facilitate consultation, collaboration and cooperation in OSH between governments, employers and workers through effective dialogue;
- strengthen national employment injury compensation legislation and administrations to interact with OSH systems and programmes through integrated functions, where appropriate, and economic incentives for investment in prevention and compliance.

The programme will respond to multiple challenges in a structured and integrated manner making use of the ILO's multidisciplinary expertise, working at the global, regional and national levels, building on existing initiatives and networks and bringing together the key stakeholders in an inclusive approach to improve the working conditions of workers, as well as promoting a preventative safety culture for all.

I would also like to take this opportunity to thank the government of Finland for its continued support to the ILO efforts in the field of OSH, including support to this flagship programme. Being a global leader in the field of OSH, Finland's continued support is highly valued and greatly appreciated by the ILO.

Hence, I welcome you to join the ILO in taking action to building a worldwide culture of prevention, a world that has zero tolerance for work-related hazards that result in injuries, disease and death.



Mr. Guy Ryder, Director-General
International Labour Organization

Marie-Paule Kieny
WHO

Governance and leadership at the heart of preventing health emergencies

In a world where people, goods and information are constantly on the move, infectious disease outbreaks in one country can easily become terrifying global threats. However, health emergencies due to infectious disease outbreaks are not inevitable events. The recipe for epidemic or pandemic prevention, nationally and globally, is a mix of ingredients we know well and have promoted for many years. These include surveillance and response capacity in all countries, effective health systems, and the ability to identify potential problems and solutions to stimulate the necessary research and development. However, there are two elements the global community has often left out of some of the conversation – governance and leadership. In addition, collaboration between countries, both at regional and global levels, must be strengthened.

In the 2014–2015 Ebola outbreak in West Africa we saw the culmination of a situation that had long been incubating. The catalyst happened to be Ebola, a fierce virus that engenders great anxiety and which, until now, was unknown to the populations of West Africa. But the conditions of the health sector in the three stricken countries, and the lack of an efficient regional and global alert and response mechanism, meant that any other disease epidemic would have wreaked similar panic and tragedy. The fact that these systems were extremely fragile not only caused thousands of avoidable deaths, but also made it difficult for international teams to assess the extent of the epidemic and intervene in a timely way to stop it from spiralling out of control.

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Vaccination campaign against yellow fever in villages.
A woman receives the shot.

In order to have functioning health systems in place, including surveillance and response capacity, and the ability to identify imminent outbreaks and potential solutions, governments must have legitimacy with their populations and the leadership capacity to mobilize health staff, resources and communities towards the resolution of a common problem. However, when the outbreak started in West Africa, the limited public health services available were already struggling to deal with routine health conditions, let alone have the capacity to address a vicious virus.

For many years the populations of Guinea, Liberia and Sierra Leone have relied on themselves to look after their health problems – either by going to traditional healers or, for those who could afford it, by turning to the private sector, where healthcare is more available but paid for out of pocket. Years of war, but also subsequent neglect of the health sector, had already corroded people's confidence in the system and driven them away from the hospitals and health facilities. Even the medical profession itself had abandoned ship for better futures abroad. And those few who remained worked in dire conditions and were rarely remunerated.

Professor Cheikh Ibrahima Niang, a Senegalese socio-anthropologist who has assisted WHO in understanding the behaviour and attitudes of communities in West Africa, argues that trust and confidence are the strategic tools for ending the epidemic and rebuilding the countries. To achieve that, governments, which are best placed to understand their populations' needs and reactions, must take leadership and initiate open and fruitful dialogue with their communities in order to regain their trust and the legitimacy to finally close the Ebola chapter and enact effective reforms.

The Ebola outbreak placed an unconscionable burden on the already fragile health systems of Guinea, Liberia and Sierra Leone, but also on their economies and on the very fibre of social life, reversing small but hard-earned development achievements of recent years. What Ebola has shown most of all is that a top-down approach is not the optimal way to go. Even now, after more than a year of efforts, we see that many people in West Africa are still resisting medical help and are hiding infected loved ones, opening the door to more transmissions. In the words of Professor Niang, "Many of these people may be illiterate, but they are not stupid. They do not want to be passive recipients, they want to be actors in their own response to the crisis." Ending the Ebola epidemic, reconstructing the health systems and preventing another such crisis from occurring will demand an ownership on the part of communities and a gradual improvement in the governance of the health sector.

But good governance is not just the duty of the Ebola stricken countries. Because of increased connectedness between states, ensuring that all national health systems are adequate and prepared for health crises is an international concern, and not just the concern of low-resourced countries. The international community has an interest in directing funds and development assistance where they will have a lasting effect. The challenge for global health now – beyond Ebola – is to ensure that international health aid and strategies work to achieve sustainable health systems, equitable access to health products and services and collaborative approaches to epidemic prevention, including R&D into diseases for which no modern line of defence exists. In parallel, countries needing to reform or strengthen their systems must invest in the task financially and through effective reform, including by establishing a well trained and remunerated health workforce, functioning health infrastructure, social security schemes and processes to ensure that populations have a stake in their health system, and a say in the health decision-making process.

Dr Marie-Paule Kieny
Assistant Director-General
Health Systems and Innovation
World Health Organization

Mary H Ross
South Africa

Guidance to workplaces and occupational health professionals in prevention of occupational infections

Introduction

Any infectious agent affecting humans can potentially cause an occupational infection. Thus, the range of these infections covers the spectrum of organisms, while the span of affected occupations continuously increases as infections are recognized as being work-related (1). Infectious diseases traverse boundaries between public health, clinical medicine, travel medicine and occupational health. Although work-related infectious diseases involve a wide variety of infectious agents across various occupational groups, it is difficult to determine either the morbidity or mortality from occupationally-acquired infections per se; the diseases often occur in the community and any association with exposure in the workplace is not always recognized (2,3). It is, however, estimated that globally, over 300 000 employees die from work-related infectious disease (2). In their comprehensive review of the 13 million new cases of cancer that occurred globally in 2008, de Martel and colleagues estimated that approximately 2 million or 15% were caused initially by viral infections, bacteria, or parasites with as much as 30% attributable to infections in the less-developed areas (4).

Infectious diseases are of international concern in the workplace. The International Commission on Occupational Health (ICOH) established a Working Group on Occupational Infectious Agents (WGOIA) which is mandated to advise and to assist ICOH to identify the most important issues and to gather or develop relevant material for occupational health professionals. The goal is to provide practical guidance on health surveillance and reporting of infectious diseases in the workplace, risk assessment and prevention, and assessment of fitness to work (1). The WGOIA has explored networks for sharing information that its members have reviewed and developed. In addition, the World Health Assembly has identified the workplace as well-suited to prevention and control of global health threats, such as tuberculosis, HIV/AIDS, malaria and avian influenza (5).

Despite miners' 'consumption' (silicotuberculosis) being one of the earliest documented occupational diseases, occupational infections have been under-recognized, under-reported and under-researched (1). However, the advent of the HIV epidemic, particularly in Southern Africa, has created a resurgence of interest in and research on occupational infections from healthcare workers to itinerant professional drivers and migrant miners, who are exposed through working-related lifestyle. Co-existing HIV and silicosis in miners increases multiplicatively the risk of developing tuberculosis and, before the advent of antiretroviral treatment, led to incidence rates of tuberculosis in South African gold miners of over 5% per annum (6). Likewise, pandemics of SARS, avian influenza and H1N1 influenza pre-

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Medical visit; influenza illustration in South Africa.

cipitated a response from the occupational health fraternity, not only in relation to healthcare workers, but also among employers who clamoured for policies and procedures to protect and manage infection in the workplace.

The role of occupational health professionals

Occupational health professionals (OHPs) are consulted by workers and management regarding actual and potential infections, be these occupational or community-acquired. Nevertheless, it appears that occupational infections that are legally notifiable are more likely to be diagnosed and notified by primary care providers than OHPs (2). Once recognized, unlike most other occupational diseases that have a long latency period from exposure to manifestation and are non-communicable, infectious diseases tend to create a higher level of concern and more urgent response in terms of both management and prevention. The recent devastating Ebola epidemic in Africa epitomizes the overlap between workplace and public health as well as the effects of cross-border transmission on occupational infections and the far-reaching impact of both a community and workplace-acquired infection. In discussing international health assistance, Gostin emphasized that, 'most funding is driven by emotional, high-visibility events; diseases that capture the public's imagination such as the human immunodeficiency virus and AIDS; or diseases with the potential for rapid global transmission such as haemorrhagic fever, severe acute respiratory syndrome, or pandemic influenza' (7). In their excellent review of globalization and infectious diseases, Saker et al. provide guidance on the influence of globalization on the spread, control and prevention of infections in both industrialized and developing countries; they highlight that the acute and epidemic infections receive a disproportionate focus in the workplace from management and the occupational health professionals (8).

While the running of occupational health services may not be influenced as much as other health care services, we are in the age of intense media coverage that certainly focuses both employer and worker attention on high-visibility infections, potentially at the expense of actual priority infections in the workplace. The prevention and management of many infectious diseases in the workplace are dependent on well-functioning health services that, among other activities, promote herd immunity against a variety of vaccine-preventable diseases, and prevent water-borne and vector-borne infections. Workplace health professionals can play an important role in preventing infectious diseases for groups that may not consult other preventive health care, such as healthy adult males, through targeted immunization, health promotion, peer-education and screening and treatment programmes. Disease programmes of public health importance, such as for tuberculosis and HIV, need to be synergistic with the local health services.

Since only a small proportion of workers have direct access to OHPs in the larger formal industries (5), there is a great need for recognition of occupational infections by primary health care providers. Thus, there is an important role for awareness through education and training by OHPs through their national societies and in training institutions.

It is vital for occupational health practitioners to become familiar with relevant infectious diseases in the industries and geographical areas they serve and, in particular, with those infections that can be prevented by effective environmental or medical interventions, such as vector and water management, or immunization and chemoprophylaxis (1). It is also important for OHPs to remain updated on infectious diseases of relevance to their worker demography and exposure since advances in fields such as screening, vaccines, and both preventive and curative medication are ongoing. Thus identification of accessible international and national resources and support of local innovation are vital to maximizing preventive interventions.

Stakeholder involvement cannot be overemphasized. Saker et al. state that it 'needs to be understood that resources committed to infectious disease prevention, treatment and control is a worthwhile investment' (8). The role of OHPs is not only to inform, counsel and protect employees, but also to involve management in the risk assessment and formulation of solutions. With the competing priorities in the workplace, the economic and humanitarian case for prevention and treatment may be required for funding from the employer. OHPs should assist the employer in formulating workplace policies and programmes for priority infections, such as HIV and tuberculosis in high burden countries.

Prioritizing infections in the workplace

The initial requirement for the OHP is to prioritize, using public health principles, the infectious agents in any particular workplace, focussing on conditions that are important and preventable. These should include, whenever feasible, work-related infections plus community infections that may affect health and productivity. There are numerous variables such as: the exposures specific to the processes; the pathogenicity of the infectious agent; the demography and susceptibility of the workforce, including gender; personal and occupational hygiene; endemicity of infections according to the geography and other environmental conditions; available cost-effective interventions; and local resources and preventive programmes.

There are excellent resources available in 'open' journal articles that categorize the most important occupational infections by organism, industry and occupation, primary source and the route of infection. (2,3,9) These generic resources should be supplemented by targeted literature review, personal experience and medical surveillance in the workplace plus consultation with local stakeholders, such as state health services and clinical microbiologists who have an understanding of the workplace exposures and activities. Although the literature indicates that occupational infections mainly affect healthcare workers, those with animal contact, and laboratory and waste workers (2), infections of occupational origin may occur in many other occupations, often not widely recognized. For example, the incidence of skin infections from herpes gladiatorum is quoted as being as high as 40% in wrestlers from skin-to-skin contact in the 'lock-up position'(10), while professional drivers who pass through polluted industrial areas with their windows open may be at increased risk of contracting legionellosis (11).

Once the potential infections have been identified, the next step is to investigate the intervention options with an emphasis on primary prevention. Again, there are many readily available generic and disease-specific resources, such as the websites of the World Health Organization (www.who.int) and the Centers for Disease Control and Prevention (www.cdc.gov and www.cdc.gov/niosh) which are frequently updated.

Uptake of preventive care by the workers and their families or community may require additional health promotion activities and interdisciplinary collaboration is important inside and outside the workplace. The Faculty of Occupational Medicine in the United Kingdom has a valuable model for promoting stakeholder awareness by producing specific material on each topic such as pandemic influenza for employers, workers and health professionals (www.fom.ac.uk). Material designed elsewhere for specific targets, such as for health care workers in industrialized countries, may require adaptation, and for this OHPs need to harness the local expertise to produce suitable material and appropriate programmes.

Prevention and management of work-related infections

In 2007, the World Health Assembly stated that 'primary prevention of occupational health hazards should be given priority' and that 'protecting health at the workplace requires enacting regulations and adopting a basic set of occupational health standards to make certain that all workplaces comply with minimum requirements for health protection (5). National legislation and surveillance systems, where they exist, provide guidance to OHPs in relation to notification, compensation and prevention of occupational infections and the implementation of obligatory programmes. These requirements can be the basis for OHPs developing cost-effective interventions tailored for a specific workplace.

Primary prevention interrupts the spread of micro-organisms to susceptible human hosts and comprises a variety of possible interventions that are implemented concurrently rather than in a hierarchy of control (8, 12):

- Basic public health activities e.g. provision of clean water, sanitation
- Environmental intervention e.g. eliminate vectors or intermediate hosts
- Barriers reducing exposure e.g. window screens, bed nets
- Promotion of healthy personal behaviour e.g. cough etiquette, insect repellents
- Some forms of chemoprophylaxis e.g. anti-malarial medication
- Immunization of susceptible persons
- Screening for undiagnosed infections e.g. respiratory questionnaire for TB
- Isolating infectious workers if the disease is spread from person-to-person.

Of all interventions, immunization is likely to be the most effective. Unfortunately, the expense may render all recommended protection unattainable, particularly in small and medium-sized workplaces. However, regulations and workplace standards may require workers to be offered testing and immunization against potential occupational infections such as hepatitis A and B, rabies, tetanus and yellow fever, depending on the risk of exposure and the consequences of the infection. An invaluable resource for OHPs with regard to immunizations is the annually updated list of recommendations for adult immunization from the Centers for Diseases Control and Prevention (13). OHPs should consider immunization programmes related to the relevant risk, the feasibility, the availability and cost of the vaccine, and the likely uptake.

Infectious diseases are the only occupational diseases that can be transmitted from one worker to another. Thus, unlike many other occupational or work-related diseases, treatment of infected individuals, or so-called secondary prevention for the affected individual, can also serve as effective primary prevention for others by breaking the transmission cycle.

The ECHO (Extension for Community Healthcare Outcomes) model for treating and thus reducing transmission of hepatitis C in underserved areas and prisons in New Mexico provides an excellent prototype for any workplace programme (14). The objective of the ECHO model is to expand the capacity to provide best-practice care in underserved areas, monitor outcomes and set up a knowledge network. Arora and colleagues created a protocol for treating chronic hepatitis C infection for everyone to use with standardized care supported by video conferencing and training of primary physicians and nurses on HCV infection. Within the prisons, 40% of prisoners were infected and a prisoner-teaching-prisoner education programme was established to complement the treatment programme (14). A similar model is already being used in South African workplaces which have established HIV Counselling and Testing (HCT) programmes in which OHPs collaborate with trained peer educators to involve the workforce, families and communities to increase testing and treatment for HIV.

There are initiatives to investigate the burden of occupational infectious diseases to define and then address the problem. It is reported from South Korea that occupational disease resulting from bioaerosols has become the third most common occupational disease reported after pneumoconiosis and hearing loss (15). A review of over 1000 compensated cases of occupational infections in South Korea indicated that forestry workers followed by health care workers were most frequently affected with over 50% of cases caused by Scrub typhus (16). The study highlighted the need for both surveillance systems and preventive measures in the workplace (16). Saker et al. maintain that infectious diseases present a considerably higher burden in low-income than high-income countries and that there is a 'need to develop surveillance systems that can be used effectively in low-tech developing world contexts' (8). OHPs in industry, academia and government should lead the development of such systems and developing innovative solutions.

Conclusion and future action in prevention of occupational infections

Occupational health professionals can contribute significantly to the prevention of occupational infections through risk assessment, prioritization of infections, and implementing appropriate programmes for surveillance and prevention in the workplace. However, while this is feasible in formal worksites, only an estimated 10–5% of workers have access to occupational health services (5, 12). Since 'workers represent half the world's population and the growing informal economy often involves such vulnerable groups as children, pregnant women, older persons and migrant workers', the World Health Assembly urges member states to include 'those in the informal economy, small- and medium-sized enterprises, agriculture, and migrant and contractual workers' and also promotes the inclusion of 'workers' health in the training of primary health care practitioners' (5).

In Africa, the focus for OHPs beyond the workplace should be collaboration with public health care professionals to promote prevention, recognition and management of occupational infectious diseases, and their ongoing knowledge update through reliable websites and journals; internet access has become a sine qua non.

Mary H. Ross
Honorary Professor,
School of Public Health,
University of the Witwatersrand,
Johannesburg, South Africa
Chair of Working Group on
Occupational Infectious Agents,
International Commission
on Occupational Health

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Dingani Moyo
Zimbabwe

The workplace as an arena for raising awareness of infectious diseases

Occupational or work-related infectious diseases account for an estimated 320 000 deaths of employees annually around the world (1). Moreover, lost productivity due to sickness absenteeism caused by infectious diseases is a major concern for workplace dynamics. It is important to note that the increased risk of infectious diseases tends to be concentrated in specific occupations: health care workers, workers in contact with animals, laboratory workers and refuse workers are at the highest risk of infection from a variety of organisms (1, 2, 3). It is thus prudent to set up robust preventive strategies to curb the risk of occupational or work-related infections within the workplace. The most fundamental step in any preventive programme is to raise awareness of the risks at stake. Since most control programmes are dependent on an individual's behaviour, organizational culture plays a pivotal role in raising awareness of infectious diseases at the workplace.

Occupational infections are human diseases caused by work-related exposure to microbial agents, which range from toxins to allergens that may be harmful to health (1, 3, 4, 5). Exposure to occupational infections may be the result of intentional use of certain organisms, especially in the laboratory, or to accidents in, for example, health care settings or animal handling. The prevention of occupational infections in the health care setting is of considerable public health importance (2).

In the health care sector, the main blood borne infectious diseases are HIV, Hepatitis B and Hepatitis C (2, 3). Very few occupations and work tasks have the potential to transmit HIV to a worker, but the main occupations with such a risk include sex workers and healthcare workers (6).

In most health care workplaces, there has always been an emphasis on the prevention of needle stick injuries through the safe use and disposal of sharps (3, 7, 8). In addition, the Post-exposure prevention of the spread of HIV and Hepatitis B has been strongly advocated in most settings.

However, although it is not extensively recognized, it would be critical that preventive measures begin with organizational cultural transformation. Organizational cultural transformation is a pivotal stage in the creation of strong initiatives developed to manage workplace infections, blood borne infections in particular. It is thus important to address organizational culture well ahead of all other relevant instruments such as policies, health promotional activities, health and safety slogans, and protective personal equipment.

Corporate culture is one of the main drivers of employee commitment and engagement (9). Hence, in any occupational safety and health management system, commitment to workplace programmes will depend on the prevailing organizational cultural climate. Organizational culture relates to the basic pattern of shared assumptions, values and beliefs that govern the way employees within an organization think about and act on problems and opportunities (9). It defines what is important or unimportant in an organization. Reason, J (1997) defines culture as the shared values (what is important) and beliefs (how things work) that interact with an organization's structures and control systems to produce behavioural norms ('the way we do things around here') (10). Creating val-

The increased risk of infectious diseases tends to be concentrated in specific occupations: health care workers, workers in contact with animals, laboratory workers and refuse workers are at the highest risk of infection.

ue and commitment to workplace programmes targeted at the prevention of workplace infections will largely depend on culture transformation.

In order to put this into perspective, it is important to understand the elements of organizational culture. Assumptions, values and beliefs that represent the organizational culture are not obviously visible or directly observed, as they operate below the surface of organizational behaviour (9). These elements guide individual decisions and behaviour at the workplace. In a workplace situation, an organizational culture is seen indirectly through artefacts. Von Glinnow and McShane (2005) describe artefacts as the observable symbols and signs of an organization's culture (11). These include physical structures, language, rituals, ceremonies, stories and legends.

In the health care sector, the prevention of blood borne infections includes care in the use of sharp instruments; the use of gloves for surgical, obstetric and dental procedures and phlebotomy; the safe disposal of sharp instruments in well-designed containers; and paying attention to safe work systems, especially during the performance of exposure-prone procedures (8). Health promotion activities usually take place in the context of wellness programmes or villages of learning, in a quest to raise awareness among employees. These are good activities that normally result in some improvement in occupational health and safety (OH&S) performance. The dilemma is usually the result of the dependence of these strategies on individual behaviour, which more often than not is amenable to short cuts and memory loss, and dependent on an individual's personality and behavioural characteristics.

The fundamental approach to the prevention of occupational infections lies in moving on from the traditional approach to occupational health and safety. Simple, religious adherence to the above mentioned strategies, even in the strictest of terms, is a futile exercise in preventing workplace infections if the health and safety culture has not been transformed. An organization's cultural transformation is the starting point that guides an organization's OH&S management system to the greater echelons of organizational effectiveness in the prevention of workplace infections. Stone (2002) asserts that without a culture that values the well-being of everyone in the workplace and believes that illnesses can be prevented, people will continue to be ill, injured and killed. (12)

Thus the prevention of occupational infections in any workplace setting first starts with a cultural transformation in health and safety issues in the organization. This transformation should focus on the integral elements of culture, i.e. assumptions, values and beliefs. In this regard, it has to start by aligning the assumptions, values and beliefs with the organization's preferred OH&S management system. Through values, an atmosphere in which the behaviours and perceptions of preventive approaches to workplace infections are in line with the preferred system can be created. Once the shared mental models that guide the ideal health and safety behaviours have been created, and common health and safety values have been cultivated, it becomes easy to implement all the other routine preventive strategies in the organization. Creation of the right beliefs in the importance and management strategies of occupational infections ensures that the employees operate on the same plane as regards preventive strategies. A transformed health and safety culture will manifest itself through different aspects, as next described.

Improvement in physical structures will show in the standard of housekeeping and maintenance of equipment at the workplace; for example, in a health care facility, proper sharps disposal, and adherence to policy and standard operating procedures. A transformed culture will also show through in the organization's safety language and slogans that illustrate its culture. Rituals manifest themselves in the way in which workers induct new employees on safety issues in the organization, management's commitment to health and safety issues as evidenced by planned task observations at the workplace, routine walk-through assessments and various other planned health and safety activities that are meant to prevent infections at the workplace.

Following the cultural transformation phase, the focus should turn to the routine hierarchy of controls. In the health care sector this would include the following areas, as referred to by Palmer, Brown and Hobson (2013) (6): the adherence to standard precautions, the hierarchy of controls, regular and effective training in safe work systems, and the reduction of invasive techniques.

In summary, the key to safe and healthy workplaces is a cultural transformation in OH&S management systems. This begins by transforming values, beliefs and assumptions, so that individual behaviour is in line with the organization's desired, envisaged and preferred OH&S management system. After this, the adoption of the hierarchy of controls becomes a reality, which will bear long-lasting fruit.

Dr Dingani Moyo
Baines Occupational and Travel Medicine Centre
27 Baines Avenue, Dutton Court
Box 1008
Harare, Zimbabwe
moyod@iwayafrica.co.zw and
bainesoccmed@gmail.com

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Angela Dramowski, Lucille Blumberg, Jacqueline Weyer
South Africa

Protecting frontline health care workers: practical Ebola virus disease prevention and control

Outbreaks of infection due to the African viral haemorrhagic fever (VHF) viruses are frequently recognized and diagnosed too late due to their occurrence in remote geographical areas, non-specific signs, symptoms that may mimic those of many common tropical infections, poor accessibility of definitive diagnostic tests and under-resourced health facilities. Poor infection control practices also make health workers particularly vulnerable to infection. There is a broad differential diagnosis of acute febrile illnesses in Africa, many of which are clinically indistinguishable. However, a cluster of health workers in Africa with unexplained acute febrile illness and high mortality is often what is required to trigger consideration of a VHF as a possible cause of disease.

Since the first Ebola virus disease (EVD) outbreaks reported in 1974 in the Democratic Republic of Congo and Sudan, about 20 outbreaks of the disease have occurred in equatorial Africa (1). Evidence for the maintenance of Ebola viruses in specific species of arboreal bats are mounting, but the full picture of the ecology of the virus and the exact mechanisms of the spillover into animal and human populations are not fully understood (2–4). The role of bushmeat in the initial exposures of index patients in EVD outbreaks has been implied on various occasions (examples 5–6). Once the virus has spilled over to humans, outbreaks are perpetuated by direct contact with infected bodily fluids, secreta and excreta. This mode of transmission predisposes health care workers (HCWs), relatives and friends caring for the sick (7–9). Burial ceremonies have also been recognized as a major transmission risk factor (7–9).

Since December 2013, the largest EVD outbreak to date has resulted in 24 782 cases in Guinea, Liberia and Sierre Leone, and 10 311 deaths as of 25 March 2015 (8). Ebola has been diagnosed in 852 HCWs to date, with 492 deaths reported (CFR: 58%). The CFR among HCWs ranged from 48 to 73%, the highest being reported in Sierra Leone. (10)

This article will look at some practical guidelines for protecting front-line health workers from infection by the haemorrhagic fever-causing viruses, and will focus more specifically on EVD.

Ebola outbreak control measures in Nigeria.

Nosocomial transmission of the Ebola virus

Many outbreaks of EVD have been centred in hospitals, due to poor infection control procedures, lack of required equipment (including personal protective equipment), but also due to the close contact of HCWs with their patients (8). Nosocomial transmission may occur through contact with the bodily fluids (e.g. blood, urine, vomitus, faeces) of an Ebola virus-infected person. The mechanisms of direct transmission include bodily fluid splashes to the HCWs mucous membranes or non-intact skin, accidental cuts, and needle-stick injuries. Indirect transmission can occur through contact with a contaminated object; for example, medical devices, protective equipment or environmental surfaces, with subsequent inoculation of the HCWs mucous membranes (through touching) (11).

Risk of Ebola virus transmission to HCWs

The risk of transmission to HCWs is high when the possibility of an EVD or VHF diagnosis is not considered. Failure to follow standard infection control precautions (12) and the recommended procedures for the use of personal protective equipment (PPE) (13) also places HCWs at high risk. Clinical scenarios with a very high risk of transmission include close contact with critically ill EVD patients or corpses (owing to high viral loads) and cleaning of contaminated equipment, surfaces and blood/body fluid spills.

Health care facilities and Ebola (VHF) preparedness

It is critical that all health care facilities have written plans for the management of potential or confirmed EVD cases and other VHF. All front-line staff (particularly in hospital emergency departments and clinic triage areas) should undergo 'VHF preparedness' training. As highlighted in the current EVD outbreak, transmission to personnel can occur anywhere, even in well-resourced facilities if they are unprepared. Several comprehensive checklists are available to guide health care managers and infection control personnel through the process of institutional VHF preparedness (14).

Identification and triage of suspected Ebola cases

To reduce their risk of infection, all HCWs should routinely apply standard infection control precautions in all circumstances (12). These precautions (including hand hygiene, protective equipment usage and sharps safety) are actions that reduce the chance of infection transmission from both known and unknown, unrecognized sources of infection. In addition, health care facilities should implement patient screening at presentation (15) (using a standard case definition). This approach will rapidly identify patients at risk of EVD who should be immediately removed (triaged) from waiting areas to a separate isolation room. Contact with suspected EVD cases should be restricted to essential, trained staff only, to reduce the number of workers exposed. If EVD is suspected on the basis of history, healthcare workers examining and obtaining laboratory specimens from the patient should use full PPE [Table 1] (13). The PPE recommendations for EVD will vary depending on the organization or institution, and on which items are available at any particular time. The most important principle is that the PPE used should cover all of the HCWs mucous membranes and skin. Special care and a formal sequence of PPE removal are followed to avoid contamination of the worker with blood and/or body fluids. The putting on (donning of PPE) and removing (doffing of PPE) procedures should be supervised by a trained HCW. This person, known as a 'PPE buddy', helps with the dressing procedure to ensure that there is maximum skin coverage (preferably with no skin left exposed) and that all PPE has been correctly fitted.

Table 1. Recommended personal protective equipment (PPE) for Ebola. Adapted from Dramowski and Mehtar, 2014 (16).

Equipment	Recommendation
Head and neck cover	The purpose of head covers is to protect the skin and hair from contamination by virus and possible subsequent unrecognized transmission to mucosal surfaces. A head cover that also protects the neck and sides of the face is preferred. Hair/hair extensions should fit inside the head cover.
Eye cover	Any eye cover that adequately protects the conjunctival mucous membranes from splashes is acceptable e.g. goggles or face shields (visors). Normal reading glasses are not acceptable, as fluid splashes can still reach the wearer's eyes.
Mouth and nose cover	A surgical mask or N95 respirator is acceptable. The WHO recommends a structured mask, e.g. a cup-shape or duckbill (so-called 'face-off' mask) and face-shield.
Body cover	Cool, comfortable 'underclothes' should be worn under a waterproof (fluid-resistant) disposable gown or coverall. The type of body cover used will depend on local policy and availability, although gowns are cooler and easier to remove than coveralls. Gowns should be long enough to cover the top of the worker's boots.
Aprons	Aprons must be worn over gowns/coveralls to reduce contamination levels of the PPE by blood and body fluids. Thin plastic aprons are disposable, whereas heavy duty, thick plastic aprons may be reused if safe disinfection is ensured.
Foot cover	Ideally the HCW should wear correctly sized gumboots. Boots are preferred over closed shoes with shoe covers, because they are easier to disinfect, non-slip and provide protection from sharps injuries.
Hand covers	Two layers (double gloving) of correctly sized non-sterile latex or nitrile gloves should be worn. If damaged, torn or heavily contaminated during use, the gloves should be replaced and a new pair of (outer layer) gloves should be used for each patient. Alcohol hand rub should be applied to the inner gloves before putting on a new pair of outer gloves. For environmental cleaning or waste management, heavy-duty rubber gloves should be used.

Infection control precautions for EVD

The infection control precautions recommended for the management of EVD and other VHF are provided in Table 2. In addition to standard precautions, contact precautions are recommended for EVD, as virus can be transferred to a HCW's mucous membranes by a coughing or vomiting patient. Unlike tuberculosis, Ebola virus is not spread through the airborne route. For this reason airborne precautions and negative pressure ventilation are generally not required (except when performing aerosol-generating procedures, e.g. intubation, bronchoscopy).

Risk reduction for HCWs managing EVD patients

Any observations that require invasive procedures, for example, blood glucose estimation, could potentially result in needle-stick injury to HCWs (with inoculation of the virus). For this reason, all invasive procedures should be carefully considered and limited to absolutely essential investigations and procedures only. Phlebotomy and medical procedures should be conducted with adequate staff, good lighting, and sharps containers within arm's reach, and preferably with the use of safety-engineered devices. In the countries worst affected by EVD, there are no facilities to provide intensive care. In addition, there is an extremely high risk of Ebola virus transmission to HCWs during resuscitation attempts. For both these reasons, active attempts at patient resuscitation are not widely supported. In well-resourced settings, with ability to provide intensive care, resuscitation may be considered.

Hand hygiene reduces transmission risk

Effective hand hygiene is an extremely important way to reduce transmission risk (18). By washing hands after all contact with patients, the patient environment, medical items/equipment and personal protective equipment (using the WHO 5 moments for hand hygiene indications), HCWs reduce the risk of introducing the virus to their mucous membranes. Routine hand washing with ordinary soap or antimicrobial soap and water should be performed for at least 40–60 seconds when hands are visibly dirty or contaminated with blood and/or body fluids. Alternatively alcohol-based hand rub can be used if hands are not visibly soiled, ensuring that hands remain wet for at least 15 seconds and are then allowed to dry completely (20–30 seconds altogether). Chlorine has not been shown to be as effective as hand washing with soap and water or alcohol hand rub, as it needs a longer skin contact time to be effective. Importantly repeated washing with chlorine (0.05%) can irritate and/or damage the skin, which may increase the chance of Ebola virus entering the body through broken skin. However, chlorine (at a concentration of 0.5%) is very useful for disinfecting contaminated surfaces (at least daily) and equipment, and guidelines for preparation of solutions are available (11).

Table 2. Recommended isolation precautions for EVD. Adapted from Dramowski and Mehtar, 2014 (16).

Precaution	Recommendation
Standard precautions	For all patients at all times.
Contact precautions	Gloves and meticulous hand hygiene is needed as virus can be acquired by direct contact with blood and/or bodily fluids or indirect contact with virus-contaminated surfaces, items or equipment.
Droplet precautions	Virus (in respiratory droplets) can be generated by forceful coughing or vomiting and may gain entry via HCWs' mucous membranes or contaminate nearby surfaces resulting in indirect transmission.
Risk-prone procedures	Personal protective equipment should be worn whenever touching the patient/ blood/body fluids/contaminated items/equipment. Very high-risk procedures would include insertion/suctioning of endotracheal tubes, nasogastric tubes and surgical procedures. For aerosol generating procedures e.g. intubation/suctioning, airborne precautions are advised.
Patient placement	Ideally single rooms with en-suite bathroom/toilet are required, but in an outbreak setting, cohort isolation is used (where two or more patients with confirmed Ebola virus disease are placed together in a single room/area). For suspected (but as yet unconfirmed Ebola cases) the same precautions apply, but these patients should be cohorted in a separate location to patients with confirmed disease. Ideally, isolation areas should be access-controlled, with a security officer recording the names of HCWs and the times they entered the isolation area.
Patient Care Considerations	Keep all procedures (phlebotomy etc.) to an absolute minimum required for care. Handle contaminated needles and sharps with extreme caution, and dispose all types of contaminated sharps in a puncture-proof, sealed container located at the point of care.
Equipment and Personal Protective Equipment (PPE)	All entry to Ebola patient care areas must be restricted to trained staff wearing full PPE. When assessing potential Ebola suspect patients, precautions should be applied when within one metre (three feet) of a patient, including, as an absolute minimum: alcohol hand rub, non-sterile gloves, disposable aprons, waterproof masks/ respirators and eye protection. All disposable PPE items, whether visibly contaminated or not, should be discarded immediately after removal. Do not be tempted to 'save' or 'recycle' single-use (disposable) items.
Patient equipment	Dedicated items/equipment or adequate cleaning with appropriate disinfection of shared equipment.
Medical (clinical) waste	Put in clinical (infectious) waste box and label as biohazardous waste. Follow accepted methods of waste disposal (see WHO recommendations). (17)
Ventilation	No special requirements.
Environmental cleaning	Thorough cleaning of all surfaces (worktops, trolleys, matresses) should be performed with chlorine 0.5% at least daily, with full PPE worn by staff.
Discontinue precautions	Only once the patient is discharged.

Dealing with blood and body fluid spills

The spillage should be covered with paper towels or an absorbent cloth. The spill can be cleaned up using domestic gloves. Glass and solids should be removed using a brush and pan, and discarded in a sharps container, or if too large, wrapped in newspaper before safely disposing in medical waste. The remaining fluids should be blotted using as many paper towels as needed; these should be discarded in the clinical waste. Water and detergent should be used to remove all visible blood. The area should be wiped over with a chlorine-based solution (at a concentration of 1000 parts per million or 1%) and allowed to dry. Every healthcare facility (but especially those dealing with EVD (or VHF) requires a written, easily understandable and accessible standard operating procedure for managing blood and body fluid spills.

Monitoring exposed HCWs

EVD is not infectious in the incubation period. As long as an individual remains healthy, they do not pose a danger to their families or colleagues. HCWs with known EVD exposure/s should carefully monitor their own health for possible EVD symptoms and record their body temperature twice daily (for 21 days after exposure). Should a HCW have fever or any symptoms of EVD they should avoid all physical contact and report for EVD testing as soon as possible. Comprehensive testing is required to confirm and/or exclude EVD diagnosis in patients. The results of tests should be interpreted with cognisance of the time of collection of the specimens (i.e. early disease), as PCR tests, for example, have been reported to test false negative during the first 72 hours of onset of disease. Any known accidental exposure incident, occupational or otherwise, of a HCW should be reported immediately to the authorities and recorded in an incident register.

Protecting HCWs in the community

Mobile community-based surveillance teams have been used in current and previous outbreaks to conduct field epidemiology: active case finding, contact tracing and follow-up. In addition, HCWs and ambulance service staff enter the community to provide care and to transport suspected EVD patients to treatment centres. All HCWs with direct physical or close (< 1 metre) contact with suspected EVD patients should wear PPE (including coveralls or gowns, aprons, gloves, visors or goggles, respirators and boots or shoe covers). All transport vehicles (private cars and ambulances) should be thoroughly cleaned with soap and water, followed by disinfection with a 0.5% chlorine-based solution (while wearing PPE to avoid mucous membrane splashes).

Protecting laboratory workers

Transporting and processing potential EVD or VHF specimens poses a serious biohazard risk. Basic principles of infection control in the laboratory include: using only experienced, VHF trained virology personnel; processing of all samples with extreme caution (inside specialized safety cabinets); wearing full PPE; caution when removing PPE; safe discarding of all used disposable PPE; immediate disinfection of reusable items; meticulous attention to hand hygiene and thorough disinfection of specimen containers and work surfaces with an effective disinfectant, e.g. 70% alcohol or a 0.5% chlorine solution. Safety checklists for laboratories processing specimens are available from WHO (19).

Protecting support service personnel

The work of the support service teams is absolutely critical to the smooth operation and safety of patients and HCWs in outbreak settings. They provide a safe environment in a busy and potentially highly infectious work setting. During EVD outbreaks, there is excessive use of PPE, water, electricity, medical equipment, linen, and disposal of infectious waste. Well-trained support staff will ensure a safer work environment for themselves, HCWs and patients, particularly when handling laundry and infectious waste. Intensive training in infection control is required particularly for personnel involved in the cleaning and disinfection of Ebola patient areas and equipment, as these are very high risk tasks. Standard operating procedures must be in place as visual reminders to reduce occupationally acquired exposure in support service staff.

Protecting mortuary workers and burial teams

Bodies of EVD victims are most infectious around the time of and just after death, because of high viral loads and the extravasation of blood and body fluids. For this reason, infection of family members who perform traditional burial rites on EVD victims has been a major source of secondary transmission. Only adequately trained workers should be allowed to handle infected human remains and strict protocols should be followed to minimize the risk of nosocomial infection (20). Personal protective equipment (preferably coveralls) should be used before contact with the body, both during collection and placement in body bags. The PPE should be removed with care not to contaminate the wearer, discarded appropriately and hands should be washed with soap and water (if hands visibly soiled) or

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with 70% alcohol-based hand rub (if not visibly contaminated).

Other issues facing HCWs in the current EVD outbreaks

All HCWs (whether local or foreign volunteers) remain at risk of other infectious diseases that occur in the outbreak area, e.g. malaria and diarrhoeal diseases in West Africa. Adequate precautions (vaccines and/or prophylaxis) should be taken as indicated. The management of non-infectious issues, for example, road traffic accidents and non-communicable diseases in health care staff may also be challenging, as health systems are often overwhelmed in outbreak situations. Another risk to HCWs in the current EVD outbreak has been physical violence and intimidation, although this has been sporadic.

Conclusion

Where the next VHF outbreak will occur cannot be predicted, and HCWs will unfortunately always be vulnerable to infection. However maintaining a high index of suspicion for VHF and implementing simple infection control measures may prevent VHF transmission to HCWs.

Angela Dramowski
Department of Paediatrics and Child Health,
Division of Paediatric Infectious Diseases,
Faculty of Medicine and Health Sciences,
Stellenbosch University, PO Box 19063,
Tygerberg 7505, South Africa

Lucille Blumberg
Division of Public Health
Surveillance and Response,
National Institute for Communicable Diseases,
Private Bag X4,
Sandringham, 2131, South Africa

Jacqueline Weyer
Centre for Emerging and Zoonotic Diseases,
National Institute for Communicable Diseases,
Private Bag X4,
Sandringham, 2131, South Africa

Corresponding Author: Angela Dramowski; dramowski@sun.ac.za

A.P. Ayelo, F. Gounongbe, B. Aguemon, A. Hinson, B. Fayomi
Benin

How to protect enterprise workers against the threat of Ebola fever in Benin

Introduction

The World Health Organization (WHO) estimates that since the beginning of the Ebola outbreak in West Africa in February 2014, over 830 health care workers have been infected with the Ebola virus disease. WHO also estimates that 488 health care workers have already died in Guinea, Sierra Leone and Liberia since 11 February 2015 (1,2). Ebola is a real danger for both the health system and the economy of developing countries (3).

Although Benin currently has no recorded cases of Ebola fever, its threat has been keenly felt because of the presence of the epidemic in neighbouring Nigeria.

This work aims to report the preventive measures taken by the occupational health department of a bank with offices at the frontiers, port and airport.

Preventive measures

When the media announced the outbreak of Ebola in Nigeria, an emergency meeting was convened by the Health and Safety Committee of this bank. The recommendations arising from this meeting were immediately followed.

Personal protective equipment (gloves, masks and antiseptic gel pockets) were acquired and made available to workers. In terms of collective measures, antiseptic liquid soap kits were deposited in toilets for regular hand washing. Automatic hand sanitizer dispensers were also set up at service entrances for routine disinfection of the hands after contact.

All these recommended hygiene measures are continually reinforced through training and supervision of workers, and are monitored closely.

Photo by A.P. Ayelo

Photo 1. Hydro-alcoholic gel dispenser

Results and comments

Means of prevention

All workers have been sensitized and placed under maximum alert. Kits were made available for washing and systematically disinfecting the hands before and after each contact (Photo 1). Gloves and masks (Photos 2 and 3) were also introduced, mostly at the borders, port and airport.

These devices are attached to walls of service entrances, especially toilets. Disinfection should complement, not replace routine hand washing.

Photos 2 and 3 show the use of gloves and masks by workers notably those working in the borders, port and airport. At these workstations, the physical barrier has been strengthened not only for se-

Photos 2 and 3. Individual protection of workers (mask and gloves mandatory).

Photos by A.P. Ayelo

Photo 5. Ebola-virus awareness poster. The message of this poster indicates the severity of Ebola, its routes of transmission and how to behave to avoid it.

Photo 4. Hand-washing awareness poster.

This poster shows the most reliable method of hand washing. Washing of the hands is a hygienic measure recommended by WHO to reduce the risk of contamination by and the spreading of the Ebola virus. This measure is preceded by rubbing the hands with hydro-alcoholic gel (Photo 1).

curity in general, but also to avoid physical contact with clients, which is strictly not recommended due to the threat of the Ebola virus.

The occupational health physician and occupational nurse of the bank conducted unannounced checks to reassure staff, and to evaluate and strengthen the safety measures.

The observed risk prevention behaviour of the workers was quite reassuring in the offices. But outside the offices, particularly in public transport, the risk is still fully unavoidable.

Awareness posters

Some posters were placed at workstations and in places crowded by workers, including the occupational health service unit.

Conclusion

The threat of Ebola is a real danger for companies. The work involved in preventing and managing such large-scale emergencies is straining the capacity of health professionals. While stress in the real epidemic situation is higher, the risk of a potential epidemic also causes stress, given the rapid spread of the virus and its high lethality.

A.P. Ayelo
B. Aguemon
A. Hinson
B. Fayomi.
Department of Public and Occupational Health in Faculty of Health Sciences of Cotonou,

F. Gounongbe
Department of Occupational Health in Faculty of Medicine of Parakou, Republic of Benin

Corresponding author:
Dr. Paul Ahoumenou Ayelo
Occupational Health Physician,
Senior lecturer, Faculty of Health Sciences of Cotonou
01BP188 Cotonou, Benin
Email: paulayelo@yahoo.fr

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Jeanneth Manganyi, Kerry Wilson
South Africa

The importance of respirator fit testing and proper use of respirators

Although respirators provide protection against the inhalation of harmful and infectious agents, in the occupational hygiene hierarchy of controls, their use is listed as the least effective and inferior means of exposure or infection control. The hierarchy of infection controls recommended by the WHO consists of facility-level measures, administrative controls, ventilation, and lastly, the use of personal protective equipment including particulate respirators (1). However, the use of respirators is often the primary means of protection in many resource-limited workplaces in which employees are exposed to a large range of chemicals, dust, and infectious agents such as tuberculosis (TB) and Ebola.

Protection is, however, only achieved if the correctly selected respirators function correctly and fit adequately. The use of poorly fitting respirators could create an impression of false protection at a workplace in which employees are possibly exposed to infectious agents. Leakage of contaminants through face seals has long been recognized as a major limitation of the degree of protection provided by respirators (2). To reduce leakage, the respirator selected must be appropriate for the specific individual, and take into account factors affecting fit, such as face size and shape, as well as the presence of facial hair (2).

Design of respirators

It is well recognized that manufacturers need to consider the population's facial shapes and sizes when designing respirators (2). Respirators are designed to fit as many people as possible, but due to variation in face sizes and shapes, there is no single size that fits everyone. The current designs are based on facial anthropometric (human facial size and shape) data, obtained from large groups of people who have participated in projects that design respirator fit test panels (3, 4). These test panels provide an objective tool for selecting representative human test subjects on the basis of their facial characteristics, that can be used in the research, product development and certification of respirators (5).

Currently in South Africa, the public literature available on South African face shapes and sizes for designing and testing respirators for our workforce is limited. Therefore respirators supplied to the South African workforce are based on anthropometry from other countries, and their designs do not necessarily consider the facial characteristics of South Africans.

Photo by Jeanneth Manganyi

Quantitative fit testing (moving the head up and down exercise) conducted by Danisile Wuma.

Respirator fit testing

Respirator fit testing is important for checking if the selected respirator adequately fits a specific individual. There are two types of respirator fit testing methods, namely qualitative and quantitative. The quantitative respirator fit test is the most accurate and has been shown to give a meaningful approximation of actual protection in the actual workplace environment (6, 7). The qualitative respirator fit test, which is affordable and available from local PPE suppliers, can be used in under-resourced areas in particular.

Respirator fit testing in South Africa is not regulated, therefore it is perceived as an optional responsibility. A South African pilot study on respirator fit testing by Spies et al. in 2011 found a large percentage of South African workers failed fit tests using a common medium respirator, and concluded that reliance on medium-sized respirators is likely to be a problem, and can cause many employees a false sense of protection (8). In order to improve workers' health, a respiratory protection programme is essential before issuing respirators, and more than one respirator type or shape and size should be available. "One size does not fit all" (8).

In the absence of respirator fit testing methods, employees should be trained to perform a daily seal check to ensure that respirators are worn properly. It should, however be noted that a seal check does not replace proper fit testing. Respirator fit testing also ensures that an individual knows how to don and wear the respirator properly (9, 10). Although respirator fit testing is an important element of a respiratory protection programme, it is not, however, the only aspect (11).

Respiratory Protection Programme (RPP)

An effective RPP should include the following constituents (12):

- A policy on respirator use by men containing a clear statement, along with an understanding of the implications of religion and culture
- Risk assessment – to identify potential inhalation exposure, the employees requiring respirators, and the correct types
- Medical evaluations of employees – ensuring employees are physically fit to wear respirators
- Selection of correct size and style of respirators
- Training and information on the use and limitations of respirators
- Respirator fit testing
- Respirator maintenance and care, including the safe disposal of respirators

Knowledge gaps in South Africa

Individual

- The majority of respirator users are not aware of information relating to their proper use
- Not all employees required to wear respirators are given formal training on the proper fitting, wearing and limitations of respirators
- The majority of employees are not aware of the different respirator sizes and styles available
- Most respirator users are not able to differentiate between respirator sizes of the same style
- Employees, especially men, have no idea of the effect of facial hair on the effectiveness of the seal

Workplace

- Few organizations in South Africa implement a full respiratory protection programme
- Most organizations are not aware of the benefit of conducting respirator fit testing
- The current perception in many workplaces in South Africa is that one respirator size fits all employees.

Recommendations

It is recommended that where respirators are used, workplaces should compile and implement a respiratory protection programme. It is vital to provide protection against inhaled hazards, and where respirators are chosen, employees need to be fit tested. This testing is required prior to placement, to ensure that employees are protected by their supplied respirators. Research is needed to identify and conduct cost benefit analyses on exposure controls at source, which can reduce reliance on respirators.

Future research is needed to investigate African face sizes and shapes to allow a comparison with the models used to design respirators in other countries. Information on this important aspect will allow rational decisions to be made by suppliers, importers, purchasers, and employers regarding the styles of respirators that fit the majority of African employees.

Jeanneth Manganyi
Registered Occupational Hygienist
(ROH –SAIOH)
National Institute for Occupational Health,
Division of National Health Laboratory Service
P.O. Box 4788
Johannesburg
2000 South Africa
jeanneth.manganyi@nioh.nhls.ac.za

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Joe Afihene
GHANA

Foodborne illnesses at workplaces

Introduction

Infectious diseases continue to attract global attention despite significant achievements by epidemiologists and other public health practitioners over the years in this field. The incidence and prevalence of infectious diseases such as HIV/AIDS, malaria, tuberculosis, SARS, H1N1 and Ebola (most recent outbreak in West Africa, 2014) remain a constant global burden. In many developing countries, critical concerns have been raised about inadequate healthcare facilities and workers, and other healthcare logistics, which are essential during outbreaks of infectious diseases.

The agents of infectious diseases, which include bacteria, viruses, fungi, protozoa, helminthes and arthropods, constantly feature in global etiologic work involving infectious diseases. The global estimation of mortalities due to infectious diseases per year is 15 million, with over 80% of these reported in Africa (1). Due to increasing world travel, a deadly or rare infectious disease can be transmitted from a remote corner of the globe to a crowded city within the time span of a long-distance plane flight (2). Of the epidemiologically significant infections at workplaces, foodborne infections are those that are considered as emerging due to the incidence, increase in prevalence, and association with pathogens in new food vehicles.

Importantly, infectious diseases at workplaces have often been associated with the economic burden, which, when translated as absenteeism, low productivity, disability and death attracts the attention of the government and employers alike. A number of infectious diseases can be associated with different workplaces and have various effects on health at different levels: departmental, organizational, community, national, and even global. Although point-source infections (often related to foodborne diseases) may not be associated with the relatively high number of cases of mortality, the frequency and distribution of foodborne infections at workplaces have attained global concern due to the associated economic burden.

Foodborne infections

Foodborne infections are acquired when foods are contaminated by disease-causing agents. The pathways to contamination may be via types of food or preparation and handling. Locations and events at which foods are served also significantly affect the contamination of foods by disease agents. Foodborne illnesses such as gastroenteritis, diarrhea, and cholera have often been associated with groups of individuals eating from a common point/source of meal preparation and serving. Cases of these infections have also been reported at luncheons, picnics, parties, and school or workplace canteens. However, foodborne infections have particularly increased in organizations with camped residential facilities and canteens (where employees have common residential and dining facilities). (Figure 1).

Photo by Joe Afihene

Photo 1. Poor storage of poultry products in a freezer.

Exposures to foodborne pathogens at workplaces are direct sources of infection; exposures increase with external/third-party engagement (kitchen attendants, techni-

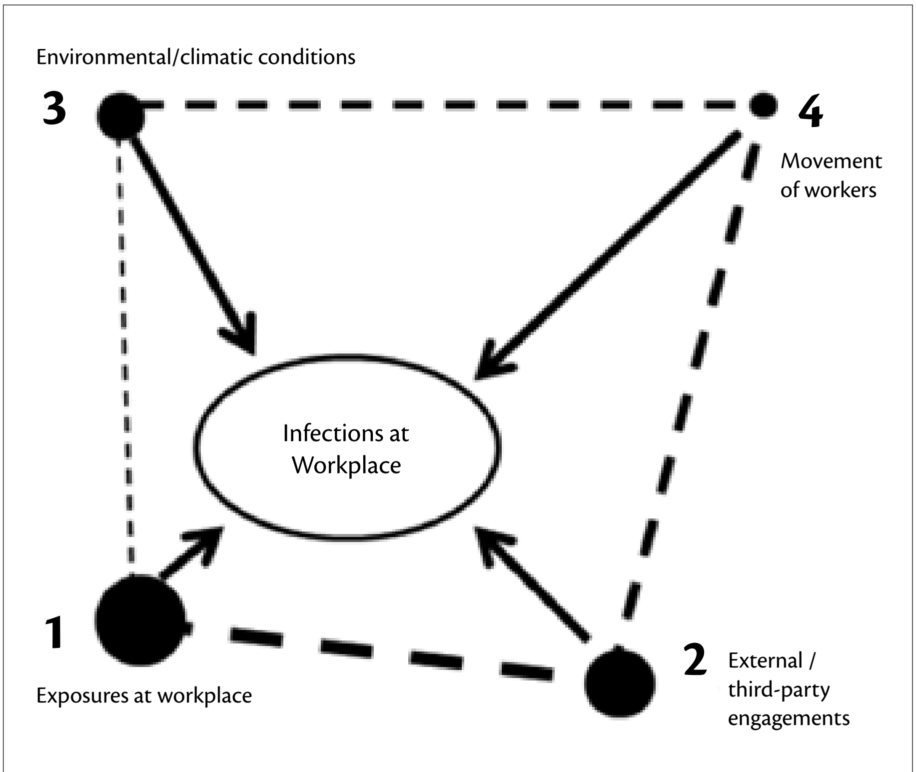

Figure 1. Relationship model for foodborne illnesses at workplaces.

cians, artisans, etc.). Workers' increased movements and travel (in and out) from occupational locations particularly tend to increase the exposure of the workers to infections, because of susceptible environments and contact with infected passengers. Poor storage of foods, in the case of ready-to-eat (RTE) salads, and inappropriate packaging of foods before refrigeration have also been noted as providing convenient conditions for the proliferation of and contamination by disease-causing agents. (Photo 1) Food that causes pathogens such as Escherichia coli O157:H7, Salmonella spp., and Listeria monocytogenes have been commonly associated with contaminated leafy green vegetables (3). Strict, rigid working periods, as well as production schedules that are related to camped workers are considered a source of time constraint by kitchen and canteen attendants. Thus, processing or preparation failure may lead to the survival of microorganisms or toxins, and time-temperature abuse may allow the proliferation of pathogenic bacteria.

Who is at risk?

From the perspective of managing occupational health, camped workers are more likely to eat from a common canteen with foods prepared in and served from a common kitchen. Typically, work schedules and the structure of industries such as mining, coal, plantations, oil and gas encourage the camping of workers, in order to reduce the idle time associated with shift change-overs and productivity. The locations of occupational camps and project sites are usually isolated from commercial towns and cities. Therefore, incidents related to the poor, unhygienic handling and storage of food items often remain a challenge.

Risk factors

Current food distribution systems are able to move contaminated food products throughout a given locality or region in the world within days of processing. The contamination of foods from local markets and poor handling and storage, even in canteens, is a source of exposure for susceptible workers. Risk factors include the following:

- Foods such as fruits and vegetables, which are not usually cooked before serving.
- Poor preparation and handling of prepared food.
- Lack of proper hygiene and sanitation in kitchens and canteens.

Preventing and controlling exposure to foodborne illnesses

In addition to caterers' training in basic food hygiene, rapid reporting of local outbreaks on national and international levels can improve the surveillance and control of foodborne diseases. Rapid reporting also helps to quickly identify defects associated with infection control systems. (4). Frequent inspections of kitchens and canteens improve monitoring, and are helpful in controlling disease-causing agents.

Reporting and bias

Outbreak investigations with high values, reporting the strength of association (risk ratios), have been skewed towards biases. Typically retrospective in nature, study designs tend to influence risk ratios more than the measures of frequency and distribution of infections. Reliable surveillance systems at workplaces as part of the occupational health system are also a possible means of ensuring accurate reporting of foodborne illnesses.

Joe Afihene
Health Coordinator
Ghana National Gas Company
P.O. Box CT 3686
Cantonments
Accra-Ghana
E-mail: afihenejoe@gmail.com / joe.afihene@ghanagas.com.gh

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Tanusha S Singh, Onnicah D Matuka
South Africa

Airborne infection control in health care facilities: effecting change

Introduction

Airborne transmission of hazardous biological agents (e.g., viruses, bacteria and fungal spores) remains both a social and occupational health hazard, particularly in crowded and resource-limited health care settings. Health care facilities face the unique challenge of high density populations of potentially contagious and immunocompromised people, which poses a problem for acquired infections (1–2). However, the extent to which airborne transmission contributes to the overall infection rate in hospitals continues to be debated (3). Infectious risk should be defined not only by the frequency of transmission and number of people infected, but also by the severity and consequences of these infections. Therefore implementing infection prevention and control measures is fundamental to mitigate the burden of airborne infectious diseases.

Origins of airborne pathogens in health care facility environments

The origins of airborne contaminants may be infectious people, heating, ventilation, air conditioning (HVAC) systems, or cooling tower water in hospitals (4–7). Fungal aerosols and their spores (e.g., *Aspergillus* sp., *Blastomyces* sp., *Coccidioides* sp., *Cryptococcus* sp. and *Histoplasma* sp.) can also enter through open windows and doors and can be potentially life-threatening to immunocompromised patients (8). Aerosolized particles from an infectious or contaminated source can remain suspended in the air for extended periods of time and ultimately be inhaled by susceptible individuals (9–11). Transmission of these contaminants is dependent on particle properties and environmental factors (12). Microorganisms also vary in how they respond to changes in environmental stresses such as temperature, relative humidity and ultraviolet radiation, as some are more resilient than others, (13) leading to either desiccation or hygroscopicity (i.e. moisture retention) of the particle (14). The ability of infectious particles to cause an infection depends on the concentration and virulence of the pathogen and the human infectious dose which differs by pathogen (12).

Airborne infection control strategies

Health care facilities are subject to the Occupational Health and Safety Act as well as to regulations relating to Hazardous Biological Agents (15) and their HVAC systems (16) and compliance thereof is the cornerstone to disease prevention and control. The World Health Organization (WHO), the Centre for Disease Control and Prevention (CDC), the International Labour Organization (ILO) and the International Union of Tuberculosis and Lung Disease has guidelines regarding the control of airborne infection in both developed and developing nations (17). Addressing infection control in hospitals is a multifaceted approach unique to each facility, and the suggested measures from the regulations and guidelines include an integrated three-pronged approach, namely administrative, environmental or engineering, and personal controls as described below (17–18). A framework for approaching airborne infection control strategies is illustrated in Figure 1.

Best practice and robust technology have several indications, the most important being the reduction of the transmission of airborne infections in high-burden settings, especially those dealing with epidemics of drug-resistant disease. For the effective airborne infection control of a health care facility, one needs to be able to understand and predict the airborne infection risk, which will involve knowing the aerosol's generation, pathogen transport, infectivity loss and inhalation and deposition. A low-cost, low-maintenance, effective solution is needed to support the use of engineering controls, as identified by the facility risk assessment in developing countries and countries with significant airborne infection rates.

Administrative controls

Administrative control measures take first priority over other controls and include education and training on infection control procedures for staff, patients and visitors. This aims to control the transmission of pathogens by applying source control measures such as respiratory hygiene and cough etiquette; segregation of infectious from non-infectious sources through infection detection, triage and communication; control transmission through activity management ensuring that buildings are used in the way that they were designed for; as well as strengthening technical controls (engineering and personal) (19).

Engineering and environmental control measures

These are recommended mainly for reducing the concentration of infectious particles; ensuring effective ventilation at all times; and giving special attention to "high-

Photo 1: Illustration of non-functional UVGI fixtures in an ICU ward at a regional hospital in South Africa.

Photos by NIOH /Buhle Binta

Photo 2: Photo illustrating non-compliance of respiratory protection of health care workers.

risk" areas, as identified through the facility risk assessment (e.g. anti-retroviral therapy centres, outpatient and inpatient departments, bronchoscopy procedure rooms, and multidrug resistant tuberculosis wards, waiting areas). Strategies such as ventilation and filtration to reduce airborne pathogens and upper room ultraviolet germicidal irradiation (UVGI) to decontaminate the air have been shown to be effective if designed and maintained appropriately (20).

Ventilation

The choice of ventilation for environmental controls (natural, mechanical or hybrid of both types) depends on local conditions, building site (location, layout, orientation, and landscaping) and building design (type of building, functions, form, envelope, internal distribution of spaces, and thermal mass) analysis, and vent opening design (position, type, size, and control of openings) (10). Overcrowding often correlates with increased rates of infection, therefore occupant density is an important factor to consider, because thermal load affects airflow distribution, and infectivity status influences airborne pathogen concentration (19, 21). These conditions in turn need to be tailored to local climate, regulations, culture, socio-economic conditions, and outdoor air quality. While the concentration of airborne infectious particles decreases with increased air changes per hour (ACH) through natural and mechanical ventilation, even very frequent air changing does not radically reduce the airborne infectious particle count (22). At 12 air changes per hour (80 litre/second/patient for a room size of 24m^3), which is the recommended minimum for hospital isolation rooms (23), it would take about 23 minutes to reduce the load by 99% and about 35 minutes to reduce the load by 99.9%, assuming perfect mixing of air, which does not often occur in practice. Indeed, simple natural ventilation (opening windows and doors) has been shown to be a very useful approach to combating transmission in health care settings (24). However, it must be borne in mind that natural ventilation depends on climatic conditions that are inherently changing and unpredictable (19). In addition, windows are often closed when temperatures drop, for comfort, and even in warm climates for security reasons.

Mechanical ventilation systems require correct design, have high installation costs, and require ongoing maintenance. This requires both resources and expertise, and is an obvious limitation. It is also important to know that rooms with short circuited airflow patterns will have very high ventilation effectiveness in some areas while stagnant air in other areas resulting in low ventilation effectiveness (19). Due to the unpredictability of patient volumes and infectivity status, neither natural nor mechanical ventilation (working properly) can reliably achieve the high levels of room air changes recommended for airborne infection control. It may also not be feasible to reengineer or retrofit existing buildings for optimal ventilation.

Filtration

Filtration can be applied to refresh indoor air and reduce the pathogen load. High efficiency air (HEPA) filtration remains the most widely deployed technology for removing infectious particles from air, (22–23) due to a lack of industry standards for evaluating new technologies that attempt to solve airborne particle transmission. HEPA filtration systems can be expensive to operate and may be prone to leakage and bypass problems that compromise the overall effectiveness of the system. This requires ongoing maintenance to ensure that filters are not blocked, and validation of the desired performance when filters have been changed (22).

Ultraviolet Germicidal Irradiation (UVGI)

Engineering controls to reduce airborne contamination can be expensive; therefore there has been renewed interest in ultraviolet germicidal irradiation (UVGI) to remove airborne infectious agents from indoor air (19, 25). UVGI is an important technology in a multi-tiered approach to reducing airborne contamination and improving indoor air quality, and it is essential that the appropriate devices have been selected with its performance data, and that the installation has been correctly designed for specific areas, good air mixing (use of relatively inexpensive low-velocity ceiling fans) and maintained regularly (26). As upper-room UVGI usually cannot be applied throughout health facilities, institutions need to prioritize their use on the basis of a risk assessment, in consultation with transmission control experts. UVGI can be considered in these cases, although it should complement rather than replace a ventilation system. Appropriate procedures for the monitoring, validation, maintenance and disposal of lamps need to be implemented, and health care workers must be trained in the safe use of UVGI. If not maintained properly, UVGI can provide little or no 'protection/control', creating a false sense of biosecurity for health care workers, patients and visitors. UVGI can reliably and safely add the equivalent of 10–20 room air changes per hour (EqACH) to whatever natural or mechanical ventilation already exists (27). The number of facilities currently using these technologies, of which most are non-functional, is thought to be a very small fraction of the total buildings and hospitals in Africa that could benefit (27–28). International application (dosing) guidelines are needed, as are safety standards and commissioning procedures (29, 30). There is a scarcity of reports on UVGI overexposure (e.g., eye and skin injury), and those reported have mostly been through accidental exposure through incorrect installation. However, many practical barriers to the broad implementation of upper-room UVGI remain. Operating and maintenance costs of upper-room UVGI are considerably lower than mechanical ventilation, but still an important factor, and electricity is intermittent and costly (28, 30) in some countries. While the use of portable UV-GI lamps to disinfect unoccupied rooms is not new, more research is needed on these applications of UVGI.

Personal protection controls

An essential personal protective practice is the regular, proper wearing of a respirator such as a N95 respirator during aerosol-generating procedures associated with a high risk of airborne pathogens, such as TB transmission (e.g. bronchoscopy, intubation, sputum induction procedures, aspiration of respiratory secretions, autopsies or lung surgeries with high speed devices); and when providing care to infectious patients or people suspected of having an infection. However, there is great concern for the unsuspecting infectious individual, particularly in high airborne disease burden countries. It would be appropriate to make the distinction here between a surgical mask and a respirator. A surgical mask is a loose fitting disposable mask that covers the nose and mouth and as such only offers partial protection due to a poor seal against the face. A respirator, in turn, is designed to protect the worker from inhaling airborne contaminants by forming a proper seal between the face and the respirator, offering 95% filter efficiency. Ultimately, the selection will be driven by the facility risk assessment and the personal characteristics of the wearer. Respirators can provide the necessary protection if the filtering efficiencies are selected for the specific task, training is conducted periodically, fit testing is performed periodically, seal checks done before each use, and compliance with respirator use is improved (31).

Variation in face size and shape and different respirator designs mean that a proper fit is only possible for a minority of health care workers for any particular respirator. Winter et al. reported that, for any one of three widely used respirators, a satisfactory fit was achieved by fewer than half of the health care workers tested, and that for 28% of the participants, none of the masks gave a satisfactory fit (32). Fit-testing is a costly, laborious task, taking around 30 minutes to do properly, and needs to be done periodically. Hence it is likely to remain problematic for health care organizations in the foreseeable future. Selecting a respirator that fits a health care worker is not the only challenge; many health care workers find that respirators are uncomfortably hot and interfere with breathing and communication. In addition, previous studies have found self-checking of a seal to be a highly unreliable technique (32). Since the use of respirators is subject to personnel's behavioural issues, limitation of available sizes for the variety of face sizes and shapes and staff turnover, it is beneficial to have a primary infection prevention and control system in place, which is used in conjunction with respirators. A recent South African study demonstrated poor compliance of respirator use, despite staff being trained and being exposed to coughing patients (27). Although the ultimate effectiveness of these respirator masks is debated, they are believed to be the best currently available method of guarding against inhalation of highly infectious airborne particles from known and unsuspecting individuals or sources (17).

The use of a mask by visitors is a contentious issue, and should be decided on the basis of the level of interaction between them and the patient, i.e. during contact with a patient with known or suspected infection through airborne transmission (31). However, the questions then arises about unsuspecting infectious individuals. Considering the risk of stigma that the use of respirators may generate, there should be a strong focus on behaviour-change campaigns for health workers, patients, and communities.

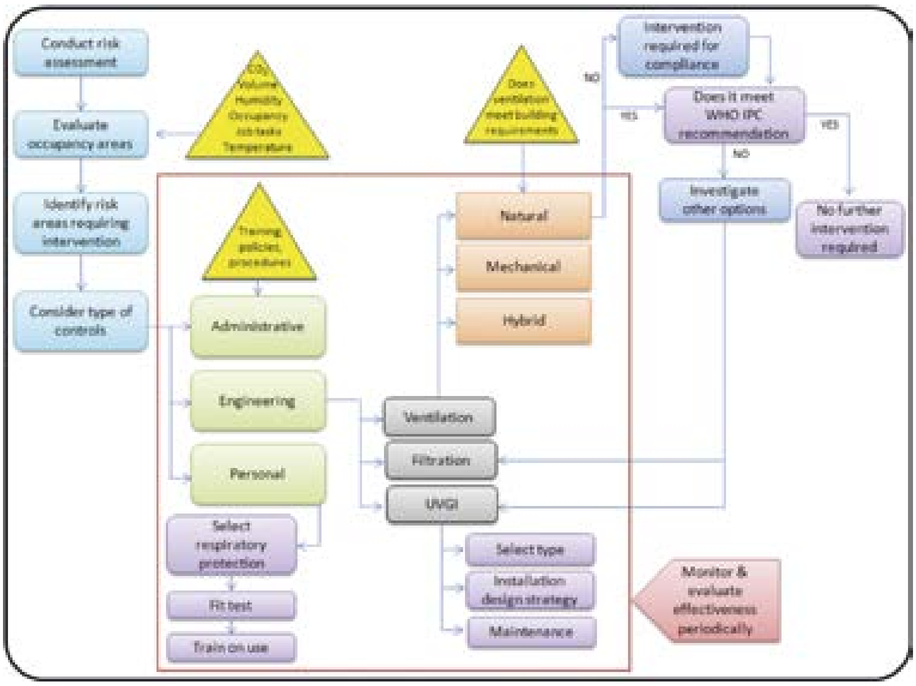

Figure 1. Framework for approaching airborne infection control strategies

Alternative air cleaning technologies

There are several alternative technologies that claim to reduce levels of air contamination. The most promising include ozonation, photocatalytic oxidation, plasma or corona technologies, pulsed light, passive solar exposure, ionization, vegetation air cleaning, and antimicrobial coatings. However, evidence-based reduction data are quite limited for these technologies, and should be carefully considered before implementation (28).

Monitoring the environment for airborne microorganisms (air sampling)

Microbiological testing methods including animal tests, culture, molecular and plaque assay methods are a reliable means of identifying the microbial contamination of hospital air. Although sampling is only used on a needs basis in health care facilities, and regular sampling is generally not recommended, sampling provides the only means of investigating the efficacy of intervention controls; apart from well-designed epidemiological studies, which take time and can be more costly. Knowledge of airborne concentrations in different areas, and the species detected, can be invaluable in identifying potential problems and determining the success of decontamination efforts (28). The true viability and infectivity of airborne pathogens depend on complex physical and biological mechanisms, which affect the survival of pathogens while suspended in air, their deposition onto susceptible sites in the host, and their ability to defeat the defence mechanisms of the host. None of the existing measurement techniques are standardized or accurately account for all of these mechanisms. As a result, it must be understood that any measurement technique, at best, approximates true viability and infectivity by focusing on only limited aspects of viability or infectivity (19).

Conclusion

Regardless of the challenges to implementing preventive control strategies, the high rate of infection in low resourced health facilities reinforces the need to reconsider how protection can be strengthened. Airborne transmission of infectious disease is a major public and occupational health concern, advocating a multi-sectoral rather than an individual approach for optimal control. This can be achieved through incremental steps with positive outcomes, by linking infectious disease risks and evidence-based solutions and sharing best practices.

Tanusha S Singh, Onnicah D Matuka
National Institute for Occupational Health,
National Health Laboratory Services
Department of Clinical Microbiology and Infectious Diseases, School of Pathology
University of Witwatersrand
Johannesburg, South Africa

Corresponding author:
Tanusha S Singh
National Institute for Occupational Health
Immunology & Microbiology Section
P.O. Box 4788, Johannesburg, 2000
South Africa
Tel: +27 11 712 6475
Fax: +27 11 712 6426
Email: Tanusha.singh@nioh.nhls.ac.za

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Jani Ruotsalainen, Jos Verbeek
Cochrane Work, Finnish Institute of Occupational Health

Use of blunt suture needles halves the risk of needle stick injuries among surgeons

Surgeons are exposed to the risk of needle stick injuries at work, which may lead to infection by blood borne viruses. According to a recent Cochrane review (1), the use of blunt suture needles instead of sharp needles reduces the risk of needle stick injury by over 50%.

Health care workers are at risk of acquiring infectious diseases through exposure to needle stick and cut injuries at work. Exposure to blood or bodily fluids from infected patients can lead to, for example, Hepatitis B (HBV), Hepatitis C (HCV) and HIV infection. These are serious viral infections that may cause a chronic disease process and eventually lead to death. Infections or suspicions of infection also cause stress and absenteeism from work. A significant proportion of these injuries and close calls remain unreported. Worldwide it is estimated that nearly three million health care workers suffer from needle stick injuries annually.

Surgeons and their assistants are especially at risk of exposure to blood due to glove perforations and needle stick injuries during operations. The use of blunt needles can reduce this risk because they do not penetrate the skin so easily, but still sufficiently penetrate other tissues. This hypothesis was tested in a Cochrane review (1) by summarizing the results of ten different studies. The to-

Study or Subgroup	log[Rate Ratio]	SE	Weight	Rate Ratio IV, Fixed, 95% CI	Year
Wright 1993	-0.7472144	0.296334	8.6%	0.47 [0.27, 0.85]	1993
Thomas 1995	-0.35667494	0.348466	6.2%	0.70 [0.35, 1.39]	1995
Mingoli 1996	-0.73315252	0.173816	25.1%	0.48 [0.34, 0.68]	1996
Hartley 1996	-1.70552479	0.636209	1.9%	0.18 [0.05, 0.63]	1996
Meyer 1996	-0.85131877	0.138984	39.2%	0.43 [0.33, 0.56]	1996
Rice 1996	-3.11351531	1.449138	0.4%	0.04 [0.00, 0.76]	1996
Ablett 1998	-0.64435702	0.421637	4.3%	0.52 [0.23, 1.20]	1998
Nordkam 2005	-0.8303483	0.290628	9.0%	0.44 [0.25, 0.77]	2005
Wilson 2008	-0.2048782	0.67082	1.7%	0.81 [0.22, 3.03]	2008
Sullivan 2009	-0.8873032	0.449089	3.8%	0.41 [0.17, 0.99]	2009
Total (95% CI)			100.0%	0.46 [0.38, 0.54]	

Heterogeneity: $Chi^2 = 7.45$, $df = 9$ ($P = 0.59$); $I^2 = 0\%$
Test for overall effect: $Z = 9.03$ ($P < 0.00001$)

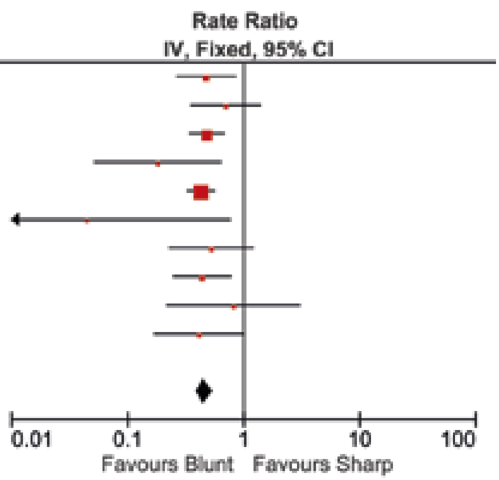

Figure 1. Forest plot of meta-analysis summarising results of ten studies comparing blunt versus sharp suture needles (on glove perforations). A forest plot describes the results of all included studies (little red boxes) relative to the line of no effect. The horizontal position of the box indicates the magnitude of effect, whereas the size of the box refers to the weight ascribed to the study in the meta-analysis due to its size. The horizontal lines through the boxes show the 95% confidence intervals around the means, which in this case are rate ratios. At the bottom, the little diamond figure is the result of meta-analysis, i.e. the pooled result obtained by combining all the individual rate ratios.
The I^2 test is a way to quantify how much the individual studies differ from one another statistically. Here the result is zero, meaning no difference, so we can be sure that the summary effect is truly meaningful.

tal number of operations in these studies was 2961. Six of the studies concentrated on abdominal surgery, two on hip replacement, and two on vaginal repair. On average, a surgeon who used sharp needles sustained one glove perforation per three operations. The use of blunt needles reduced the perforation rate by 54%. The surgeons mainly rated blunt needles as acceptable for use even though the force needed in their use was higher. It is unlikely that future research will change this conclusion.

In conclusion, we can say there is high quality evidence that blunt suture needles lead to fewer perforations of surgical gloves than sharp needles. There is also moderate quality evidence that blunt needles reduce the number of needle stick injuries. The results were not influenced by the quality of the studies, albeit that in abdominal closure, the effect may be more noticeable than in vaginal repair operations.

Jani Ruotsalainen, Managing Editor
Cochrane Work
Finnish Institute of Occupational Health
Neulaniementie 4 PO Box 310, FI-70101
Kuopio, FINLAND
Tel: +358 304 747 334,
jani.ruotsalainen@ttl.fi

Jos Verbeek, Coordinating Editor
Cochrane Work
Finnish Institute of Occupational Health
Neulaniementie 4 PO Box 310,
FI-70101 Kuopio, FINLAND
Tel: +358 304 747 289, +358 468 108 709,
jos.verbeek@ttl.fi

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Jos Verbeek, Jani Ruotsalainen
Cochrane Work, Finnish Institute of Occupational Health

How effective is personal protective equipment against Ebola?

The ongoing search for evidence

Health care workers (HCWs) are generally at risk of developing life-threatening infectious diseases from contact with patients. However, the current Ebola epidemic has made it clear that these risks can be enormous, and have highly serious consequences. The Centre for Disease Control and Prevention (CDC) estimated the relative risk of HCWs contracting Ebola to be 100 times that of the general population. Not only nurses and doctors are at risk, but also staff engaged in the transportation, washing and burial of patients. Unprecedented numbers of HCWs have died in the epidemic areas.

Infection occurs when splashes or droplets of contaminated body fluids land on the mucous membranes in the eyes, mouth or nose, or when the same mucous membranes come into contact with contaminated skin, such as when rubbing one's eyes with one's hand, which carries pathogens after shaking hands with a patient. Infection can also occur through needle stick injuries.

In order to prevent occupational infections, health services should be organized in such a way that exposure to infected patients is minimized. An effective policy to prevent needle stick injuries should also be implemented. We have firm evidence that blunt needles and other safe devices, for example, help prevention, as does using two pairs of gloves. Since the exposure of HCWs cannot be avoided, the main strategy for reducing it is personal protective equipment (PPE). Choosing the right type of PPE is made easier by the use of standards. Unfortunately, there is no single standard for Ebola-resistant PPE. To understand, one has to delve a bit deeper into the PPE classification systems.

Figure 1. biohazard symbol

First there is the global standard for protective clothing against chemical hazards, ISO 16602, which classifies PPE into six categories. Class 3 clothing protects against high liquid volumes under pressure. Class 4 protects against liquid sprays. For Ebola, the PPE most often currently used is class 3. However, the problem is that it also greatly reduces breathability and thus increases heat stress. There are no strong arguments as to why class 4 would not provide sufficient protection, and it would have the great advantage of being more breathable (1). In addition to being liquid spray proof, the fabric of the clothing should comply with the standard for protection against biohazards, EN 14126. The US has a slightly different but comparable standard: ANSI PB70. The biohazard symbol (Figure 1) indicates that clothing is meant to protect against biohazards. This standard again has six different levels of protection, depending on how resistant the fabric is to viral permeation under pressure, with 6 being the highest and 1 the lowest level. WHO recommends using level 3 or 2. (2).

Several guidelines for choosing proper PPE are available. Even though all guidelines propose using more or less similar protective clothing, there are also noticeable differences. For example, WHO does not recommend taping but the European

CDC does (2, 3). Overprotection can be a problem. Some propose using three layers of gloves because this is best practice according to their experience. However, this may also make work more difficult and eventually lead to an increased rather than a decreased risk of infection.

Probably the highest risk of infection, despite the use of proper PPE, is associated with taking the PPE off (also called doffing) incorrectly in such a way that HCWs may contaminate themselves. How contamination of PPE occurs has also been clearly illustrated with a simulation study on cleaning up vomit (4). The results of such simulation studies can be used to underpin choices for the safest procedures. Several NGOs and WHO have developed specific guidance for donning and doffing PPE, but again there is no consensus on the ideal procedure. The procedures are so complicated that instructions, training and supervision are necessary. There is also no consensus on the best training or the amount needed before this can be safely practised.

Compliance with the guidance on correct PPE use in health care is historically poor. HCWs sometimes distrust infection control and the stress on PPE. As regards respiratory protection, such as masks and respirators, compliance has been reported to be around 50% on many occasions. Hand hygiene reports also reveal a great deal of room for improvement, and WHO guidelines recommend education and training in combination with other implementation measures.(5).

We conclude that uncertainty prevails as to the optimal type, composition, amount and way of using full body PPE to prevent skin and mucous membrane contamination of HCWs while they treat patients with highly infectious diseases such as Ebola. This is also reflected in the different ways in which guidelines for PPE are implemented in Europe (6) and acknowledged in current WHO guidelines (2).

Therefore we have set out to collect all evidence available to help determine the best protective equipment, how to best put it on, take it off and use it, and how to achieve the highest compliance with guidelines. A protocol for such a Cochrane Review of the literature is available. (http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD011621/abstract) Simulation studies or reports of training sessions may go unpublished in the heat of an epidemic. We believe that they could add to the evidence base. New epidemics of highly infectious diseases will emerge, and we have to make sure that we better protect HCWs. Therefore, we call on anybody who has or knows of evidence of the effectiveness of PPE against highly infectious diseases such as Ebola, which is not available in the regular medical literature, to send this information to us.

Jos Verbeek, Jani Ruotsalainen
Cochrane Work
Finnish Institute of Occupational Health
Neulaniementie 4 PO Box 310
FI-70101 Kuopio, FINLAND

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ILO SafeDay

The ILO celebrates the World Day for Safety and Health at Work on the 28 April to promote the prevention of occupational accidents and diseases globally. It is an awareness-raising campaign intended to focus international attention on emerging trends in the field of occupational safety and health and on the magnitude of work-related injuries, diseases and fatalities worldwide.
Please visit the SafeDay website with new and useful information including a campaign kit; a PPT presentation with notes, the poster and the brochure.
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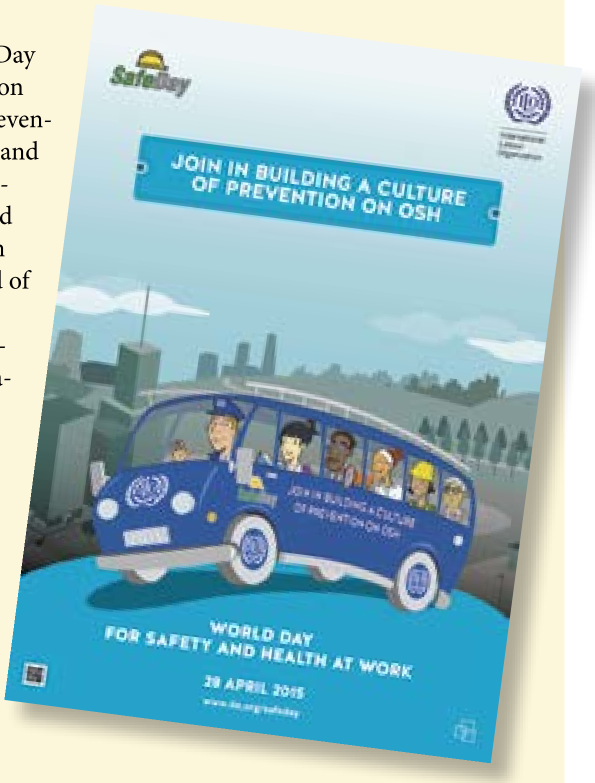

Contact persons/country editors

Director
Department of Occupational Health and Safety
(Ministry of Labour and Home Affairs)
Private Bag 00241
Gaborone
BOTSWANA

Samir Ragab Seliem
Egyptian Trade Union Federation
Occupational Health and
Safety Secretary
90 Elgalaa Street
Cairo
EGYPT

Kebreab Zemer Ghebremedhin
Ministry of Labour and Human
Welfare
Department of Labour
P.O. Box 5252
Asmara
ERITREA

Ministry of Labour and Social Affairs
P.O. Box 2056
Addis Ababa
ETHIOPIA

Commissioner of Labour
Ministry of Trade Industry and
Employment
Central Bank Building
Banjul
GAMBIA

Dr Edith Clarke
Occupational and Environmental Health
Ministries
GHANA

The Director
Directorate of Occupational
Safety and Health Services
P.O. Box 34120-00100
Nairobi
KENYA

The Director
Occupational Safety and Healh
Private Bag 344
Lilongwe
MALAWI

H. Ali El Sherif
Chief Medical Officer
Occupational Health Service
Ministry of Health and Social Services
P/Bag 13198
Windhoek
NAMIBIA

Mrs Ifeoma Nwankwo
Federal Ministry of Labour
and Productivity
Occupational Safety and
Health Department
P.M.B. 4
Abuja
NIGERIA

Chief Inspector of Factories
Ministry of Labour
SIERRA LEONE

Peter H. Mavuso
Head of CIS National Centre
P.O.Box 198
Mbabane
SWAZILAND

Chief Executive
Occupational Safety and
Health Authority (OSHA)
Ministry of Labour and Employment
P.O. Box 519
Dar es Salaam
TANZANIA

Commissioner
Occupational Safety and
Health
Ministry of Gender, Labour and
Social Development
P.O. Box 227
Kampala
UGANDA

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Editorial Board

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