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Environmental Security of Healthcare Facilities

Michal Zelenák, Jan Kyselák
(Tomas Bata University, The Czech Republic)

Abstract: A healthcare facility is a complex environment in which different aspects, including patients, staff, equipment, services and information, come together. Maintaining a secure environment reflects the level of competent healthcare that must be met to ensure patient safety. There are many factors that influence the environment in healthcare facilities, i.e., on the one hand, internal effects such as waste management, noise and infection control and, on the other hand, external effects such as water sources, water treatment, cleaning and disposal of waste water. The article focuses on selected internal factors, namely: waste management, infection control, radiation safety, general security of a building, water quality, heating, ventilation, and air conditioning.

Key words: security, safety, infection, waste, healthcare, environment
JEL codes: Q

1. Introduction

The relationship between the environment and security is becoming increasingly important, regardless if we view these relations through the lens of human safety and quality of life, or see them as sources of potential conflict and instability in society. The concept of environmental security has many different meanings, which result from the merging of two very important areas — the environment and security, and the way in which a person or a group understands the meaning of both terms.

In general, the environment means the biological, physical and chemical components and systems necessary to sustain life. This is a very broad spectrum within which there are a number of areas such as resource scarcity (reducing the supply of inputs to human systems) and contamination (contamination of inputs to human systems), occurring in several scales (from global to local) and in different ways and to varying degrees in places around the world.

Similarly, security is a very diverse area. It can refer to many different things that can be valued in some way (e.g., reference objects such as work, health, state and territory), or it can refer to a variety of risks (such as unemployment, hunger, change of government and invasion).

It can thus be said that environmental security is a situation in which the likelihood of an emergence of a crisis situation caused by environmental disturbance is still acceptable. In relation to ecosystem services, it can be defined as a long-term maintenance of ecosystem services that determine the quality of human life. Just as human activity poses a variety of risks to the functioning of ecosystems, a healthcare facility is the source of a variety of risk factors affecting our environment.

Michal Zelenák, MBA, Tomas Bata University, research areas: health, safety and environment. E-mail: michal.zelenak@email.cz.
Jan Kyselák, Ph.D., Tomas Bata University, research areas: population protection, crisis management. E-mail: kyselak@utb.cz.

The potential threat to ecosystem security has two time horizons. These are long-term and short-term aspects that represent different types of crisis situations. Crisis situations in the human environment may arise not only from individual adverse events and phenomena, but especially from combinations of them. Combinations of hazards can be of two types, in one of which a concatenation of events occurs so that one (or more) initial incident leads to the possible occurrence of another adverse event different in type from the initial one, whereas in the other case the combination leads to an escalation of an existing incident.

2. Internal Environmental Security Factors for Healthcare Facilities

A healthcare facility is a complex environment in which a variety of factors that can affect environmental security come together. Some of these factors exist throughout the entire operation of the healthcare facility, others occur randomly, may interact, are conditioned by the existence of others, or may exist separately on others.

2.1 Waste Management

Waste management is essential to promote high quality healthcare and a safe environment in hospitals. Medical waste is any waste resulting from medical services and scientific research conducted in medicine. Out of the total waste generated by healthcare activities, 85% is conventional waste (paper, plastic products, municipal waste), and the remaining 15% is hazardous waste. The World Health Organization (WHO) divides medical waste into seven elementary categories based on their characteristics and level of risk:

- infectious waste,
- pathological waste,
- sharp objects,
- chemical substances and mixtures,
- pharmaceuticals,
- genotoxic waste,
- radioactive waste.

In waste management systems, the following most important factors should be taken into account:

- collection system at the point of origin (i.e., separation, type of containers/bags),
- time and temperature of temporary storage (at origin side),
- transport requirements,
- central storage conditions,
- disposal method.

For a proper waste management system all factors must be taken into consideration. For example, in a collection system, the medical personnel responsible for the separation phase must comply with the rules of correct waste classification before it is transported to the central waste collection point of the healthcare facility. The waste disposal process must be carried out according to an approved disposal method for the relevant type of waste, such as incineration, which is necessary for the disposal of pathological samples or inventive waste.

Currently it is important for healthcare facilities to abide with correct procedures for handling waste arising from the prevention of the dangerous development and spread of COVID-19 disease.

2.2 COVID-19 Waste

Currently, wastes produced by healthcare facilities have been supplemented with wastes arising from

SARS-CoV-2 disease causing COVID-19. The procedure for disposal is set out in the statement published by the National Reference Centre for Soil and Waste Hygiene.

Any individual disposable protective items used that may be contaminated with an infectious agent must be considered hazardous waste featuring dangerous properties indicated as "H9 infectivity". The recommended classification for this type of waste is under catalogue number 15 02 02 labelled as COVID-19. Healthcare facilities may also classify individual protective equipment used under catalogue number 18 01 03, within the meaning of the Certified Methodology for Handling Waste from Healthcare, Veterinary and Other Similar Facilities. Such labelled waste must be stored separately from other hazardous waste in covered, sealable, leak-proof and mechanically resistant containers. The outer packaging must be treated with a disinfectant.

2.3 Control of Infection

Control of infection provides a framework for identifying hazards and developing an action plan to eliminate hazards or minimize their effect through control measures. The conditions for the emergence, reproduction and transmission of pathogenic micro-organisms must be identified by the established procedures. The main components of an effective infection control program are shown in Figure 1.

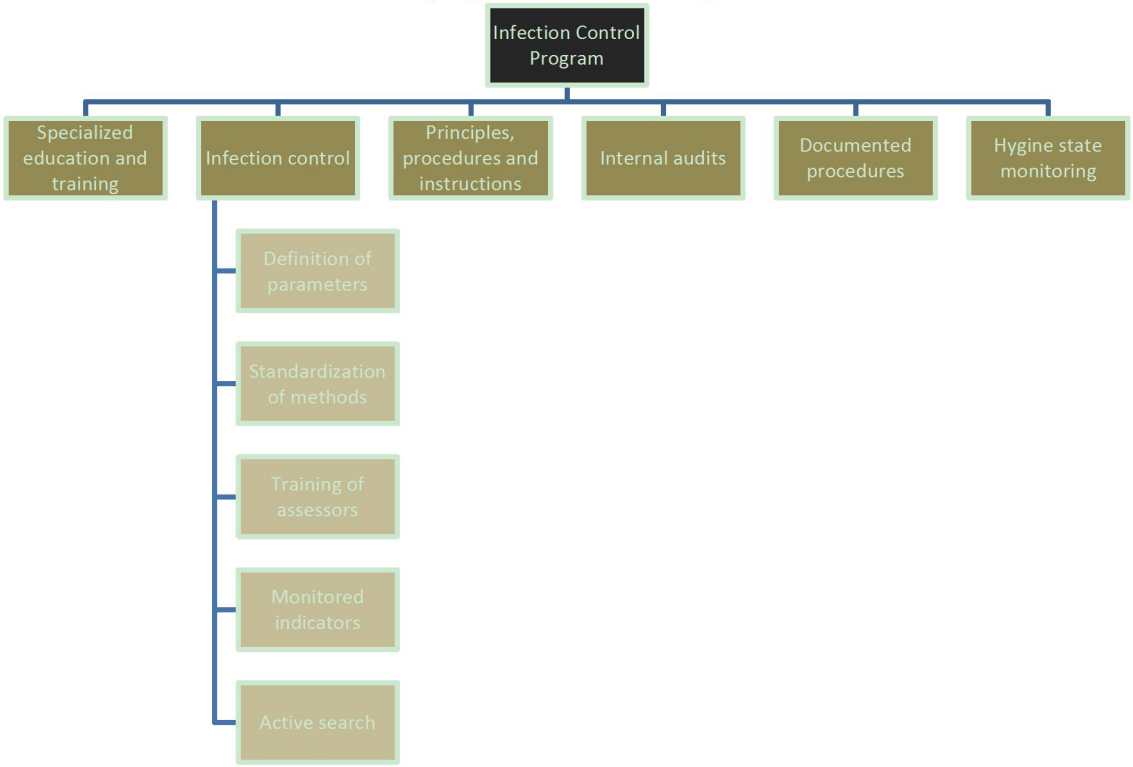

Figure 1 Main Components of an Effective Infection Control Program

Infection control procedures can be divided into two main categories, i.e., standard preventive measures and other preventive measures (based on transmission). Standard measures include the following items:

- washing hands and antiseptics (hand hygiene),
- use of personal protective equipment when handling blood, body substances and secretions,
- proper handling of patient care equipment and fouled laundry,
- prevention from needles/sharp object injuries,

- environmental cleaning and leakage management,
- proper waste management.

Other (transmission-based) preventive measures to ensure standard preventive steps include:

- precautions for air transmission,
- precautions for droplet transmission,
- precautions for contact transmission.

For proper handling infection control, the healthcare facilities need a clear written policy which will closely monitor and implement infection control processes through measurement, feedback and compliance with the infection control procedures. In addition, routine practices such as aseptic techniques, individual devices, transporting tools and equipment, antibiotic use, handling and using blood products, as well as environmental management practices, are essential to this issue.

Compliance with the above principles is particularly important in this day and age, as the building blocks of disease prevention for COVID-19.

2.4 Radiation Safety

The last two decades have seen a technological revolution in diagnostic and therapeutic medical imaging. However, minimizing the risk of radiation exposure is still a challenge. Radiation protection is a public health issue for several reasons. First, the health effects of radiation are not unique. Second, individuals have only limited ability to structure or control their own environment. Although awareness of radiation exposure has increased among the general public, there is still very little monitoring of cumulative radiation exposure throughout patients' lives. Successful radiation safety programs in healthcare facilities must balance prepared safety and personnel training with regard to the technical, scientific, economic, human and ethical aspects of the radiation emitting devices used. The radiation safety program must adequately protect patients, care providers, visitors and the general public. To minimize the risk of exposure to external radiation in ionizing radiation, the basic principles of radiation protection should be identified as follows:

1) the existence of a radiation safety program which includes and supports the following activities:

- regulatory activities related to the licensing of radioactive materials,
- multilevel safety training,
- monitoring of employees for radiation doses,
- management of radioactive materials,
- active participation in planning new or reconstructed facilities,
- response to and investigation of incidents/accidents,
- quality management program.

2). Time, distance and shielding are other key elements of radiation safety that need to be taken into account.

- Time: The simplest method of protection from ionizing radiation is to spend as little as possible near the source of the radiation, plus a reduction in exposure time by one-half reduces the dose received by half
- Distance: Doubling the distance between the person and source helps reduce exposure to a quarter of the original value
- Shielding: Shielding is considered the most important line of defense. The more matter is placed between the source and person, the less radiation the person receives. The gamma ray may be attenuated by the use of lead shields or concrete.

- Non-ionizing radiation poses a significant health risk in all healthcare facilities. This type includes ultraviolet, microwave and laser radiation. Ultraviolet (UV) radiation is often used in sterilization procedures. In fact, UV exposures are best controlled by limiting the exposure as a function of energy. In application, microwave radiation is commonly used in hospital diathermy and microwave ovens. Microwave radiation is controlled by exposure limitation and sources should be regularly monitored by a measuring device. On the other hand, lasers have a growing role in medical treatment. Glasses are the most common method of protection.

2.5 General Security of Buildings

The safety of a building consists of a set of activities starting with its design, construction, operation and maintenance in a way that cannot be the cause of deterioration of health, injury or death. Maintaining good technical condition of buildings in healthcare facilities requires quite considerable investment in healthcare infrastructure. Hospitals can be made safer and more functional by appropriate application of measures to improve the sustainability of healthcare infrastructure, including measures to increase the reliability of energy and water supply systems.

The physical structure of a hospital can pose a danger to patients and staff. The most common causes of compensable work-related accidents are manual handling of material, falls and being hit by falling or moving objects. Accidents and injuries due to falls and collisions can be minimized by:

- setting internal rules, e.g., a fall prevention program,
- providing clean, dry, unlimited and non-slippery surfaces,
- maintenance of handrails and stair surfaces in good condition,
- minimizing pathways for patients.

A significant aspect of buildings safety is the fire protection system, which is seen as a means of ensuring both the safety of life and the safety of the building. Similarly, gas bottles and distribution systems are usually considered an integral part of a hospital structure. Medical gases are vital elements in the treatment of patients as well as in laboratory procedures. Most hospitals have a permanently installed gas distribution system. In this system, gas bottles can be stored in a centralized location separately and detached from other hospital functions. Every gas bottle should be handled with the utmost care, which includes:

- identification of bottles by name and color coding,
- fixing as protection against falls,
- safe valve closure for pressure bottles not in use,
- protection of bottles against extreme temperatures,
- avoiding oil contamination or any kind of lubricant in oxygen cylinders,
- no smoking near oxygen or oxide cylinders.

2.6 Water Quality

Water is a strategic energy source that should be used and managed properly. In hospitals and other healthcare facilities, water is an essential means that is supplied from external sources and can serve as a medium for spreading infections when running from outside sources to the hospital. Chemical analysis of the water or its treatment before use is required to determine the quality level. A typical case is the prevention of Legionella. The sanitary limit in water is set by Decree 252/2004 Coll. laying down hygiene requirements for drinking and hot water, and the frequency and extent for checking drinking water. The Legionella limit for hospitals is set to — 100

KTJ (Legionella)/100 ml. Methods to prevent Legionella multiplication:

- regulating the system so that it does not allow water stagnation,
- prevent the formation of algae, mucus and sediments in which bacteria are protected,
- operate hot sanitary water above 60°C with the possibility of overheating to 70°C,
- keep cold water distribution below 20°C,
- use chemicals to prevent biofilms,
- proper maintenance and sanitization of the distribution system and all equipment connected to it.

Demand for water in healthcare facilities is dependent on different consumption sites. Potential risks and negative impacts of water use (e.g., infection) and facilities (e.g., damage) must always be taken into account. Further crucial aspects are sample collection and treatment prior to final disposal and discharge into the sewerage system and possible environmental impact (e.g., contamination).

Once water comes to the hospital, it requires further treatment and conditioning to meet specific needs. Typical modifications to the hospital water supply include deionization, distillation and sterilization. Most healthcare facilities have six main areas of water consumption: hygiene, heating, ventilation and air conditioning (HVAC), clinical and medical procedures, washing, eating and other uses. Sanitation and HVAC consume approximately 60 percent of water. Sewage collected from various parts of the medical facility also carries a variety of chemicals and biological pollutants, some of which are hazardous. Waste water should be included in hospital water management and thoroughly monitored and pre-treated before discharge into public sewers.

4. Conclusion

The article did not include in its scope all aspects of healthcare facilities that can or do have an impact on the environment, nor did it have such ambitions. Each healthcare facility is particularly specific in its range of services provided, however the correct identification of all influences, both internal and external, and the subsequent correct determination of working practices will lead to minimization of their impacts.

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