

FACTORS AFFECTING ENVIRONMENTAL HEALTH AND SAFETY IN HEALTHCARE SECTOR

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ABSTRACT

Environmental Health and Safety (EHS) is a discipline, which involves creating a culture of health, safety, and environmental protection in a workplace. It provides workplaces that are injury-free and incident-free for all employees, visitors and contractors, as well as enhances the wellbeing of those parties and local communities. Therefore, EHS has a direct impact on morale of stakeholders, employee productivity as well as on organisational performance. Healthcare facilities are specific from others, and customers and workers in healthcare sector are exposed to huge amount of harmful contaminants compared to other working environments. There are many EHS issues that can be identified in healthcare sector, and inability to control such issues will become an epidemic to the whole society. Various factors determine the EHS condition of an organisation such as ventilation, lighting levels, noise, and design of workstations, safety measures in emergencies, to name few. Having a better understanding on those factors will enable the maintenance of effective EHS practices so that the negative impact of poor EHS practices can be minimized. Hence, the financial goals and objectives of the organisation can be achieved. Even though, such importance is there, studies on EHS is hardly found and a less attention has received to this subject. Therefore, the aim of this paper is to critically evaluate the factors affecting EHS in healthcare facilities. A comprehensive literature review was carried out to identify the EHS factors. Five environmental factors and eight occupational health and safety related factors were identified through the review and they be used to study the critical factors affecting EHS of healthcare facilities in future research agenda.

Keywords: *Environmental Health and Safety (EHS), Environmental Health and Safety Factor; Healthcare Facilities.*

1. INTRODUCTION

The concept of the safety of employees goes back to the start of the industrial revolution in Britain. However, with the scale-up of plant sizes in the 1950s and 1960s, new safety concerns were recognized and it was not only the slips, trips, falls and similar events, but also the processes and events (Ashton and Crawley, 2002). Further, it was recognised that occupational health and safety issues and the working environment have become linked to environmental issues and a proper Environmental Health and Safety (EHS) conditions provides workplaces that are injury-free and incident-free for all employees, visitors and contractors and enhances the well-being of its employees and local communities. Thus, the Environmental Health and Safety (EHS), was identified as a discipline which should be given a special attention.

Managing and implementing proper EHS strategies lead to achieve business objectives and improve the productivity of organisations. Though the occupational safety and health has become popular in the industry, managing impacts of the environment, safety and health of the customer as well as workers has received a little attention. However, identification of EHS factors and their effect on organisations' operations and stakeholders helps to take preventive measure and minimise the negative effects. Especially this is very much important for healthcare sector in which a huge amount of EHS issues can be found. Though such study is needed, a research which specifically addresses the EHS factors in healthcare sector is hardly found. Therefore, this paper aims at identify the EHS factors in

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health care sector.

The paper structure begins with EHS issues and followed by a literature review on identifying factors affecting to the EHS in healthcare environment within the Sri Lankan context. Finally it presents the discussion of research findings together with future research agenda.

2. ENVIRONMENTAL HEALTH AND SAFETY

According to the World Health Organisation (2013), environmental health is defined as physical, chemical and biological aspects of the human health and diseases that are determined by factors in the environment. It also refers to the theory and practice of assessing and controlling factors in the environment that can potentially affect human health. In addition, it includes ensuring that the surrounding environment, including work areas, laboratories or facilities, are free of dangers that could cause harm to a person working in those areas. A safe place to work is the key element of environmental safety. EHS together optimise the health and safety of the occupants while controlling the impacts of the environment. Further, as Stevens (2010) mentioned, the practicable EHS minimizes the negative impact of an organization's operations, activities, products and services on environment.

Early in 20th century in the industrialized countries, occupational health and safety was often driven by a simplistic focus on control the protection of the workers from exposure to health and safety risks. Special emphasis was given to engineering control and protective devices. For example, as people's knowledge of the health consequences related to the exposure of workers chemicals have increased, improving ventilation system or wearing protective devices have enhanced the protection of the workers (Stellmen, 1998). However, with the growing concerns of the community on eliminating the emission or exposure of the toxic chemicals, the public became increasingly aware of and actively participated in environmental management. Hence, as the people became aware of that occupational health and safety issues and the working environment have become linked to environmental issues, EHS management in work environments was given a special attention (Stellmen, 1998).

Traditionally, EHS investments have been looked upon as being expensive. However, with present day's fast-paced and competitive environment, all components of business organizations are being asked to demonstrate their value to the organization and environment. Therefore, organisations try to invest in strong EHS management on behalf of the betterment of environment and keeping people healthy and safe. EMS involves creating a systematic approach to managing waste, complying with environmental regulations, or reducing the company's carbon footprint. Organisations have experienced many benefits of incorporating these environmental and health and safety measures into the workplace. When there is establish good waste management concept leads to reduce waste, utilization of fewer raw materials and costs. In addition, by managing environmental issues before a problem arises, companies benefit from reduced liability. Successful EHS programs also include measures to address ergonomics, air quality, and other aspects of workplace safety that could affect the health and well-being of employees (International Financial Corporation, 2007). Even though, a less attention has received to this subject, managing the EHS factors can also achieve the organizational financial goals and objectives.

3. ENVIRONMENTAL HEALTH AND SAFETY IN HEALTHCARE FACILITIES

Out of other business sectors, healthcare sector is specific from others. Customers and workers in healthcare facilities are exposed to various mixtures of chemicals in the working environment. Therefore, many EHS issues can be identified in health-care sector, and they end with serious damages to the lives of customers as well as the reputation damages to the hospital (Egbu and Liyanage, 2008). Therefore, inability of controlling such issues will lead to epidemic to the whole society (Egbu and Liyanage, 2008). According to the recent incidents, the reliability of healthcare sector has reduced (Sattler and Lipscomb, 2003). . The main reason is after admission, the infections has developed during the course of a stay in hospital. As Adams *et al.* (2008) mentioned, generally, 5% to 30% of patients develop one or more infections during a stay in hospital. Further, Legionellosis is a well-

established risk associated with health-care facilities, with an average proportion of health-care associated infections close to 10%. However, the development of infections during hospitalization can be minimised by managing better EHS practices in healthcare sector.

Most the healthcare workers including nurses and attendants are working in standing posture. However, sitting has certain advantages over standing (Grandjean, 1988). Therefore, work environment has to be designed according to the capabilities of the individual workers. Exposed high environmental heat load, the health impairment, and physiological damages occurred of the workers due to heat stress (Dinman, 1974). In addition, insufficient, too strong, or glaring illumination causes visual inefficiency, resulting in fatigue, headache, dizziness, and increased accident risk. Large amounts of time and money are lost due to visual inefficiency on jobs (Nakagawara, 1990). Further, workers are exposed to various kinds of noise in their working environment. Some kinds of noise not be harmful but are annoying. However, exposures to extremely loud noises (<20000Hz) caused temporary or permanent hearing losses. Noise in general, is annoying sound that can inversely affect safety and performance as well (Smith and Tayyari, 2003). As Chukwuma (1998) mentioned, chemists exposed to elevate levels of chemicals in the workplace experience various degrees of cancer of the pancreas, lymphatic and vascular systems, as well as spontaneous abortions, birth defects, low in addition, impaired sperm production. Further, a paternal exposure to various chemical has been associated with childhood defects or cancer. Therefore, EHS practices should be given a high attention in order to minimise the impact, which happens to performance of healthcare facilities due to above EHS issues.

4. FACTORS AFFECTING TO THE EHS IN HEALTHCARE ENVIRONMENT

In order to address the EHS issues in healthcare facilities and to address those issues, a better understanding on the factors affecting EHS in healthcare facilities is necessary. A comprehensive literature survey and desk study was carried out to identify the EHS factors related to healthcare facilities. The findings of the review are given in Table 1. The identified factors were categorized into two sections environmental and occupational health and safety related factors.

Table 1: EHS Factors Identified through Literature Review

| EHS Factors | Literature Source | | | | | | | | | |
|---|--|-----------------------|----------------------|-------------------|------------|----------------|---------------------|---------------|-------------|-------------------------|
| | International Financial Corporation (2007) | Gershon et al. (2008) | Adams, et al. (2008) | Commission (2011) | WHO (2013) | Sadleir (2013) | Wangsaatmaja (1997) | Clever (1981) | Anon (2013) | Lundstrom et al. (2002) |
| Environmental Factors | | | | | | | | | | |
| Air Emissions and Ambient Air Quality | | | | | | | | | | |
| Water Conservation | | | | | | | | | | |
| Waste Management | | | | | | | | | | |
| Waste water and Ambient Water Quality | | | | | | | | | | |
| Noise | | | | | | | | | | |
| Occupational Safety and Health Related Factors | | | | | | | | | | |
| Physical Hazards | | | | | | | | | | |

| | | | | | | | | | | |
|----------------------|--|--|--|--|--|--|--|--|--|--|
| Chemical Hazards | | | | | | | | | | |
| Biological Hazards | | | | | | | | | | |
| Psychosocial Hazards | | | | | | | | | | |
| Radiological Hazards | | | | | | | | | | |
| Ergonomics | | | | | | | | | | |
| Infection Safety | | | | | | | | | | |
| Food Safety | | | | | | | | | | |

4.1. AIR EMISSIONS AND AMBIENT AIR QUALITY

Environment of a healthcare facility is generally contaminated with harmful substances. Where infected and susceptible people share the same air space and there is a risk of airborne transmission of infection (Jensen *et al.*, 2005). Therefore, all occupied areas of the health-care facility should be adequately ventilated to meet comfort requirements. As Jensen *et al.* (2005) mentioned, ventilation rates should be maximized to dilute and remove any infectious particles.

4.2 WASTE MANAGEMENT

The public is increasingly concerned over the improper disposal of medical waste, particularly those contaminated with communicable disease agents. Medical wastes include all types of wastes generated by health care organisations such as hospitals, clinics, physicians' offices, dental offices, veterinary facilities, other medical laboratories and research facilities. The medical waste can be categorized into several types like sharps, bio-degradable, radioactive, hazardous and non-bio-degradable. When managing the waste, it has several ways like 3R concept (Reduce, Reuse and Recycle), combustion and composting (Wangsaatmaja, 1997). According to the Chukwuma (1998), lack of an adequate management system creates a large risk for the spread of infection, parasitic and epidemic diseases, through people involved in the collection or handling the waste.

4.3. WASTEWATER TREATMENT

Wastewater is produced from washbasins, showers, sinks, etc. (grey water) and from flushing toilets (black water) (WHO, 2002). It should be removed in standard waste drainage systems to off-site sewer or on-site disposal systems. All open wastewater drainage systems should be covered, to avoid the risks of disease vector breeding and contamination from direct exposure. The most appropriate wastewater disposal option is connecting the health-care setting to a properly built and functioning sewer system, which is, in turn, connected to an adequate treatment plant. If the sewer does not lead to a treatment facility, an on-site retention system with treatment will be necessary before wastewater is discharged (WHO, 2002). According to Cheremisinoff and Shah (1990), in developed countries, most hospitals are connected to relatively large community waste disposal systems and hospital wastes represent only a small fraction of the volume of sewage. A major concern in the disposal of hospital waste is that hospitals have their own sewage treatment facilities (usually found in developing countries). Smaller systems may be more hazardous owing to smaller volumes of wastewater and hence, less dilution of contaminants. Furthermore, smaller systems are less efficient and may permit the discharge of infectious agents into ground water or other media, which may, in turn permit these agents to survive, a hazard to both hospital personnel and the nearby community. The general wastewater treatment methods depend on biological processes, principally bacteria feeding on organic material in the wastewater. If the composition of the wastewater is significantly modified by the addition of chemical or toxic, solvents are allowed into sewer/drains, the operation of the treatment plants can be seriously affected, perhaps making them completely ineffective for some days.

Therefore, hospital wastewater deserves to be given more attention in terms of environmental problems (Wangsaatmaja, 1997).

4.4. WATER CONSERVATION

Healthcare facilities are generally operated 24 hours a day throughout the year and therefore they require a huge amount of for their operations. However, when dealing with increasing demand on water supply or water shortage problem and environmental awareness, water conservation is becoming a pressing issue (Wangsaatmaja, 1997). Further, water quality is also an important factor to be considered in healthcare EHS management. Water purification is an expensive and difficult undertaking, for a hospital and a clean water supply and delivery system should be guaranteed by the authorities. Water is often supplied by the municipal water authorities and is the stored before distribution through the hospital. Such stored water must be monitored for contamination at regular intervals (Mehtar, 1992).

4.5. NOISE

Healthcare workers are exposed to various kinds of noise in their working environment. Some kinds of noise not be harmful but are annoying. However, exposures to extremely loud noises (<20000Hz) caused temporary or permanent hearing losses. Noise in general, is annoying sound that can inversely affect safety and performance as well (Smith and Tayyari, 2003). No employee should be exposed to a noise level greater than 85 dB for a duration of more than 8 hours per day without hearing protection. In addition, no unprotected ear should be exposed to a peak sound pressure level (instantaneous) of more than 140 dB. The use of hearing protection should be enforced actively when the equivalent sound level over 8 hours reaches 85 dB, the peak sound levels reach 140 dB, or the average maximum sound level reaches 110dB(A). Hearing protective devices provided should be capable of reducing sound levels at the ear to at least 85 dB (International Financial Corporation, 2007).

4.6. PHYSICAL HAZARDS

The occupants of healthcare facilities can be subjected to various physical hazards as in other environments do. Physical hazards represent potential for accident or injury or illness due to repetitive exposure to mechanical action or work activity. Single exposure to physical hazards may result in a wide range of injuries, from minor and medical aid only, to disabling, catastrophic, and/or fatal. Multiple exposures over prolonged periods can result in disabling injuries of comparable significance and consequence (International Financial Corporation, 2007).

4.7. CHEMICAL SAFETY

Chemical hazards represent potential for illness or injury due to single acute exposure or chronic repetitive exposure to toxic, corrosive, sensitizing or oxidative substances. They also represent a risk of uncontrolled reaction, including the risk of fire and explosion, if incompatible chemicals are inadvertently mixed (International Financial Corporation, 2007). In addition, some chemical dusts can enter the organism and pass to the bloodstream, thus being carried through the organism and exerting toxic action on one or more organs or systems, e.g., kidneys, liver, blood. The healthcare industry is utilised high amount of various types of chemicals. Drugs, laboratory chemicals, cleaning chemicals, laundry chemicals are used frequently compared with other industries. However, proper chemical handling has to be applied to achieve a better performance.

4.8. BIOLOGICAL HAZARDOUS

Biological agents represent potential for illness or injury due to single acute exposure or chronic repetitive exposure. For employees' highest level of hygiene and personal protection, biological agents

should be designed to enable their full segregation and isolation in emergency circumstances, include independent ventilation systems, and be subject to standard operating procedures requiring routine disinfection and sterilization of the work surfaces. HVAC systems should be equipped with High Efficiency Particulate Air (HEPA) filtration systems. Equipment should readily enable their disinfection and sterilization, and maintained and operated so as to prevent growth and spreading of disease agents (International Financial Corporation, 2007). There are three important modes of disease transmission from patients to staff. They are airborne and droplet aerosol exposure, skin contact exposure and exposure to infectious fluids via broken skin, eyes, mucous membranes, and parenteral exposure. If acute exposure to a biological hazard does occur, staff members need to be aware of relevant policies and procedures for appropriate management of the exposure. This will include appropriate washing for mouth, eyes or skin exposure, first aid for penetrating sharps injury, prophylaxis for high risk exposure, testing of the source if possible, testing and follow up of exposed staff and incident reporting (Sadleir, 2013).

4.9. RADIATION EXPOSURE

There is a wide range of radiation hazards related to medical imaging (X rays, nuclear scans utilizing radioactive isotopes, PET CT Scanner) and radiation oncology which utilizes ionizing radiation from a variety of sources to treat a range of malignant tumors. These sources include sealed sources containing radioactive material such as isotopes of radium, cobalt and strontium, and linear accelerators emitting short wave length gamma waves (Sadleir, 2013).

The use of radiation in medicine has led to major improvements in the diagnosis and treatment of human diseases. Annually, worldwide, more than 3,600 million X-ray examinations are performed, 37 million nuclear medicine procedures are carried out, and 7.5 million radiotherapy treatments are given. As the benefits for patients gain recognition, the use of radiation in medicine increases. While the development of modern health technology makes new applications safer, their inappropriate use can lead to unnecessary or unintended radiation doses, and can cause potential health hazards for patients and staff. Specially Children are vulnerable to environmental threats and have a longer life-span to develop long-term radiation-induced health effects like cancer (WHO, 2013).

4.10. ERGONOMICS

Disorders of the musculoskeletal system represent a main cause for absence from occupational work. The main work factors associated with these injuries are forceful exertions and awkward postures during patient-care tasks, especially while lifting and moving patients (Galinsky *et al.*, 2001). Musculoskeletal disorders lead to considerable costs for the public health system. Specific disorders of the musculoskeletal system may relate to different body regions and occupational work. For example, disorders in the lower back are often correlated to lifting and carrying of loads to the application of vibration. Upper-limb disorders may result from repetitive or long-lasting static force exertion or may be intensified by such activities. The severity of these disorders may vary between occasional aches or pain to exactly diagnosed specific diseases (WHO, 2013).

In addition, awkward postures or movements such as bending and/or twisting, raised arms, bent wrists, over reaching and over exertion; repetitive activities/handling, prolonged standing such as in the operating theatre at the operating table or in the kitchen, often combined with a bent over or awkward position; sitting while doing administrative work and documentation, often also combined with screen working. The stress engaged with the occupation is another factor that badly affected to the effective and efficient performance (Commission, 2011). Therefore, the design of work tasks or work station according to the capacity and performance of the worker is the most promising approach for preventing injuries, and for enhancing the comfort and safety of workers and patients (Galinsky *et al.*, 2001).

4.11. PSYCHOLOGICAL HAZARDS

Psychosocial risk factors can arise among all occupational groups in the healthcare sector including nurses, doctors, cleaning staff and those in the medical-technical service. However, they can also be stressful for staff due to shift work or on call duty; high work load and demand; unrealistic patient expectation; verbal abuse or threat from disgruntled or intoxicated patients; high or unrealistic expectations from supervisors and management; frustration due to limited resources, especially staffing levels; time pressure; rigid hierarchical structures; lack of gratification and reward; inadequate personnel leadership; lack of relevant information; lack of support from management staff and social conflicts, harassment, bullying, violence and discrimination (Commission, 2011). Hospitals are part of a high demand, high expectation service industry and are heavily reliant on staff for the friendly, safe, effective and efficient delivery of services. To optimize productivity and attitude of staff, senior management must be committed to ensure a conducive organisational climate with high staff morale. Clear priorities and direction, realistic performance goals and workloads, commitment to continuing education and quality assurance, reception to staff feedback, and support with counseling services for stressed staff are all important components (Sadleir, 2013).

4.12. INFECTION SAFETY

Health care-associated infections lead to death, disability and excess medical costs. Infection control is an important matter for employees and patients. Hepatitis B (HBV) is the major hepatitis threat to hospital employees who come into contact with patient blood (the chief culprit) and secretions. The current consensus is that patients with HBV pose more of a danger to employees than vice versa, although scattered employee-to-patient reports have appeared.¹⁰ Hemodialysis, oncology, blood bank and venipuncture personnel are at highest risk (Clever, 1981). Unsafe health-care settings contribute to a significant proportion of some diseases. Sharps waste, although produced in small quantities, is highly infectious. Contaminated needles and syringes represent a particular threat because they are sometimes scavenged from waste areas and dump sites, and reused (Adams *et al.*, 2008). HealthCare facilities must implement infection prevention and control policies like hand hygiene, personal protective equipment, isolation precautions, aseptic technique, cleaning and disinfection, sterilizations, waste management, immunizations and exposure management and antibiotics use protocol (WHO, 2013).

4.13. FOOD SAFETY

Foodborne diseases take a major toll on health. Millions of people fall ill and many die as a result of eating unsafe food. Food safety encompasses actions aimed at ensuring that all food is as safe as possible. Food safety policies and actions need to cover the entire food chain, from production to consumption (WHO, 2013). Food handlers should wash their hands after using the toilet and whenever they start work, change tasks, or return after an interruption. Soap and water should be available at all times during food preparation and handling, to ensure that hand washing can be done conveniently. Food handling and preparation is done with utmost cleanliness. Contact between raw food stuffs and cooked food is avoided. Food is cooked thoroughly. Food should be kept at safe temperatures and safe water and raw ingredients are used (Adams *et al.*, 2008). The HACCP (Hazard Analysis Critical Control Point) is a well-established food safety system of hazard analysis which is derived from the NASA space programme, which would ensure food for astronauts would not lead to food poisoning. The system they developed was Hazard Analysis - Critical Control Point or HACCP (Lloyd, 2013). This system is frequently used by many organisations.

5. SUMMARY AND FUTURE RESEARCH AGENDA

According to Bohdanowicz *et al.* (2005), healthcare facilities have been found to have the highest negative impact on the environment of all commercial/ service buildings. And compared to other facilities, a large amount of health and safety hazards are also available in healthcare environment.

EHS factors negatively affect different levels healthcare organisations. Therefore, managing and implementing proper EHS strategies lead to improve the productivity and achieve the business objectives and of healthcare organisations.

Having a proper understanding on EHS factors is essential to take preventive measures to minimise the EHS issues of a healthcare facility. The study identified thirteen EHS affecting the EHS issues in healthcare facilities. The identified factors were classified into two groups namely environmental factors and occupational health and safety related factors. Among them ergonomics, physical, biological, chemical, radiation, psychological hazards, infection safety and food safety were identified as the health and safety factors. In addition, air emissions and ambient air quality, waste management, water conservation, noise, waste water and ambient water quality were identified as environmental factors. Both environmental and health and safety aspects act as a two sides of the same coin. Therefore, the objective of EHS management should be to find ways to protect both workers' health and safety and the broader environment (Stellmen, 1998).

Though occupational safety and health has popular among industry sector, managing impacts of the environment, safety and health of the customer as well as workers has to be considered. The research done by this subject is much less compared with other areas including occupational safety and health in hospital sector. The consideration of environmental factor of the healthcare sector is important and therefore the future research agenda would be to carry out an in-depth study to identify the most critical EHS factors affecting EHS of healthcare facilities.

6. REFERENCES

- Adams, J., Bartram, J. and Chartier, Y., 2008. *Essential environmental health standards in health care*. New York.
- Anon., 2013. *Healthcare Environment*. [Online] Available at: <http://www.safety.duke.edu/Healthcare/default.htm> [Accessed 25 4 2013].
- Ashton, and Crawley, 2002. Safety, health or the environment—which comes first?. *Journal of Hazardous Materials*, 17-32.
- Bohdanowicz, P., Simanic, B. and Martinac, I., 2005. *Sustainable hotels—environmental reporting according to green globe 21, Green Globes Canada/GEM UK, IHEI benchmark hotel and Hilton environmental reporting*. In: Sustainable building (SB05) Conference, 27 (29).
- Dinman, B.D., 1974. Work in Hot Environments: I. Field Studies of Work Load, Thermal Stress and physiologic Response.. *Occupational Medicine*, pp. 785-791.
- Cheremisinoff, P. and Shah, M., 1990. Hospital Waste Management. *Pollution Engineering*, 22(4), 60-66.
- Chukwuma, C., 1998. Environmental issues and our chemical world - the need for a multidimensional approach in environmental safety, health and management. *Environmental Management and Health*, 9(3), 136-143.
- Clever, L. H., 1981. *Health Hazards of Hospital Personnel*. s.l.:s.n.
- Commission, E., 2011. *Occupational health and safety risks in the healthcare sector*.
- Egbu, C. and Liyanage, C., 2008. A performance management framework for healthcare facilities management. *Journal of Facilities Management*, 6(1), 23-36.
- Galinsky, T., Waters, T. and Malit, B., 2001. Overexertion injuries in home health care workers and the need for ergonomics.. *Home Health Care Serv Q*, 20(3), 57-73.
- Gershon, R., 2008. Home Health Care Patients and Safety Hazards in the Home: Preliminary Findings. *Advances in patient safety: New directions and alternative approaches*, 1, 407-422.
- Grandjean, E., 1988. *Fitting the Task to the Man": a classic practitioner's handbook in ergonomics*. 4th ed. London: Taylor and Francis.
- International Financial Corporation, 2007. *Environmental, Health, and Safety (EHS) Guidelines*. 30 April.

- Jensen, P. A., Lambert, L. A., Lademarco, M. and Ridzon, R., 2005. *guidelines for preventing the transmission of mycobacterium tuberculosis in health-care settings*. s.l.:
- Lloyd, J., 2013. *HACCP*. [Online] Available at: <http://www.haccptraining.co.uk/default.asp> [Accessed 9 5 2013].
- Lundstrom, T., 2002. Organisational and environmental factors that affect worker health and safety and patient outcomes. *Lundstrom* , pp. 95-106.
- Mehtar, S., 1992. *Hospital infection control: setting up with minimal resources*. s.l.:Oxford University Press.
- Nakagawara, V., 1990. *The use of contact lenses in the civil airman population : final report*. 1 ed. s.l.:Washington, D.C. : Office of Aviation Medicine, U.S. Dept. of Transportation, Federal Aviation Administration .
- Sattler, B. and Lipscomb, J., 2003. *Environmental Health and Nursing Practice*. s.l.:Springer Publishing Company
- Sadleir, B., 2013. *Environmental and Occupational Health Issues in Hospitals*. [Online] Available at: http://www.tropmed.org/rreh/vol1_2.htm [Accessed 24 4 2013].
- Smith, and Tayyari, 2003. *Occupational Ergonomics Principles and Application*. s.l.:Kluwer Academics Publishers.
- Stellmen, M. J., 1998. *Encyclopedia of the health and safety*.
- Stevens, A., 2010. Safety, Health and Environment (SHE). *Safety, Health and Environment Management Standards*, 2.
- Wangsaatmaja, S., 1997. Environmental action plan for a hospital.
- WHO, 2002. *Water Sanitation Health*. [Online] Available at: http://www.who.int/water_sanitation_health/wastewater/en/ [Accessed 15 2 2013].
- WHO, 2013. *Health worker occupational health*. [Online] Available at: http://www.who.int/occupational_health/topics/hcworkers/en/index.html[Accessed 24 4 2013].