



## Research Newsletter Vol. 5 (1): Jan – April 2016

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### Healthcare Associated Infections - An overview

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#### Introduction

Healthcare Associated Infections (HAIs) or Nosocomial Infections are a major public health problem in both developed and developing countries. Unfortunately, a variety of microorganisms do flourish in a typical health care setting and breaks in infection control practices can cause HAIs. Hospitalized patients are prone to developing such infections as a result of surgery, invasive procedures, use of medical devices, long term antibiotic treatment, immunosuppressive drugs, organ transplants and many other similar interventions.

It is estimated that, out of every 100 patients hospitalized at any given time, 7 patients in developed countries and 10 patients in developing countries acquire at least one HAI [1]. HAIs result in significant increase in morbidity and mortality, further leading to increased hospital stay and hence, also financial losses to patients as well as hospitals.

#### Definition of HAI

HAI is defined as

‘Infection acquired in a hospital or other health care facility by a patient who was admitted for a reason other than that infection and was not incubating it at the time of admission’ [2].

Infections occurring after more than 48 hours of the patient’s admission are usually considered nosocomial. These infections may manifest during patient’s stay in the hospital or may appear after discharge. Types of HAI include surgical site infections, medical device associated infections such as Ventilator Associated Pneumonia (VAP), Catheter Associated Urinary Tract Infections (CAUTI), Central Line Associated Blood Stream Infections (CLABSI), and airborne infections such as tuberculosis or viral or fungal pneumonia. HAIs also include infections occurring among the Health Care Workers (HCW) during patient care and a typical example is the needle stick injuries.

#### Historical perspective

The segregation of ‘fever hospitals’ from general hospitals were some of the initiatives taken in early nineteenth century towards control of HAI. Ignaz Semmelweiss (1861) was the first to introduce the concept of ‘asepsis’. While observing the patients suffering from puerperal sepsis, he noticed that medical staff who attended to these patients also performed autopsies. Therefore, he introduced a simple technique of hand washing with chlorinated lime, which led to a dramatic reduction in puerperal sepsis rates.

Joseph Lister (1827-1912) introduced antiseptic in surgeries and use of surgical gloves was introduced in the USA by the end of nineteenth century. The three decades between 1950 and 1980 saw an upsurge in establishment of many organizations, which provided guidelines and standards for control and prevention of HAI. Foremost amongst these are – Centers for Disease Control and Prevention (CDC); Healthcare Infection Control Practices Advisory Committee (HICPAC); Society for Healthcare Epidemiology of America (SHEA) and

Association for Professionals in Infection Control and Epidemiology (APIC). Furthermore, with the advent of HIV/AIDS in 1980s the concept of 'Universal Precautions' was introduced by CDC in 1989.

In spite of all these developments, today we still see that HAI due to Multi Drug Resistant Organisms (MDRO) are a common occurrence worldwide. The problem is endemic and ongoing and no institution or country can claim that they have been able to overcome it.

### Global scenario of HAIs

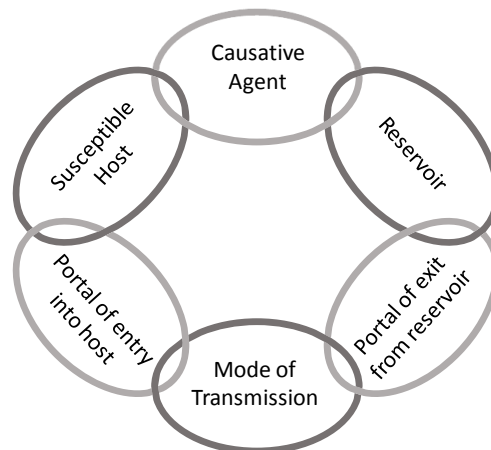
The prevalence of HAI in developed countries varies between 3.5% to 12%. The European Centre for Disease Prevention and Control (ECDC, Sweden) reports an average HAI prevalence of 7.9% in European countries.[1]. Approximately 41,00,000 patients are estimated to acquire HAIs in the EU each year and the number of deaths occurring as a direct consequence of these infections is estimated to be at least 37,000 [3]. According to CDC's HAI prevalence survey, there were estimated 722,000 HAIs in the USA's acute care hospitals in 2011 and about 75,000 of these died [4]. Furthermore, the attributable mortality due to HAIs, especially device associated infections in the ICUs, can be as high as 25% [5].

In developing countries, WHO's recent analysis states that the prevalence of HAI varies between 5.7% to 19.9% [1]. The proportion of ICU acquired infections ranged from 4.4% to 88.9% in these countries with frequency of overall HAI as high as 42.7 episodes per 1000 patient days [1]. This is almost three times higher than in developed countries. Overcrowding in hospitals, understaffing, inadequate environmental hygienic conditions, poor knowledge and enforcement of infection control measures, absence of local and national policies are some factors specific to developing countries resulting in high prevalence of HAI.

### The Chain of HAI

Within the 'Chain of HAI' shown in Figure 1, the occurrence of HAI needs four vital links

1. Causative agent,
2. Reservoir,
3. Mode of transmission,
4. Susceptible host



**Figure 1. The Chain of HAI**

(Adopted from Manual of Infection Control Procedures by Dr. N. N. Damani, 2nd edition, Cambridge University Press, UK, 2003)

The causative agents can be any microorganisms such as bacteria, mycobacteria, fungi and viruses such as Hepatitis B and HIV. These microorganisms can be part of the patient's own body microbial flora residing on the skin or in the gut or can come from an exogenous source. Reservoirs of infection can be patients themselves, visitors, HCWs, environmental factors such as food, water, contaminated medical equipment and devices, linen etc. The transmission of these microorganisms to the susceptible host can occur through direct contact or indirect contact with contaminated objects or hands. HCWs can become transient or permanent carriers of microorganisms and cause cross transmission to patients. Transmission can also occur through respiratory mode of inhalation. The patients at extremes of their age, with chronic diseases such as

malignancies, diabetes mellitus, AIDS and patients who undergo invasive procedures are particularly prone to HAIs.

The long term usage of broad spectrum antibiotics for prophylaxis or treatment in hospitals and health care centres promotes emergence of multidrug resistant strains of bacteria due to selection pressure. Clonal spread of such MDROs within a hospital may result in outbreaks of HAIs.

### **Prevention of HAIs**

Prevention of nosocomial infections is a moral responsibility of all healthcare professional and institutions. There must also be an effective support at the national and regional levels [2].

At an institutional level, the Hospital Infection Control Committee (HICC) provides a forum for multidisciplinary input and information sharing. The key members of this committee include a Microbiologist, in-charges of Critical Care Units and Operation Theatres, Nursing in-charge, Infection Control Nurse, representatives of the Housekeeping Department and Pharmacy. HICC formulates institutional policies for control of HAIs. These policies are adapted from international guidelines provided by organizations such as CDC, INICC and SHEA. These policies are compiled in the Hospital Infection Control Manual which forms an important document for staff education. The policies make recommendations for hospital infection control practices such as sterilization and disinfection, hand hygiene, control of device associated infections such as VAP, CAUTI, CLABSI, waste management policy, isolation policy, employee safety, outbreak management etc.

The surveillance process to monitor rates of HAI forms the back bone of hospital's infection control program. It enables identification of areas which need intervention and corrective actions. It also identifies outbreaks and facilitates timely intervention. This is expected to decrease the incidence of HAIs and reduces health care cost [2].

The Hospital Infection Control Nurse (ICN) is a key member of the HIC team. ICN supervises the day to day implementation of the HICC's policies and protocols. She carries out surveillance of the HAIs and monitors the HAI incidence rates in various units of the hospital. The epidemiological surveillance data is reviewed by the HICC to identify areas that need intervention. ICN also ensures that appropriate training on infection control and safety is imparted to all HCWs. (DMHRC has a team of 2 ICNs and 30 link nurses dedicated to supervise HIC practices). The hospital administration supports the hospital infection control programme by providing infrastructure, necessary facilities and authorities.

At the national level, development of a national system to monitor HAIs in public and private sector hospitals is essential and a national plan to address the problem of HAIs with the help of a national expert committee is the need of India's health care sector today. India's draft of National Health Policy 2015, coming thirteen years after the previous version, has focussed on various important issues in health care delivery and aims to make healthcare Accessible, Affordable and Accountable. Accountability can only be achieved if challenges in the form of HAIs that severely compromise patient safety, are addressed and effectively overcome.

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