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HEALTH CARE ASSOCIATED INFECTIONS (HAIS) - A MAJOR PATIENT SAFETY ISSUE!

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ABSTRACT

Context: Health Care Associated Infections (HAIs) is a major patient safety issue for the patient**s** and health care providers in any health care settings. As per WHO prevalence study in 55 hospitals of 14 countries in 4 WHO Regions (Europe, East Mediterranean, South West Asia and Western Pacific) average of 8.7% patients had HAIs with the highest frequencies from East Mediterranean countries (11.8 %). However, in many countries including India the epidemiology and magnitude of the problem of HAIs is not exactly known. **Aims:** The objectives were to find out the magnitude of problem of the HAIs and to study the epidemiology of HAIs health care settings. Settings and **Design:** Health Care Settings, Case Control, Cohort, Cross-sectional, Point-Prevalence Studies. Methods and **Material:** The PRISMA (Preferred Reporting Items for Systematic Reviews & Meta analysis) guidelines were used to search the articles from January 1993 to December 2012 in English language from different electronic databases. **Statistical analysis used:** Odds Ratio and 95% confidence interval. **Results:** 35 papers out of 594 searched, qualified for the study. There were 2 systematic reviews, 11 cohort studies, 6 cross sectional studies, 7 case control studies and 7 were one day point prevalence/survey studies. The prevalence of HAIs ranged widely from 1.4% to 30%. The most common troublesome microorganisms are found to be Pseudomonas aeruginosa, Methicillin Resistant Staphylococcus Aureus (MRSA), Escherichia coli and other Gram negative bacteria. The HAIs prevalence rates are found to be highest in the Intensive Care Units (ICUs) of heath care settings. **Conclusions:** The study showed that HAIs is a major patient's safety issue due to serious socio-economic implications on the patients and their families. Only few countries have surveillance and monitoring system to collect data on HAIs from Health Care Settings at regular intervals.

KEYWORDS: (Health Care Associated Infections, Nosocomial Infections, Cross-Infections, Hospital Acquired, Prevalence, Incidence)

KEYMESSAGES: (HAIs is a Major Patient Safety Issue causing emotional stress, functional disability, hospital over stay, excess of estimated costs and eventually death. There is need to develop health systems at National and Local levels to track and monitor the HAIs along with Infection Control Policy implementation in Health Care Settings.)

INTRODUCTION

Health care associated infections (HAI) occur worldwide and affect both developed and resource-poor countries. HAI is a major patient safety issue for the patients and health care providers in any health care settings.[1, 2, 3] "Infections acquired in health care settings are among the major causes of death and increased morbidity among hospitalized patients. They are a significant burden both for the patient and for health professionals". As per WHO prevalence study in 55 hospitals of 14 countries in 4 WHO Regions (Europe, Eastern Mediterranean , South-East Asia and Western Pacific) average of 8.7% patients had HAI. At any time, over 1.4 million people worldwide suffer from infectious complications acquired in hospital. The highest frequencies were reported from the hospitals in the South-East Asia Regions (10%) and East Mediterrean countries (11.8 %), while a prevalence rate of 7.7 and 9.0% respectively in the European and Western Pacific Regions. In developed countries, the toll is 5-10% of patients admitted to hospitals. In general wards and in intensive care units up to 50% or more of patients may have it.[7,8] In many countries including India, the magnitude of the problem is not exactly known or grossly underestimated. This is mainly due to because HAIs diagnosis is complex and surveillance activities to guide interventions require expertise and resources[6] HAI infection rates are higher among patients with increased susceptibility due to old age, underlying disease, or chemotherapy. These infections have serious socio-economic implications on the patients and their families. It not only causes the emotional stress, functional disability, hospital over stay, potential

disability with lowered quality of life but also exceeds of estimated costs of treatment and eventually death.[4,5,6] HAI is defined as an infection occurring in a patient during the process of treatment care in a hospital or other health-care facility that was not manifest or incubating at the time of admission. It is secondary to the patients original condition for hospital admission. It also includes infections acquired in the hospital and any other setting where patients receive health care and may appear even after discharge. Surveillance systems do exist in some developed countries like USA, UK and Germany which regularly reports on HAIs trends at national level.[9] However, such systems do not exist in most developing countries because of many health-care system deficiencies.[10] The problem of HAI is further aggravated by overcrowding and understaffing in hospitals which often result in poor infection control practices. There is also a lack of infection control policies, guidelines and professionals trained in infection control. Since the antimicrobial resistance to antibiotics is increasing rapidly worldwide, it is crucial to focus the research activities on reducing resistance to drugs and also the spread of multidrug resistant strains of microorganisms. Similarly, there is an urgent need to look into the epidemiology of risk factors involved in health care-associated infections in hospitals along with feasibility and effectiveness of current infection control practices. Many studies have shown that measures for infection prevention and control can effectively reduce the morbidity and mortality associated with the HAIs.[33]

SUBJECTS AND METHODS

Search Terms: The search terms used are Health Care Associated Infections, Noscomial Infections, and Key Words Of Mesh Terms : Cross Infections, Hospital Acquired, Prevalence, Incidence.

Search Strategy: A literature search on HAIs was performed from January 1993 to December 2012 with restriction of English language. The time period taken is arbitrary so as to collect the recent information. The search was made to retrieve articles on epidemiology of the most common health care associated Urinary Tract Infections (UTI), Surgical Site Infection (SSI), Hospital-Acquired Pneumonia/Ventilator Associated Pneumonia (VAP) and Catheter Related Bloodstream Infection (CRBSI). PubMed was searched using a combination of the following keywords, including "Cross-Infection" as the MeSH term: "Nosocomial Infection", "Hospital-Acquired", "Incidence", "Prevalence" And "Rate" together with special reference to India. The Cochrane Library was also searched for review papers. Similarly the reference quoted in retrieved articles were hand searched for other available studies. WHO web sites and regional medical database was also searched. Cochrane library and TRIP data base was too searched for relevant articles on HAI. An attempt was also made to retrieve data from abstract books of the International conferences on infection prevention and control like International Federation of Infection control, International Congress on Infectious diseases.

The PRISMA (Preferred Reporting for Items for Systematic Review and Meta analysis) guidelines were used for identifying and screening of the articles for eligibility and qualified criteria.

Inclusion and Exclusion Criteria

All articles studying the epidemiology incidence/prevalence of any or all types of HAI were included. Similarly studies with other outcomes with HAI like microorganism responsible and assessment of costs, antibiotics sensitiveness, interventions to improve, attributable mortality and hospital stay were also screened for inclusion in review. Outbreaks reports were excluded. Only full free texts of relevant English articles were scrutinized. The studies containing letters, editorials, observational studies, case reports were excluded.

Quality of paper assessment

Duplicate articles removed on basis titles, examination and abstracts. Full free text of abstracts of interest was taken for inclusion in the study. Internal validation of the articles was done by using a critical appraisal checklist . Meta-analysis was not attempted due to wide variations of studies and indicators used for measurement of outcomes.

Data Management

Full text articles was documented on a predesigned eligibility form having eight columns to assess whether to include or exclude for critical review. The sections designed to gather data from articles (i) title, name of authors, year of publication (ii) the characteristics of the study i.e. country , type of study, (iii) sample size and setting (iv) observation and results in terms of outcomes (v) Critical comments on the articles, The Odds's ratio and 95% confidence intervals for all indicators found.

RESULTS

A total of 594 study papers were searched. Out of this PubMed showed 175 articles, Cochrane 212 articles and TRIP 207 articles. After removing duplicates 43 papers found eligible to be included in the study. Further reviewing the full text and abstracts of papers, 35 papers finally qualified for the review of the literature. Free full texts were available for 22 articles. There were 2 systematic reviews, 11 prospective cohort studies, 6 cross sectional studies, 7 case control or retrospective studies and 7 were one day point prevalence/survey studies. The 19 articles were from India while rest articles from countries Africa, Sudan, Russia, Mangolia and European areas. All studies were taken at Tertiary Care Hospitals except one at Community Health Centre. Health Care Associated Infections were classified into UTI, SSI, VAP,CRBSI. 12 studies measured all the HAIs. While only UTI, SSI, VAP, or CRBSI Health Care Associated Infections were measured in 5, 6, 3 and 4 studies only respectively.

Table 1- Showing Epidemiological Distribution of HAIs by Type and Microorganism

Type of HAI	Number of Studies *	Rate of Infection	Most Common Organism	Other Organisms
Urinary Tract Infections (UTI)	5	4-52.7%	Escherichia coli	Klebsiella spp. , Candida spp., Pseudomonas aeruginosa, enterococci
Surgical Site Infection (SSI)	6	4.34-25.3%	Staphylococcus Aureus	Streptococcus , Klebsilla
Blood Stream Infections, Catheter Related Blood Stream Infections (BSI,CRBSI)	4	20.6-25.8/1000 Central line days	Staphylococcus pathogen	Staphylococcus aureus and Escherichia coli , Gram negative bacteria
Ventilator Associated Pneumonia (VAP)	3	8.87-16.8/1000 Ventilation days	Pseudomonas Aeruginosa MRSA**	Staphylococcus Aureus , Streptococcus pneumoniae
Total HAIs Rate		1.4% to 30% (a wide variation observed)		

* Other 12 studies observed all HAIs showed wide variation in same range.
** MRSA-Methicillin Resistant Staphylococcus Aureus

DISCUSSIONS

The overall different HAIs rates along with different types of microorganisms were found in the range of 1.4% to the tune of 30% in different studies in different countries across the globe (Table 1). The 5 studies which measured UTI only showed HAI rates ranging from 4% to 52.7%. The 6 studies which measured only SSI revealed a range of HAI rates from 4.34 % to 25.23%. Similarly BSI health care associated infections rates were found from 8.5 per 1000 discharges to 18 per 10000 patients days by 2 studies.[10,15] The CRBSI rates were found to be 20.6 per 1000 central line days to 25.8/1000 central line days in two studies (9,14). VAP rates were reported by 3 studies as ranging from 8.87 per 1000 ventilation days to 16.8 per 1000 ventilation days.[8,16,21,35,36] The other 4 studies which reported all the types of HAI showed a wide varied range of rates for different HAIs. Few studies observed different results for occurrence of HAIs in different wards. One study found major proportion of HAIs was among patients admitted on non-intensive care unit mainly in the wards of internal medicine, surgery, geriatrics and rehabilitation.[1] The other study reported most HAIs in ICU 46.7% followed by the medical and surgical wards.[12] HAI in medical wards accounted for 47.8% of the total, followed by community-acquired infections in 27.0%, and MICU-acquired infections in 25.2% of the cases as reported by one study (24).HAI rates were highest for nursery 35.8%, intensive care (19.8%), gynaecological (16.2%) and surgical (11.7%) patients, as observed in one study.

The epidemiology of the microorganisms responsible for HAIs are almost the same observed in different studies. In UTI Escherichia coli (32.4%) was the most common reported pathogen, followed by Klebsiella spp. (17.0%), Candida spp. (12.8%),Pseudomonas aeruginosa (11.7%) and enterococci 8.5%.[26] Staphylococcus aureus (23%) and Pseudomonas aeruginosa (11%), caused more than 90% of the HAI infections of UTI, BSI and others in the study.[25,37]

Pseudomonas aeruginosa was found to be the most common organism followed by Staphylococcus aureus with other gram-negative organisms in VAP patients.[16,36] Similarly in other study of VAP the gram-negative rods were main pathogens responsible. In community-acquired pneumonia it was gram-negative rods.[24] Staphylococcus epidermidis (55.4%), Staphylococcus aureus (9.5%) of which 14% were methicillin resistant, Streptococcus pneumoniae (S. pneumoniae) (4.5%), 40% of which were resistant to penicillin and Enterococcus faecalis (4%). Gram negative bacteria were found in 44 cases (20%) and included Escherichia coli and Klebsiella pneumoniae (K. pneumoniae) (3.6% each) responsible for HAIs.[14, 15] Gram-negative organisms were responsible for 67% of the BSI in the paediatric cardiac ICU, with Pseudomonas (28%) and Enterobacter (22%) as the main causative organisms.[10] In a study which measured BSI and CRBSI the Staphylococcus was the leading pathogen (23.7%) followed by Staphylococcus aureus (11.1%) and Escherichia coli (11.1%) .Of all episodes of HAIs the Candida caused (5%), Klebsiella pneumonia (9%) and Pseudomonas aeruginosa (7.3%).[9] Two studies also tried to estimate the extra costs of Noscomial Infections acquired during hospitalizations. It was both for treating infections and misuse of antibiotics. It was US $318,705. The minimum government cost estimated to be US $273,180 and $565,603 for Nosocomial Infections and overuse of antibiotics respectively to get further cure of HAIs.[23,25] The risk factors for HAIs were identified as both prophylaxis and treatment mostly misguided and clinically not wanted by one author.[25] While in other studies the risk factors for hospital acquired infection included prematurity, prolonged hospitalization, ICU admission, indwelling catheterization for long period of time, mechanical ventilation and prior antimicrobial therapy.[15]

The study showed that very few studies are available which assessed the magnitude of the problem of HAIs in health care settings on regular basis. Wide variation in

different HAIs rates is found. Limited information is available for HAIs epidemiology and it seems that many HAIs are underreported or not reported by many health care settings and hospitals. The different authors tried to develop the bench markers for HAIs. They have recommended more epidemiological studies in the country to assess the correct picture of HAIs. The study also observed a lack of well-designed prospective/cross sectional studies to study the epidemiology of the HAIs in health care settings. Unfortunately, none of the studies tried to evaluate the existing infections control practices, protocols and guidelines in health care settings to improve upon it as continuous quality improvement. There is need to estimate the extra cost of the treatment to cure the HAIs as well the cost of hospital overstay in health care settings. The major patient safety issue of HAIs is of utmost importance in today's scenario viewing the raising voice of the patients rights for safer and quality health care in health care settings.

CONCLUSIONS

The study showed that HAIs is a major patient's safety issue. This is mainly due to serious socio-economic implications on the patients and their families. Few countries have surveillance and monitoring system to collect data on HAIs from Health Care Settings at regular intervals, therefore, there is an urgent need to establish good surveillance system for HAIs, across the globe. Limitations of the study –The English language may be limiting factor. Some reports might have been missed in spite of very good search made. Limiting the study to health sector interventions. Paid articles left out.

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