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Root Cause Analysis of Fluctuations in Hospital Acquired Infection Trends as Per Training Based Supervisory Checklist of Bundled Care Interventions in a Tertiary Care Hospital of Central India

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ABSTRACT

Health care associated infections are becoming challenging day by day. Just to perceive the interplay of underlying epidemiological factors in current scenario this prospective study was undertaken for a period of ten months in associated hospital of LN Medical College, Bhopal. Various hospital acquired infection's related data was evaluated in separate time periods. Over a period of 10 months catheter-associated urinary tract infections (CAUTI), central-line-associated blood stream infections (CLABSI), ventilator-associated pneumonias (VAP) related rates were revealed as 12.59, 12.4 & 16.15 respectively per thousand device days. Surgical site infection (SSI) rates were found to be fluctuating in-between 0.792% to 10.5%. It was concluded that in order to bring down these rates bundled intervention based surveillance checklists are to be followed along with other disinfection & sterilization related measures. Also root cause analysis approach has been recommended to gain control over the problem.

KEYWORDS : Hospital Acquired Infections, Surveillance, Bundled Care Interventions, Root Cause Analysis, In Patient Department, Bhopal

Introduction:

Healthcare associated infections (HAIs) are defined as infections not present & without evidence of incubation at the time of admission to a health care setting.[1]Hospital acquired infection is a key factor determining clinical outcome among patients admitted in critical, semi critical & non critical care areas. Hospital based programs of surveillance; prevention & control of HAIs have been in place since 1950s. The SENIC project from the 1970s showed that the HAI rates could be reduced by as much as 32% if surveillance were coupled with appropriate infection control program.[2]Of every 100 hospitalized patients at any given time, 7 in developed & 10 in developing countries will acquire at least one HAI. At any given time, the prevalence of HAIs in these countries varies between 3.5 and 12 % whereas in low & middle income countries it varies between 5.7 & 19.1%.

Surveillance of hand hygiene protocol, barrier/task nursing, device-associated infections have become an integral aspect of infection control strategy in all health care facilities. These infections include catheter-associated urinary tract infections (CAUTI), central-line-associated blood stream infections (CLABSI), ventilator-associated pneumonias (VAP) & surgical site infections (SSIs). The Center for Disease Control and Prevention (CDC) has provided simple definitions for the diagnosis of these infections.[3] Estimation of hospital associated infection rate/1000 device days allows all hospitals to compare their rates for trend analysis purposes and to identify all bottle necks that needs to be readdressed. Moreover, surveillance of health-care-associated infections defines the extent and nature of problem, which is the initial step toward reducing threat of infection in vulnerable hospitalized patients. Infection Control Committee's general supervisory checklist along with NHSN based HAI datasheets [3] of any hospital, serves as a major tool for the surveillance of these infections. The hospitals in developed countries generate their infection-control surveillance data from time to time. This is also pertinent for empirically treating infections, especially in the intensive care unit (ICU) settings, where a thorough knowledge of the epidemiology, type, nature, and risk factors for infections as well as the antimicrobial resistance patterns of invading microorganism is needed. It has been observed that there is little contribution of Indian IPD settings in various databases about device-associated infections. Nowadays, devices are the most important causes of Hospital-acquired infections due to their prolonged use and lack of regular care or timely change when required, particularly in ICUs. [4,5] Various factors contribute to this malady particularly prolonged length of hospital stay, excessive use of invasive devices for prolonged periods (device utilization [DU]), indiscriminate use of antibiotics, and increased bacterial resistance.[6] A multimodal supervision program which incorporates training of the staff with respect to infection control measures & use of CDC/NHSN guideline checklists & quality results from microbiology laboratory can be effective in reducing the Hospital Acquired Infections in hospitals.

Aim & Objectives:

1) To stop indiscriminate use for long durations of various invasive devices by training etc.

2) To implement various infection control policies (Bundled Interventions etc.) in order to reduce critical issues related to high morbidity and mortality in admitted patients.

3) The objective of this study is to ascertain the epidemiology and risk factors of health-care-associated infections in IPD settings of a tertiary care hospital.

Methodology:

This prospective study was conducted from 1st Oct 2015 to 30th July 2016 in a 760 bedded tertiary care hospital having eight multidisciplinary ICUs consisting of five to twelve beds each & about 27 general wards; Here ICUs are a multidisciplinary unit, with arrangement of each bed in separate cubicles & nurse patient ratio of 1:2. Each bed is equipped with a single hand sanitizer fitted at foot end of the bed. The profile of patients admitted were critical surgical, medical, pediatric cases etc. Whereas in general wards set up is of regular pattern, with arrangement of each bed at a distance of 1.5 to 2 meters.

Routine surveillance of various health-care-associated infections such as CAUTI, CLABSI, VAP & SSI was done by the Department of Community Medicine, Critical Care Medicine & Microbiology by using specific infection control surveillance proformas. Training was also imparted on the standard definitions and the guidelines, as was outlined by the NABH standards. Multiple training sessions were conducted periodically for health care workers (HCWs). WHO/NHSN/CDC protocols based checklists were designed & used because checklists have tremendous potential for improving the safety and the quality of the infection control guidelines and for reducing the chances of omissions. On every 100 admitted patients we have 1 Infection Control Nurse (ICN). Data was gathered on technically designed datasheets for statistical analysis.

Baseline assessment of every admitted patient is conducted either clinically or by baseline laboratory investigations to exclude infection at the time of admission. The laboratory evidence such as TLC/DLC, culture reports (repeat isolation of same bacterial strain), and other investigations like X-ray findings were correlated with the clinical

findings such as temperature, pulse rate, blood pressure, auscultatory findings, and any other specific symptoms to assess infection or colonization.

Results:
In our 760 bedded hospital, many patients were registered for IPD & were taken on various healthcare related devices (Foley's catheters, central lines, ventilators etc.) from October 2015 to July 2016 (period of 10 months). Ventilator associated pneumonia (16.15) was the most common observed health-care-associated infection per thousand device days followed by CAUTI (12.59) and CLABSI (12.4) in total duration of 10 months [Table No.1]

Supervision programs which involve bundled infection control practices in hospital do bring the rates down with some unfavorable fluctuations.

Table No. 1: Distribution of various Hospital Acquired Infection's data from October 2015 to July 2016 in a tertiary care hospital setting.

Quarter & Year	Last quarter 2015: Oct/Nov/ Dec.	Ist quarter 2016: Jan/Feb/ March.	April/ May 2016.	June/July 2016.
Type of HAI Rate data (For IPDs only)				
Catheter Associated UTI: Device days & CAUTI cases	3000 (approx..) & 42	2010 & 47	3793 & 30	2468 & 23
Central line Asso. Blood Stream Infections: Device Days & CLABSI cases	600 (approx.) & 4	567 & 8	496 & 11	362 & 2
Ventilator Asso. Pneumonia: Device Days & VAP cases	600 (approx..) & 12	772 & 21	498 & 5	421 & 1
Surgical Site Infection Rates (in %)	Not calculated	6.68/10.54/6.07	1.95/3.01	0.792/1.31

Total number of Foley's catheterization days was 11,271. The number of UTI episodes was found to be 142 among the ICU & general wards patients who had indwelling urinary catheter. In addition, CAUTI was calculated as 12.59 per 1000 catheter days. Out of the total number of urinary isolates, E. Coli, Klebsiella, Pseudomonas aeruginosa and Enterococcus species were more commonly implicated.

Total number of central venous line days was 2005. The episodes of blood stream infection was 25 among patients having central line catheters. Also, CLABSI was found to be 12.4 per 1000 central line days. Klebsiella pneumonia, Enterococcus were the most commonly isolated organism from blood stream infections among ICU patients.

Total number of ventilator days was 2291. A total of 37 episodes of VAP was found respectively and for 10 months VAP was calculated as 16.15 per 1000 ventilator days. Klebsiella, Pseudomonas, Acinatobacter, enterococcus species were the most common isolate from tracheal secretions of ICU patients.

Discussion:
Infection control surveillance is a peremptory necessity for quality care and prevention of device-associated infections. As per many studies routine surveillance of these infections can reduce the incidence by as much as 30%.[2] However, in developing countries, due to lack of formal surveillance the rate of health-care-associated infections is high and compliance with hand sanitation etc. is badly compromised. In India, the rate of device-associated infections shows variations and has great implication. Habibi *et al.* in their study from AIIMS, Delhi, India, found the incidence rates of health-care-associated infections to be 11.3/1000 urinary catheter days, 3.4/1000 central venous pressure line days and 31.4/1000 ventilator days.[7] In the ICU›s of seven hospital members of the international infection control consortium (INICC) of seven Indian cities the overall infection rates were 1.41/1000 catheter days for CAUTI, 7.92/1000 catheter days for CLABSI and 10.46/1000 ventilator days for VAP.[8] Rates were comparable with that of 55 ICUs in developing countries (CAUTI-8.9/1000 catheter days, CLABSI- 12.8/1000 catheter days and VAP - 24/1000 ventilator days).[9] Considering these values, the rate of VAP was relatively less whereas CAUTI was higher in our hospital. This all identifies the need of generating and evaluating own hospital data for development of proper infection control stratagem.

The occurrence of CLABSI depends upon the site, type of catheter, frequency of catheter manipulation, hand hygiene, scrubbing of catheter tubings before & after use with some alcohol based disinfectant and patient's primary illness etc. There is evidence that the use of central line through the subclavian access (in contrast to internal jugular or femoral access) reduces infection rates. Like many other research studies, various reasons for increased incidence of CLABSI in our set up include multidisciplinary ICU, less stringent infection control practices and high cost of alcoholic hand disinfectant that is not available at the bed side of all patients. Berenholtz *et al.* found a significant decline in CLABSI after following five points intervention module in their surgical ICU. The intervention module included education of staff, asking providers each day whether catheters could be removed, implementing a checklist to ensure the adherence to evidence-based guidelines for preventing CLABSI and empowering nurses to stop the catheter insertion procedure if a violation of the guidelines was observed.[10]

The nurses in our ICUs take care of Foleys in the form of scrubbing (with betadine and chlorhexidine based disinfectant) of catheter entry site and several inches of the tubing daily and after bowel movement, emptying of urobags after fixed period of time, keeping the urobags always below the bladder, maintenance of closed systems etc. For the prevention of VAP, the patients are kept in the semirecumbent position, draining of condensate is performed from ventilator circuits after a particular time period (after 4-6 h or earlier if need); continuous subglottic suctioning is performed, adequate pressure is maintained in endotracheal-tube cuff (palpation method), and strict adherence to all the elements of ventilator bundle protocol. But relatively higher incidence of CAUTI and VAP could be probably because of non-vigilant nursing care.

There are several drawbacks in our study. There may be generalization of factors since all the patients admitted in ICU for 10 months were included in the study. Severity of illness (SOFA or APACHE) scores as important risk factors were not assessed. Data regarding various catheter insertion sites like subclavian vein, internal jugular vein and femoral vein could have been analyzed to check for any relationship between them and CLABSI. Also device utilization ratio & median time from admission to development of nosocomial infection are not taken into account. Gender, age, medical/surgical patients were also not tackled separately.

In this study, fluctuations in HAIs rates in the same areas over a period of time aroused most probably due to attrition i.e., moving out of trained staff & recruitment of untrained staff, heavy patient load due to frequent camps, certain environmental factors, careless attitude of patients, relatives & of coarse of certain health care workers (HCWs), lack of training in new comers leading to compromised hand washing/barrier/task nursing precautions, inadequate fogging & CSSD services. Also capture of data increased which could be a strong reason for increased rates, In addition change in brand of many disinfectants may be responsible for low efficacy & thereafter increase in infection rates.

Conclusion:
HAIs are a major public health problem throughout the world. The most likely complication of hospital care, HAIs, mainly CAUTI, CLABSI, VAP and SSIs significantly impacts the morbidity and mortality, and financial cost implications due to prolonged hospital stay and related expenditure, thus adding to the overall healthcare cost for patients. The burden of HAIs is even higher in developing countries like India, as compared to developed countries. So in any health care facility along with proper training of HCWs on HAIs, regular surveillance based on supervisory checklist of bundled care interventions etc. is to be conducted. Also benchmarking overall HAIs surveillance

metrics with appropriate accounting/adjusting for potential confounders will result in clear conclusions. [11] A structured & problem solving approach of root cause analysis is recommended to focus on corrections for prevention of problem recurrences.

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