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Assessing the Burden of Health Care Associated Infection in Correlation with Patient Characters and Length of Stay

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ABSTRACT

Background: Health Care Associated Infections [HAI] are most common among patients who get admitted to any kind of health care setting. The percentage of Health Care Associated Infections is more in developing countries when compared to developed countries. Health Care Associated Infections commonly spreads through the medical devices, medical and para medical professionals. It has been shown that Severity of HAI depends on patient characteristics such as age, gender, underlying diseases, immune status, invasive devices used during procedures.

Methods: Retrospective data was collected for all the in-patients admitted to Ramaiah medical college hospital for the period of 2013 to 2015 (3 years). Data included factors like total number of in-patient's age group, gender, average length of stay (ALS).

Results: Retrospective data collected for the period of 3 years from January 2013 to December 2015 for the inpatients who got admitted for more than 48 hours of duration, the data collected included the parameters for major category of health care associated infections like urinary tract infections, blood stream infection, ventilator associated pneumonia and surgical site infection. The data collected showed results of various age categories, gender under various age groups, mean age and standard deviation of average length of stay for all the patients with HAI.

Conclusion: Age plays an important role in determining the average length of stay. Analysis showed that more HAI were detected among the elderly and the children who are immune comprised due to underlying co-morbid conditions. Finding out the co-relations helps in identifying the age and the length of stay.

Key words: Burden of HAI, Patient characters, Length of stay, Expenditure

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INTRODUCTION

Health care associated infections [HAI] are known by different terminologies such as "Nosocomial" or "Hospital Acquired infection". These are the type of infections that patient develops during their course of receiving healthcare treatment for other conditions, which are not present during the time of admission. These HAI infections can occur within 48 hours of admission, Within 3 days after discharge from the health care settings and Within 30 days after performing any procedure, operation/ surgery [1]. Health-care-associated infections many times causes life threatening situations to patients all over worldwide [2,3,4]. As per world health organization [WHO] at any given time among 100 hospitalized patients, 7 patients in the developed countries will acquire any one of the health care-associated infections [5].

The burden of HAI is more common among low income countries and also middle-income countries when compared to than in high-income countries ones [6]. Healthcare-associated infections (HAIs) causes economic burden to the healthcare system in terms of costs to patients and the health care providers, and leads to inefficiencies in the quality of patient care and low monitoring of hospital operations systems [7,8]. HAI has become an important global burden in any health care setting as data collected may not be relevant and also it is difficult to get information which is relevant. Systematic reviews of the literature have been conducted by many authors regarding HAI. Published studies say that both developed and developing countries faces a burden of HAI in varying degrees and the authors highlighting the magnitude of the HAI problem. Hospital-acquired infections occurs commonly in any health care setting and causes infections to patients, and the outcome of these infections is that it results in excess amount being spent by patients as healthcare expenditure [9].

Patient characteristics play an important role development of health care associated infections patient related characters include the demographic details, type of gender, category of ward, type of intensive care units, patient co- morbid conditions, number of diseases the

patient is suffering during the time of admission, antimicrobial stewardship, type of admission, length of stay, type of disease patient had at the time of admission.

Health care associated infections are time varying and they substantially increase the burden for the patients, their relatives, payer, third party administrators, hospital administrators HAI causes patient stay in the hospital (ALS), increases mortality, increases morbidity, Increases antibiotic resistance, increases financial burden for the patients, increases the number of bed days, additional burden to the insurance.

METHODS

Study was conducted in Ramaiah medical college hospital, a tertiary care teaching hospital with 12 – general specialty and 13 – super specialty departments with 800 bed strength. The hospital offers clinical services like outpatient services, in-patient services, multidisciplinary intensive care, pediatric intensive care units [PICU], neonatal intensive care units [NICU] services, accident and emergency services-24/7, 13 major operation theatres. Non clinical/supportive services includes national accreditation board for laboratories [NABL] accredited laboratory radiology, maintenance department, biomedical engineering department, medical records department, laundry, central sterile supply department [CSSD], dietary services, rehab and physical medicine, mortuary.

Retrospective collection of data pertaining to patient demographics and other variables and HAI. Bivariate correlation of independent variables and the dependent outcome is measured using Pearson's correlation coefficient. Pearson's correlation coefficient is used to determine the positive and the negative correlation between the two variables. Denominator for calculating the HAI rates would be obtained from the medical records. HAI as per the definitions would be considered and computed. Correlation of the patient characteristics, Economic burden with the HAI would be undertaken with appropriate stratifications. Identification of the pertinent patient characteristics that have an association with the HAI. Significant correlation variable will then be used to build a predictive model. Discussion of the results with the available literature and verification with the Hospital infection control committee records.

Statistical analysis

Quantitative analysis for continuous variables was done and summarized by using excel spread sheet presented in the form of tables, frequency of mean age, demographic details, was calculated and average length of stay.

RESULTS AND DISCUSSION

Study period included records 3 years, total in-patient admissions of 23,964 for the year 2013, 24483 for the year 2014 and 30954 for the year 2015. Among these patients the most commonly occurring Health care Associated Infections like Urinary tract infections [UTI], blood stream infections [BSI], ventilator associated pneumonia [VAP], surgical site infections [SSI] were taken for the study purpose as these health care associated [HAI] are devastating causing greater mortality and morbidity. HAI was assessed based on the various factors. The year wise data is explained in the Table 1.

Age stratification of different HAIs done. This is based on the 5 different age categories like 0-15 years, 16-30 years, 3-45 years, 46-60 years, Above 60 years. The age classification and the percentage of each HAI has been explained in the below mentioned Table 2.

For all different types of HAI like UTI, BSI, VAP, SSI Length of stay, average length of stay, standard deviation, inter quartile has been tabulated in the below Table 3.

95% Confidence interval for the mean calculated considering upper bound and lower bound and tabulated in the Table 4.

Table 1: HAI mean age below 50 years, above 50 years-male and female patients.

HAI–Year Wise	Confirmed Cases	Below 50 years	Above 50 years	Female Patients	Male Patients
UTI-2013	439	229	210	232	207
UTI-2014	450	221	229	230	220
UTI-2015	429	248	181	220	209
BSI-2013	114	71	43	56	58
BSI-2014	120	62	58	55	65
BSI-2015	126	66	60	42	84
VAP-2013	43	30	13	15	28
VAP-2014	55	35	20	17	38
VAP-2015	50	30	20	24	26
SSI-2013	8	2	6	4	4

SSI-2014	13	8	4	4	9
SSI-2015	10	5	5	2	8

Table 2: Age group for different types of HAI.

Age in Years	UTI	BSI	VAP	SSI
0-15 years	70 (31.4%)	101 (45.3%)	51(22.9%)	1 (.4%)
16-30 years	171 (65.5%)	77 (29.5%)	7 (2.7%)	6 (2.3%)
31-45 years	178 (65.2%)	84 (30.8%)	8 (2.9%)	3 (1.1%)
46-60 years	295 (67.7%)	120 (27.5%)	17 (3.9%)	4 (9%)
Above 60 years	367 (66.7%)	146 (26.5%)	31 (5.6%)	6 (1.1%)

Table 3: Length of stay [LOS], average length of stay [ALS], standard deviation [SD] and inter quartile range [IQR].

Over All Factors	UTI	BSI	VAP	SSI
Mean age of patients	49.6	40.2	30.3	48.2
Length of stay	9.3	11.9	12.5	18.9
Average length of stay (ALS)	7.2	8	7.6	8.8
Standard deviation of ALS	2.6	3.3	3.03	3.8
Inter quartile range ALS	4.1	3.3	2.8	2.8

Table 4: Confidence interval for mean.

HAI–Category (N)	Mean ± SD	95% Confidence Interval for Mean
		Lower Bound-Upper Bound
UTI (1081)	9.41 (8.0)	8.93-9.88
BS I (528)	12.47 (12.4)	11.41-13.53
VAP (114)	12.55 (13.0)	10.14-14.97
SSI (20)	15.95 (17.7)	7.66-24.24
Total (1743)	10.62 (10.1)	10.14-11.09

DISCUSSION

HAI leads to increase in more number of hospital days by increasing the average length of stay. Age stratification has been done for category of HAI patients 0-15 years -70 (31.4%), 101 45.3%), 51(22.9%), 1 (0.4%) UTI, BSI, VAP and SSI. 16-30 year 171 (65.5%), 77 (29.5%) 7 (2.7%), 6 (2.3%) UTI, BSI, VAP and SSI. 31-45 years 178 (65.2%), 84 (30.8%), 8 2.9%), 3 (1.1%) UTI, BSI, VAP and SSI. 46-60 years 295 (67.7%), 120 (27.5%), 17 (3.9%), 4 (9%) UTI, BSI, VAP and SSI. Above 60 years 367 (66.7%), 146 (26.5%), 31 (5.6%), 6 (1.1%) UTI, BSI, VAP and SSI respectively.

Similar study conducted by Dodek et al. [10] regarding length of stay, analysis showed that 15314 patients admitted to the ICUs during the study period 236 developed *Clostridium difficile* infections (CDI). CDI in the ICU In the complete cohort analysis, the hazard ratios (95% confidence interval) for CDI related to ICU and Hospital discharge were 0.82 (0.72, 0.94) and 0.83 (0.73, 0.95), respectively (0.5 additional ICU days and 3.4 hospital days), and related to death in ICU and hospital, they were 1.00 (0.73, 1.38) and 1.19 (0.93, 1.52), respectively. In the matched analysis, the hazard ratios for CDI related to ICU and hospital discharge were 0.91 (0.81, 1.03) and 0.98 (0.85, 1.13), respectively, and related to death in ICU and hospital, they Were 1.18 (0.85, 1.63) and 1.08 (0.82, 1.43), respectively.

A similar study was conducted by Kleef et al. [11] showed similar findings results showed that data comprised 157 (including 48 severe) HA-*Clostridium difficile* infection (CDI) cases among 42,618 patients. HA-CDI reduced the daily discharge rate by nearly one-quarter [hazard ratio (HR): 0.72; 95% confidence interval (CI): 0.61e0.84] and increased the in-hospital death rate by 75% Compared with non-HA-CDI patients (HR: 1.75; 95% CI: 1.16e2.62). Overall HA-CDI resulted in a mean excess LOS of about seven days (95% CI: 3.5e10.9), severe cases had an average excess LOS which was twice (w11.6 days; 95% CI: 3.6e19.6) that of the non-severe Cases (about five days; 95% CI: 1.1e9.5).

Recent review of publications on HA-CDI-associated additional hospital stay showed wide variation in excess LOS, ranging from 2.8 to 16.1 days [12]. Study conducted by Hensgens et al. showed that HA-CDI resulted in a prolonged LOS of about seven days. Moreover, the daily mortality rate of HA-CDI patients was almost twice that of non-HA-CDI-infected patients, as has been suggested elsewhere [13].

Study conducted by Kyeong et al. [14] analysis showed that among 10,660 hospitalizations, prevalence of never events ranged from 0.2% to 5.0%. Mean hospitalization charge and LOS were $75,654 and 6.8 days, respectively. Never events were associated with 5.6-10.0 longer LOS and $49,153-$124,057 excess charges. Author concluded Occurrence of never events was associated with at least 5.6 longer hospital days and $49,153 charge compared with hospitalizations without a never event.

My study showed that Mean age of patients 49.6, 40.2, 30.3, 48.2, Length of stay 9.3, 11.9, 12.5, 18.9, Average Length of stay (ALS) 7.2, 8, 7.6, 8.8, Standard Deviation Of ALS 2.6, 3.3, 3.03, 3.8 Inter quartile range ALS 4.1, 3.3, 2.8, 2.8 UTI, BSI, VAP and SSI respectively. Confidence level has been calculated considering the upper bound and lower bound factors and there were similar findings as compared with my study such as study conducted by Ohannessian, et al. showed that there was an increased length of stay of 5 days due to HAIs in the ICU was estimated in a study of France [15].

Study conducted in the intensive care unit showed that the excess of days of hospitalization for infected patients in ICU was 7.7 days in another study. For different infection sites, the extra LOS was 27.1 days, 22.2 days, and 19.2 days for CLABSI, VAP, and CAUTI, respectively, in adult and pediatric ICUs. The mean LOS attributable to CLABSIs was 19 days in another study [4]. The extra length of stay was 3.48 days for BSI, 3.59 days for UTI, 7.23 days for SSI, and 11.52 days for VAP in medical-surgical ICU [16,17].

Healthcare-associated infections (HAIs) affect millions of patients worldwide. HAIs are associated with increased hospital length of stay (LOS), thus increasing the healthcare cost which not only burdens medical resources but also increases patients' suffering and even causes medical disputes [18]. Study found that the increased LOS of HAI was about twice as long as those of the noninfected patients, with an average prolongation of 10.4 days which was close to the results of Sun et al. [19] and Zhou et al. [20].

CONCLUSION

HAI can significantly increase the Length of stay. The increase varies according to hospital level, region, site of infection, and infected pathogen, and it also varies if the pathogens were multidrug-resistant. The length of stay is significally noticeable with the prevalence of HAI. The average length of length of stay increases with the infections. The disease pattern of HAI varies according to the age and gender wise. There is always a co-relation which in turn relates to all the common factors related to the pattern of diseases.

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