A Multicenter Point Prevalence Survey of Health Care Associated Infections in Pakistan; findings and implications

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Abstract:

Purpose: Healthcare associated infections (HAIs) are seen as a global public health threat, leading to increased mortality and morbidity as well as costs. However, little is currently known about the prevalence of HAIs in Pakistan. Consequently, this multicenter prevalence survey of HAIs was conducted to assess the prevalence of HAIs in Pakistan.

Method: We used the methodology employed by European Centre of Disease prevention and control in order to assess the prevalence of HAIs in Punjab Province, Pakistan. Data was collected from 13 hospitals using a structured data collection tool.

Results: Out of 1553 hospitalized patients, 130 (8.4%) patients had symptoms of HAIs. The most common HAI was surgical site infection (40.0%) followed by blood stream infection (21.5%) and lower respiratory tract infection (14.6%). The prevalence of HAI was higher in private sector hospitals (25.0%), among neonates (23.8%) and patients admitted to ICUs (33.3%). Patients without HAIs were mostly admitted in public sectors hospitals and in adult medical and surgical wards.

Conclusion: The study found a high rate of HAIs among hospitals in Pakistan, especially surgical site infections, blood stream infection and LRTIs. This needs to be addressed to reduce morbidity, mortality and costs in the future, with further research planned.

Keywords: Health care associated infections, Point prevalence survey, Infection Prevention Policy, Pakistan

Introduction:

Healthcare associated infections (HAIs) are seen as a global public health threat, increasing mortality and morbidity in association with infectious disease as well as increasing the length of stay in hospitals and overall healthcare costs. In Europe alone, healthcare-associated infections are believed to cause 16 million extra days of hospital stay each year, with costs estimated to exceed €7 billion annually [1], and preventing HAIs could save an estimated US$25 to US$35.1billion per year in the US [2]. The prevalence of HAIs is substantially higher in lower and middle income countries, with concerns with available facilities, personnel and techniques [3]. The prevalence of HAIs reported in high income countries is 7.5%, although others have reported rates of 5.7% to 7.1% in Europe and 4.5% in the USA, while in LMIC countries prevalence rates of 5.7-19.2% are seen [4-7]. In Australia, it has been estimated 175,000 cases of HAIs occur annually [8]. In Europe and North America, it is reported that 12-32% of HAI blood steam infections result in death [9]. However, the exact burden of HAI in each country is still unknown.

Several studies have reported the effectiveness of interventions to help prevent HAIs [2, 10-12]. Strategies for handling substantial issue of HAIs is dependent on infection prevention and control programmes that suggest good hygiene following standard precautions, instigating antibiotic stewardship programmes, appropriate use of indwelling devices and screening in combination with decolonization [12]. Effective infection control measures including hand and environmental hygiene, sterilization of devices, screening and vaccination programmess should be adopted to minimize risk of HAIs. Surveillance of HAIs is a critical component of any infection control strategy to identify problems, assess control programs and prioritize resources [5].

Prospective surveillance is the recommended method for screening HAIs. However, this method can be expensive and intended for common types of infections such as ventilator-associated infections. However, cross-sectional prevalence surveys are not only cost-effective but also a quick method for assessing the burden of all types of HAIs within hospitals as prelude to instigating future programmes [5, 6]. The point-prevalence surveys are of evident benefit for defining rates of HAIs particularly to hospitals with limited resources. Moreover, data from point prevalence surveys can be transformed to incidence data, which are important for observing the trends in HAIs [13]. Emphasizing interventions to prevent infections would not only be beneficial for the hospitals but also have a high public health impact, with HAIs considered to be a significant outcome indicator within hospitals [14]. Assessing the prevalence of HAIs through point prevalence and other surveys helps detect priority areas for initiation of infection prevention and control programmes in hospitals [5]. We are aware that several point prevalence surveys have been conducted to monitor emerging trends in the prevalence of HAIs [5, 6]. However, to the best of our knowledge, no published data is available on the prevalence of HAIs in Pakistan. Consequently, this survey was instigated to assess the prevalence of HAIs in Pakistan as a first step. The findings can be used as a baseline for future prevalence studies as well as for instigating future measures to reduce HAI rates in the future if pertinent.

METHODOLOGY:

Study Design:

A multicenter point prevalence survey of HAIs was conducted among hospitals in Pakistan using the methodology employed by European Centre of Disease prevention and control (ECDC) [5]. This methodology provides a standardized tool for hospitals to estimate the prevalence of HAIs and to identify targets for quality improvement.

Study Settings:

The complete lists of all hospitals of Punjab were acquired from the Director General Health Services office, Department of Health, Government of the Punjab, Pakistan. The study centers were included by selecting 13 hospitals identified from the different geographical regions of the Punjab, Pakistan. In case of refusal of the first hospital, the next health care setting from the list was selected, and so on, as participation of hospital was solely voluntary. The health care facilities providing only nursing care, rehabilitation centers or psychiatric centers were not included. Punjab was chosen for this initial study as a representative region of Pakistan.

Instrument of Measure:

A structured and validated questionnaire with ward and patient level data was used for data collection [5]. The ward data form included the department specialty, total bed capacities, the total number of patients and patients with HAIs. Different parameters in the patient data form were collected from the patient profiles. These included: demographic variables, clinical data of patient, reason for admission and hospitalization, causative microorganisms, reason for antimicrobial prescribing, prescribed antimicrobials and their dosage regimen and any HAIs.

Inclusion and Exclusion criteria:

The sample comprised all in-patients that stayed overnight in hospital. Data were collected from the patients who were showing symptoms of HAIs. The patients staying in long-term care units including dialysis centers and patients in emergency and outpatient departments were not included in the survey.

Case definition:

The HAI case definitions were adopted from ECDC protocol [5]. HAI is an infection occurring in a patient during the process of care in a hospital or other health care facility which was not present or incubating at the time of admission. For the purposes of this protocol, an infection was defined as active on the day of the survey when: signs and symptoms were present on the date of the survey; OR signs and symptoms were no longer present but the patient was still receiving treatment for that infection on the date of the survey. An active infection was defined as healthcare-associated when: the onset of the signs and symptoms was on Day 3 of the current admission or later; OR the signs and symptoms of an active surgical site infection were present at admission or started before Day 3, and the surgical site infection occurred within 30 days of a surgical intervention.

Data Collection:

The data were collected by using structured data collection tool. All the patients admitted on the ward at 0800 hr on the day of survey were counted in the denominator. Whereas, all those inpatients showing the symptoms of HAIs were included in the numerator, and the patient forms were filled in for these patients only. The details of variables from the patient's medical case notes and prescribing charts were recorded after discussing with nursing staff and physicians. The data were dually checked for completeness and accuracy in order to rule out missing or inconsistent data. If necessary, pertinent physicians or pharmacists were requested to review the patient medical records again for clarification. All of the data were transferred to the computer. Up to 2 weeks were taken to collect the data from all wards of a single hospital. In order to minimize the effect of movement of patients between wards and within the hospital, each ward was completely surveyed within one day. Process of data collection was completed during September 2017 to February 2018.

Ethical Considerations:

The study design was non-experimental and involved neither patient examination nor any intervention advised or made. Application for Ethical clearance prior to the conduct of the study was sought from the Human Ethics Division of University College of Pharmacy (HEC/1000/PUCP/1925HAI). Subsequent approval to conduct the study in the identified hospitals was obtained from the hospital management. All collected data were anonymized during the time of data collection and verified for accuracy before transmission to the investigators by the data collectors at the health facility.

Statistical Analysis

Data were analyzed using the latest versions of Microsoft Excel and SPSS (version 22 IBM, California, USA). On categorical variables, descriptive statistics (frequency and percentages) were applied. Crosstabs was applied to check any association between the variables. Binary logistic and multinomial logistic regression analysis was performed to check for likely confounding effects. Age groups were categorized in different groups with the oldest age group serving as reference to which other age groups were compared. Patients in charity hospitals, surgical departments and neonatal medical wards were also used as reference. Risk of HAIs among females was compared by using male patients as the reference. These groups were kept in the logistic model if they were associated with an HAI after adjustment at the 0.05 significance level. Odds ratios (ORs) with 95% confidence intervals (CIs) were also calculated.

Results:

Thirteen hospitals participated in this point prevalence survey. The survey was conducted in three private, three charity and seven public sector hospitals including secondary, tertiary and specialized health care facilities. The total number of beds in these thirteen hospitals was 2347. Of these, 1553 beds were occupied (66.2%). Out of these hospitalized patients, 130 (8.4%) patients were showing the symptoms of HAIs ranging from 3.5%-29.7% in the different hospitals. A detailed distribution of HAIs is given in Tables I and II. The most common HAIs were surgical site infections (40.0%), with the highest prevalence among patients in the adult age group >18 years-65 years (82.7%) who were in the surgical departments (69.2%). The second most common infection was blood stream infection (21.5%) and the third most common HAI was lower respiratory tract infections (LRTIs) (14.6%). Other sites of infections included urinary tract, gastrointestinal (GI), bone and joint and obstetric and gynecological infections. Patients with blood stream infections and gastrointestinal infections were admitted to the adult medical wards of charity hospitals, whereas patients with urinary tract infections were admitted to adult medical wards of the public sector hospitals. Variables including hospital type, department, age group, gender and wards were analyzed through binary logistic and a multinomial logistic regression model (Table II). The prevalence of HAI was higher among private sector hospitals (25.0%) as compared to charity (16.9%) and public sector hospitals (4.6%). The burden of HAI was also much higher among patients admitted to the ICU (33.3%) as compared to patients admitted to the medical wards (6.8%) and surgical wards (7.6%). Likewise, neonates (23.8%) were among the high risk groups afflicted with HAIs as compared to other age groups. Patients without HAIs were mostly admitted in public sectors hospitals and in adult medical and surgical wards.

Discussion

HAIs are key outcome parameters in health care systems, and reducing the threat of HAIs is indispensable to reduce morbidity, mortality and costs associated with hospitalized patients. The reported prevalence of HAIs in this study (8.4%) is higher than values mentioned in most of the previous studies among high income countries but not for LMICs [4-6]. In addition, the burden of HAI in Pakistan was lower than the reported prevalence rates in some other countries [15, 16]. This high prevalence rate of HAIs in Pakistan can potentially be due to the lack of infection control and prevention programs typically seen Pakistani hospitals, and also by high bed occupancy rates. Studies have also reported higher prevalence rate of HAIs in patients admitted to intensive care units , which may be due to the high use of invasive devices and high frequency of serious illness [15, 17, 18]. This is similar to our findings. However, the prevalence of hospital-acquired surgical site infections, septicemia, lower respiratory tract infection and other HAIs in our study is different to the findings reported from other countries [4-6, 19]. Substantial differences though in the surveyed populations, healthcare facilities, skill of the surgeon and surveillance methods, often do not permit direct comparison of the outcomes.

Surgical site infections were the most frequent HAI detected in this study, significantly higher than seen in some other published studies [5, 6, 19] and lower than seen in Ethiopia [16]. We believe this high rate is due to a lack of guidelines for SSI prophylaxis and poor infection control programs among the study hospitals, and we will be exploring this further in future research. We will also be looking at the length of administration of any antibiotic given to prevent SSIs as a high percentage have been given postoperatively among LMICs and for a number of days against agreed guidance [20, 21]. Blood stream infections were the second most common HAIs in this study. However, the prevalence is less than those reported in some other studies [22, 23]. As the microbiology laboratory reports are the primary source for diagnose of blood stream infections, the low rate in this study may be due to the inadequacy of microbiological documentation. We will again be following this up in future studies. LRTIs were the third most frequent HAI detected in this study. One reason for this high rate could be the fact that this survey was conducted in the autumn and winter months where the incidence of nosocomial respiratory tract infections is higher. Furthermore, inadequate hand hygiene and overcrowded wards of hospital might also be a causative factors [24]. Hospital acquired pneumonia surveillance could help with a better understanding of this and pave the way to implement more focused interventions to fight against this high-cost infection [25]. This will again be the subject of future research in hospitals in Pakistan. Moreover, surveillance and prevention of *C. difficile* is also a recent focus as this is a major threat associated with HAIs [6]. Whilst *C. difficile* infections were not identified in this study because of a lack of laboratory findings, gastrointestinal infections were noted in patients especially those who were receiving intensive chemotherapy, and we will be looking at this more closely in the future.

We are aware that this survey has a number of limitations. Being a cross-sectional study, we are aware that point prevalence surveys can underestimate the burden of HAIs. Secondly, the investigators in the prevalence survey were not qualified infection disease specialists; therefore, potential misclassification of infections could be expected. Thirdly, most of the hospitals do not have their own microbiological laboratory and susceptibility testing was only carried out occasionally. The date of onset of infection and duration of hospital stay were also not noted in this prevalence survey. In addition, patients who were earlier hospitalized and readmitted may not have been included; consequently, underrating the actual prevalence of that particular infection. Last, the results of this prevalence survey may have been influenced by the seasonal variations. There was the high rate of LRTIs, since it was conducted during the autumn and winter months. Despite these limitations, we believe the data has made an appreciable contribution to understanding the pattern of HAIs in Pakistani population. Overall, we believe the findings of this survey are robust, providing a baseline to enhance surveillance skills and structure and raise awareness of the importance of preventing HAIs in the future. The important features of this methodology are its cost-effectiveness and simplicity, both indispensable to conduct such surveys on a regular basis among lower and middle income countries.

Conclusion:

The study found a high rate of HAIs among hospitals in Pakistan, especially surgical site infections, blood stream infection and LRTIs. This needs to be addressed to reduce morbidity, mortality and costs in the future, with further research planned. Overall, repeated point prevalence surveys are needed across Pakistan to further assess trends in the epidemiology of HAIs and potential causes to instigate appropriate interventions. This is being followed up.

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Conflict of interest

The authors declare that there are no actual or potential conflicts of interest in relation to this article.

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Table I: Distribution of Health Care–Associated Infections

Variables	LRTI N (%)	SSI N (%)	BSI N (%)	UTI N (%)	BJ N (%)	OBGY N (%)	GI N (%)
Hospital Type							
Public	8 (42.1)	26 (50.0)	9 (32.1)	7 (63.6)	2 (25)	-	1 (11.1)
Private	8 (42.1)	10 (19.2)	6 (21.4)	1 (9.1)	3 (37.5)	2 (66.7)	3 (33.3)
Charity	3 (15.8)	16 (30.8)	13 (46.4)	3 (27.3)	3 (37.5)	1 (33.3)	5 (55.6)
Department							
ICU	7 (36.8)	3 (5.8)	10 (35.7)	2 (18.2)	-	-	2 (22.2)
Medical	12 (63.2)	12 (23.1)	17 (60.7)	6 (54.5)	4 (50.0)	3 (100)	5 (55.6)
Surgical	-	37 (71.2)	1 (3.6)	3 (27.3)	4 (50.0)	-	2 (22.2)
Age group							
<1month	4 (21.1)	-	6 (21.4)	-	-	-	-
>1 month-18year	3 (15.8)	7 (13.5)	5 (17.9)	1 (9.0)	1 (12.5)	-	1 (11.1)
>18 years-65years	8 (42.1)	43 (82.7)	14 (50.0)	7 (63.6)	5 (62.5)	3 (100)	7 (77.8)
>65years	4 (21.1)	2 (3.8)	3 (10.7)	3 (27.3)	2 (25.0)	-	1 (11.1)
Gender							
Female	4 (21.1)	27 (51.9)	14 (50.0)	5 (45.5)	5 (62.5)	3 (100)	3 (33.3)
Male	15 (78.9)	25 (48.1)	14 (50.0)	6 (54.5)	3 (37.5)	-	6 (66.7)
Wards							
Adult ICU	7 (36.8)	3 (5.8)	4 (14.3)	2 (18.2)	-	-	2 (22.2)
Adult MW	5 (26.4)	9 (17.3)	7 (25.0)	5 (45.5)	4 (50.0)	3 (100)	1 (11.1)
Adult SW	-	36 (69.2)	1 (3.6)	3 (27.3)	4 (50.0)	-	2 (22.2)
Oncology	3 (15.8)	4 (7.7)	10 (35.7)	1 (9.1)	-	-	4 (44.4)
Neonatal ICU	-	-	6 (21.1)	-	-	-	-
Neonatal MW	4 (21.1)	-	-	-	-	-	-
Total	**19 (14.6)**	**52 (40.0)**	**28 (21.5)**	**11 (8.5)**	**8 (6.2)**	**3 (2.3)**	**9 (6.9)**

BJ; Bone & Joint, **BSI;** Blood stream infection, **GI;** Gastro-Intestinal Tract, **OBGY;** Obstetric or Gynaecological, **LRTI;** Lower Respiratory Tract Infection, **SSI;** Surgical Site Infections, **UTI;** Urinary Tract Infection

Table II: Risk factors of HAIs

	HAIs N (%)	Without HAIs N (%)	OR (CI)	P-Value
Hospital Type				
Public	53 (4.6)	1108 (95.4)	2.778 (1.58-4.87)	0.000
Private	33 (25.0)	99 (75.0)	0.388 (0.20-0.74)	0.004
Charity	44 (16.9)	216 (83.1)	Ref	
Department				
ICU	24 (33.3)	48 (66.7)	0.164 (0.09-0.29)	0.000
Medical	59 (6.8)	803 (93.2)	1.100 (0.70-1.60)	NS
Surgical	47 (7.6)	572 (92.4)	Ref	
Age group				
<1month	10 (23.8)	32 (76.2)	0.350 (0.14-0.85)	0.021
>1 month-18year	18 (9.3)	176 (90.7)	1.100 (0.70-1.50)	NS
>18 years-65years	87 (7.5)	1078 (92.5)	1.130 (0.90-1.90)	NS
>65years	15 (9.9)	137 (90.1)	Ref	
Gender				
Female	61 (7.7)	729 (92.3)	0.840 (0.60-1.20)	NS
Male	69 (9.0)	694 (90.1)	Ref	-
Wards				
Adult ICU	18 (26.6)	45 (71.4)	0.400 (0.10-1.30)	NS
Adult MW	34 (5.8)	744 (95.6)	3.501 (1.15-10.62)	0.027
Adult SW	46 (7.6)	562 (92.4)	1.900 (0.60-5.80)	NS
Oncology	22 (33.3)	44 (66.7)	0.320 (0.09-1.03)	0.049
Neonatal ICU	6 (66.7)	3 (33.3)	0.080 (0.01-0.46)	0.004
Neonatal MW	4 (13.8)	25 (86.2)	Ref	

HAI; Healthcare Associated Infection, **ICU;** Intensive Care Unit, **MW;** Medical Ward, **NS;** Non Significant, **SW;** Surgical Ward