Journal of Epidemiology and Global Health xxx (2017) xxx–xxx

Contents lists available at ScienceDirect

Journal of Epidemiology and Global Health

journal homepage: www.elsevier.com/locate/jegh

Device-associated nosocomial infection in general hospitals, Kingdom of Saudi Arabia, 2013–2016

Eiman Gaid [a,*], Abdullah Assiri [a,b], Scott McNabb [b], Weam Banjar [a]

[a] Ministry of Health, Riyadh, Saudi Arabia
[b] Hurbet Department of Global Health, Rollins School of Public Health, Emory University, Atlanta, GA, USA

ARTICLE INFO

Article history:
Received 16 June 2017
Received in revised form 23 September 2017
Accepted 24 October 2017
Available online xxxx

Keywords:
Healthcare-associated infection
Infection control
Public health
Central line-associated blood stream infection
Ventilator-associated pneumonia
Catheter-associated urinary tract infection

ABSTRACT

Healthcare-associated infections (HAIs) including device-associated HAI (DA-HAI) are a serious patient safety issue in hospitals worldwide, affecting 5–10% of hospitalized patients and deadly for patients in intensive care units (ICUs). (Vincent, 2003; Al-Tawfiq et al., 2013; Hu et al., 2013). DA-HAIs account for up to 23% of HAIs in ICUs and about 40% of all hospital infections (i.e. central line-associated blood stream infections [CLABSI], ventilator-associated pneumonia [VAP], and catheter-associated urinary tract infections [CAUTI]). This study aims to identify DA-HAI rates among a group of selected hospitals in the Kingdom of Saudi Arabia (KSA), 2013–2016. Secondary data was analyzed from 12 medical/surgical intensive care units (M/SICUs) and two cardiac care units (CCUs) from 12 Ministry of Health (MoH) hospitals from different regions in KSA. These data were reported by infection control practitioners to the MoH via electronic International Nosocomial Infection Control Consortium (INICC) systems in each hospital. Among 6178 ICU patients with 13,492 DA-HAIs during 2013–2016, the average length of stay (LOS) was 10.7 days (range 0–379 days). VAP was the most common DA-HAI (57.4%), followed by CAUTI (28.4%), and CLABSI (14.2%). In CCUs there were no CLABSI cases; CAUTI was reported from 1 to 2.6 per 1000 device-days; and VAP did not occur in Hospital B but occurred 8.1 times per 1000 device-days in the CCU in Hospital A. In M/SICUs, variations occurred among time periods, hospitals, and KSA provinces. CLABSI varied between hospitals from 2.2 to 10.5 per 1000 device-days. CAUTI occurred from 2.3 to 4.4 per 1000 device-days, while VAP had the highest rates, from 8.9 to 39.6 per 1000 device-days. Most hospitals had high device-utilization ratios (DURs) (from the 75th to 90th percentile of National Healthcare Safety Network (NHSN)'s standard and the 50th to 75th percentile of INICC's). This study showed higher device-associated infection rates and higher device-utilization ratios in the study's CCUs and M/SICUs than NHSN benchmarks. To reduce the rates of infection, ongoing monitoring of infection control practices and comprehensive education are required. Furthermore, a sensitive and specific national healthcare safety network is needed in KSA.

1. Introduction

Healthcare-associated infections (HAIs) are a serious patient safety issue in hospitals worldwide, affecting approximately 5–10% of hospitalized patients, and can be deadly for patients in intensive care units (ICUs) [1]. An estimated 100,000 patients die every year due to HAIs, at a cost of $17 billion to $29 billion [4,5]. The pooled ICU data shows a catheter-associated urinary tract infections (CAUTI) rate of 3.1–7.5/1000 days, a central line-associated blood stream infections (CLABSI) rate of 1.6–6.8/1000 days, and a ventilator-associated pneumonia (VAP) rate of 2.5–12 .3/1000 days [5]. In developing countries, although accurate estimates and information about device-associated HAI (DA-HAI) is scant [2,3], surveillance study conducted by the International Nosocomial Infection Control Consortium (INICC) of 503 ICU beds in countries in Latin America, Asia, Africa, and Europe from 2007 to 2012 showed that DA-HAIs rates were higher in the ICUs of those hospitals. The pooled rate of CLABSI infection is nearly 5-fold higher than the reported CLABSI rates from comparable United States (U.S.) ICUs. The overall rates of VAP and CAUTIs were also higher [6].

Many studies and literature reviews have demonstrated that effective implementation of an integrated infection control program that focuses on DA-HAI surveillance can prevent about

Peer review under responsibility of Ministry of Health, Saudi Arabia.
* Corresponding author.
E-mail address: ekaid@moh.gov.sa (E. Gaid).

https://doi.org/10.1016/j.jegh.2017.10.008
2210-6006/

two-thirds of HAIs. Studies reported that with the implementation of such programs, there can be a reduction in DA-HAI by as much as 30%, along with a reduction in health care costs [7,8].

Surveillance is an essential tool in quality improvements and patient safety that helps to determine the endemic infection rates, which allows for the early detection of epidemics, risk assessment for better future planning, and evaluation of new interventions [9].

Targeted DA-HAI surveillance has been implemented in most hospitals in developed and developing countries, as has benchmarking with the National Healthcare Safety Network (NHSN) database [3].

The INICC system is also used as a benchmark; it consists of DA-HAI data collected from 215 enrolled hospitals from 36 countries, including developing countries [10].

To minimize the occurrence of DA-HAIs in ICUs, the NHSN-recommended infection control measures to be implemented and enforced. Evidence-based approaches include daily device assessments, intervention bundles, reducing risk factors, continuing health education for ICU staff, the establishment of infection control committees, and antimicrobial stewardship programs [11].

Although DA-HAI represents a real public health problem [12], it is still an evolving area of critical care research and continued advancements in this field are foreseen [11]. Also, although previous studies have shown that developing countries have higher DA-HAI rates than the United States and other European countries, the amount of accurate surveillance data remains insufficient [2,3,6].

The Kingdom of Saudi Arabia (KSA), like other developing countries, has limited data regarding DAI rates in general hospitals, and most of the published studies are limited to certain devices [2]. The main aim of this study is to identify DA-HAIs rates in KSA in general hospitals over the timeframe 2013–2016 based on the dataset received from different general hospitals.

Knowing this information is critical and vital for the sake of patient health as well as for the benefit of health authorities in identifying areas or health care settings with high infection rates. With this information, they can take action accordingly and initiate immediate improvement plans. Additionally, studies like this one are an important addition to the published literature and serve as a resource for further research.

2. Methodology

This study is a retrospective cohort study using secondary data from 12 Ministry of Health (MoH) referral hospitals in KSA.

2.1. Study setting

The study took place in adult ICUs of 12 MoH hospitals in different provinces of KSA, with two different ICU types (Cardiac and Medical and Surgical ICU) and differing bed capacities. The surveillance data was completed by trained infection control practitioners in every hospital using a special online INICC multidimensional approach format sent to the MoH Infection Control Department on a monthly basis.

Selected general hospitals implemented the INICC multidimensional approach in their DA-HAI surveillance. The INICC system is focused on the surveillance and prevention of DA-HAI in adult ICUs, pediatric ICUs, and neonatal intensive care units (NICUs).

2.2. INICC multidimensional approach

The INICC implements the methodology of the CDC's NSHN but adds the collection of other data essential to increasing infection control personnel's sensitivity to detecting HAIs and avoid underreporting. The INICC method also includes collecting data from all patients, with and without HAI, and the results of cultures, antibiotic therapy, the average length of stay (LOS), and mortality.

Outcome and process surveillance for this study were conducted by means of an online platform called the INICC Surveillance Online System (ISOS) where information was collected by infection control personnel and uploaded daily to calculate DA-HAI rates per 1000 device days to diagnose CLABSIs, CAUTIs, and VAPs and capture denominator data, patient days, and specific device days in the ICUs. Infection control personnel were trained by the INICC team onsite and also provided with tutorial movies, manuals, and training tools that described in detail how to perform surveillance and upload surveillance data through the ISOS [7].

2.3. Data collection and data source

Data was collected from 12 general governmental hospitals enrolled in the INICC system. The selected hospitals are referral hospitals that are Joint Commission International (JCI) accredited (Table 1).

Data was received from the MoH as a Microsoft Excel™ workbook with personal health identifiers. The data source was de-identified and a unique de-identification key was created in a separate encrypted and locked file for each patient to replace medical record number, date of birth, and bed number. Prior to removing these variables from the initial dataset, age was calculated using the date of birth. Data was received as a separate Excel file for each hospital containing 221 variables, and the data entry fields of the INICC form. The separated files were merged together and all variables were aligned with identical data type, length, and format to create a uniform structured dataset. The de-identified dataset was subsetted and times were transposed to create the variables of interest.

Table 1
List of Participating Hospitals in the current study of the device associated infection rates in Adult ICUs of MoH general hospitals, Kingdom of Saudi Arabia, 2013–2016.

Group#	Included hospitals	Bed size	Hospital category	Time frame
1	Hospital B – Asser Province Hospital C – Jeddah Province Hospital D – Riyadh Province Hospital E – Qassim Province	<15	All are referral and secondary hospitals	05/15–02/16
2	Hospital A – Asser Province Hospital F – Taif Province	>15	Both are referral and secondary hospitals	09/13–03/15
3	Hospital G – Najran Province Hospital H – Tabuk Province	>15	Both are referral and secondary hospitals	09/13–02/16
4	Hospital I – Taif Province Hospital J – Hail Province Hospital K -Madina Province	>15	All are referral and secondary hospitals	09/15–03/16
5	Hospital L – Riyadh Province	>15	Referral and secondary hospital	01/15–02/16

Please cite this article in press as: Gaid E et al. Device-associated nosocomial infection in general hospitals, Kingdom of Saudi Arabia, 2013–2016. J Epidemiol Global Health (2017), https://doi.org/10.1016/j.jegh.2017.10.008