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Major Article

Health care-associated infections in Iran: A national update for the year 2015

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Key Words:

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Surveillance**Background:** A national surveillance system for health care-associated infections (HAIs) in Iran is relatively new, and an update on incidence and mortality rates can aid clinicians and stakeholders in development of new guidelines and imperative modifications to be made.**Methods:** Data were extracted from the national HAIs surveillance software for more than 7 million hospitalizations during 2015. Data regarding age, gender, deaths, ward of admission, and microbiologic findings were collected and analyzed.**Results:** From 491 hospitals, 7,018,393 hospitalizations were reported during 2015; 82,950 patients had been diagnosed with at least 1 HAI, 6,355 of whom died (crude fatality rate, 7.7). Men comprised 51.4% of the patients. The incidence rate was calculated to be 1.18. Urinary tract infections and pneumonia were the most commonly reported infections (27.9% and 23.8%) and 33% of patients were older than age 65 years. Intensive care units had the highest incidence rates, followed by burn units with incidence rates close to 9. Highest percentages of deaths were reported among patients with an HAI in the intensive care unit (20.6%) and those with pneumonia (39.6%).**Conclusion:** Although the underreporting of HAIs hinders accurate calculation of incidence, the present study provides a general update. The results can help in modification of national guidelines and appropriate choice of antimicrobial agents in the management of HAIs.

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Health care-associated infections (HAIs) remain a serious threat to health care systems.¹⁻⁴ In addition to increased mortality and morbidity rates and the considerable financial burden imposed on systems, the hidden nature of HAIs complicates diagnosis, data gathering, and interpretation of emergence of new trends.^{1,4} Globally, 7%-10% of patients admitted to intensive care units (ICUs) are diagnosed with at least 1 HAI; higher prevalence and incidence rates have been reported from low- and middle-income countries where data are available.^{1,2}

A national surveillance system was established by the Iranian Center for Communicable Disease Control (ICCDC) to register and monitor HAIs during 2007⁵⁻⁷ and the Iranian Nosocomial Infection

Surveillance (INIS) software was designed to facilitate data registry and management.^{8,9}

Four major categories of HAIs are defined in this system: pneumonia, bloodstream infection (BSI), urinary tract infection (UTI), and surgical site infection (SSI). The program initially covered major hospitals with more than 200 beds throughout the country; further versions have had higher coverage rates.⁵ By the end of 2015, ICCDC reports included surveillance data from 491 (55% of all) hospitals throughout the country (unpublished data).

Since the implementation of standard surveillance forms in major hospitals of Iran, many academic centers have focused on HAIs in their research work.¹⁰⁻¹⁶ Other than epidemiologic studies on prevalence and types of diagnosed HAIs in various hospital settings, microbiologic and molecular evaluations have been performed on common causative agents.^{17,18} A recent study investigated the financial burden of antibiotic use associated with HAIs,¹⁹ whereas another³ highlighted many challenges faced by the progress of the surveillance program. The unnecessary prescription of antimicrobial agents leading to high antimicrobial resistance has been alarmingly reported in the mentioned studies.²⁰ Studies have also

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been conducted on adherence to international guidelines in provision of patient safety measures that raise awareness on areas of concern in implementation of preventive interventions.²¹

For clinicians, scientists, and health care policymakers, access to precise information on recent data at the country level can help with better allocation of resources when targeting the areas of concern in their daily practice, research projects, and national guidelines.^{4,22} Hence, the authors reported the data on national surveillance of HAIs with the aim to update and present a comprehensive picture of the incidence and mortality attributed to different HAIs in various hospital units in Iran. We hope the results of the study will show an overview of the current situation of nosocomial infections in the country.

METHODS AND MATERIALS

Data were derived from the INIS software. The software has been used by ICCDC since the first year of implementation of the surveillance program in 2007. Registry is performed on a monthly basis upon completion of individual hospital forms. The forms are completed by a trained infection control nurse who has been assigned to the program in each hospital. The criteria for diagnosis of HAIs are per advice of the ICCDC guidelines; HAI is diagnosed when symptoms start after 48 hours of admission.

Definitions

From the beginning of 2017, the new Centers for Disease Control and Prevention National Healthcare Safety Network 2016 definitions of HAI have been used in the ICCDC guideline; however, older Centers for Disease Control and Prevention diagnostic criteria were used in 2015 because the software and the national guideline were not updated. The diagnostic criteria were as follows.⁷

BSI

The patient had a recognized pathogen in 1 or more blood culture samples and the growing organism was not related to infection at another site; or the patient had at least 1 of the following signs or symptoms: fever, chills, or hypotension (for patients aged ≤ 1 year: fever, hypothermia, apnea, or bradycardia) and the signs and symptoms and positive laboratory results were not related to infection at another site and common skin contaminants were cultured from 2 or more blood samples drawn on separate occasions.

UTI

The patient had at least 1 of the following signs or symptoms with no other recognized cause: fever, urgency, frequency, dysuria, suprapubic tenderness, or costovertebral angle pain/tenderness (for patients aged ≤ 1 year: fever, hypothermia, apnea, bradycardia, dysuria, lethargy, or vomiting) and a positive urine culture of $\geq 10^5$ CFU/mL of no more than 2 isolated species. For other UTIs, organisms were isolated from body fluids other than urine or from tissues of the affected site; the patient had an abscess or other evidence of infection seen on direct examination, during a surgical procedure, or a histopathologic examination; or the patient had at least 2 of the following signs or symptoms with no other recognized cause: fever, localized pain, or localized tenderness at the involved site (for patients aged ≤ 1 year: fever, hypothermia, apnea, bradycardia, dysuria, lethargy, or vomiting) and at least 1 of the following: purulent drainage from affected site, organisms cultured from blood that are compatible with suspected site of infection, or radiographic evidence of infection.

Pneumonia

The oldest definition of pneumonia (not used anymore) was that the patient should have rales or dullness to percussion on physical examination of the chest; and at least one of the following: new onset of purulent sputum or change in character of sputum, organisms cultured from blood samples, isolation of an etiologic agent from a specimen obtained through transtracheal aspirate, bronchial brushing, or biopsy.

For clinically defined pneumonia, a patient had 2 or more serial chest radiographs with at least 1 of the following findings: new or progressive and persistent infiltrates, consolidation, cavitation, or pneumatoceles in infants aged ≤ 1 year and at least 1 of the following signs/symptoms/findings: fever, leukopenia or leukocytosis, or altered mental status for adults aged >70 years and at least 2 of the following: new onset of purulent sputum, or change in character of sputum, or increased respiratory secretions, or increased need for suction; new onset or worsening cough, or dyspnea, or tachypnea; rales or bronchial breath sounds; or worsening gas exchange.

For pneumonia with specific laboratory findings, in addition to the above, there needed to be a positive culture (from respiratory secretions, pleural fluid, lung tissue, or blood not related to another source of infection) or histopathologic evidence of infection such as abscess formation or foci of consolidation with intense polymorphonuclear cell accumulation in bronchioles and alveoli, or evidence of fungal hyphae or pseudohyphae invasion in lung parenchyma.

For pneumonia in immunocompromised patients, besides the radiologic findings and signs/symptoms of pneumonia (mentioned above), hemoptysis or pleuritic chest pain were also considered as symptoms; and additional criteria were included besides all other laboratory findings, including matching positive blood and sputum cultures with *Candida* spp, or evidence of fungi or *Pneumocystis carinii* from lower respiratory tract specimen (direct microscopic exam or positive culture of fungi).

SSI

Three types of SSI were defined as superficial incisional, deep incisional, and organ/space SSI.

A superficial incisional SSI must meet the following criteria: infection occurs within 30 days after the operative procedure and involves only skin and subcutaneous tissues of the site of incision and the patient has at least 1 of the following: purulent drainage from the superficial incision, organisms isolated from an aseptically obtained culture of fluid or tissue from the superficial incision; at least 1 of the following signs or symptoms of infection: pain or tenderness, localized swelling, redness, or heat; and if a superficial incision is deliberately opened by the surgeon and is culture positive or not cultured, diagnosis of superficial incisional SSI by a surgeon or attending physician.

A deep incisional SSI must meet the following criterion: infection occurs within 30 days after the operative procedure if no implant is left in place or within 1 year if the implant is in place and involves deep soft tissues of the incision and the patient has at least 1 of the following: purulent drainage from the deep incision but not from the organ/space component of the surgical site; a deep incision spontaneously dehisces or is deliberately opened by a surgeon and is culture positive or not cultured when the patient has at least 1 of the following signs or symptoms: fever, localized pain, or tenderness; an abscess or other evidence of infection involving the deep incision is found on direct examination, during reoperation, or by histopathologic or radiologic examination; and diagnosis of a deep incisional SSI by a surgeon or attending physician.

An organ/space SSI must meet the following criterion: infection occurs within 30 days after the operative procedure if no implant is left in place or within 1 year if the implant is in place and infection involves any part of the body (excluding the skin incision, fascia,

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