American Journal of Infection Control ■■ (2016) ■■-■■

Contents lists available at ScienceDirect

American Journal of Infection Control

journal homepage: www.ajicjournal.org

Major Article

National surveillance of health care–associated infections in Egypt: Developing a sustainable program in a resource-limited country

Maha Talaat MD, MPH, DrPH [a,b,*], Mona El-Shokry MD, PhD [a,b,c], Jehan El-Kholy MD, PhD [d], Ghada Ismail MD, PhD [c], Sara Kotb MD, MPH [a,b], Soad Hafez MD, PhD [e], Ehab Attia MD, MPH [f], Fernanda C. Lessa MD, MPH [g]

[a] *Global Disease Detection Center, US Centers for Disease Control and Prevention, Cairo, Egypt*
[b] *US Naval Medical Research Unit, No. 3, Cairo, Egypt*
[c] *Ain Shams University Hospitals, Cairo, Egypt*
[d] *Cairo University Hospitals, Cairo, Egypt*
[e] *Alexandria University Hospitals, Alexandria, Egypt*
[f] *Ministry of Health and Population, Cairo, Egypt*
[g] *Centers for Disease Control and Prevention, Atlanta, GA*

Key Words:
Health care–associated infections
antimicrobial resistance
surveillance in intensive care units

Background: Health care–associated infections (HAIs) are a major global public health concern. The lack of surveillance systems in developing countries leads to an underestimation of the global burden of HAI. We describe the process of developing a national HAI surveillance program and the magnitude of HAI rates in Egypt.

Methods: The detailed process of implementation of a national HAI surveillance program is described. A 3-phase surveillance approach was implemented in intensive care units (ICUs). This article focuses on results from the phase 2 surveillance. Standard surveillance definitions were used, clinical samples were processed by the hospital laboratories, and results were confirmed by a reference laboratory.

Results: Ninety-one ICUs in 28 hospitals contributed to 474,544 patient days and 2,688 HAIs. Of these, 30% were bloodstream infections, 29% were surgical site infections, 26% were pneumonia, and 15% were urinary tract infections. Ventilator-associated pneumonia had the highest incidence of device-associated infections (4.3/1,000 ventilator days). The most common pathogens reported were *Klebsiella* spp (28.7%) and *Acinetobacter* spp (13.7%). Of the *Acinetobacter* spp, 92.8% (157/169) were multidrug resistant, whereas 42.5% (151/355) of the *Klebsiella* spp and 54% (47/87) of *Escherichia coli* were extended-spectrum β-lactamase producers.

Conclusions: Implementation of a sustainable surveillance system in a resource-limited country was possible following a stepwise approach with continuous evaluation. Enhancing infection prevention and control programs should be an infection control priority in Egypt.

Health care–associated infections (HAIs) are the most frequent adverse events threatening patient's safety worldwide[1] and cause significant morbidity and mortality. A growing proportion of HAIs are related to antimicrobial resistant pathogens, such as methicillin-resistant *Staphylococcus aureus* and multidrug-resistant gram-negative bacilli.[2-4]

The global burden of HAIs is underestimated because data from resource-limited countries are sparse. Very few countries of low and middle income have national HAI surveillance programs,[5] which may be related to a lack of strong infection prevention and control (IPC) programs in most developing countries, limited human resources and expertise in the design and implementation of a surveillance

* Address correspondence to Maha Talaat, MD, MPH, DrPH, 3A Imtidad Ramses St, Adjacent to Abbassia Fever Hospital, Abbassia, Cairo 11517, Egypt.
E-mail address: maha.m.talaat.ctr@mail.mil (M. Talaat).

Funding/Support: Supported by the U.S. Agency for International Development (USAID-Egypt), Work Unit 263-T-14-0001.

Conflicts of Interest: None to report.

Disclaimer: The views expressed in this article are those of the authors and do not necessarily reflect the official policy or position of the Department of the Navy, Department of Defense, U.S. Government, the Centers for Disease Control and Prevention, or the Egyptian Ministry of Health and Population.

Additional Information: This protocol was approved by the Institutional Review Board at the U.S. Naval Medical Research Unit No. 3, Cairo, as a nonhuman research activity protocol no. 1114. M.T., M.E.-S., and S.K. are contractors of the U.S. Government. This work was prepared as part of their official duties.

http://dx.doi.org/10.1016/j.ajic.2016.04.212

program, or a lack of microbiology laboratory capacity at the hospitals. In countries such as the United States, Australia, Canada, England, and Germany, IPC programs have instituted HAI surveillance as an essential element of health care.[6-10] These developed countries focus mainly on device-associated infection (DAI) surveillance, allowing them to further analyze the impact of specific risk factors and guide targeted interventions.[11] In the developing countries of the Eastern Mediterranean region, limited efforts have been done to institutionalize national HAI surveillance programs.

Sentinel site surveillance in tertiary care hospitals in Egypt showed high HAI rates.[12-14] During the last decade, while IPC activities were progressing in Egypt, it was deemed important to implement a standardized national HAI surveillance program to define the magnitude and scope of HAIs in the country and to allow for interhospital comparisons of HAI rates. Therefore, a plan to implement a nationwide HAI surveillance program in intensive care units (ICUs) was developed with support from several partners: the U.S. Centers for Disease Control and Prevention's (CDC's) Global Disease Detection (GDD) Program in Egypt, the U.S. Naval Medical Research Unit (NAMRU-3), and the U.S. Agency for International Development in Egypt. The objectives of the national HAI surveillance were to estimate the incidence of HAIs, obtain national benchmarks, describe the microbiologic profile of pathogens causing HAIs, and inform prevention activities of HAIs. This report describes the process of developing a national HAI surveillance program in Egypt, including progress, challenges, future plans, and findings of the interim (phase 2) surveillance.

METHODS

Baseline assessment of hospitals

An initial baseline assessment across 37 hospitals in Egypt was conducted between October and December 2010 to assess laboratory and surveillance capacity. Trained personnel interviewed hospital directors, infection control personnel, and senior physicians and evaluated the microbiology laboratories. The baseline assessment revealed that most hospitals had some sort of IPC program; however, HAI case definitions varied widely across hospitals. Although all hospitals had microbiology laboratories, only 30% performed pathogen identification and susceptibility testing. The baseline assessment provided useful information on the hospital needs and informed the design of the surveillance approach.

Formation of a panel of experts

A panel of experts was composed of members from the CDC, World Health Organization, U.S. universities, Ministry of Health and Population in Egypt, and universities. The panel of experts was responsible for defining the strategic approach for the surveillance program, providing regular evaluation, and updating the surveillance methodology over time.

Surveillance strategy and stepwise implementation of surveillance

The surveillance approach recommended by the panel of experts was a 3-phase approach: phase 1) small-scale and pilot surveillance to assess feasibility, define optimal methodology, including case definitions, and inform phase 2; phase 2) expansion to additional hospitals to inform the design and conduct of full-scale surveillance; and phase 3) full-scale surveillance. All surveillance phases were active prospective surveillance and focused on ICU patients, a vulnerable patient population at increased risk of HAI because of severity of illness, high exposure to invasive procedures and devices, and high use of broad-spectrum antibiotics.[15,16] Surveillance case definitions were derived from the CDC's National Healthcare Safety Network (NHSN) HAI case definitions published in 2008.[17]

Surveillance phases

For hospitals to participate in the surveillance, they had to meet the following eligibility criteria: (1) presence of an IPC team with at least 1 full-time employee, (2) capacity for data entry and transfer, (3) functional laboratory with supplies and personnel able to perform culture of all specimens and full bacterial identification and antimicrobial susceptibility testing, and (4) presence of ICUs and IPC link nurses to monitor HAIs. Hospitals that were not ready for surveillance implementation were supported by GDD-Egypt and NAMRU-3 to enhance their capabilities to join the surveillance activities at later stages.

Phase 1 surveillance (pilot)

The aim of this phase was to pilot the surveillance program in ICUs at 11 hospitals. Phase 1 was conducted from April 2011-March 2012. The 2008 NHSN case definitions were used.[17] The methods implemented and the results of phase 1 surveillance have been previously published.[18]

Phase 2 surveillance

The results of phase 1 showed a predominance of 3 HAI types: hospital-acquired pneumonia, primary bloodstream infections (BSI), and urinary tract infections (UTI). The panel of experts suggested limiting the surveillance activities to the 3 most prevalent HAI types to reduce data collection burden and to allow for an expanded rollout to other hospitals while ensuring collection of good quality data. They also suggested adding surgical site infection (SSI) identified in ICUs and excluding ICUs with an average length of patient stay <3 days. Adaptation of the primary BSI case definition was done to address the limitations identified in phase 1 and to increase the sensitivity of the surveillance program as follows: (1) instituting the clinical sepsis case definition for adult and neonates given blood cultures were not routinely collected; (2) considering only 1 blood culture for the diagnosis of BSI in patients with clinical signs of infection (even if the organism is a possible contaminant) given that collection of 2 blood culture bottles was very uncommon because of the lack of resources; and (3) excluding the requirement of antibiotic treatment as a component of the BSI case definition given the widespread use of antibiotics at Egyptian hospitals. Finally, HAI types were not restricted to DAIs given that 58% of BSIs were not central line associated and a large proportion of pneumonias were also not ventilator associated.[18]

Phase 1 surveillance was conducted from April 2012-August 2014. The 11 hospitals that started phase 1 surveillance transitioned into phase 2, and an additional 17 hospitals joined the program for a total 28 hospitals, 91 ICUs, and 989 ICU beds in phase 2 surveillance.

Phase 3 surveillance

Phase 3 surveillance started in September 2014, and as of February 2016, the HAI surveillance program included 61 hospitals with 216 ICUs and 2,035 ICU beds. The surveillance methods remained the same as phase 2, and the only changes implemented were related to improving the electronic reporting system of data, including improvements of the electronic algorithm for HAI type.

Surveillance definitions

For this surveillance, only ICU-onset infections were captured. An ICU-onset infection was defined as an infection occurring on or after 3 calendar days after ICU admission or an SSI identified while