ANALYSIS OF HEALTHCARE-ASSOCIATED INFECTIONS IN HOSPITALS

Mădălina Diana DAINA [1], László FEHÉR [1], Cristian Marius DAINA [1]

[1]*University of Oradea, Faculty of Medicine and Pharmacy, Street Piata 1 Decembrie, no.10, Oradea, Romania*

RESEARCH ARTICLE

Abstract

Healthcare-associated infections (HAI) are a major global and national concern, with a significant impact on public health. These infections occur during the provision of healthcare services and can affect patients, medical staff and visitors. The present study aimed to analyze healthcare-associated infections in county hospital sections by identifying their number by type of infection and location, as well as the packages of pathogens involved in their production. A retrospective study was conducted within the Bihor County Emergency Clinical Hospital, by collecting data from the Healthcare-Associated Infection Prevention Service during the period 2019-2023. The analysis also included pathogens involved in the production of HAI, as well as the type of infection. The number of HAI reported during the analyzed period had a fluctuating evolution, the fewest cases reported were in 2020 and the most HAI cases reported were in 2022. The departments with the most registrations and reports were ICU, Cardiology, Neurology and General Surgery I. The most frequent pathogens encountered during the analyzed period were: Klebsiella pneumoniae, Acinetobacter baumanni, Proteus mirabilis, and during the Covid 19 pandemic, SARS CoV2 infections were the most frequent. The most frequent infections, by type of infection, were those with respiratory, urinary and surgical wound localization. Continuous monitoring of HAI and correct reporting of these cases must be a permanent concern of all persons involved in patient care.

Keywords: healthcare-associated infections, hospital, pathogen

#Corresponding author:
diana_daina98@yahoo.com

INTRODUCTION

Healthcare-associated infections (HAI), also known as nosocomial infections, are infections acquired during hospitalization or other healthcare settings that were not present at the time of admission (Șerban, 2011). They can occur in hospitals, clinics, nursing homes, or other healthcare settings, affecting both patients and healthcare staff (Hallam, 2019).

HAIs are responsible for severe complications that prolong the length of hospital stay and the need for additional treatment (Zhang, 2019). Affected patients are at increased risk of severe complications, including sepsis and multiple organ failure. In many cases, HAIs are associated with antibiotic-resistant bacteria, which makes treatment difficult and increases mortality rates (Nkuchia, 2015).

Medical doctors and nurses in hospitals are exposed to the risk of contacting HAIs on a daily basis, especially in intensive care units or in wards where immunocompromised patients are treated. The increase in the number of infections can lead to professional burnout and absenteeism, further affecting healthcare capacities (Allegranzi, 2011).

The financial costs of HAIs are significant for hospitals and healthcare systems as a whole. It is estimated that, at a European level, the treatment of these infections generates additional expenses of over 7 billion euros annually, and in the USA the costs may exceed 45 billion dollars per year (Fung, 2003).

A key feature of HAI is antibiotic resistance, caused by excessive and sometimes inappropriate use of antibiotics (Berceanu, 1999). Bacteria such as MRSA (methicillin-resistant Staphylococcus aureus), carbapenem-resistant Klebsiella pneumoniae or multidrug-resistant Acinetobacter baumannii are responsible for severe infections, often difficult to treat. According to the WHO, if rapid action is not taken, antimicrobial resistance could become one of the leading causes of death worldwide by 2050, surpassing even cancer (Haque, 2018).

HAI is a major problem in the healthcare system, with serious implications for patients, healthcare professionals and for the economy (Magill, 2017). In an era where antimicrobial resistance is becoming increasingly worrisome, the prevention and control of these infections are essential to maintain the effectiveness of medical treatments and reduce the negative

impact on the healthcare system. The adoption of strict hygiene measures, the development of new disinfection technologies and the responsible use of antibiotics are just some of the strategies that can contribute to reducing the incidence of HAI and creating patient safety (Order of the Minister of Health no. 1101/2016; Order of the Minister of Health no. 961/2016).

The present study aimed to analyze healthcare-associated infections in county hospital departments by identifying their number by type of infection and location, as well as the pathogen packages involved in their production. Identifying the factors involved in the production of HAIs is essential in their prevention.

MATERIAL AND METHOD

A retrospective study was conducted within the Bihor County Emergency Clinical Hospital, by collecting data from the Healthcare-Associated Infection Prevention Service during the period 2019-2023. The data collected concerned reports regarding the appearance of HAI, by departments and compartments of the hospital – Inpatient I, including a number of 19 departments and compartments. Given that no HAI was reported in the Ophthalmology department during the analyzed period, this compartment was excluded from the study. It should be noted that the sections included in the study did not undergo structural changes during the analyzed period.

The analysis also included pathogens involved in the production of HAI, as well as the type of infection. This data was broken down by each ward and compartment.

RESULTS AND DISCUSSIONS

A total of 811 HAIs were reported between 2019 and 2023, with an annual average of 162.2 HAIs/year. The fewest infections were reported in 2020, as hospital activity was greatly reduced due to the SARS-CoV-2 pandemic. The most infections were reported in 2022 (Figure 1).

The most frequent pathogens encountered during the analyzed period were: Klebsiella pneumoniae, Acinetobacter baumanni, Proteus mirabilis, and during the Covid 19 pandemic, SARS CoV2 infections were the most frequent (2021-2023) (figure 2).

Acinetobacter baumanni was reported by all departments, except the Nephrology and USTACC departments. It predominates in the ICU department.

Klebsiella pneumoniae predominates in the ICU department. It was not reported in the General Surgery II, Internal Medicine II, Nephrology, Orthopedics I and Orthopedics II, Gastroenterology departments.

Proteus mirabilis was recorded predominantly in the ICU department. No infection with this germ was reported in the Orthopedics II department during the period analyzed.

SARS CoV2 infection was recorded and reported in 2020 in the ICU department, then in the following years in all departments except the Urology and ENT-BMF departments (figure 3).

A small number of infections were reported for: Stenotrophomonas Maltophilia, Enterococcus spp, Enterocolitis with clostridium difficile, Providencia stuarti, Pseudomonas aeruginosa, E. coli, Staphylococcus aureus, Enterococcus faecalis, Enterococcus faecium, Seratia, Streptococcus pneumoniae, Staphylococcus aureus pneumoniaeae, Morganella morgani, Enterobacter cloacae.

The analysis carried out on the sections that reported nosocomial infections is shown in the following figures. The sections with the most healthcare-associated infections reported are: ICU, Cardiology, Neurology and General Surgery I (figure 4).

In the ICU section, we find, during the period 2019-2020, various healthcare-associated infections reported with variability. The fewest infections were reported in 2020 when the hospital had a series of restrictions on the admission of patients due to SARS CoV2 infections. Predominant in this section: Acinetobacter baumanni, Klebsiella pneumoniae and Proteus mirabilis.

In the Cardiology department we find few reported infections, up to 5 infections on average per year, in a number of approximately 60 beds.

The Neurology department has frequently reported HAIs, but their number is not worrying. In this department, with the exception of SARSCov2 infections, we find Klebsiella pneumoniae infections most frequently reported.

In the General Surgery I department, the infections reported varied both in terms of pathogen and reporting period. In 2023, we find the most infections reported.

The rest of the departments analyzed reported a small number of infections, with years in which no infection was reported.

Next, the reported HAIs are analyzed by type of infection produced, data being structured into 10 categories: sepsis, respiratory (influenza/SARS Cov2 and Pneumonia/Bronchopneumonia), digestive, urinary, infections produced after the application of a central venous catheter, cutaneous, after injections or peripheral venous catheter, peripheral surgical infections. Respiratory, urinary and surgical wound infections predominate (figure 5).

No influenza-related HAIs were recorded during the analyzed period. Since 2020, SARSCoV2 infections have been reported, which predominate in 2022, in ICU, cardiology, neurology and internal medicine 1.

Respiratory infections with the diagnosis of Pneumonia or Bronchopneumonia are reported predominantly in the ICU section.

In the reporting years, ICU is the only section that reported a digestive infection every year. The rest of the sections sporadically reported digestive infections. A total of 4 infections were reported by USTACC in 2021, 3 infections/year reported by the Internal Medicine 1 section, Gastroenterology in 2021 and 2022, and USTACC in 2022.

Urinary tract infections are more frequently reported to the ICU, Neurology, Advanced cardiac patient monitoring and treatment unit (USTACC) and Acute stroke unit (UAVCA).

Infections occurring after the application of central venous catheters are reported by the ICU section and only one case by the gastroenterology section in 2021. The largest number of infections were reported in 2020. Without any reporting we find the years 2022 and 2023.

We do not find skin infections reported in 2021. 2 skin infections were reported by the ICU section in 2020 and 2022, and General Surgery I in 2022. general surgery 1 (2023), internal medicine 1 (2019) and cardiology (2019 and 2023).

Infections due to peripheral injections or venipunctures were reported by the ICU department (3 infections per year in 2022 and 2023, 1 infection /year in 2020) and neurosurgery (1 infection in 2021).

Infections due to surgical wounds were reported by both medical and surgical departments (Prelipcean, 2017). Most infections of this type were reported by general surgery 1 (15 infections in 2023), vascular/cardiovascular surgery (14 infections in 2023).

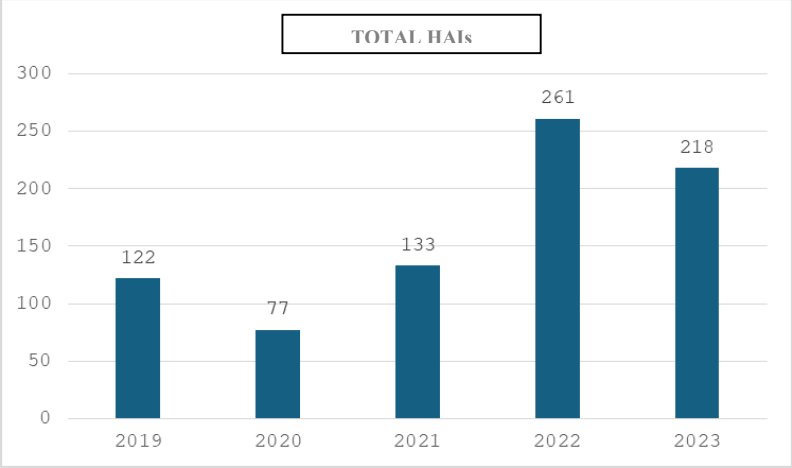

Figure 1. Total number of HAIs in the period 2019-2023

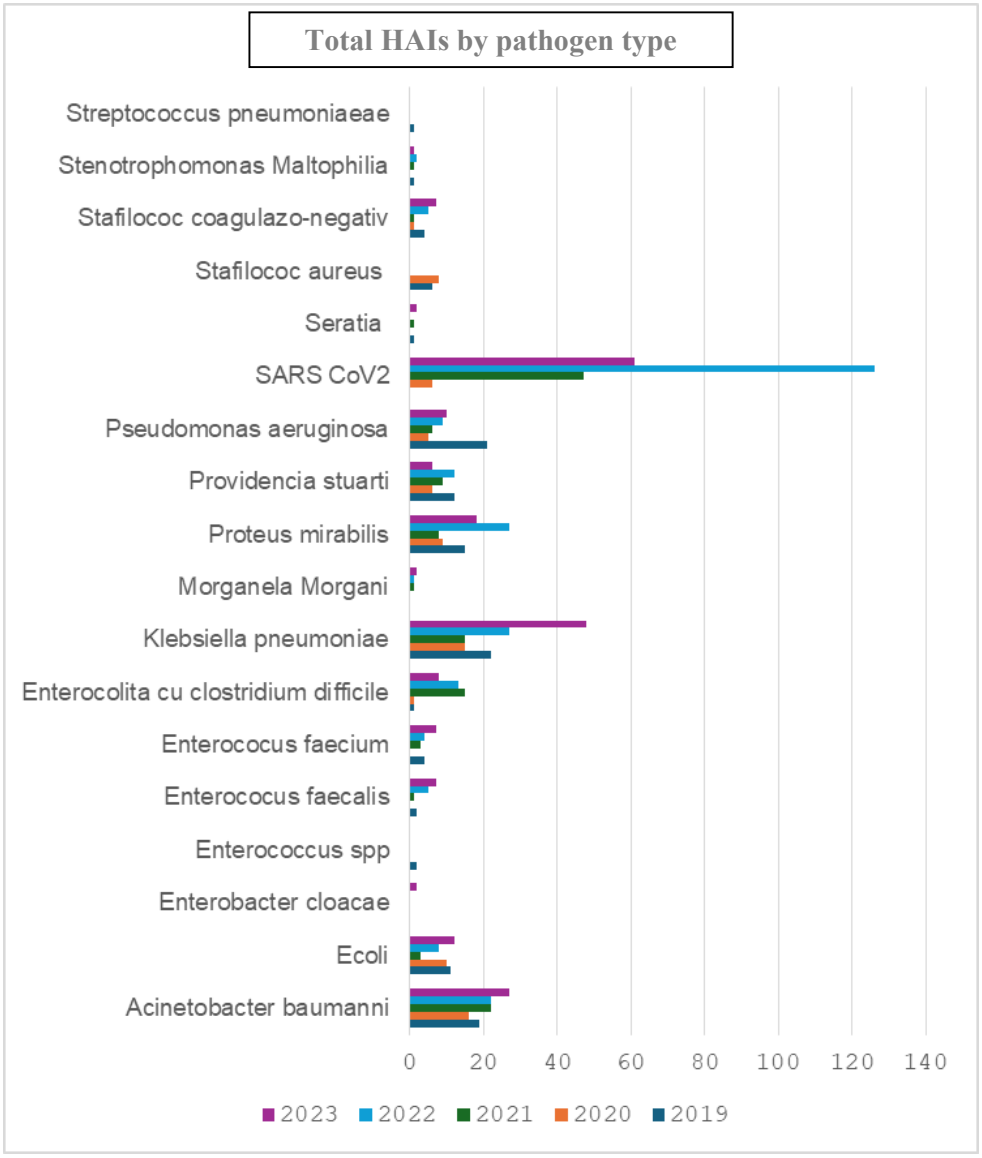

Figure 2. Number of HAIs, by pathogen type in the period 2019-2023

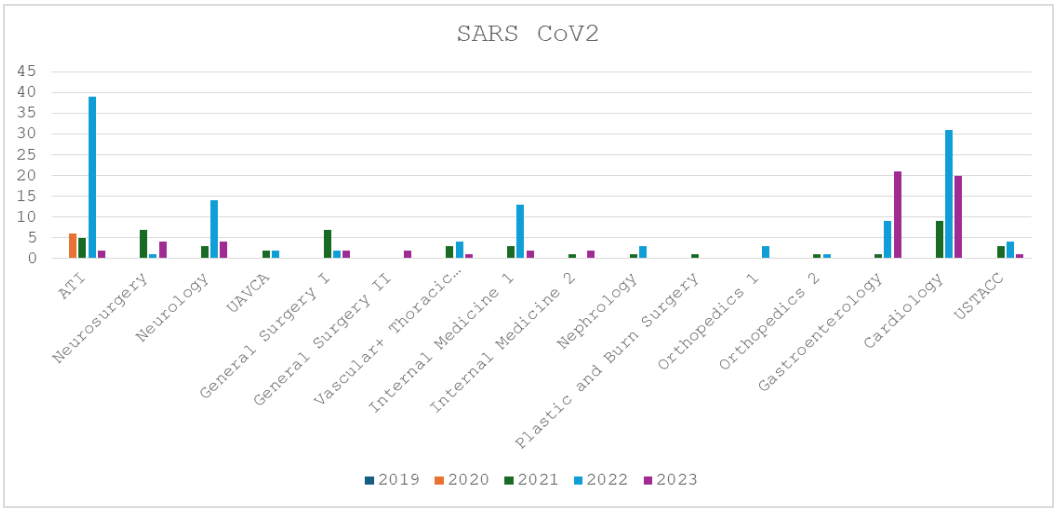

Figure 3. Number of HAIs by SARS CoV2

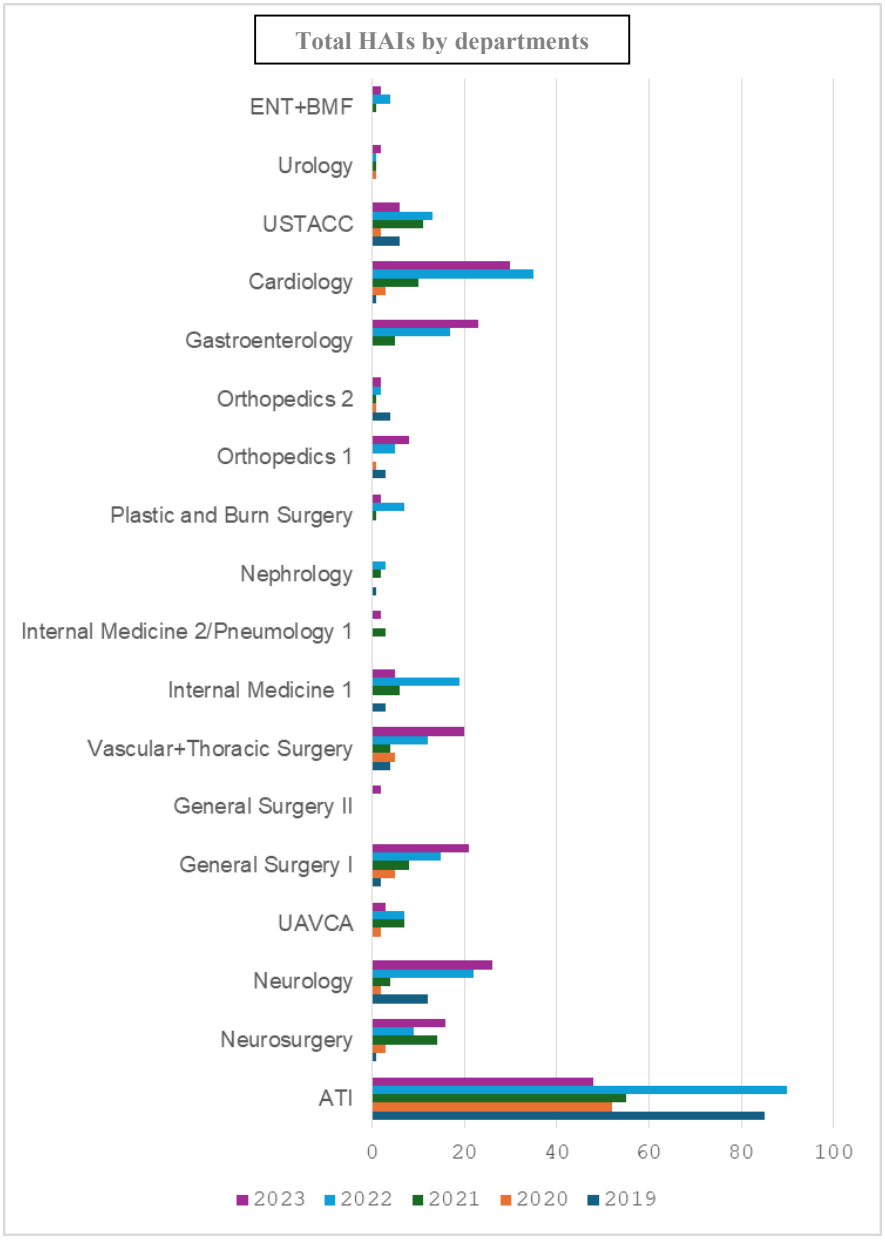

Figure 4. Total number of HAIs, by hospital wards, 2019-2023

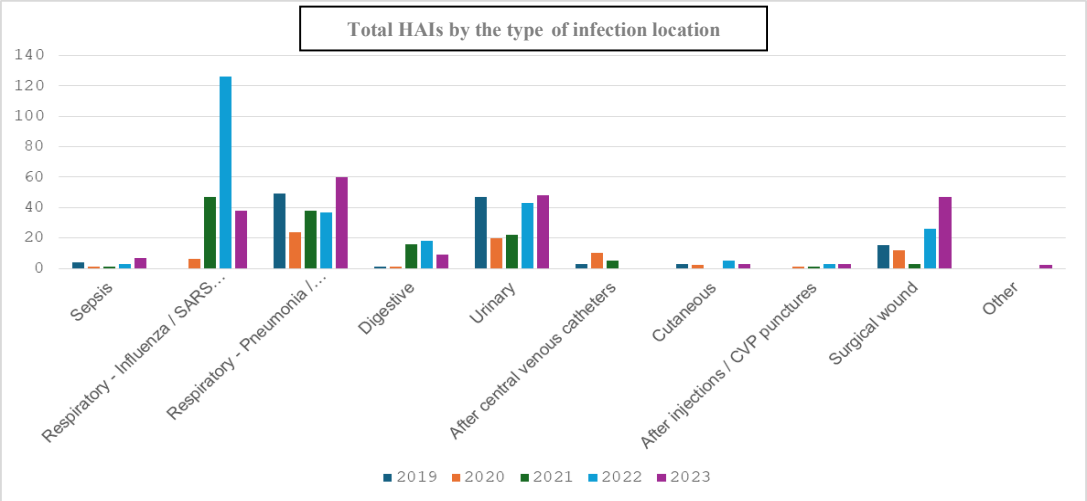

Figure 5. Total number of HAIs, by the type of infection location

CONCLUSIONS

Healthcare-associated infections were analyzed over a 5-year period, across 20 departments and compartments of a county hospital. The number of HAI reported during the analyzed period fluctuated, the few cases reported were in 2020 (a pandemic year with reduced medical activity in the hospital, due to government measures) and the most HAI cases reported were in 2022.

The departments with the most records and reports were ICU, Cardiology, Neurology and General Surgery I.

The most frequent pathogens encountered during the analyzed period were: Klebsiella pneumoniae, Acinetobacter baumanni, Proteus mirabilis, and during the Covid 19 pandemic, SARS CoV2 infections were the most frequent.

The most frequent infections, by type of infection, were those with respiratory, urinary and surgical wound localization.

Continuous monitoring of HAIs and correct reporting of these cases must be a permanent concern of all people involved in patient care.

REFERENCES

Șerban IG, Rugină S., 2011. European experiences in the surveillance and control of nosocomial infections. National Conference with international participation, Braşov, March 31-April 2, 2011. Ed. Ecran Magazin SRL, 11-12.

Hallam C, Marincaș R., 2019. "Primum non nocere" – First of all, do no harm – recommendations for preventing healthcare-associated infections, 2nd ed. Cluj-Napoca: Caiete silvane.

Zhang Y, Du M, Johnston JM et al., 2019. Incidence of healthcare-associated infections in a tertiary hospital in Beijing, China: results from a real-time surveillance system. Antimicrob Resist Infect Control. 8:145.

Nkuchia M. M'ikanatha, 2015. Concepts and methods in infectious disease surveillance, John Wiley & Sons.

Allegranzi B, Kilpatrick C, Pittet D, 2011. Hand Hygiene in IFIC Basic Concepts of Infection Control, International Federation of Infection Control, 2 Edition, Portadown.

Fung H.B., Chang J.Y., Kuczynski S., 2003. A practical guide to the treatement of complicated skin and soft tissue infections, Drugs; 63:1459-1480.

Berceanu Văduva D., Anghelescu E., Lazăr D., Iacobiciu I., 1999. Nosocomial infections, Publishing House Mirton Timişoara.

Haque M, Sartelli M, McKimm J, Abu Bakar M., 2018. Health care-associated infections – an overview. Infect Drug Resist. Nov 15;11:2321-2333.

Magill SS, Wilson LE, Thompson DL, Ray SM, Nadle J, Lynfield R, Janelle SJ, Kainer MA, Greissman S, Dumyati G, Beldavs ZG, Edwards JR., 2017. Emerging Infections Program Hospital Prevalence Survey Team. Reduction in the Prevalence of Healthcare- Associated Infections in U.S. Acute Care Hospitals, 2015 vs 2011. Open Forum Infect Dis. Oct 4;4(Suppl 1):S49.

Order of the Minister of Health no. 1101/2016 on the approval of the Norms for the surveillance, prevention and limitation of healthcare-associated infections in healthcare facilities.

Order of the Minister of Health no. 961/2016 for the approval of the Technical Norms regarding cleaning, disinfection and sterilization in public and private healthcare facilities, the working technique and interpretation for tests to evaluate the efficiency of the cleaning and disinfection procedure, the recommended procedures for hand disinfection, depending on the level of risk, the methods of applying chemical disinfectants depending on the support to be treated and the methods of evaluating the progress and efficiency of the sterilization process.

Prelipcean M, Fochi M., 2017. Assessment of infectious risk during invasive medical-surgical maneuvers, ANCSM.