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Nosocomial Infections: A Literature Review

[1]Kreshnik Kamberi, [2]Arlinda Jakupi

Medical Polyclinic "Zeka," Ferizaj, Republic of Kosovo

Coresponding author : Arlinda Jakupi

Abstract

Introduction – The term nosocomial originates from the Greek words "nosos" (disease) and "komein" (care), referring to infections acquired as a result of medical care. The contemporary framework for diagnosing these infections stipulates a timeframe of at least 48 hours post-admission to a hospital, 3 days after discharge, or 30 days following surgical intervention. The primary aim of this study was to explore the literature regarding nosocomial infections and to highlight the role of nurses in their prevention. An additional objective was to present relevant data concerning these infections in Kosovo and to compare them with statistics from other countries worldwide.
Methodology – We employed a literature review methodology focused on nosocomial infections and the role of nurses in monitoring and reducing these infections. The literature utilized for this purpose is relevant and includes recent data published in prestigious scientific journals.
Results of the Literature Review – In Kosovo, a general prevalence rate of 17.4% for nosocomial infections was recorded in 2003, with bloodstream infections being the most prevalent (62%). The highest prevalence was noted among newborns in intensive care units (77.8%). In a subsequent study conducted in 2019, the overall prevalence rate of HAIs in Kosovo was found to be 4.9%, which is lower than expected; in fact, the ECDC survey from 2011-2012 indicated an average prevalence of 6%, ranging from 2.3% in Latvia to 10.8% in Portugal. In EU member states, the gross prevalence of residents with at least one HAI was 3.7%.
Conclusions – The prevalence of nosocomial infections in Kosovo has significantly declined over the years. However, further improvements are needed in this area to achieve standards comparable to those of other EU countries.

Keywords – Nosocomial Infections, Nurse, Infection Control.

I. INTRODUCTION

Nosocomial infections are those acquired during the treatment of a patient in a hospital, who, prior to undergoing hospital treatment, was neither infected nor carrying any infection. Intrahospital infections are defined as infections that were not present or in the incubation phase at the time of the patient's admission to the hospital. The term "nosocomial" derives from the Greek words "nosos" (disease) and "komein" (care), indicating infections acquired as a consequence of medical care. The contemporary framework for diagnosing these infections stipulates a minimum of 48 hours after admission to the hospital, 3 days after discharge, or 30 days after surgical intervention.

The methods of acquiring these infections vary and depend on numerous factors, primarily related to hygiene and working conditions, particularly adherence to antiseptic and sterilization methods. Healthcare-associated infections (HCAIs) and antimicrobial resistance pose significant public health challenges globally. They lead to high morbidity and mortality rates, prolonged hospital stays, increased antibiotic use, and elevated costs. In developing countries, this challenge is more prevalent due to inadequate healthcare policies and insufficient governmental funding for prevention and control (Pittet et al., 2008).

Kosovo, with a population of 1.7 million, is located in Southeast Europe in the Western Balkan region. Over the past decade, healthcare in Kosovo has undergone significant reforms but faces numerous challenges, with the most pressing being a lack of political commitment and limited resources. The budget for the healthcare system in Kosovo in 2015 was only €160 million (or €80 per capita). Infection control in Kosovo is still in its early stages. Similar to other developing countries, common issues in infection control in Kosovo include insufficient financial support, lack of political engagement, inadequate trained personnel for infection control, overcrowded wards, and insufficient equipment and supplies. This can lead to inappropriate infection control practices and a high rate of HCAIs (Raka et al., 2019).

Healthcare-associated infections affect hundreds of millions of people worldwide and are a major global issue for patient safety. They complicate between 5% and 10% of admissions in acute care hospitals in industrialized countries. In developing countries, the risk is two to twenty times higher, and the percentage of infected patients often exceeds 25%. An increasing awareness of this issue has prompted the World Health Organization to promote the establishment of the World Alliance for Patient Safety. Preventing healthcare-associated infections is the objective of the First Global Patient Safety Challenge of the Alliance, titled "Clean Care is Safer Care," launched in October 2005. After two years, an official declaration was signed by 72 health ministers as a commitment to support actions to reduce healthcare-associated infections; of these, 30 are from developing countries. Given the emphasis on proposed strategies involving simple and affordable solutions, the challenge is expected to have a high impact in developing countries. The combined efforts anticipated within the framework of the Challenge have the potential to save millions of lives, prevent diseases and long-term disabilities for hundreds of millions of patients, and lead to significant cost savings through improved basic infection control measures in all healthcare settings, regardless of available resources or levels of development (Pittet et al., 2010).

In reporting the results of a panel study aimed at assessing critical aspects of healthcare-associated infections in European countries with limited resources and identifying priority issues for effective infection control, questionnaires were developed, and information was gathered from national representatives of EUNETIPS in Bulgaria, Hungary, Kosovo, Romania, and Serbia. Based on the collected data, it was concluded that rigorous enforcement of existing laws, standardized training, and political commitment constitute a common background and provide lessons to be learned for aligning healthcare systems in this field with internationally recommended infection control standards (Licker et al., 2017).

Purpose of the Paper

The primary aim of this paper is to investigate the existing literature concerning nosocomial infections and to emphasize the critical role that nurses play in their prevention. Additionally, this work seeks to present relevant data regarding these infections in Kosovo and to compare this information with data from other countries around the globe. By exploring the factors contributing to the high rates of these infections, the paper aims to shed light on the challenges faced by healthcare systems, particularly in terms of infection control measures.

II. Literature Review

The prevalence of hospital-acquired infections in Kosovo is notably higher than that observed in other European nations, with estimates ranging from 20% to 35%. This elevated prevalence can be attributed to various factors, including a lack of financial resources allocated to healthcare, an inadequate number of trained personnel specializing in infection control, and insufficient staffing levels within hospital units. Furthermore, the availability of medical equipment and supplies is often lacking, compounding the challenges faced by healthcare providers.

These findings highlight the urgent need for effective preventive interventions targeting infections in Intensive Care Units (ICUs). Implementing comprehensive infection control strategies is essential not only for reducing the incidence of these infections but also for improving patient safety and outcomes. Addressing the root causes of these issues will be crucial in advancing the quality of healthcare in Kosovo and ensuring better protection for patients against nosocomial infections (Spahija et al., 2015).

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Assessing the burden of healthcare-associated infections (HAIs) compared to other infectious diseases remains an ongoing challenge, given the need for high-quality data on the incidence of these infections and associated comorbidities. Based on the methodology of the Burden of Communicable Diseases in Europe (BCoDE) project and data from 2011-2012 from the European Centre for Disease Prevention and Control (ECDC), the prevalence survey of HAIs and antimicrobial use in European acute care hospitals evaluated the burden of the six most common HAIs.

The first descriptive study on the prevalence of Healthcare-Associated Infections (HCAIs) in targeted high-risk areas of the University Clinical Center of Kosovo (UCCK) was conducted in 2003 with a sample of 167 surveyed patients. This study revealed an overall prevalence rate of 17.4%. Patients with HCAIs had an average of 13.2 to 22 additional days of hospital stay, indicating a significant impact on patient outcomes and healthcare resources.

Subsequent point prevalence surveys (PPS) were conducted in the central Intensive Care Unit (ICU) at UCCK in 2006, 2008, and 2009. In the latest survey, 16 patients were assessed, and a total of 18 HCAIs were identified among 11 of those patients. Notably, ventilator-associated pneumonia was diagnosed in 8 patients, underscoring the ongoing challenges in managing infections within critical care settings (Raka et al., 2006).

These findings emphasize the need for continuous surveillance and effective infection control measures in healthcare facilities, particularly in high-risk environments like ICUs. The persistence of HCAIs in Kosovo's healthcare system calls for targeted interventions to reduce their prevalence and improve overall patient care.

The Role of Healthcare Professionals in Preventing Nosocomial Infections

According to the Centers for Disease Control and Prevention (CDC, 2010), universal precautions have been established to prevent the transmission of bloodborne pathogens when providing first aid or healthcare. These precautions apply to a wide variety of bodily fluids, including blood, cerebrospinal fluid, amniotic fluid, semen, and vaginal secretions. However, they do not apply to nasal secretions, saliva, sweat, tears, urine, feces, or vomit unless these fluids contain visible blood. Following the universal precautions, nurses are required to wear personal protective equipment when coming into contact with the specified bodily fluids.

Hand hygiene is another powerful tool in the nurse's arsenal against infection and is considered the single most important nursing intervention for preventing infection. Effective handwashing can be performed with antimicrobial soap and water, and specific guidelines have been provided by the CDC for using alcohol-based hand rubs as acceptable alternatives.

Nurses can implement many additional strategies to prevent infection at the bedside. It is recommended to avoid urinary catheterization whenever possible. Thorough wound cleansing between dressing changes, effective removal of necrotic material, and appropriate dressing of wounds to absorb exudates are all methods by which nurses can protect patients from healthcare-associated infections (HAIs).

Intravenous therapy presents a significant concern regarding HAIs. Nurses can make substantial contributions to the fight against infection by using complete precautionary measures (sterile field, caps, gowns, masks, and gloves) when preparing for the insertion of central venous catheters. All catheters, regardless of their location, should always be placed aseptically. A 2% chlorhexidine preparation is the preferred agent for cleaning catheter sites, and the injection ports and diaphragm of multi-dose vials should be disinfected with 70% alcohol before access (CDC, 2010).

Intravenous administration sets, add-ons, and secondary sets should be replaced every 72 hours, unless infection is suspected or documented.

In addition to practical bedside interventions, nurses can promote a safe environment for patients by fostering an open, non-punitive atmosphere where errors and near misses can be reported. This approach helps organizations identify how to improve systems and prevent errors in the future.

Nurses in all roles and settings can demonstrate leadership in infection prevention and control by utilizing their knowledge, skills, and judgment to initiate appropriate and immediate infection control procedures.

A recent study found that nurses' knowledge and practices regarding HAI prevention were inadequate. Greater experience and participation in formal training showed a positive correlation with knowledge; however, higher education status, experience, and reading guidelines on HAI prevention were linked to better practices. Continuing educational programs, in-service training, and ensuring access to necessary guidelines are essential steps to improve nurses' knowledge and practices concerning HAI prevention (Asfaë, 2021).

Furthermore, another study highlighted gaps and disparities in nurses' knowledge and attitudes, leading to insufficient understanding of HAIs. Of the total number of studies reviewed, few indicated that urinary tract infections and respiratory tract infections (RTIs) were the most common HAIs in surgical wards, attributed to higher educational levels. Therefore, nurses with a higher educational background tend to perform proper antisepsis when working with surgical wounds. They are also more likely to adhere to the principle of handwashing before and after treatment to prevent the transmission of infectious diseases. Some hospitals reported employing qualified HAI nurses who had a proper understanding of disinfection and hygiene procedure guidelines, showing a more positive attitude. Other studies revealed that nurses have insufficient knowledge about hospital infections in surgical and emergency departments. Hand hygiene measures related to preventing needle-stick injuries were associated with a basic level of knowledge. Meanwhile, the lowest level of knowledge was linked to precautionary measures such as the proper techniques used for wearing gowns, masks, gloves, and eyewear during clinical procedures in internal medicine, pediatrics, dialysis, and surgical wards (Arruum D et al., 2021).

The Chain of Infection and Risk Factors for Healthcare-Associated Infections (HAI)

Considering the chain of transmission of infectious diseases, we understand that each disease has its own vulnerable points for attack. The basic approach for controlling and preventing infectious diseases involves identifying and breaking these points in the chain. Preventive measures against infectious diseases should be directed toward the following: the microbial reservoir; routes of transmission; and the host population at risk (Tolaj et al., 2019).

The chain of infection refers to six sequential events that enable successful transmission of an infection. These interconnected events that facilitate the emergence of an infection begin with the existence of a pathogen or infectious agent. Secondly, there must be a favorable environment or reservoir for the flourishing of the existing infectious agent, which in a healthcare setting may involve the development of care, contaminated surfaces, or infected individuals through which the pathogen exits the reservoir.

The portal of exit is the third link in the chain, which may include body fluids, aerosols, or open wounds through which the infectious agent leaves the host's body. Once released from the host, the infectious agent can be transmitted directly or indirectly. The transfer to an appropriate portal of entry, which successfully includes broken sensitive skin, tubes, catheters, and other personal care devices, involves new hosts, who may be patients or healthcare workers. After a sufficient pathogenic load is present to cause an infection, a clinically significant disease state may occur. The interaction of the pathogen, the host, and the environment can ultimately result in infection. Direct transmission occurs from single contact and spread through droplets. Indirect transmission may occur via air, carriers that include fomites and ingestible substances, and mechanical vectors (CDC, 2012). Figure 1 below illustrates the chain of infection with additional biological information on how the chain can be broken at any point during the course of the six sequential events.

Overview of Nosocomial Infections Worldwide

In 2016, the European Centre for Disease Prevention and Control (ECDC) estimated that the burden of six major types of healthcare-associated infections (HAIs) (healthcare-associated pneumonia, urinary tract infection, surgical site infection, Clostridium difficile infection, neonatal sepsis, and primary bloodstream infection), expressed in years of life adjusted for disability in the European Union and European Economic Area (EU/EEA), was higher than the combined burden of 31 other infectious diseases under ECDC surveillance. The estimated number of HAIs used in the study was based on data from the first ECDC Point Prevalence Survey (PPS) of HAIs and antimicrobial use in acute care hospitals (ACHs) from 2011 to 2012 and did not take into account HAIs occurring in other healthcare facilities. Specifically, the ECDC had previously estimated that the number of residents with an HAI on any given day in European long-term care facilities (LTCFs) was of the same order of magnitude as the number of patients with an HAI

on any given day in ACHs. The most commonly reported types of HAIs in LTCFs were respiratory tract infections (33.2% overall, 3.7% pneumonia, 22.0% other lower respiratory tract infections, 7.2% common cold/pharyngitis, 0.3% influenza), urinary tract infections (32.0%), and skin infections (21.5%). The majority of reported HAIs (84.7%) were associated with the LTCF where the study was conducted, while 7.5% and 1.4% were respectively associated with a hospital or another LTCF. The origin was unknown for 6.4% of HAIs in LTCFs. Microbiological data in LTCFs were available for 742 (19.2%) HAIs. The ten most frequently isolated bacteria were E. coli (30.7%), S. aureus (12.3%), Klebsiella spp. (11.4%), Proteus spp. (10.6%), P. aeruginosa (7.1%), Enterococcus spp. (4.8%), C. difficile (4.4%), Streptococcus spp. (2.8%), Enterobacter spp. (2.1%), and coagulase-negative staphylococci (1.9%) (Sutens et al., 2018).

Healthcare-associated infections (HAIs) are a significant cause of morbidity and mortality worldwide. The annual prevalence of HAIs in Italy is estimated to be between 5% and 8% per year. The most common HAIs are lower respiratory tract infections (LRTIs), followed by urinary tract infections (UTIs), bloodstream infections (BSIs), and surgical site infections (SSIs). In Italy, approximately 450,000 to 700,000 patients acquire at least one HAI during their hospital stay. Thus, monitoring HAIs is recognized as a critical activity for prevention and control programs. Excessive and inappropriate use of antibacterial drugs is a major public health problem worldwide, as it is associated with an alarming increase in drug resistance and adverse drug reactions, and it also incurs substantial economic costs. Available international and national data regarding the quantity and pattern of antibiotic use in both community and hospital settings are not always sufficiently informative, as national databases may use different and non-standardized methods to measure antibiotic use. For this purpose, the PPS (Point Prevalence Survey) can provide baseline information regarding the occurrence and distribution of HAIs and antibiotic use in healthcare institutions (Carubia S et al., 2013).

A standardized methodology for a combined point prevalence survey (PPS) on healthcare-associated infections (HAIs) and antimicrobial use in European acute care hospitals, developed by the European Centre for Disease Prevention and Control, was piloted across Europe. Variables were collected at national, hospital, and patient levels in 66 hospitals from 23 countries. A patient-based protocol and a unit-based protocol were available. Feasibility was assessed through national and hospital questionnaires. Of the 19,888 surveyed patients, 7.1% had an HAI, and 34.6% were receiving at least one antimicrobial agent. Prevalence results were highest in intensive care units, with 28.1% of patients having HAIs and 61.4% of patients using antimicrobials. Pneumonia and other lower respiratory tract infections (2.0% of patients; 95% confidence interval (CI): 1.8-2.2%) represented the most common type (25.7%) of HAIs. Surgical prophylaxis was indicated for 17.3% of the antimicrobials used and exceeded one day in 60.7% of cases. Risk factors in the patient-based protocol were provided for 98% or more of the included patients and were all independently associated with both the presence of HAIs and the receipt of an antimicrobial agent. The patient-based protocol required more work than the unit-based protocol but allowed detailed data collection and analysis of risk factors for the use of HAIs and antimicrobials (Zarb P et al., 2012).

In a pilot study conducted in 10 member states of the European Union (EU), as part of a point prevalence survey (PPS) of healthcare-associated infections (HAIs) and antimicrobial use in Europe in 2011, including 29 EU/European Economic Area (EEA) countries and Croatia, a total of 20 acute hospitals and 1,950 patient records were included in the pilot study, which aimed to test the validity and reliability between assessors (IRR) using an in-hospital observational approach. In terms of validity, a sensitivity of 83% (95% confidence interval (CI): 79-87%) and a specificity of 98% (95% CI: 98-99%) were found for HAIs. The level of agreement between the primary PPS and validity results was very good for HAIs overall (Cohen's kappa (κ): 0.81) and for all types of HAIs (range: 0.83 for bloodstream infections to 1.00 for lower respiratory tract infections). Antimicrobial use had a sensitivity of 94% (95% CI: 93-95%) and a specificity of 97% (95% CI: 96-98%) with a very good level of agreement (κ: 0.91). Agreement for other demographic elements ranged from average to very good (κ: 0.57-0.95): age (κ: 0.95), gender (κ: 0.93), physician specialty (κ: 0.87), and McCabe outcome (κ: 0.57). IRR showed a very good level of agreement (κ: 0.92) for both the presence of HAIs and antimicrobial use. This pilot study suggested valid and reliable reporting of HAIs and antimicrobial use in the PPS dataset. The lowest level of sensitivity regarding HAI reporting reinforces the importance of training data collectors and including validity studies as part of a PPS to better assess the burden of HAIs (Reilly J et al., 2015).

III. Problem Statement

The issue of nosocomial infections is a global problem with varying degrees of incidence depending on the overall development level of a country and the quality and safety of healthcare services. In our country, due to numerous healthcare reforms, the overwhelming number of cases requiring services where there is a significant possibility of acquiring an infection, along with the negligence of medical staff, has greatly increased the number of infections acquired during healthcare delivery.

The primary areas where the risk of nosocomial infections is highest include operating rooms and intensive care units, particularly neonatal intensive care units. Undoubtedly, much work is needed to reduce this number as much as possible by raising the standards of healthcare providers in terms of preventing the occurrence of these infections and organizing additional educational courses for healthcare personnel working in the aforementioned units.

The role of nurses and other healthcare workers is undeniably crucial. Their presence in areas where the risk of acquiring a nosocomial infection is high makes them key players in infection prevention. Therefore, their knowledge on this topic must be solid and up to date.

IV. Methodology

In this thesis, we employed a literature review methodology focused on nosocomial infections and the role of nurses. The literature used for this purpose is relevant and includes recent data, consisting of works published in prestigious scientific journals.

Based on our literature research, we have collected extensive data regarding the situation of these infections in our country and subsequently compared this information with data presented in studies from various other countries.

To facilitate the comparison of these data and fulfill the objectives of this research, we approached the selection of comparative data with particular care, especially regarding the quality of the healthcare level being assessed. Naturally, data from developed countries were also presented to provide insight into what measures can be taken to prevent these infections as effectively as possible.

V. Results

In a study conducted by Raka et al. (2006) to determine the prevalence of nosocomial infections at the Clinical University Center of Kosovo, out of 167 surveyed patients, 27 had a total of 29 hospital-acquired infections, resulting in an overall prevalence rate of 17.4%. Bloodstream infections were the most common (62%), and the highest prevalence was observed among newborns in intensive care units (77.8%).

The Clinical University Center (QKUK) is the only tertiary care center in Kosovo, with 2,400 beds serving approximately 2 million residents. The study recorded data on the following types of infections: nosocomial pneumonia, nosocomial urinary tract infections, surgical site infections, and nosocomial bloodstream infections. The criteria from the American Centers for Disease Control and Prevention (CDC) were used to define hospital-acquired infections. Samples were collected from endotracheal aspirates, sputum, and urine, as well as swabs from the nose, throat, axilla, and perineum. Among 28 surveyed patients, 11 had a total of 18 hospital-acquired infections. Of these 18 infections, which all occurred in the central ICU, ventilator-associated pneumonia accounted for 8 (44.4%), bloodstream infections for 5 (27.8%), urinary tract infections for 4 (22.2%), and surgical site infections for 1 (5.6%). The overall prevalence rate was 64.3%. No infections were detected in the pulmonology and neurology ICUs. In the central ICU, 68.7% of patients had hospital-acquired infections, with a predominance of ventilator-associated pneumonia (72.7% of infections). Laboratory tests revealed isolates for 26% of patients. Gram-negative bacilli represented 63.6% of all isolates, with Acinetobacter (27.2%) and Pseudomonas aeruginosa (18.2%) being the most predominant species. Of the 28 surveyed patients, 17 (60.7%) were receiving antimicrobial treatment at the time of the survey. The prevalence of hospital-acquired infections in Kosovo is higher than in other European countries, where estimates range from 20% to 35%. The high prevalence in Kosovo can be attributed to several factors, including a lack of financial support, an inadequate number of trained personnel working in infection control, insufficiently staffed hospital units, and inadequate equipment and supplies. These results underscore the need for preventive infection interventions in ICUs (Spahija et al., 2008).

Antimicrobial resistance is another challenge closely related to hospital-acquired infections (HCAIs). Inappropriate use of antimicrobials is the most significant cause of the emergence and spread of resistant microorganisms in communities and hospitals. Consumption and resistance trends are escalating in many countries across Europe, particularly in Eastern and Central Europe. Kosovo ranks high in overall antibiotic consumption in Europe, with a wholesale sales level of 26.3 DDD (Defined Daily Doses/1000 inhabitants/day); it ranks sixth for cephalosporin consumption (DDD 4.0) and has the highest proportional parenteral use of ceftriaxone in Europe. Prevalence surveys have been utilized to provide information on the burden of HCAIs and antimicrobial use.

A total of 915 patients were included in the prevalence survey study. Fifty-eight patients were infants aged 0-10 months, and 498 (54.4%) were female. Overall, about five patients had an HCAI; the national HCAI prevalence rate was 4.9%. The highest rate was observed at the tertiary care level at QKUK (7.2%), followed by regional hospitals in Pejë (5.6%) and Gjakovë (2.4%). The prevalence of HCAIs in regional hospitals was 2.1%. Table 1 shows that more than half of the registered patients in the survey were from Prishtina (54.3%), followed by Prizren and Gjilan (each representing 10.6%) and Pejë (9.6%). The smallest participating hospital in the survey was Ferizaj Hospital, and the largest was QKUK in Prishtina. The overall bed occupancy rate in Kosovo's hospitals during 2015 was 60%. At QKUK, it was 65.7%, while in all other hospitals, it was 53.3%. The lowest rate was observed in Ferizaj at 41.6% (Raka et al., 2019).

In the survey conducted in Kosovo, the average length of hospital stay until the onset of HCAI was 11 days, which was similar to the ECDC survey, which reported 12 days. In European Union (EU) hospitals, the prevalence of HCAI was highest among patients admitted to the ICU (19.5%), while in the survey conducted in Kosovo, surgical departments had the highest rate (35.5%). It is worth mentioning, along with the possible limitations mentioned above, that the total number of ICU beds in Kosovo is only 95. In the study referenced here, 70% of patients had peripheral devices on the day of the survey, and all UTIs occurred in patients with urinary catheters. The results for UTIs may be biased due to the very small sample size (only 7 patients with UTIs). In the ECDC study, 1,694 (59.5%) patients had catheter urination within 7 days prior to the onset of HCAI. A peripheral vascular catheter was present in 46.7% of patients, ranging from 30.6% in France to 70.6% in Greece.

Based on data from 2011-2012, a study estimated that 2,609,911 (95% UI: 2,451,235–2,778,451) new cases of HAI occur each year in the EU/EEA. These HAIs account for a total of 2,506,091 daily (95% UI: 2,163,850–2,877,574) each year in the EU/EEA, which corresponds to 501 daily per 100,000 of the general population (95% UI: 429–58).

When applying an annual reduction rate of 3.5%, HAIs are estimated at 1,335,159 daily (95% UI: 1,153,291–1,536,343), corresponding to 261 daily cases per 100,000 of the general population (95% UI: 226–226). For any type of HAI, the relationship between HAI incidence, the number of deaths attributed to HAIs, and the total burden of HAIs in one day per 100,000 of the general population depends on the severity of the disease and its long-term complications.

Table 2 describes the relative burden for female patients, patients under 5 years of age, and patients aged 65 years and older for each HAI and in general (including and excluding neonatal sepsis HAI).

In a study conducted in 2012 on the prevalence of HAI in Europe, a total of 7.1% of patients had at least one HAI, ranging from 0.2% in psychiatry to 28.1% in intensive care departments. The prevalence of HAIs was 5.8% in primary care hospitals, 6.3% in secondary hospitals, 7.4% in tertiary hospitals, and 7.8% in specialized hospitals.

The most common type of HAI was pneumonia and other infections of the lower respiratory tract, representing 25.7% of all reported HAIs (Table 2). The second most frequently reported type of HAI was surgical site infection (18.9%), followed by urinary tract infection (17.2%), bloodstream infection (14.2%), and gastrointestinal infection (7.8%). Clostridium difficile infections represented 1.4% of all HAIs. On average, there were 1.09 HAIs per infected patient (or a total of 1,531 HAIs among 1,408 patients with HAIs). The average duration of stay before the onset of the HAI acquired during the current admission (n=1,159) was 12 days (range: 4-65 days). Among 372 (24%) HAIs present at admission, 58% were associated with a prior stay in the same hospital. For 59.1% of HAIs, a positive microbiological result was available, ranging from 40.3% for gastrointestinal infections to 94.0% for bloodstream infections.

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In 2016–2017, the European Centre for Disease Prevention and Control (ECDC) organized the third point prevalence survey (PPS) of healthcare-associated infections (HAIs) and antimicrobial use in European long-term care facilities (LTCFs) or HALT-3. The survey design was based on the experiences and recommendations of the two previous PPSs in LTCFs organized by ECDC, namely HALT (2010) and HALT-2 (2013). Specifically, HALT-3 used a standardized PPS methodology that aimed to:

assess and monitor the burden (prevalence) of HAIs and antimicrobial use in LTCFs at the national and European level;

measure the structure and process indicators of infection prevention and control (IPC) and antimicrobial stewardship in LTCFs;

identify priorities for national and local intervention measures in LTCFs and evaluate their implementation in the Member States of the European Union (EU) and the European Economic Area (EEA).

The gross prevalence of residents with at least one HAI was 3.7%. The majority of reported HAIs (n=3,858) were related to the current LTCF (84.7%), while 7.5% and 1.4% were respectively linked to a hospital or another LTCF. When considering only HAIs that were related to the current LTCF, the unadjusted prevalence of residents with at least one HAI was 3.1%. The most frequently reported HAIs associated with the current LTCF were respiratory tract infections (RTIs, 34.8%, of which 68.1% were lower RTIs excluding pneumonia), urinary tract infections (UTIs, 32.5%), and skin infections (21.2%) of which 80.8% were cellulitis/soft tissue/wound infections. More than half of the UTIs (56.1%) were 'possible' UTIs, i.e., cases where the resident had sufficient signs/symptoms to suspect a UTI but without microbiological confirmation (i.e., urine culture was not performed, or was negative, or not available at the time of the survey).

During the COVID-19 pandemic, secondary bacterial infections were observed in patients with COVID-19. According to the National Healthcare Safety Network (NHSN), there were higher rates of bloodstream infections, catheter-associated urinary tract infections, and ventilator-associated infections (VAEs) during this period compared to the pre-pandemic period and as a function of the COVID-19 case load. However, these studies lack correlation between patient-level risk factors and the development of infections during hospital admission.

Interrupted time series analyses are used in public health research to assess changes in an outcome measured before and after an intervention. However, the effects of natural phenomena can also be studied by considering a well-defined point of change. In this study, interrupted time series analysis was used to investigate the impact of the COVID-19 pandemic on healthcare-associated infections (HAIs) in three hospitals in St. Louis, Missouri. The time series of HAIs were compared before and after March 2020, when COVID-19 cases were first identified in the region. Such an increase has implications for infection prevention, antimicrobial stewardship, and other care processes, and ultimately, the early era of COVID-19 was variably associated with increases in HAIs. In light of this upward trend, ongoing vigilance in maintaining optimal infection prevention practices to minimize HAIs has been emphasized, including hand hygiene, minimizing unnecessary device use, and promoting antimicrobial stewardship.

A study (Faria S. et al.) was conducted in the largest hospital in Albania to assess the prevalence and risk factors for hospital infections. A one-day prevalence study was conducted between October and November 2003 in medical, surgical, and intensive care departments. The definitions of the Centers for Disease Control and Prevention were used. In total, 185 HAIs were found in 163 out of 968 registered patients. Urinary tract infections (33.0%), surgical site infections (24.3%), pneumonia (13.0%), and venous infections (9.2%) were the most common HAIs. The prevalence of HAIs was higher in intensive care units (31.6%) than in surgical (22.0%) and medical (10.3%) departments. Overall, 132 HAIs (71.4%) were confirmed by microbiological examination; the only microorganism isolated most frequently was Staphylococcus aureus (18.2%). Using logistic regression, the following independent risk factors were identified: age >40 years, length of hospital stay, 'trauma' diagnosis at admission, and invasive devices. Although comparisons should be made with caution, the prevalence of NI was higher than in Western European countries and in some developing countri

VI. Conclusions

The healthcare system in Kosovo suffers from a lack of accountability, corruption, misuse of existing resources, communication difficulties, and poor quality assurance capabilities. There is no health insurance, and the Health Information System is not yet fully operational. Patients and their families are often required to procure their own healthcare materials. Out-of-pocket expenditures for health care account for about 40% of total healthcare spending. Infection prevention and control in Kosovo face common challenges with other countries that have limited resources. These activities are restricted to passive monitoring, and actions typically begin only in response to late-stage outbreaks. Outside of the University Clinical Center of Kosovo (QKUK) and a few other regional hospitals, infection control committees existed only on paper.

Current studies highlight the significant burden of healthcare-associated infections (HAIs) in the EU/EEA compared to other infectious diseases under surveillance in the EU, and the need for intensified efforts to prevent and control these infections, ultimately making European hospitals safer.

According to findings, less than half of the nurses had good knowledge of HAI prevention, and approximately two-thirds of nurses practiced good HAI prevention. Gender, educational status, work experience, training in infection prevention, and adequate supply of materials for infection prevention were all important factors related to nurses' good knowledge of HAI prevention.

Educational status, availability of a continuous daily water supply, and awareness of the existence of infection prevention guidelines were all important factors related to nurses effectively practicing HAI prevention.

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