Repeated prevalence studies of nosocomial infections in one university hospital in Serbia

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Short title: The nosocomial infection prevalence

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Abstract

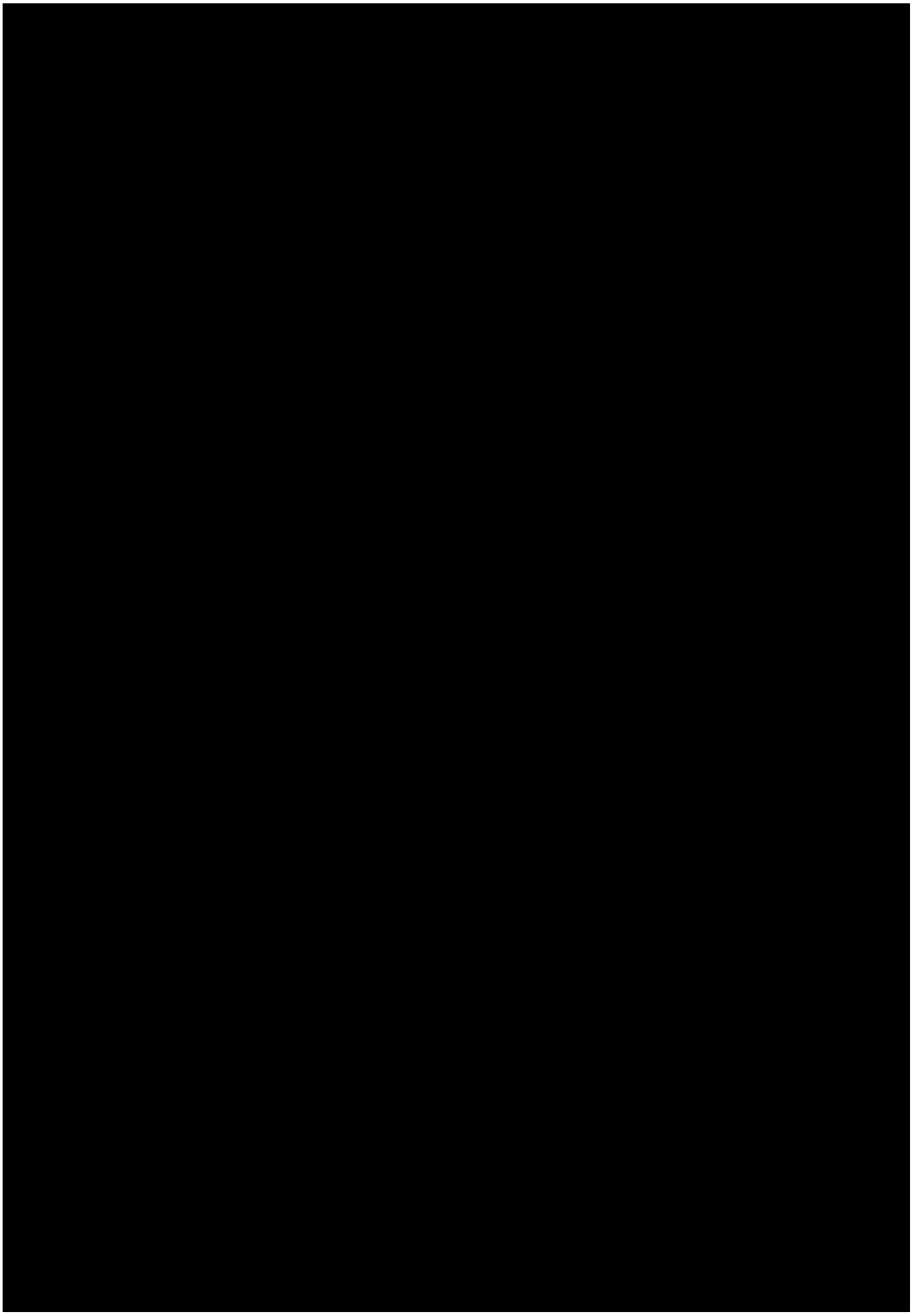
Background/aim: Nosocomial infections occur worldwide and affect both developed and resource-poor countries. The aim of this paper was to determine the prevalence and risk factors for nosocomial infections in one Serbian hospital.

Materials and methods: Three point prevalence surveys were conducted in Clinical Center Kragujevac (1,240 beds). The definitions for nosocomial infections of The Centers for Diseases Control and Prevention standard were used. The authors conducted surveys according to the same protocol.

Results: The prevalence of infected patients and the overall prevalence of nosocomial infections was 6.2% and 7.1 % in 2003, 4.6% and 4.6% in 2005, and 7.6 and 8.7% in 2009, respectively. In all three studies, the risk factors for nosocomial infections were older age, intravascular catheters, urinary catheters, longer hospital stay, hospitalization in an intensive care unit and the surgery. According to the multivariate regression analysis, a prolonged hospitalization and urinary catheter were independent risk factors for nosocomial infections in the first and the second study.

Conclusion: The overall HAI prevalence in our hospital increased from 2003 to 2009 that provided an incentive for better definition of infection control priorities in high-risk departments.

Key words: Nosocomial infection, prevalence, repeated survey, university hospital, risk factors.



care unit. Until 2000, Clinical Centre Kragujevac did not have a ratified infection control program. However, the guidelines for rational antibiotic use have been suggested recently, as well as the guidelines for prevention of surgical site infection and hand hygiene.

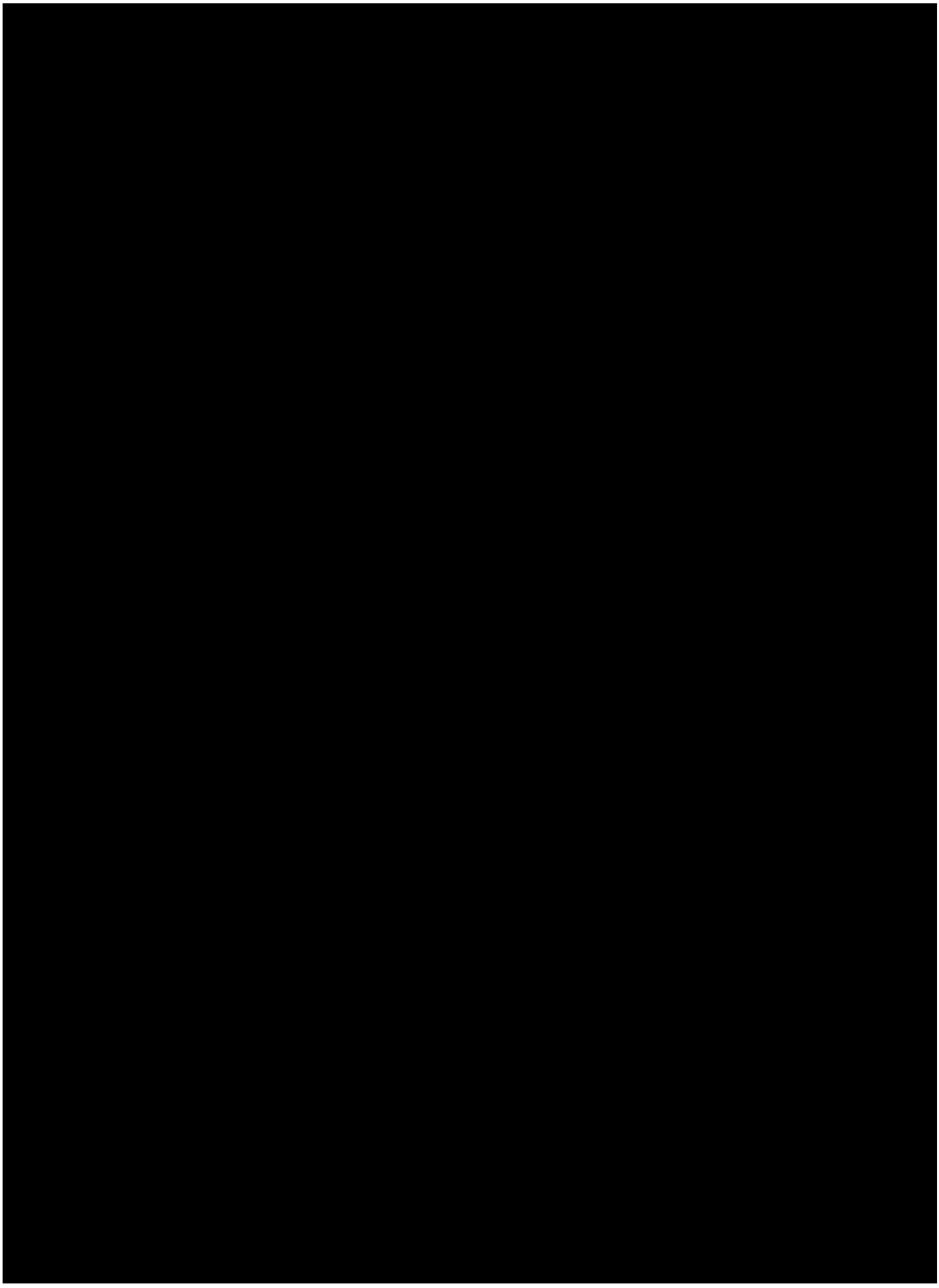
2.2. Study design

Three point prevalence surveys were carried out in December 2003, May 2005, and June 2009. The same method was applied in all studies. To put it briefly, all patients staying >48 hours in hospital at the time of the surveys, were included in the studies. Every patient was registered only once. If a patient was visited twice on the same day at the time of the study, due to transfer between clinics, only the first treatment episode was registered. Every study was performed in one single day in one hospital ward, and the entire study was completed during one week, as it was recommended in previous research (HAI was defined according to CDC criteria (4), and then translated into Serbian (21). We used these definitions in all three studies. Therefore, we could compare the results of the surveys. All infections were categorized into 13 major and specific infection sites. Asymptomatic bacteriuria was not considered as an infection. Only HAIs active on the day of the survey were taken into account.

Data were collected using a standardized questionnaire based on the patients' medical records, and nursing records, microbiological and X-ray reports and interviews with the patients and physicians. The following clinical characteristics were recorded: demographic data, the date of admission, the type of disease and comorbidities on admission, hospital ward and intensive care unit (ICU), interventions (the presence of an indwelling catheter at the time of the survey, a surgical procedure in the month preceding the survey, or the year preceding the survey in the case of prosthesis implantation), their corresponding dates and duration, and the use of antimicrobials. We calculated length of hospitalization as number of days from admission to date of surveys. All surveys were conducted by the same trained epidemiologist and infection control nurses.

2.3. Data analysis

The prevalence of HAI was presented as the prevalence of infected patients (with at least one infection) and the prevalence of infection. The 95% confidence intervals (CIs) were calculated. The differences between infected and non-infected patients were assessed using a chi-square or the Fisher



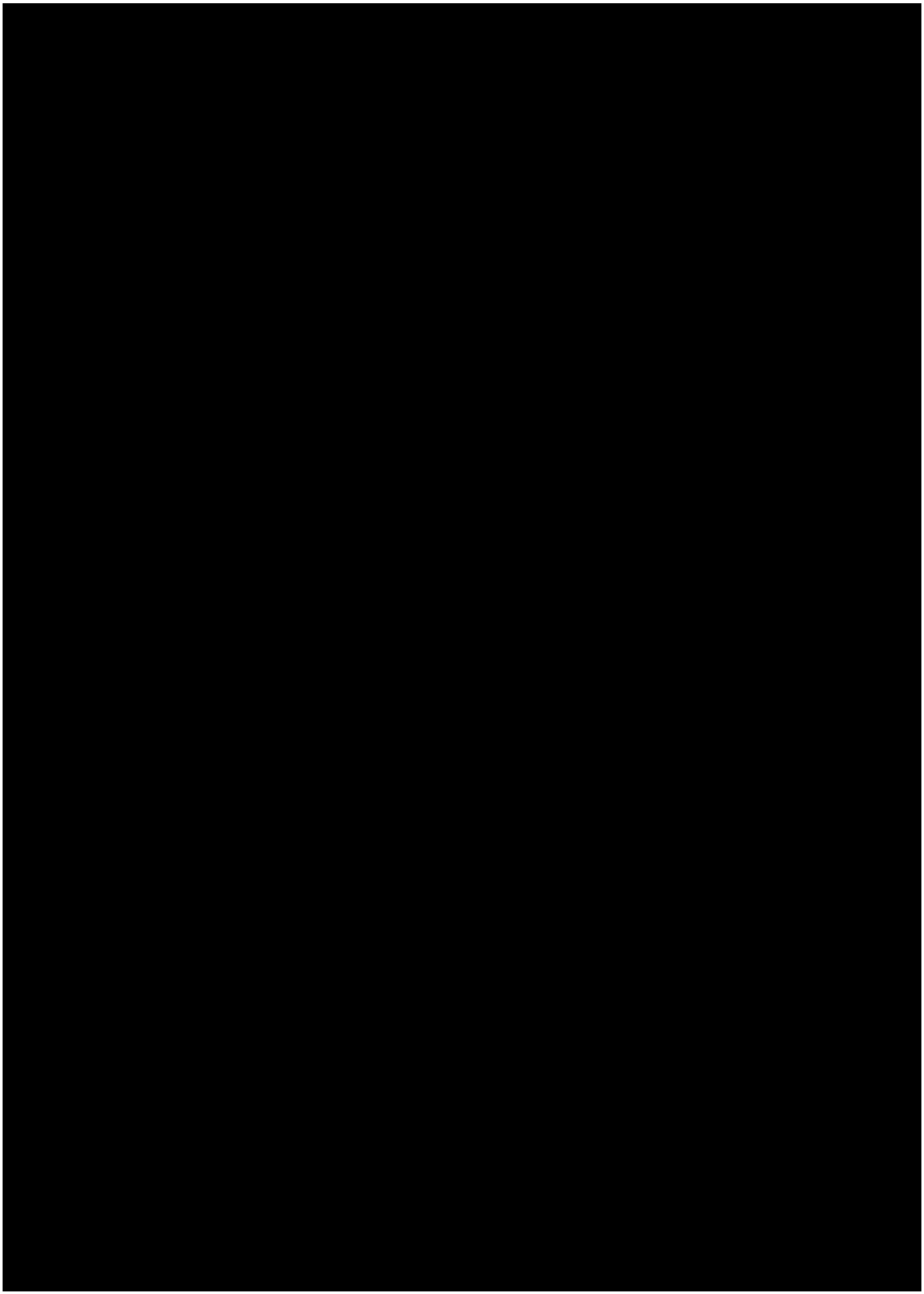
In total, microbiological examination was conducted in 71.4% cases of HAI, 87.0% (47/54) in the first study, 62.5% (25/40) in the second, and 73.3% (55/75) in the third study. The most frequently isolated bacteria are presented in the Figure 1. The increase of Gram-negative rods is noted. The number of patients receiving treatment with at least one antibiotic agent on the day of the study was 330 (45.8% of the total), in the first study, 268 (30.9% of total) in the second and 324 (37.5% of total) in the third study.

4. Discussion

The prevalence surveys of HAIs have been widely used both in national and local settings. Over time, more comprehensive data were obtained from repeated prevalence surveys. However, when prevalence surveys are conducted, they should be performed in a standardized methodology (18). Despite the long period that elapsed between our studies, we assume that the prevalence rate can be compared, because the same infection control staff conducted all studies, using the same definitions of HAI, and the same laboratory for microbiology confirmation of infections.

The overall prevalence rates of HAI in our study were 7.1%, 4.6%, and 8.7% in the first, the second, and the third study, respectively. These rates were lower than the rates of studies performed at university hospitals in some neighboring countries (15,22) and in other developing countries (14,23), but higher than the rates in most developed countries. Studies in western European countries showed that the prevalence of HAI in hospitals was between 3.5% and 8.5% (9-13,24). Ten annual prevalence surveys were conducted in 900-bed tertiary-care hospital in the USA: the prevalence of patients with HAIs showed no significant increase during the 10-year period, although the rate of bloodstream infection significantly increased (25).

Although surgical interventions are still an important risk factor for HAI (26), in our study the prevalence of SSIs non-significantly decreased over time, while the prevalence of UTI prevalence significantly increased. The national recommendation for prevention of SSI, which includes antibiotic prophylaxis, published at the beginning of 2005, probably influenced this decreasing trend. Similar results were obtained for the whole Serbia, too. Namely, SSIs were the most common in the first national study conducted in 1999, accounted for 34% of all HAI, but at second position in the second



was noted. According to our results, patients who had been in the hospital longer than 8 days at the time of the survey, had an increased risk of nosocomial infections. It is well known that prolonged hospital stay can expose patients to the hospital flora and increase the risk of infection. However the HAIs itself prolonged the duration of hospitalization.

The antibiotic use is rather the consequences of HAIs treatment than a risk factor for their development. Antibiotic use in all three studies was higher than in study conducted in four European countries where about one-third of patients were being treated with antimicrobials at the time of the study (11). Moreover, only a few patients with HAIs were without antibiotherapy. As a result, the confidence interval for the antibiotic use was wide, especially in the second survey. It has already been found that Serbia is ranked fifth out of 12 counties newly independent and south-eastern European countries in terms of overall use of antibiotics, after Turkey, Montenegro, Tajikistan and Kosovo (33) All things considered, further analyses of the antibiotic use and their influence on the development of resistant strains are needed in our hospital.

According to the definitions of HAI, bacteriological confirmation is needed for many types of infections. However, some HAIs, like SSI and PNE can be diagnosed according to the clinical symptoms and signs. For this reason, the number of bacterologically confirmed HAI is always less than the total number of infections. The episodes of HAIs documented by microbiological results were similar to those published in other European surveys (9,13,15). The most common isolated organisms in our surveys were Gram-negative rods, which were similar to those in the published results in developing countries (15,22,23).

The main limitation of our investigation is the type of study design as a point prevalence survey. In prevalence study, a cross-sectional approach is used, and it is more likely to capture HAIs of longer duration, and the patient with more comorbidities. Also, the quality of data depends on the availability of information in the patient records, nursing records, prescribing records, etc. Availability of bacteriological results influences the quality and accuracy of the HAI diagnosis too. However, the well documented protocol, trained data collectors and validation of the collected data, could decrease the potential bias. In our study, one trained infection control doctor (M.I.) and the same infection

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Competing interests

The authors declare that they have no competing interests.

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